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Ongoing Face Recognition Vendor Test (FRVT)

Part 1: Verification

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DISCLAIMER

Specific hardware and software products identified in this report were used in order to perform the evaluations described in this document. In no case does identification of any commercial product, trade name, or vendor, imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products and equipment identified are necessarily the best available for the purpose.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

FRVT STATUS

This report is a draft NIST Interagency Report, and is open for comment. It is the sixteenth edition of the report since the first was published in June 2017. Prior editions of this report are maintained on the FRVT website, and may contain useful information about older algorithms and datasets no longer used in FRVT.

FRVT remains open: All four tracks of the FRVT remain open to new algorithm submissions indefinitely. This report will be updated as new algorithms are evaluated, as new datasets are added, and as new analyses are included. Comments and suggestions should be directed to frvt@nist.gov.

Changes since July 3 2019:

- The HTML table on the FRVT 1:1 homepage has been updated to list the 20 most accurate developers rather than algorithms, choosing the most accurate algorithm from each developer based on visa and mugshot results. Also, the algorithms are ordered in terms of lowest mean rank across mugshot, visa and wild datasets, rewarding broad accuracy over a good result on one particular dataset.
- This report includes results for a new dataset - see the column labelled "crossEV" in Table 5. It compares a new set of high quality visa portraits with a set webcam photos that exhibit moderately poor pose variations and background illumination. The two new sets are described in sections 2.3 and 2.5. The comparisons are "cross-domain" in that the algorithm must compare "visa" and "wild" images. Results for other algorithms will be added in future reports as they become available.
- This report adds results for algorithms from 9 developers submitted in early July 2019. These are from 3DiVi, Camvi, EverAI-Paravision, Facesoft, Farbar (F8), Institute of Information Technologies, Shanghai U. Film Academy, Via Technologies, and Ulucu Electronics Tech. Six of these are new participants.
- Several other algorithms have been submitted and are being evaluated. Results will be released in the next report, scheduled for September 5. That report will include results for new datasets.
- Older algorithms from Everai, Camvi and 3DiVi, have been retired, per the policy to list only two algorithms per developer.

Changes since June 20 2019:

- This report adds results for algorithms from 18 developers submitted in early June 2019. These are from CTBC Bank, Deep Glint, Thales Cogent, Ever AI Paravision, Gorilla Technology, Imagus, Incode, Kneron, N-Tech Lab, Neurotechnology, Notiontag Technologies, Star Hybrid, Videonetics, Vigilant Solutions, Winsense, Anke Investments, CEIEC, and DSK. Nine of these are new participants.
- Several other algorithms have been submitted and are being evaluated. Results will be released in the next report, scheduled for August 1.
- Older algorithms from Everai, Thales Cogent, Gorilla Technology, Incode, Neurotechnology, N-Tech Lab and Vigilant Solutions have been retired, per the policy to list only two algorithms per developer.

Changes since April 2019:

- This report adds results for nine algorithms from nine developers submitted in early June 2019. These are from Tencent Deepsea, Hengrui, Kedacom, Moontime, Guangzhou Pixel, Rank One Computing, Synesis, Sensetime and Vocord.
- Another 23 algorithms have been submitted and are being evaluated. Results will be released in the next report, scheduled for July 3.
- Older algorithms for Rank One, Synesis, and Vocord have been retired, per the policy to list only two algorithms per developer.

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Changes since February 2019:

- This report adds results for 49 algorithms from 42 developers submitted in early March 2019.
- This report omits results for algorithms that we retired. We retired for three reasons: 1. The developer submitted a new algorithm, and we only list two. 2. The algorithm needs a GPU, and we no longer allow GPU-based algorithms. 3. Inoperable algorithms.
- Previous results for retired algorithms are available in older editions of this report linked here.
- The mugshot database used from February 2017 to January 2019 has been replaced with an extract of the mugshot database documented in NIST Interagency Report 8238, November 2018. The new mugshot set is described in section 2.4 and is adopted because:
  - It has much better identity label integrity, so that false non-match rates are substantially lower than those reported in FRVT 1:1 reports to date - see Figure 30.
  - It includes images collected over a 17 year period such that ageing can be much better characterized - - see Figure 112.
- Using the new mugshot database, Figure 112 shows accuracy for four demographic groups identified in the biographic metadata that accompanies the data: black females, black males, white females and white males.
- The report adds Figure 9 with results for the twenty human-difficult pairs used in the May 2018 paper *Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms* by Phillips et al. [1].
- The report uses an update to the wild image database that corrects some ground truth labels.
- Some results for the child exploitation database are not complete. They are typically updated less frequently than for other image sets.

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FNMR(T) "False non-match rate"
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270 ALGORITHM ALLGOVISION-000 CROSS COUNTRY FMR . . . 307
271 ALGORITHM AMPLIFIEDGROUP-001 CROSS COUNTRY FMR . . . 308
272 ALGORITHM ANKE-003 CROSS COUNTRY FMR . . . 309
273 ALGORITHM ANKE-004 CROSS COUNTRY FMR . . . 310
274 ALGORITHM ANYVISION-002 CROSS COUNTRY FMR . . . 311
275 ALGORITHM ANYVISION-004 CROSS COUNTRY FMR . . . 312
276 ALGORITHM AWARE-003 CROSS COUNTRY FMR . . . 313
277 ALGORITHM AWARE-004 CROSS COUNTRY FMR . . . 314
278 ALGORITHM AYONIX-000 CROSS COUNTRY FMR . . . 315
279 ALGORITHM BM-001 CROSS COUNTRY FMR . . . 316
280 ALGORITHM CAMVI-002 CROSS COUNTRY FMR . . . 317
281 ALGORITHM CAMVI-004 CROSS COUNTRY FMR . . . 318
282 ALGORITHM CEIEC-001 CROSS COUNTRY FMR . . . 319
283 ALGORITHM CEIEC-002 CROSS COUNTRY FMR . . . 320
284 ALGORITHM COGENT-003 CROSS COUNTRY FMR . . . 321
285 ALGORITHM COGENT-004 CROSS COUNTRY FMR . . . 322
286 ALGORITHM COGNITEC-000 CROSS COUNTRY FMR . . . 323
287 ALGORITHM COGNITEC-001 CROSS COUNTRY FMR . . . 324

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

288 ALGORITHM CTBCBANK-000 CROSS COUNTRY FMR . . . 325
289 ALGORITHM CYBEREXTRUDER-001 CROSS COUNTRY FMR . . . 326
290 ALGORITHM CYBEREXTRUDER-002 CROSS COUNTRY FMR . . . 327
291 ALGORITHM CYBERLINK-001 CROSS COUNTRY FMR . . . 328
292 ALGORITHM CYBERLINK-002 CROSS COUNTRY FMR . . . 329
293 ALGORITHM DAHUA-001 CROSS COUNTRY FMR . . . 330
294 ALGORITHM DAHUA-002 CROSS COUNTRY FMR . . . 331
295 ALGORITHM DEEPGLINT-001 CROSS COUNTRY FMR . . . 332
296 ALGORITHM DEEPSEA-001 CROSS COUNTRY FMR . . . 333
297 ALGORITHM DERMALOG-005 CROSS COUNTRY FMR . . . 334
298 ALGORITHM DERMALOG-006 CROSS COUNTRY FMR . . . 335
299 ALGORITHM DIGITALBARRIERS-002 CROSS COUNTRY FMR . . . 336
300 ALGORITHM DSK-000 CROSS COUNTRY FMR . . . 337
301 ALGORITHM EVERAI-002 CROSS COUNTRY FMR . . . 338
302 ALGORITHM F8-001 CROSS COUNTRY FMR . . . 339
303 ALGORITHM FACESOFT-000 CROSS COUNTRY FMR . . . 340
304 ALGORITHM GLORY-000 CROSS COUNTRY FMR . . . 341
305 ALGORITHM GLORY-001 CROSS COUNTRY FMR . . . 342
306 ALGORITHM GORILLA-002 CROSS COUNTRY FMR . . . 343
307 ALGORITHM GORILLA-003 CROSS COUNTRY FMR . . . 344
308 ALGORITHM HIK-001 CROSS COUNTRY FMR . . . 345
309 ALGORITHM HR-000 CROSS COUNTRY FMR . . . 346
310 ALGORITHM HR-001 CROSS COUNTRY FMR . . . 347
311 ALGORITHM ID3-003 CROSS COUNTRY FMR . . . 348
312 ALGORITHM ID3-004 CROSS COUNTRY FMR . . . 349
313 ALGORITHM IDEMIA-003 CROSS COUNTRY FMR . . . 350
314 ALGORITHM IDEMIA-004 CROSS COUNTRY FMR . . . 351
315 ALGORITHM IIT-000 CROSS COUNTRY FMR . . . 352
316 ALGORITHM IIT-001 CROSS COUNTRY FMR . . . 353
317 ALGORITHM IMAGUS-000 CROSS COUNTRY FMR . . . 354
318 ALGORITHM IMPERIAL-000 CROSS COUNTRY FMR . . . 355
319 ALGORITHM IMPERIAL-001 CROSS COUNTRY FMR . . . 356
320 ALGORITHM INCODE-003 CROSS COUNTRY FMR . . . 357
321 ALGORITHM INCODE-004 CROSS COUNTRY FMR . . . 358
322 ALGORITHM INNOVATRICS-004 CROSS COUNTRY FMR . . . 359
323 ALGORITHM INNOVATRICS-005 CROSS COUNTRY FMR . . . 360
324 ALGORITHM INTELLIVISION-001 CROSS COUNTRY FMR . . . 361
325 ALGORITHM IQFACE-000 CROSS COUNTRY FMR . . . 362
326 ALGORITHM ISITYOU-000 CROSS COUNTRY FMR . . . 363
327 ALGORITHM ISYSTEMS-001 CROSS COUNTRY FMR . . . 364
328 ALGORITHM ISYSTEMS-002 CROSS COUNTRY FMR . . . 365
329 ALGORITHM ITMO-005 CROSS COUNTRY FMR . . . 366
330 ALGORITHM ITMO-006 CROSS COUNTRY FMR . . . 367
331 ALGORITHM KAKAO-001 CROSS COUNTRY FMR . . . 368
332 ALGORITHM KAKAO-002 CROSS COUNTRY FMR . . . 369
333 ALGORITHM KEDACOM-000 CROSS COUNTRY FMR . . . 370
334 ALGORITHM KNERON-003 CROSS COUNTRY FMR . . . 371
335 ALGORITHM LOOKMAN-002 CROSS COUNTRY FMR . . . 372
336 ALGORITHM LOOKMAN-004 CROSS COUNTRY FMR . . . 373
337 ALGORITHM MEGVII-001 CROSS COUNTRY FMR . . . 374
338 ALGORITHM MEGVII-002 CROSS COUNTRY FMR . . . 375
339 ALGORITHM MEIYA-001 CROSS COUNTRY FMR . . . 376
340 ALGORITHM MICROFOCUS-001 CROSS COUNTRY FMR . . . 377
341 ALGORITHM MICROFOCUS-002 CROSS COUNTRY FMR . . . 378
342 ALGORITHM MT-000 CROSS COUNTRY FMR . . . 379
343 ALGORITHM NEUROTECHNOLOGY-005 CROSS COUNTRY FMR . . . 380
344 ALGORITHM NEUROTECHNOLOGY-006 CROSS COUNTRY FMR . . . 381

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

345 ALGORITHM NODEFLUX-000 CROSS COUNTRY FMR . . . 382
346 ALGORITHM NODEFLUX-001 CROSS COUNTRY FMR . . . 383
347 ALGORITHM NOTIONTAG-000 CROSS COUNTRY FMR . . . 384
348 ALGORITHM NTECHLAB-006 CROSS COUNTRY FMR . . . 385
349 ALGORITHM NTECHLAB-007 CROSS COUNTRY FMR . . . 386
350 ALGORITHM PIXELALL-002 CROSS COUNTRY FMR . . . 387
351 ALGORITHM PSL-001 CROSS COUNTRY FMR . . . 388
352 ALGORITHM PSL-002 CROSS COUNTRY FMR . . . 389
353 ALGORITHM RANKONE-006 CROSS COUNTRY FMR . . . 390
354 ALGORITHM RANKONE-007 CROSS COUNTRY FMR . . . 391
355 ALGORITHM REALNETWORKS-002 CROSS COUNTRY FMR . . . 392
356 ALGORITHM REALNETWORKS-003 CROSS COUNTRY FMR . . . 393
357 ALGORITHM REMARKAI-000 CROSS COUNTRY FMR . . . 394
358 ALGORITHM REMARKAI-001 CROSS COUNTRY FMR . . . 395
359 ALGORITHM SAFFE-001 CROSS COUNTRY FMR . . . 396
360 ALGORITHM SAFFE-002 CROSS COUNTRY FMR . . . 397
361 ALGORITHM SENSETIME-001 CROSS COUNTRY FMR . . . 398
362 ALGORITHM SENSETIME-002 CROSS COUNTRY FMR . . . 399
363 ALGORITHM SHAMAN-000 CROSS COUNTRY FMR . . . 400
364 ALGORITHM SHAMAN-001 CROSS COUNTRY FMR . . . 401
365 ALGORITHM SHU-001 CROSS COUNTRY FMR . . . 402
366 ALGORITHM SIAT-002 CROSS COUNTRY FMR . . . 403
367 ALGORITHM SIAT-004 CROSS COUNTRY FMR . . . 404
368 ALGORITHM SMILART-002 CROSS COUNTRY FMR . . . 405
369 ALGORITHM SMILART-003 CROSS COUNTRY FMR . . . 406
370 ALGORITHM STARHYBRID-001 CROSS COUNTRY FMR . . . 407
371 ALGORITHM SYNESIS-004 CROSS COUNTRY FMR . . . 408
372 ALGORITHM SYNESIS-005 CROSS COUNTRY FMR . . . 409
373 ALGORITHM TECH5-001 CROSS COUNTRY FMR . . . 410
374 ALGORITHM TECH5-002 CROSS COUNTRY FMR . . . 411
375 ALGORITHM TEVIAN-003 CROSS COUNTRY FMR . . . 412
376 ALGORITHM TEVIAN-004 CROSS COUNTRY FMR . . . 413
377 ALGORITHM TIGER-002 CROSS COUNTRY FMR . . . 414
378 ALGORITHM TIGER-003 CROSS COUNTRY FMR . . . 415
379 ALGORITHM TONGYI-005 CROSS COUNTRY FMR . . . 416
380 ALGORITHM TOSHIBA-002 CROSS COUNTRY FMR . . . 417
381 ALGORITHM TOSHIBA-003 CROSS COUNTRY FMR . . . 418
382 ALGORITHM ULUFACE-002 CROSS COUNTRY FMR . . . 419
383 ALGORITHM UPC-001 CROSS COUNTRY FMR . . . 420
384 ALGORITHM VCOG-002 CROSS COUNTRY FMR . . . 421
385 ALGORITHM VD-001 CROSS COUNTRY FMR . . . 422
386 ALGORITHM VERIDAS-001 CROSS COUNTRY FMR . . . 423
387 ALGORITHM VERIDAS-002 CROSS COUNTRY FMR . . . 424
388 ALGORITHM VIA-000 CROSS COUNTRY FMR . . . 425
389 ALGORITHM VIDEONETICS-001 CROSS COUNTRY FMR . . . 426
390 ALGORITHM VIGILANTSOLUTIONS-006 CROSS COUNTRY FMR . . . 427
391 ALGORITHM VIGILANTSOLUTIONS-007 CROSS COUNTRY FMR . . . 428
392 ALGORITHM VION-000 CROSS COUNTRY FMR . . . 429
393 ALGORITHM VISIONBOX-000 CROSS COUNTRY FMR . . . 430
394 ALGORITHM VISIONBOX-001 CROSS COUNTRY FMR . . . 431
395 ALGORITHM VISIONLABS-006 CROSS COUNTRY FMR . . . 432
396 ALGORITHM VISIONLABS-007 CROSS COUNTRY FMR . . . 433
397 ALGORITHM VOCORD-006 CROSS COUNTRY FMR . . . 434
398 ALGORITHM VOCORD-007 CROSS COUNTRY FMR . . . 435
399 ALGORITHM YISHENG-004 CROSS COUNTRY FMR . . . 436
400 ALGORITHM YITU-003 CROSS COUNTRY FMR . . . 437
401 IMPOSTOR COUNTS FOR CROSS COUNTRY FMR CALCULATIONS . . . 438

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

402 ALGORITHM 3DIVI-003 CROSS AGE FMR . . . 440
403 ALGORITHM ADERA-001 CROSS AGE FMR . . . 441
404 ALGORITHM ALCHERA-000 CROSS AGE FMR . . . 442
405 ALGORITHM ALCHERA-001 CROSS AGE FMR . . . 443
406 ALGORITHM ALLGOVISION-000 CROSS AGE FMR . . . 444
407 ALGORITHM AMPLIFIEDGROUP-001 CROSS AGE FMR . . . 445
408 ALGORITHM ANKE-003 CROSS AGE FMR . . . 446
409 ALGORITHM ANKE-004 CROSS AGE FMR . . . 447
410 ALGORITHM ANYVISION-002 CROSS AGE FMR . . . 448
411 ALGORITHM ANYVISION-004 CROSS AGE FMR . . . 449
412 ALGORITHM AWARE-003 CROSS AGE FMR . . . 450
413 ALGORITHM AWARE-004 CROSS AGE FMR . . . 451
414 ALGORITHM AYONIX-000 CROSS AGE FMR . . . 452
415 ALGORITHM BM-001 CROSS AGE FMR . . . 453
416 ALGORITHM CAMVI-002 CROSS AGE FMR . . . 454
417 ALGORITHM CAMVI-004 CROSS AGE FMR . . . 455
418 ALGORITHM CEIEC-001 CROSS AGE FMR . . . 456
419 ALGORITHM CEIEC-002 CROSS AGE FMR . . . 457
420 ALGORITHM COGENT-003 CROSS AGE FMR . . . 458
421 ALGORITHM COGENT-004 CROSS AGE FMR . . . 459
422 ALGORITHM COGNITEC-000 CROSS AGE FMR . . . 460
423 ALGORITHM COGNITEC-001 CROSS AGE FMR . . . 461
424 ALGORITHM CTBCBANK-000 CROSS AGE FMR . . . 462
425 ALGORITHM CYBEREXTRUDER-001 CROSS AGE FMR . . . 463
426 ALGORITHM CYBEREXTRUDER-002 CROSS AGE FMR . . . 464
427 ALGORITHM CYBERLINK-001 CROSS AGE FMR . . . 465
428 ALGORITHM CYBERLINK-002 CROSS AGE FMR . . . 466
429 ALGORITHM DAHUA-001 CROSS AGE FMR . . . 467
430 ALGORITHM DAHUA-002 CROSS AGE FMR . . . 468
431 ALGORITHM DEEPGLINT-001 CROSS AGE FMR . . . 469
432 ALGORITHM DEEPSEA-001 CROSS AGE FMR . . . 470
433 ALGORITHM DERMALOG-005 CROSS AGE FMR . . . 471
434 ALGORITHM DERMALOG-006 CROSS AGE FMR . . . 472
435 ALGORITHM DIGITALBARRIERS-002 CROSS AGE FMR . . . 473
436 ALGORITHM DSK-000 CROSS AGE FMR . . . 474
437 ALGORITHM EVERAI-002 CROSS AGE FMR . . . 475
438 ALGORITHM F8-001 CROSS AGE FMR . . . 476
439 ALGORITHM FACESOFT-000 CROSS AGE FMR . . . 477
440 ALGORITHM GLORY-001 CROSS AGE FMR . . . 478
441 ALGORITHM GORILLA-002 CROSS AGE FMR . . . 479
442 ALGORITHM GORILLA-003 CROSS AGE FMR . . . 480
443 ALGORITHM HIK-001 CROSS AGE FMR . . . 481
444 ALGORITHM HR-000 CROSS AGE FMR . . . 482
445 ALGORITHM HR-001 CROSS AGE FMR . . . 483
446 ALGORITHM ID3-003 CROSS AGE FMR . . . 484
447 ALGORITHM ID3-004 CROSS AGE FMR . . . 485
448 ALGORITHM IDEMIA-003 CROSS AGE FMR . . . 486
449 ALGORITHM IDEMIA-004 CROSS AGE FMR . . . 487
450 ALGORITHM IIT-000 CROSS AGE FMR . . . 488
451 ALGORITHM IIT-001 CROSS AGE FMR . . . 489
452 ALGORITHM IMAGUS-000 CROSS AGE FMR . . . 490
453 ALGORITHM IMPERIAL-000 CROSS AGE FMR . . . 491
454 ALGORITHM IMPERIAL-001 CROSS AGE FMR . . . 492
455 ALGORITHM INCODE-003 CROSS AGE FMR . . . 493
456 ALGORITHM INCODE-004 CROSS AGE FMR . . . 494
457 ALGORITHM INNOVATRICS-004 CROSS AGE FMR . . . 495

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

458 ALGORITHM INNOVATRICS-005 CROSS AGE FMR . . . 496
459 ALGORITHM INTELLIVISION-001 CROSS AGE FMR . . . 497
460 ALGORITHM IQFACE-000 CROSS AGE FMR . . . 498
461 ALGORITHM ISITYOU-000 CROSS AGE FMR . . . 499
462 ALGORITHM ISYSTEMS-001 CROSS AGE FMR . . . 500
463 ALGORITHM ISYSTEMS-002 CROSS AGE FMR . . . 501
464 ALGORITHM ITMO-005 CROSS AGE FMR . . . 502
465 ALGORITHM ITMO-006 CROSS AGE FMR . . . 503
466 ALGORITHM KAKAO-001 CROSS AGE FMR . . . 504
467 ALGORITHM KAKAO-002 CROSS AGE FMR . . . 505
468 ALGORITHM KEDACOM-000 CROSS AGE FMR . . . 506
469 ALGORITHM KNERON-003 CROSS AGE FMR . . . 507
470 ALGORITHM LOOKMAN-002 CROSS AGE FMR . . . 508
471 ALGORITHM LOOKMAN-004 CROSS AGE FMR . . . 509
472 ALGORITHM MEGVII-001 CROSS AGE FMR . . . 510
473 ALGORITHM MEGVII-002 CROSS AGE FMR . . . 511
474 ALGORITHM MEIYA-001 CROSS AGE FMR . . . 512
475 ALGORITHM MICROFOCUS-001 CROSS AGE FMR . . . 513
476 ALGORITHM MICROFOCUS-002 CROSS AGE FMR . . . 514
477 ALGORITHM MT-000 CROSS AGE FMR . . . 515
478 ALGORITHM NEUROTECHNOLOGY-006 CROSS AGE FMR . . . 516
479 ALGORITHM NODEFLUX-001 CROSS AGE FMR . . . 517
480 ALGORITHM NOTIONTAG-000 CROSS AGE FMR . . . 518
481 ALGORITHM NTECHLAB-006 CROSS AGE FMR . . . 519
482 ALGORITHM NTECHLAB-007 CROSS AGE FMR . . . 520
483 ALGORITHM PIXELALL-002 CROSS AGE FMR . . . 521
484 ALGORITHM PSL-001 CROSS AGE FMR . . . 522
485 ALGORITHM PSL-002 CROSS AGE FMR . . . 523
486 ALGORITHM RANKONE-006 CROSS AGE FMR . . . 524
487 ALGORITHM RANKONE-007 CROSS AGE FMR . . . 525
488 ALGORITHM REALNETWORKS-002 CROSS AGE FMR . . . 526
489 ALGORITHM REALNETWORKS-003 CROSS AGE FMR . . . 527
490 ALGORITHM REMARKAI-000 CROSS AGE FMR . . . 528
491 ALGORITHM REMARKAI-001 CROSS AGE FMR . . . 529
492 ALGORITHM SAFFE-001 CROSS AGE FMR . . . 530
493 ALGORITHM SAFFE-002 CROSS AGE FMR . . . 531
494 ALGORITHM SENSETIME-001 CROSS AGE FMR . . . 532
495 ALGORITHM SENSETIME-002 CROSS AGE FMR . . . 533
496 ALGORITHM SHAMAN-000 CROSS AGE FMR . . . 534
497 ALGORITHM SHAMAN-001 CROSS AGE FMR . . . 535
498 ALGORITHM SHU-001 CROSS AGE FMR . . . 536
499 ALGORITHM SIAT-002 CROSS AGE FMR . . . 537
500 ALGORITHM SIAT-004 CROSS AGE FMR . . . 538
501 ALGORITHM SMILART-002 CROSS AGE FMR . . . 539
502 ALGORITHM SMILART-003 CROSS AGE FMR . . . 540
503 ALGORITHM STARHYBRID-001 CROSS AGE FMR . . . 541
504 ALGORITHM SYNESIS-004 CROSS AGE FMR . . . 542
505 ALGORITHM SYNESIS-005 CROSS AGE FMR . . . 543
506 ALGORITHM TECH5-001 CROSS AGE FMR . . . 544
507 ALGORITHM TECH5-002 CROSS AGE FMR . . . 545
508 ALGORITHM TEVIAN-003 CROSS AGE FMR . . . 546
509 ALGORITHM TEVIAN-004 CROSS AGE FMR . . . 547
510 ALGORITHM TIGER-002 CROSS AGE FMR . . . 548
511 ALGORITHM TIGER-003 CROSS AGE FMR . . . 549
512 ALGORITHM TONGYI-005 CROSS AGE FMR . . . 550
513 ALGORITHM TOSHIBA-002 CROSS AGE FMR . . . 551
514 ALGORITHM TOSHIBA-003 CROSS AGE FMR . . . 552

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

515 ALGORITHM ULUFACE-002 CROSS AGE FMR . . . 553
516 ALGORITHM UPC-001 CROSS AGE FMR . . . 554
517 ALGORITHM VCOG-002 CROSS AGE FMR . . . 555
518 ALGORITHM VD-001 CROSS AGE FMR . . . 556
519 ALGORITHM VERIDAS-001 CROSS AGE FMR . . . 557
520 ALGORITHM VERIDAS-002 CROSS AGE FMR . . . 558
521 ALGORITHM VIA-000 CROSS AGE FMR . . . 559
522 ALGORITHM VIDEONETICS-001 CROSS AGE FMR . . . 560
523 ALGORITHM VIGILANTSOLUTIONS-006 CROSS AGE FMR . . . 561
524 ALGORITHM VIGILANTSOLUTIONS-007 CROSS AGE FMR . . . 562
525 ALGORITHM VION-000 CROSS AGE FMR . . . 563
526 ALGORITHM VISIONBOX-000 CROSS AGE FMR . . . 564
527 ALGORITHM VISIONBOX-001 CROSS AGE FMR . . . 565
528 ALGORITHM VISIONLABS-006 CROSS AGE FMR . . . 566
529 ALGORITHM VISIONLABS-007 CROSS AGE FMR . . . 567
530 ALGORITHM VOCORD-006 CROSS AGE FMR . . . 568
531 ALGORITHM VOCORD-007 CROSS AGE FMR . . . 569
532 ALGORITHM WINSENSE-000 CROSS AGE FMR . . . 570
533 ALGORITHM YISHENG-004 CROSS AGE FMR . . . 571
534 ALGORITHM YITU-003 CROSS AGE FMR . . . 572

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

	Developer	Short	Seq.	Validation	Config[1]	Template		GPU	Comparison Time (ns)[3]	
	Name	Name	Num.	Date	Data (KB)	Size (B)	Time (ms)[2]		Genuine	Impostor
1	3DiVi	3divi	003	2018-10-09	191636	[132]4096 ± 0	[91]650 ± 90	No	[23]627 ± 11	[26]623 ± 32
2	3DiVi	3divi	004	2019-07-22	263670	[73]2048 ± 0	[139]984 ± 131	No	[35]794 ± 35	[38]801 ± 40
3	Adera Global PTE Ltd	adera	001	2019-06-17	0	[120]2560 ± 0	[4]97 ± 0	No	[69]1604 ± 71	[70]1649 ± 56
4	Alchera	alchera	000	2019-03-01	258450	[66]2048 ± 0	[81]587 ± 13	No	[97]3189 ± 32	[97]3031 ± 142
5	Alchera	alchera	000	2019-03-01	174013	[64]2048 ± 0	[87]627 ± 11	No	[100]3342 ± 81	[99]3243 ± 47
6	AllGoVision	allgovision	000	2019-03-01	172509	[82]2048 ± 0	[51]384 ± 8	No	[131]29903 ± 406	[132]29735 ± 194
7	Amplified Group	amplifiedgroup	001	2019-03-01	0	[27]866 ± 2	[3]93 ± 0	No	[135]57803 ± 4210	[135]56365 ± 1196
8	Anke Investments	anke	003	2019-02-27	340160	[109]2056 ± 0	[122]811 ± 23	No	[9]425 ± 28	[11]437 ± 32
9	Anke Investments	anke	004	2019-06-27	349388	[108]2056 ± 0	[86]625 ± 1	No	[24]633 ± 22	[28]632 ± 34
10	AnyVision	anyvision	002	2018-01-31	662659	[36]1024 ± 0	[21]248 ± 0	No	[136]74069 ± 188	[136]74019 ± 198
11	AnyVision	anyvision	004	2018-06-15	401001	[32]1024 ± 0	[43]355 ± 1	No	[76]1891 ± 51	[74]1829 ± 85
12	Aware	aware	003	2018-10-19	377729	[123]3108 ± 0	[118]783 ± 10	No	[61]1392 ± 42	[64]1334 ± 80
13	Aware	aware	004	2019-03-01	427829	[117]2084 ± 0	[135]900 ± 10	No	[58]1279 ± 50	[63]1287 ± 100
14	Ayonix	ayonix	000	2017-06-22	58505	[37]1036 ± 0	[1]18 ± 2	No	[22]621 ± 23	[25]620 ± 26
15	Bitmain	bitmain	001	2018-10-17	287734	[1]64 ± 0	[59]444 ± 88	No	[75]1887 ± 31	[76]1877 ± 26
16	Camvi Technologies	camvitech	002	2018-10-19	236278	[34]1024 ± 0	[103]677 ± 7	No	[21]612 ± 26	[22]603 ± 20
17	Camvi Technologies	camvitech	004	2019-07-12	280733	[79]2048 ± 0	[115]759 ± 10	No	[41]948 ± 40	[44]963 ± 31
18	China Electronics Import-Export Corp	ceiec	001	2019-03-01	159618	[35]1024 ± 0	[37]314 ± 3	No	[129]22831 ± 108	[129]22813 ± 120
19	China Electronics Import-Export Corp	ceiec	002	2019-06-12	269063	[63]2048 ± 0	[84]612 ± 17	No	[85]2188 ± 57	[85]2301 ± 56
20	Gemalto Cogent	cogent	003	2019-03-01	698290	[28]973 ± 0	[137]952 ± 0	No	[117]12496 ± 75	[117]11822 ± 163
21	Gemalto Cogent	cogent	004	2019-06-14	722919	[55]1983 ± 0	[136]941 ± 28	No	[120]14448 ± 56	[121]15882 ± 81
22	Cognitec Systems GmbH	cognitec	000	2018-10-19	474759	[97]2052 ± 0	[18]224 ± 1	No	[104]3835 ± 108	[103]3782 ± 83
23	Cognitec Systems GmbH	cognitec	001	2019-03-01	476809	[103]2052 ± 0	[33]297 ± 17	No	[106]4253 ± 59	[105]4102 ± 167
24	CTBC Bank Co. Ltd	ctbcbank	000	2019-06-28	257208	[67]2048 ± 0	[78]568 ± 43	No	[102]3551 ± 87	[106]4805 ± 209
25	Cyberextruder	cyberex	001	2017-08-02	121211	[9]256 ± 0	[134]893 ± 25	No	[47]1083 ± 16	[51]1079 ± 19
26	Cyberextruder	cyberex	002	2018-01-30	168909	[59]2048 ± 0	[68]532 ± 6	No	[74]1803 ± 14	[73]1779 ± 22
27	Cyberlink Corp	cyberlink	001	2019-03-01	222009	[106]2052 ± 0	[57]425 ± 29	No	[81]2051 ± 32	[81]2060 ± 31
28	Cyberlink Corp	cyberlink	002	2019-06-12	222311	[99]2052 ± 0	[94]656 ± 22	No	[87]2264 ± 71	[94]2649 ± 195
29	Dahua Technology Co. Ltd	dahua	001	2018-10-19	283642	[90]2048 ± 0	[46]363 ± 6	No	[6]367 ± 10	[7]354 ± 16
30	Dahua Technology Co. Ltd	dahua	002	2019-03-01	526452	[65]2048 ± 0	[88]628 ± 7	No	[11]461 ± 23	[13]454 ± 20
31	Deepglint	deepglint	001	2019-06-21	569802	[129]4096 ± 0	[107]721 ± 4	No	[103]3680 ± 35	[102]3517 ± 182
32	Tencent Deepsea Lab	deepsea	001	2019-06-03	147497	[29]1024 ± 0	[89]630 ± 7	No	[63]1401 ± 37	[66]1467 ± 50
33	Dermalog	dermalog	005	2018-02-02	0	[2]128 ± 0	[6]130 ± 11	No	[14]499 ± 22	[16]500 ± 22
34	Dermalog	dermalog	006	2018-10-18	0	[3]128 ± 0	[67]532 ± 12	No	[15]506 ± 23	[14]459 ± 23
35	Digital Barriers	barriers	002	2019-03-01	83002	[110]2056 ± 0	[15]209 ± 11	No	[119]13409 ± 228	[119]13267 ± 206
36	DSK	dsk	000	2019-06-28	11967	[18]512 ± 0	[35]304 ± 47	No	[113]7152 ± 115	[113]7134 ± 111
37	Ever AI	everai	002	2019-03-01	561727	[133]4096 ± 0	[113]758 ± 0	No	[26]644 ± 14	[27]624 ± 35
38	Ever AI Paravision	everai paravision	003	2019-07-01	539802	[128]4096 ± 0	[101]674 ± 4	No	[31]699 ± 20	[32]713 ± 47
39	FarBar Inc.	f8	001	2019-07-11	272977	[62]2048 ± 0	[126]822 ± 39	No	[121]15262 ± 139	[120]15277 ± 212
40	FaceSoft Ltd.	facesoft	000	2019-07-10	370120	[91]2048 ± 0	[102]675 ± 18	No	[86]2239 ± 28	[84]2277 ± 96
41	Glory Ltd	glory	000	2018-06-06	0	[15]418 ± 0	[8]165 ± 2	No	[112]7003 ± 84	[111]6978 ± 71
42	Glory Ltd	glory	001	2018-06-08	0	[52]1726 ± 0	[53]393 ± 2	No	[116]9607 ± 128	[116]9539 ± 182
43	Gorilla Technology	gorilla	002	2018-10-17	93869	[42]1132 ± 0	[40]322 ± 14	No	[94]2715 ± 68	[93]2585 ± 84
44	Gorilla Technology	gorilla	003	2019-06-19	94409	[41]1132 ± 0	[42]334 ± 25	No	[95]2840 ± 42	[95]2865 ± 87

Notes	
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Table 1: Summary of algorithms and properties included in this report. The red superscripts give ranking for the quantity in that column.

	Developer	Short	Seq.	Validation	Config[1]	Template		GPU	Comparison Time (ns)[3]	
	Name	Name	Num.	Date	Data (KB)	Size (B)	Time (ms)[2]		Genuine	Impostor
45	Hikvision	hik	001	2019-03-01	667866	[46]1408 ± 0	[92]651 ± 0	No	[13]488 ± 19	[15]477 ± 22
46	Hengrui AI Technology Ltd	hr	000	2019-03-01	284600	[115]2057 ± 0	[82]600 ± 2	No	[122]16747 ± 238	[122]16627 ± 220
47	Hengrui AI Technology Ltd	hr	001	2019-06-04	346156	[114]2057 ± 0	[95]665 ± 3	No	[124]17816 ± 260	[124]17878 ± 464
48	ID3 Technology	id3	003	2018-10-05	265951	[11]264 ± 0	[38]316 ± 19	No	[60]1330 ± 25	[65]1354 ± 28
49	ID3 Technology	id3	004	2019-03-01	171526	[10]264 ± 0	[73]541 ± 11	No	[49]1135 ± 23	[56]1156 ± 32
50	Idemia	Idemia	003	2018-10-19	427244	[14]352 ± 0	[47]368 ± 6	No	[111]6654 ± 75	[107]4835 ± 90
51	Idemia	Idemia	004	2019-03-01	406924	[13]352 ± 0	[36]306 ± 5	No	[109]5592 ± 518	[110]5533 ± 426
52	Institute of Information Technologies	ittvision	000	2019-03-01	237317	[33]1024 ± 0	[14]197 ± 8	No	[66]1537 ± 81	[62]1282 ± 20
53	Institute of Information Technologies	ittvision	001	2019-07-05	269176	[75]2048 ± 0	[105]699 ± 4	No	[45]1060 ± 48	[49]1074 ± 54
54	Imagus Technology Pty Ltd	imagus	000	2019-06-19	183453	[84]2048 ± 0	[58]425 ± 24	No	[50]1145 ± 25	[72]1718 ± 63
55	Imperial College London	imperial	000	2019-03-01	370120	[72]2048 ± 0	[97]669 ± 1	No	[83]2130 ± 32	[80]2052 ± 100
56	Imperial College London	imperial	001	2019-03-01	370260	[87]2048 ± 0	[99]671 ± 0	No	[82]2090 ± 28	[82]2062 ± 74
57	Incode Technologies Inc	incode	003	2019-03-01	170632	[131]4096 ± 0	[50]384 ± 11	No	[78]1928 ± 44	[75]1876 ± 81
58	Incode Technologies Inc	incode	004	2019-06-12	260224	[61]2048 ± 0	[61]479 ± 23	No	[77]1913 ± 60	[89]2443 ± 114
59	Innovatrics	innova	004	2018-10-19	0	[39]1076 ± 0	[52]391 ± 0	No	[115]8573 ± 274	[114]7929 ± 244
60	Innovatrics	innova	005	2019-03-01	0	[40]1076 ± 0	[79]577 ± 1	No	[123]16880 ± 194	[123]17232 ± 385
61	Intellivision	intellivision	001	2017-10-10	43692	[112]2056 ± 0	[2]62 ± 2	No	[90]2573 ± 91	[92]2544 ± 38
62	Lomonosov Moscow State University	intsysmsu	000	2019-06-18	650193	[60]2048 ± 0	[69]535 ± 20	No	[19]610 ± 22	[24]613 ± 31
63	iQIYI Inc	iqface	000	2019-06-04	268819	[137]4750 ± 32	[70]538 ± 26	No	[139]636433 ± 38446	[139]632654 ± 85615
64	Is It You	isityou	000	2017-06-26	48010	[138]19200 ± 0	[5]113 ± 5	No	[137]237517 ± 1318	[137]237374 ± 1279
65	Innovation Systems	isystems	001	2018-06-12	274621	[56]2048 ± 0	[31]291 ± 9	No	[17]557 ± 16	[19]564 ± 22
66	Innovation Systems	isystems	002	2018-10-18	358984	[78]2048 ± 0	[125]822 ± 8	No	[33]749 ± 31	[29]632 ± 28
67	ITMO University	itmo	005	2018-10-19	482155	[136]4173 ± 0	[114]759 ± 1	No	[118]13214 ± 164	[118]12576 ± 257
68	ITMO University	itmo	006	2019-03-01	599187	[119]2121 ± 0	[123]814 ± 1	No	[130]26154 ± 148	[130]26217 ± 260
69	Kakao Corp	kakao	001	2019-03-01	107616	[31]1024 ± 0	[49]379 ± 1	No	[39]930 ± 22	[43]948 ± 38
70	Kakao Corp	kakao	002	2019-06-19	479406	[92]2048 ± 0	[111]747 ± 6	No	[72]1720 ± 62	[71]1715 ± 83
71	Kedacom International Pte	kedacom	000	2019-06-03	245292	[12]292 ± 0	[64]506 ± 3	No	[27]684 ± 14	[30]682 ± 16
72	Kneron Inc	kenron	003	2019-07-01	58366	[70]2048 ± 0	[29]281 ± 3	No	[108]5237 ± 63	[109]5274 ± 99
73	Lookman Electroplast Industries	lookman	002	2018-06-13	138200	[24]548 ± 0	[9]173 ± 1	No	[20]610 ± 19	[23]612 ± 22
74	Lookman Electroplast Industries	lookman	004	2019-06-03	244775	[23]548 ± 0	[65]507 ± 5	No	[37]871 ± 29	[42]878 ± 29
75	Megvii/Face++	megvii	001	2018-06-15	1361523	[89]2048 ± 0	[75]543 ± 0	No	[107]5228 ± 32	[108]5252 ± 60
76	Megvii/Face++	megvii	002	2018-10-19	1809564	[135]4100 ± 0	[90]644 ± 0	No	[134]50630 ± 183	[134]47591 ± 716
77	Xiamen Meiya Pico Information Co. Ltd	meiya	001	2019-03-01	280055	[95]2049 ± 0	[85]622 ± 12	No	[114]8356 ± 615	[115]8134 ± 97
78	MicroFocus	microfocus	001	2018-06-13	104524	[8]256 ± 0	[25]264 ± 18	No	[1]215 ± 8	[1]217 ± 10
79	MicroFocus	microfocus	002	2018-10-17	96288	[6]256 ± 0	[23]259 ± 18	No	[4]337 ± 34	[2]230 ± 25
80	Moontime Smart Technology	mt	000	2019-06-03	372169	[93]2049 ± 0	[108]724 ± 12	No	[71]1678 ± 47	[69]1614 ± 85
81	Neurotechnology	neurotech	005	2019-03-01	270450	[7]256 ± 0	[55]399 ± 0	No	[2]238 ± 10	[3]237 ± 7
82	Neurotechnology	neurotech	006	2019-06-26	525541	[19]512 ± 0	[104]678 ± 56	No	[16]513 ± 14	[18]535 ± 26
83	Nodeflux	nodeflux	000	2019-03-01	347079	[58]2048 ± 0	[74]542 ± 1	No	[99]3283 ± 51	[101]3285 ± 56
84	Nodeflux	nodeflux	001	2019-03-01	262553	[77]2048 ± 0	[20]247 ± 1	No	[98]3242 ± 81	[100]3255 ± 93
85	NotionTag Technologies Private Limited	notiontag	000	2019-06-12	92753	[25]584 ± 0	[76]548 ± 64	No	[133]44672 ± 269	[133]44593 ± 358
86	N-Tech Lab	ntech	006	2019-03-01	7901590	[122]2600 ± 0	[112]749 ± 1	No	[44]1055 ± 93	[41]844 ± 48
87	N-Tech Lab	ntech	007	2019-06-25	2509686	[124]3348 ± 0	[120]792 ± 3	No	[53]1209 ± 59	[60]1267 ± 65
88	Guangzhou Pixel Solutions Co. Ltd	pixelall	002	2019-06-06	0	[121]2560 ± 0	[13]191 ± 1	No	[54]1223 ± 56	[58]1230 ± 47

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	Developer	Short	Seq.	Validation	Config[1]	Template		GPU	Comparison Time (ns)[3]	
	Name	Name	Num.	Date	Data (KB)	Size (B)	Time (ms)[2]		Genuine	Impostor
89	Panasonic R+D Center Singapore	psl	001	2018-10-12	382035	[113]2056 ± 0	[119]785 ± 16	No	[3]298 ± 13	[4]292 ± 14
90	Panasonic R+D Center Singapore	psl	002	2019-02-28	804934	[100]2052 ± 0	[133]888 ± 9	No	[68]1590 ± 48	[52]1133 ± 78
91	Rank One Computing	rankone	006	2019-02-27	0	[5]165 ± 0	[16]210 ± 1	No	[10]443 ± 26	[9]395 ± 22
92	Rank One Computing	rankone	007	2019-06-03	0	[4]165 ± 0	[19]245 ± 5	No	[28]688 ± 20	[21]601 ± 16
93	Realnetworks Inc	realnetworks	002	2019-02-28	95328	[54]1848 ± 0	[22]250 ± 2	No	[59]1285 ± 17	[59]1247 ± 42
94	Realnetworks Inc	realnetworks	003	2019-06-12	95334	[53]1848 ± 0	[11]177 ± 10	No	[65]1516 ± 29	[67]1522 ± 60
95	KanKan Ai	remarkai	000	2019-03-01	240152	[57]2048 ± 0	[127]829 ± 7	No	[38]873 ± 4	[40]835 ± 35
96	KanKan Ai	remarkai	001	2019-03-01	241857	[102]2052 ± 0	[128]831 ± 6	No	[55]1229 ± 20	[39]805 ± 56
97	Saffe Ltd	saffe	001	2018-10-19	85973	[44]1280 ± 0	[28]281 ± 1	No	[57]1274 ± 19	[61]1277 ± 26
98	Saffe Ltd	saffe	002	2019-03-01	260622	[83]2048 ± 0	[124]817 ± 11	No	[32]717 ± 7	[33]714 ± 29
99	Sensetime Group Ltd	sensetime	002	2018-10-19	531783	[96]2052 ± 0	[109]725 ± 3	No	[89]2546 ± 102	[87]2371 ± 45
100	Sensetime Group Ltd	sensetime	002	2018-10-19	531783	[104]2052 ± 0	[121]797 ± 3	No	[93]2713 ± 90	[86]2301 ± 25
101	Shaman Software	shaman	000	2017-12-05	0	[130]4096 ± 0	[93]653 ± 16	No	[7]380 ± 25	[8]379 ± 31
102	Shaman Software	shaman	001	2018-01-13	0	[126]4096 ± 0	[32]294 ± 2	No	[25]635 ± 19	[12]441 ± 25
103	Shanghai Universiy - Shanghai Film Academy	shu	001	2019-06-17	329513	[88]2048 ± 0	[83]612 ± 5	No	[92]2619 ± 19	[96]2987 ± 143
104	Shenzhen Inst. Adv. Integrated Tech. CAS	SIAT	002	2018-06-13	486842	[105]2052 ± 0	[80]579 ± 0	No	[34]769 ± 13	[35]750 ± 13
105	Shenzhen Inst. Adv. Integrated Tech. CAS	SIAT	004	2019-03-01	940063	[134]4100 ± 0	[98]670 ± 0	No	[105]4013 ± 45	[104]3782 ± 173
106	Smilart	smilart	002	2018-02-06	111826	[30]1024 ± 0	[10]176 ± 16	No	[126]18784 ± 136	[127]18795 ± 151
107	Smilart	smilart	003	2018-06-18	67339	[17]512 ± 0	[12]180 ± 12	No	[62]1395 ± 74	[47]1027 ± 66
108	Star Hybrid Limited	starhybrid	001	2019-06-19	100509	[68]2048 ± 0	[45]358 ± 82	No	[46]1075 ± 51	[50]1078 ± 53
109	Synesis	synesis	004	2019-03-01	270628	[86]2048 ± 0	[110]735 ± 15	No	[8]424 ± 14	[10]430 ± 22
110	Synesis	synesis	005	2019-06-06	146509	[76]2048 ± 0	[17]211 ± 9	No	[18]599 ± 23	[20]581 ± 32
111	Tech5 SA	tech5	001	2018-10-19	636346	[127]4096 ± 0	[66]522 ± 5	No	[48]1087 ± 34	[36]799 ± 44
112	Tech5 SA	tech5	002	2019-03-01	1150887	[45]1280 ± 0	[116]780 ± 10	No	[64]1406 ± 120	[48]1048 ± 57
113	Tevian	tevian	003	2018-10-19	791725	[94]2049 ± 0	[56]404 ± 15	No	[5]350 ± 11	[6]338 ± 25
114	Tevian	tevian	004	2019-03-01	863474	[69]2048 ± 0	[63]506 ± 30	No	[12]474 ± 31	[5]326 ± 20
115	TigerIT Americas LLC	tiger	002	2018-06-13	341638	[111]2056 ± 0	[54]393 ± 20	No	[84]2135 ± 29	[83]2137 ± 38
116	TigerIT Americas LLC	tiger	003	2018-10-16	426164	[107]2056 ± 0	[60]458 ± 21	No	[80]2031 ± 35	[79]2029 ± 38
117	TongYi Transportation Technology	tongyi	005	2019-06-12	1140701	[118]2089 ± 0	[7]165 ± 1	No	[127]18924 ± 65	[128]20158 ± 103
118	Toshiba	toshiba	002	2018-10-19	813606	[49]1560 ± 0	[72]541 ± 0	No	[101]3521 ± 369	[90]2449 ± 124
119	Toshiba	toshiba	003	2019-03-01	984125	[50]1560 ± 0	[71]540 ± 0	No	[88]2390 ± 41	[88]2407 ± 81
120	Shanghai Ulucu Electronics Technology Co. Ltd	uluface	002	2019-07-10	0	[74]2048 ± 0	[131]873 ± 42	No	[128]19207 ± 1114	[126]18501 ± 274
121	China University of Petroleum	upc	001	2019-06-05	0	[38]1052 ± 0	[77]551 ± 15	No	[96]3114 ± 44	[98]3165 ± 97
122	VCognition	vcog	002	2017-06-12	3229434	[139]61504 ± 5	[44]357 ± 25	No	[138]296154 ± 3077	[138]296436 ± 4183
123	Visidon	visidon	001	2019-02-26	170262	[98]2052 ± 0	[39]316 ± 6	No	[56]1258 ± 38	[54]1148 ± 109
124	Veridas Digital Authentication Solutions S.L.	veridas	001	2019-03-01	196540	[71]2048 ± 0	[100]671 ± 21	No	[110]5748 ± 20	[112]7111 ± 148
125	Veridas Digital Authentication Solutions S.L.	veridas	000	2019-03-01	193466	[22]512 ± 0	[96]669 ± 20	No	[73]1733 ± 81	[77]1934 ± 44
126	Via Technologies Inc.	via	000	2019-07-08	124422	[80]2048 ± 0	[106]707 ± 8	No	[43]966 ± 28	[46]1021 ± 44
127	Videonetics Technology Pvt Ltd	videonetics	001	2019-06-19	30875	[16]512 ± 0	[24]262 ± 3	No	[51]1153 ± 38	[53]1142 ± 65
128	Vigilant Solutions	vigilant	006	2019-03-01	343048	[48]1548 ± 0	[129]841 ± 8	No	[40]939 ± 32	[31]711 ± 37
129	Vigilant Solutions	vigilant	007	2019-06-27	255600	[47]1548 ± 0	[62]493 ± 6	No	[36]803 ± 35	[37]800 ± 40
130	Beijing Vion Technology Inc	vion	000	2018-10-19	228219	[101]2052 ± 0	[41]333 ± 1	No	[132]39839 ± 3561	[131]26830 ± 2241
131	Vision-Box	visionbox	000	2019-02-26	176501	[85]2048 ± 0	[34]304 ± 7	No	[70]1648 ± 57	[57]1192 ± 42
132	Vision-Box	visionbox	001	2019-03-01	256869	[81]2048 ± 0	[138]983 ± 7	No	[52]1161 ± 22	[55]1154 ± 20

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	Developer	Short	Seq.	Validation	Config[1]	Template		GPU	Comparison Time (ns)[3]	
	Name	Name	Num.	Date	Data (KB)	Size (B)	Time (ms)[2]		Genuine	Impostor
133	VisionLabs	visionlabs	006	2019-03-01	353044	[21]512 ± 0	[26]270 ± 0	No	[30]698 ± 19	[34]734 ± 28
134	VisionLabs	visionlabs	007	2019-06-12	357204	[20]512 ± 0	[27]272 ± 0	No	[42]965 ± 41	[45]972 ± 31
135	Vocord	vocord	006	2019-03-01	559457	[26]768 ± 0	[132]886 ± 1	No	[79]2020 ± 72	[78]1969 ± 62
136	Vocord	vocord	007	2019-06-06	587489	[51]1664 ± 0	[117]780 ± 2	No	[91]2593 ± 83	[91]2526 ± 59
137	Winsense Co. Ltd	winsense	000	2019-06-17	270819	[43]1280 ± 0	[30]283 ± 1	No	[67]1551 ± 31	[68]1532 ± 42
138	Zhuhai Yisheng Electronics Technology	yisheng	004	2018-06-12	486351	[125]3704 ± 0	[48]378 ± 12	No	[29]693 ± 137	[17]526 ± 34
139	Shanghai Yitu Technology	yitu	003	2019-03-01	1525719	[116]2082 ± 0	[130]860 ± 0	No	[125]18305 ± 71	[125]18286 ± 62

Notes	
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Table 4: Summary of algorithms and properties included in this report. The red superscripts give ranking for the quantity in that column.

		FALSE NON-MATCH RATE (FNMR)											
	Algorithm	CONSTRAINED, COOPERATIVE								LESS CONSTRAINED, NON-COOP.			
	Name	crossEV		visaMC		visa		visa		mugshot		wild		child exp	
	FMR	1e-06		0.0001		1e-06		0.0001		1e-05		0.0001		0.01	
1	3divi-003	-		0.0318	96	0.0588	97	0.0097	86	0.0389	94	0.0867	90	0.536	27
2	3divi-004	-		0.0095	28	0.0153	30	0.0049	45	0.0097	28	0.0665	85	-	
3	adera-001	-		0.1021	111	0.1757	111	0.0368	110	0.1823	117	0.1965	106	0.720	57
4	alchera-000	-		0.0165	65	0.0243	56	0.0086	81	0.0125	52	0.0370	50	-	
5	alchera-001	-		0.0183	70	0.0299	69	0.0078	76	0.0142	58	0.0372	51	-	
6	allgovision-000	-		0.0346	98	0.0527	94	0.0210	102	0.0232	82	0.0607	83	-	
7	amplifiedgroup-001	-		0.5034	130	0.5848	130	0.2999	131	0.6973	129	0.4250	122	-	
8	anke-003	-		0.0131	49	0.0213	48	0.0056	52	0.0094	24	0.0302	21	-	
9	anke-004	-		0.0080	21	0.0154	31	0.0031	18	0.0073	12	0.0288	16	0.358	4
10	anyvision-002	-		0.0660	106	0.0898	103	0.0387	111	0.0928	110	0.2227	108	0.696	50
11	anyvision-004	-		0.0267	91	0.0385	85	0.0081	77	0.0258	84	0.0470	69	0.463	12
12	aware-003	-		0.0793	108	0.1161	108	0.0288	108	0.1028	111	0.3180	119	0.851	71
13	aware-004	-		0.0690	107	0.0949	106	0.0257	105	0.0837	108	0.0516	76	-	
14	ayonix-000	-		0.4351	127	0.4872	125	0.2299	128	0.6150	127	0.3635	120	0.843	69
15	bm-001	-		0.7431	135	0.9494	136	0.6188	136	0.9586	133	0.9935	126	0.884	76
16	camvi-002	-		0.0125	44	0.0221	52	0.0049	46	0.0089	22	0.0288	15	0.576	33
17	camvi-004	-		0.0171	68	0.0316	74	0.0049	44	0.0042	4	0.0284	12	-	
18	ceiec-001	-		0.0328	97	0.0475	91	0.0163	96	0.0295	89	0.0847	87	-	
19	ceiec-002	-		0.0161	63	0.0193	43	0.0124	94	0.0122	50	0.0465	68	0.516	24
20	cogent-003	0.0187	12	0.0091	24	0.0188	42	0.0032	19	0.0098	30	0.0406	57	-	
21	cogent-004	-		0.0064	13	0.0116	19	0.0024	14	0.0096	26	0.0379	52	0.718	56
22	cognitec-000	-		0.0116	39	0.0177	37	0.0036	25	0.0118	47	0.0953	94	0.837	67
23	cognitec-001	-		0.0126	45	0.0185	41	0.0047	40	0.0120	49	0.0598	82	-	
24	ctbcbank-000	-		0.0168	66	0.0250	61	0.0064	58	0.0146	61	1.0000	134	0.880	74
25	cyberextruder-001	-		0.1972	119	0.2547	118	0.0755	120	0.4686	125	0.1747	103	0.780	65
26	cyberextruder-002	-		0.0811	109	0.1336	110	0.0265	106	0.1465	115	0.1000	96	0.610	37
27	cyberlink-001	-		0.0131	48	0.0210	47	0.0050	47	0.0439	98	0.0318	33	-	
28	cyberlink-002	-		0.0114	38	0.0195	44	0.0044	34	0.0101	32	0.0298	19	0.500	18
29	dahua-001	-		0.0250	86	0.0466	90	0.0108	91	0.0228	80	0.0457	67	0.504	20
30	dahua-002	0.0134	7	0.0129	46	0.0157	33	0.0090	84	0.0116	46	0.0323	35	-	
31	deepglint-001	-		0.0040	6	0.0062	5	0.0014	7	0.0047	5	0.0278	6	0.401	7
32	deepsea-001	-		0.0136	52	0.0215	50	0.0071	72	0.0142	59	0.0347	44	0.561	31
33	dermalog-005	-		0.1526	117	0.1823	113	0.0658	118	0.2580	120	0.0855	89	0.684	47
34	dermalog-006	-		0.0253	87	0.0369	83	0.0172	99	0.0171	67	0.0623	84	0.585	34
35	digitalbarriers-002	-		0.3360	124	0.3690	123	0.0968	123	0.0877	109	0.0436	61	-	
36	dsk-000	-		0.1526	116	0.2169	115	0.0765	121	0.3787	124	0.2201	107	0.731	59
37	everai-002	0.0182	11	0.0104	35	0.0159	34	0.0041	32	0.0063	7	0.0294	17	-	
38	everai-paravision-003	-		0.0034	2	0.0050	3	0.0011	3	0.0036	2	0.0278	7	0.267	1
39	f8-001	-		0.0249	85	0.0336	75	0.0182	100	0.0178	69	0.0475	70	0.527	25
40	facesoft-000	-		0.0085	23	0.0112	18	0.0032	20	0.0064	8	0.0275	2	0.499	17
41	glory-000	-		0.1094	112	0.1286	109	0.0514	115	0.2179	118	0.4762	124	0.894	77
42	glory-001	-		0.0902	110	0.1082	107	0.0410	112	0.1642	116	0.4261	123	0.883	75
43	gorilla-002	-		0.0256	88	0.0413	86	0.0076	75	0.0478	101	0.0507	74	0.616	38
44	gorilla-003	-		0.0165	64	0.0291	66	0.0053	49	0.0205	76	0.0359	48	0.976	82
45	hik-001	-		0.0096	29	0.0125	21	0.0036	27	0.0093	23	0.0271	1	-	
46	hr-000	-		0.0265	90	0.0434	87	0.0112	93	0.0340	91	0.1902	105	-	
47	hr-001	-		0.0044	7	0.0072	8	0.0019	10	0.0073	13	0.0303	22	0.550	28
48	id3-003	-		0.0361	99	0.0757	100	0.0104	90	0.0292	87	0.0848	88	0.586	35
49	id3-004	-		0.0198	74	0.0344	77	0.0084	79	0.0238	83	-		-	
50	idemia-003	-		0.0222	78	0.0316	73	0.0082	78	0.0188	72	0.0578	81	0.617	39
51	idemia-004	-		0.0160	62	0.0244	58	0.0065	59	0.0199	75	0.0309	28	-	
52	iit-000	-		0.1516	115	0.1981	114	0.0620	117	0.0828	107	-		-	
53	iit-001	-		0.0104	33	0.0179	38	0.0048	43	0.0099	31	0.3092	118	0.484	15
54	imagus-000	-		0.0642	104	0.0882	101	0.0330	109	0.0497	102	0.1158	97	0.694	49
55	imperial-000	-		0.0067	15	0.0108	16	0.0022	13	0.0080	17	0.0281	9	-	
56	imperial-001	0.0103	4	0.0094	27	0.0154	32	0.0033	22	0.0072	11	0.0276	4	-	
57	incode-003	0.0354	23	0.0142	55	0.0249	60	0.0054	50	0.0448	99	0.0318	32	-	
58	incode-004	-		0.0077	19	0.0132	23	0.0034	23	0.0096	27	0.0313	30	0.510	21
59	innovatrics-004	-		0.0194	72	0.0292	67	0.0068	66	0.0344	92	0.0454	65	0.465	13
60	innovatrics-005	-		0.0230	80	0.0353	79	0.0085	80	0.0398	96	0.0301	20	-	

Table 5: FNMR is the proportion of mated comparisons below a threshold set to achieve the FMR given in the header on the fourth row. FMR is the proportion of impostor comparisons at or above that threshold. The light grey values give rank over all algorithms in that column. The green column applies to "matched-covariates" i.e. impostors of the same sex, age group, and country of birth. The pink column uses only same-sex impostors; All others are zero effort. The pink column includes effects of extended ageing, and is the most important. Missing entries for visa, mugshot and wild images generally mean the algorithm did not run to completion. For child exploitation, missing entries arise because NIST executes those runs only infrequently.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

		FALSE NON-MATCH RATE (FNMR)											
	Algorithm	CONSTRAINED, COOPERATIVE								LESS CONSTRAINED, NON-COOP.			
	Name	CROSSEV		VISAMC		VISA		VISA		MUGSHOT		WILD		CHILD EXP	
	FMR	1E-06		0.0001		1E-06		0.0001		1E-05		0.0001		0.01	
61	intellivision-001	-		0.1335	114	0.2205	116	0.0417	113	0.1090	113	0.2445	110	0.777	64
62	intsysmsu-000	-		0.0135	51	0.0204	45	0.0069	68	0.0112	42	0.2330	109	-	
63	iqface-000	0.0171	10	0.0091	25	0.0143	27	0.0043	33	0.0075	16	0.0381	53	0.649	43
64	isityou-000	-		0.5682	132	0.7033	132	0.4145	134	1.0000	135	1.0000	130	1.000	85
65	isystems-001	-		0.0149	59	0.0245	59	0.0067	64	0.0138	57	0.0524	79	0.515	23
66	isystems-002	-		0.0118	40	0.0182	40	0.0066	60	0.0111	39	0.0516	77	0.488	16
67	itmo-005	-		0.0182	69	0.0345	78	0.0067	65	0.0181	70	0.0433	59	0.481	14
68	itmo-006	0.0233	16	0.0125	43	0.0220	51	0.0046	37	0.0149	62	0.0329	38	-	
69	kakao-001	0.4831	38	0.4553	129	0.5532	129	0.2034	127	0.6580	128	1.0000	139	-	
70	kakao-002	-		0.0625	103	0.1779	112	0.0168	98	0.0791	106	1.0000	132	1.000	92
71	kedacom-000	0.0415	25	0.0055	9	0.0081	10	0.0027	15	0.0111	41	0.2511	112	0.765	62
72	kneron-003	-		0.0542	101	0.0902	104	0.0218	103	0.0346	93	0.3053	117	0.696	51
73	lookman-002	-		0.0297	93	0.0547	96	0.0102	89	0.0339	90	0.2640	115	-	
74	lookman-004	0.0430	27	0.0074	18	0.0099	13	0.0037	28	0.0124	51	0.2516	113	0.766	63
75	megvii-001	-		0.0157	60	0.0244	57	0.0045	36	0.0392	95	0.0916	92	0.442	10
76	megvii-002	-		0.0104	34	0.0145	28	0.0036	26	0.0225	78	0.0692	86	0.301	2
77	meiya-001	0.0311	20	0.0171	67	0.0275	65	0.0066	62	0.0159	66	0.0363	49	-	
78	microfocus-001	-		0.4482	128	0.5524	128	0.2309	129	0.7256	130	0.2567	114	0.689	48
79	microfocus-002	-		0.3605	125	0.5057	126	0.1566	126	0.5783	126	0.1582	102	0.652	44
80	mt-000	-		0.0100	31	0.0170	35	0.0047	39	0.0074	15	0.0326	37	0.377	6
81	neurotechnology-005	0.0204	14	0.0141	54	0.0300	70	0.0051	48	0.0108	37	0.0332	39	-	
82	neurotechnology-006	-		0.0098	30	0.0136	24	0.0040	31	0.0105	35	0.0303	23	0.591	36
83	nodeflux-000	0.9079	40	1.0000	138	1.0000	138	1.0000	138	1.0000	138	1.0000	136	-	
84	nodeflux-001	0.5169	39	1.0000	139	1.0000	139	1.0000	139	1.0000	139	1.0000	137	-	
85	notiontag-000	-		0.6669	133	0.7885	133	0.3222	133	0.3715	123	0.1807	104	0.648	42
86	ntechlab-006	0.0108	5	0.0078	20	0.0111	17	0.0021	12	0.0112	43	0.0275	3	-	
87	ntechlab-007	-		0.0056	10	0.0076	9	0.0018	9	0.0073	14	0.0276	5	0.332	3
88	pixelall-002	-		0.0193	71	0.0340	76	0.0066	61	0.0127	54	0.0342	43	0.896	78
89	psl-001	-		0.0549	102	0.0927	105	0.0198	101	0.0096	25	0.0431	58	0.624	41
90	psl-002	0.0790	33	0.0107	36	0.0180	39	0.0048	42	0.0089	21	0.0295	18	-	
91	rankone-006	0.0315	21	0.0242	82	0.0460	89	0.0070	69	0.0119	48	0.0538	80	-	
92	rankone-007	-		0.0197	73	0.0366	82	0.0057	54	0.0113	44	0.0450	63	0.669	45
93	realnetworks-002	0.0371	24	0.0248	84	0.0358	80	0.0099	87	0.0513	103	0.0334	40	-	
94	realnetworks-003	-		0.0259	89	0.0372	84	0.0100	88	0.0541	104	0.0335	42	0.515	22
95	remarkai-000	0.0163	9	0.0147	58	0.0257	63	0.0062	57	0.0102	33	0.0304	24	-	
96	remarkai-001	0.0162	8	0.0144	56	0.0256	62	0.0061	56	0.0102	34	0.0308	27	-	
97	saffe-001	-		0.4339	126	0.5261	127	0.2340	130	0.7539	132	0.3887	121	0.897	79
98	saffe-002	0.0244	18	0.0119	41	0.0206	46	0.0054	51	0.0107	36	0.0308	26	-	
99	sensetime-001	-		0.0063	12	0.0092	11	0.0030	17	0.0130	55	1.0000	129	0.700	52
100	sensetime-002	-		0.0068	16	0.0098	12	0.0035	24	0.0143	60	0.9999	127	0.531	26
101	shaman-000	-		0.9297	137	0.9774	137	0.9128	137	0.9990	134	0.9575	125	0.962	81
102	shaman-001	-		0.3346	123	0.4616	124	0.1360	125	0.2368	119	0.1498	101	0.899	80
103	shu-001	-		0.0103	32	0.0140	26	0.0044	35	0.0293	88	0.0986	95	0.459	11
104	siat-002	-		0.0091	26	0.0126	22	0.0039	30	0.0109	38	0.0520	78	0.428	9
105	siat-004	0.0275	19	0.0067	14	0.0099	14	0.0028	16	0.0152	64	1.0000	128	-	
106	smilart-002	-		0.2440	122	0.3532	122	0.0821	122	-		-		0.700	53
107	smilart-003	0.0894	34	0.6944	134	0.8836	134	0.1088	124	0.0695	105	0.1190	98	-	
108	starhybrid-001	-		0.0108	37	0.0138	25	0.0058	55	0.0081	18	0.0350	46	0.558	29
109	synesis-004	0.0764	32	0.0310	94	0.0480	92	0.0166	97	0.0476	100	0.1319	99	-	
110	synesis-005	-		0.0147	57	0.0226	54	0.0073	74	0.0153	65	0.0334	41	0.560	30
111	tech5-001	-		0.0130	47	0.0176	36	0.0037	29	0.0218	77	0.0938	93	0.838	68
112	tech5-002	0.0233	17	0.0046	8	0.0063	6	0.0009	2	0.0113	45	0.0310	29	-	
113	tevian-003	-		0.0217	77	0.0298	68	0.0067	63	0.0230	81	0.0456	66	0.504	19
114	tevian-004	0.0128	6	0.0228	79	0.0304	71	0.0069	67	0.0226	79	0.0394	55	-	
115	tiger-002	-		0.0658	105	0.0889	102	0.0227	104	0.1083	112	0.0512	75	0.786	66
116	tiger-003	-		0.0313	95	0.0602	99	0.0087	82	0.0188	73	0.0482	72	0.561	32
117	tongyi-005	-		0.0073	17	0.0146	29	0.0019	11	0.0187	71	0.0399	56	0.620	40
118	toshiba-002	-		0.0134	50	0.0222	53	0.0048	41	0.0097	29	0.0434	60	0.710	54
119	toshiba-003	-		0.0125	42	0.0214	49	0.0047	38	0.0085	20	0.0282	10	-	
120	uluface-002	-		0.0081	22	0.0123	20	0.0033	21	0.0071	10	0.0444	62	0.673	46

Table 6: FNMR is the proportion of mated comparisons below a threshold set to achieve the FMR given in the header on the fourth row. FMR is the proportion of impostor comparisons at or above that threshold. The light grey values give rank over all algorithms in that column. The green column applies to "matched-covariates" i.e. impostors of the same sex, age group, and country of birth. The pink column uses only same-sex impostors; All others are zero effort. The pink column includes effects of extended ageing, and is the most important. Missing entries for visa, mugshot and wild images generally mean the algorithm did not run to completion. For child exploitation, missing entries arise because NIST executes those runs only infrequently.

		FALSE NON-MATCH RATE (FNMR)											
	Algorithm	CONSTRAINED, COOPERATIVE										LESS CONSTRAINED, NON-COOP.	
	Name	CROSSEV		VISAMC		VISA		VISA		MUGSHOT		WILD		CHILD EXP	
	FMR	1E-06		0.0001		1E-06		0.0001		1E-05		0.0001		0.01	
121	upc-001	-		0.0234	81	0.0519	93	0.0071	71	0.0291	86	0.0314	31	0.422	8
122	vcog-002	-		0.7522	136	0.9033	135	0.5040	135	-		-		0.752	60
123	vd-001	0.0424	26	0.0243	83	0.0452	88	0.0093	85	0.0271	85	0.1389	100	-	
124	veridas-001	0.2599	37	0.1998	121	0.2724	119	0.0742	119	0.2987	122	0.0501	73	-	
125	veridas-002	0.2073	36	0.1733	118	0.2257	117	0.0528	116	0.2617	121	0.0450	64	-	
126	via-000	-		0.0216	76	0.0365	81	0.0088	83	0.0177	68	0.0349	45	0.764	61
127	videonetics-001	-		0.5483	131	0.6446	131	0.3063	132	0.7517	131	0.2986	116	0.730	58
128	vigilantsolutions-006	0.0493	29	0.1264	113	0.3221	120	0.0136	95	0.0150	63	0.0321	34	-	
129	vigilantsolutions-007	-		0.0202	75	0.0307	72	0.0070	70	0.0136	56	0.0306	25	1.000	132
130	vion-000	0.0581	31	0.0419	100	0.0590	98	0.0288	107	0.0422	97	0.2479	111	0.876	73
131	visionbox-000	0.0349	22	0.0293	92	0.0541	95	0.0110	92	0.0197	74	0.0476	71	-	
132	visionbox-001	0.0190	13	0.0159	61	0.0270	64	0.0072	73	0.0111	40	0.0389	54	-	
133	visionlabs-006	0.0061	2	0.0037	3	0.0066	7	0.0012	4	0.0041	3	0.0285	13	-	
134	visionlabs-007	0.0057	1	0.0038	4	0.0048	2	0.0012	6	0.0036	1	0.0286	14	0.371	5
135	vocord-006	0.0475	28	0.0062	11	0.0102	15	0.0016	8	0.0082	19	0.0282	11	-	
136	vocord-007	0.0520	30	0.0039	5	0.0053	4	0.0012	5	0.0061	6	0.0280	8	0.847	70
137	winsense-000	0.0226	15	0.0140	53	0.0228	55	0.0056	53	0.0125	53	0.0352	47	0.860	72
138	yisheng-004	0.2044	35	0.1988	120	0.3329	121	0.0475	114	0.1147	114	0.0908	91	0.715	55
139	yitu-003	0.0064	3	0.0015	1	0.0026	1	0.0003	1	0.0066	9	0.0325	36	-	

Table 7: FNMR is the proportion of mated comparisons below a threshold set to achieve the FMR given in the header on the fourth row. FMR is the proportion of impostor comparisons at or above that threshold. The light grey values give rank over all algorithms in that column. The green column applies to "matched-covariates" i.e. impostors of the same sex, age group, and country of birth. The pink column uses only same-sex impostors; All others are zero effort. The pink column includes effects of extended ageing, and is the most important. Missing entries for visa, mugshot and wild images generally mean the algorithm did not run to completion. For child exploitation, missing entries arise because NIST executes those runs only infrequently.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

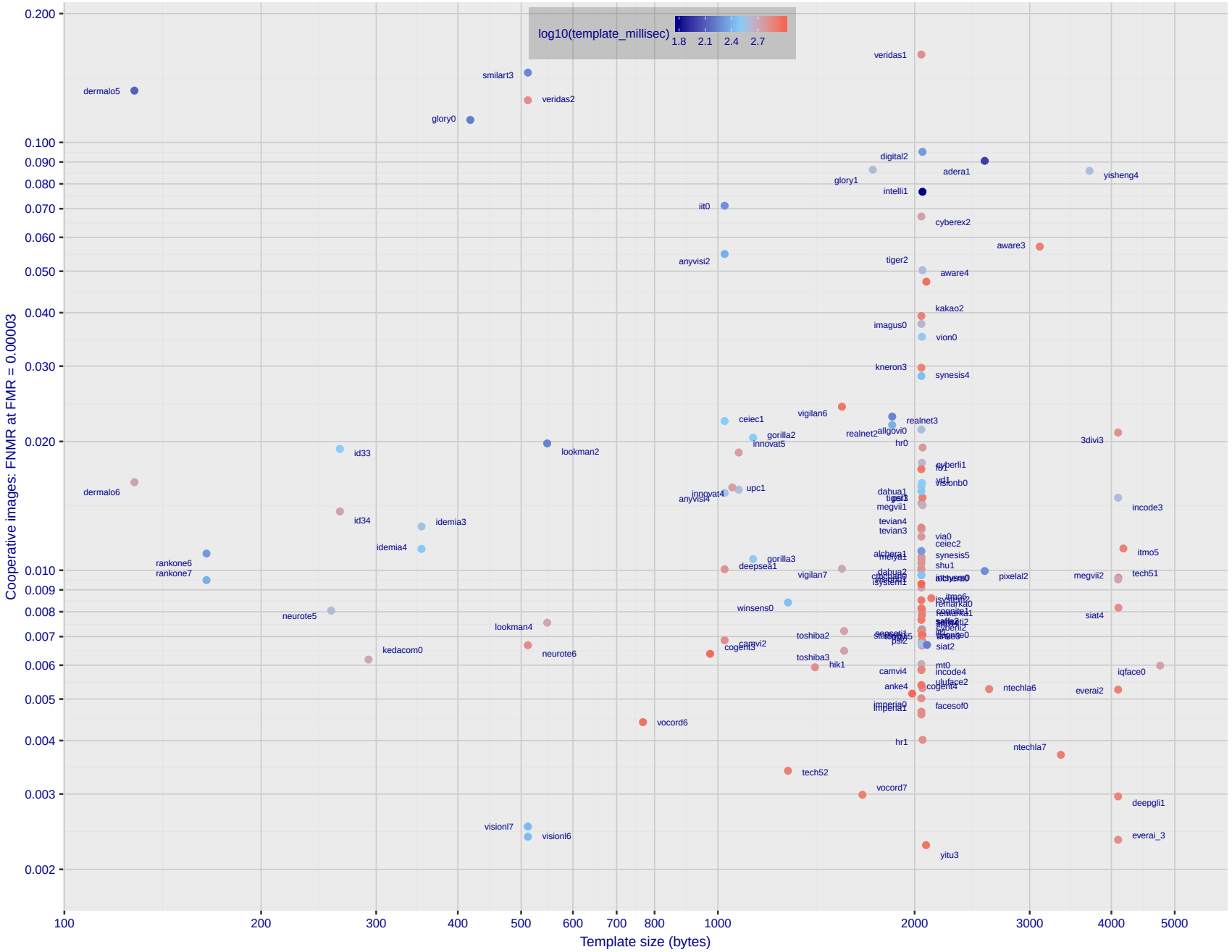


Figure 1: The points show false non-match rates (FNMR) versus the size of the encoded template. FNMR is the geometric mean of FNMR values for visa and mugshot images (from Figs. 23 and 30) at a false match rate (FMR) of 0.0001. The color of the points encodes template generation time - which spans at least one order of magnitude. Durations are measured on a single core of a c. 2016 Intel Xeon CPU E5-2630 v4 running at 2.20GHz. Algorithms with poor FNMR are omitted.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

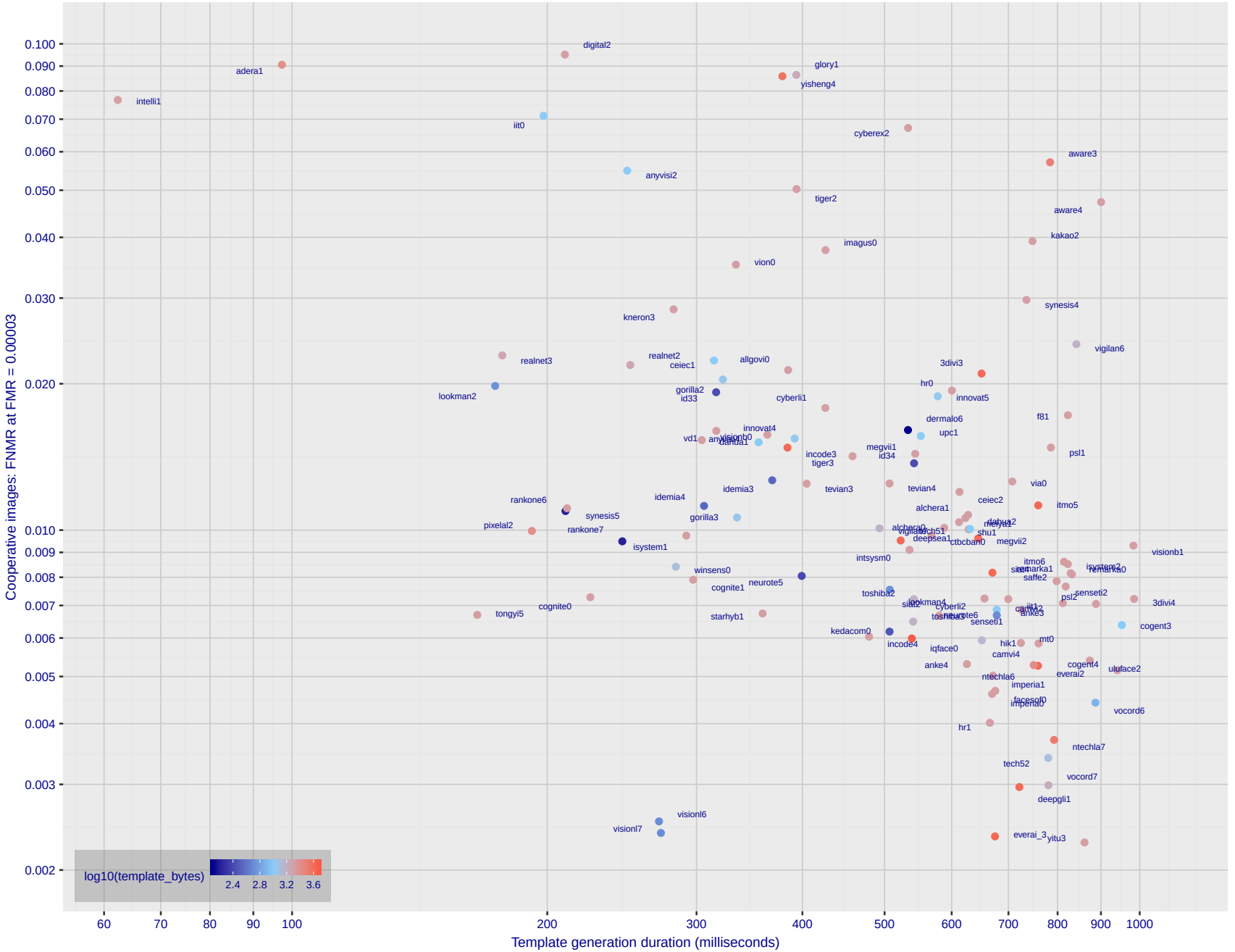


Figure 2: The points show false non-match rates (FNMR) versus the duration of the template generation operation. FNMR is the geometric mean of FNMR values for visa and mugshot images (from Figs. 23 and 30) at a false match rate (FMR) of 0.0001. Template generation time is a median estimated over 640 x 480 pixel portraits. It is measured on a single core of a c. 2016 Intel Xeon CPU E5-2630 v4 running at 2.20GHz. The color of the points encodes template size - which span two orders of magnitude. Algorithms with poor FNMR are omitted.

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

1 Metrics

1.1 Core accuracy

Given a vector of N genuine scores, u, the false non-match rate (FNMR) is computed as the proportion below some threshold, T:

$$\text{FNMR}(T) = 1 - \frac{1}{N}\sum_{i=1}^{N} H(u_i - T) \tag{1}$$

where $H(x)$ is the unit step function, and $H(0)$ taken to be 1.

Similarly, given a vector of N impostor scores, v, the false match rate (FMR) is computed as the proportion above T:

$$\text{FMR}(T) = \frac{1}{N}\sum_{i=1}^{N} H(v_i - T) \tag{2}$$

The threshold, T, can take on any value. We typically generate a set of thresholds from quantiles of the observed impostor scores, v, as follows. Given some interesting false match rate range, $[\text{FMR}_L, \text{FMR}_U]$, we form a vector of K thresholds corresponding to FMR measurements evenly spaced on a logarithmic scale

$$T_k = Q_v(1 - \text{FMR}_k) \tag{3}$$

where Q is the quantile function, and FMR_k comes from

$$\log_{10}\text{FMR}_k = \log_{10}\text{FMR}_L + \frac{k}{K}\ [\log_{10}\text{FMR}_U - \log_{10}\text{FMR}_L] \tag{4}$$

Error tradeoff characteristics are plots of FNMR(T) vs. FMR(T). These are plotted with $\text{FMR}_U \to 1$ and FMR_L as low as is sustained by the number of impostor comparisons, N. This is somewhat higher than the "rule of three" limit $3/N$ because samples are not independent, due to re-use of images.

2 Datasets

2.1 Child exploitation images

- ▷ The number of images is on the order of 10^4.
- ▷ The number of subjects is on the order of 10^3.
- ▷ The number of subjects with two images on the order of 10^3.
- ▷ The images are operational. They are taken from ongoing investigations of child exploitation crimes. The images are arbitrarily unconstrained. Pose varies considerably around all three axes, including subject lying down. Resolution varies very widely. Faces can be occluded by other objects, including hair and hands. Lighting varies, although the images are intended for human viewing. Mis-focus is rare. Images are given to the algorithm without any cropping; faces may occupy widely varying areas.
- ▷ The images are usually large from contemporary cameras. The mean interocular distance (IOD) is 70 pixels.
- ▷ The images are of subjects from several countries, due to the global production of this imagery.
- ▷ The images are of children, from infancy to late adolescence.
- ▷ All of the images are live capture, none are scanned. Many have been cropped.
- ▷ When these images are input to the algorithm, they are labelled as being of type ”EXPLOITATION” - see Table 4 of the FRVT API.

2.2 Visa images

- ▷ The number of images is on the order of 10^5.
- ▷ The number of subjects is on the order of 10^5.
- ▷ The number of subjects with two images on the order of 10^4.
- ▷ The images have geometry in reasonable conformance with the ISO/IEC 19794-5 Full Frontal image type. Pose is generally excellent.
- ▷ The images are of size 252x300 pixels. The mean interocular distance (IOD) is 69 pixels.
- ▷ The images are of subjects from greater than 100 countries, with significant imbalance due to visa issuance patterns.
- ▷ The images are of subjects of all ages, including children, again with imbalance due to visa issuance demand.
- ▷ Many of the images are live capture. A substantial number of the images are photographs of paper photographs.
- ▷ When these images are input to the algorithm, they are labelled as being of type ”ISO” - see Table 4 of the FRVT API.

2.3 Visa images II

- ▷ The number of images is on the order of 10^6.
- ▷ The number of subjects is on the order of 10^6.
- ▷ The number of subjects with two images on the order of 10^6.

FNMR(T) “False non-match rate”
FMR(T) “False match rate”

- ▷ The images have geometry in good conformance with the ISO/IEC 19794-5 Full Frontal image type. Pose is generally excellent.
- ▷ The images are of size 300x300 pixels. The mean interocular distance (IOD) is 61 pixels.
- ▷ The images are of subjects from greater than 100 countries, with significant imbalance due to visa issuance patterns.
- ▷ The images are of subjects of all ages, including children, again with imbalance due to visa issuance demand.
- ▷ All of the images are live capture.
- ▷ When these images are input to the algorithm, they are labelled as being of type ”ISO” - see Table 4 of the FRVT API.

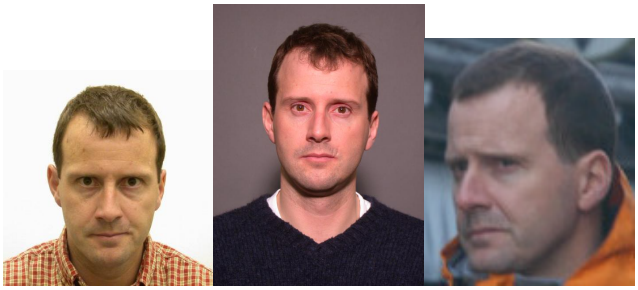
2.4 Mugshot images

- ▷ The number of images is on the order of 10^6.
- ▷ The number of subjects is on the order of 10^6.
- ▷ The number of subjects with two images on the order of 10^6.
- ▷ The images have geometry in reasonable conformance with the ISO/IEC 19794-5 Full Frontal image type.
- ▷ The images are of variable sizes. The median IOD is 105 pixels. The mean IOD is 113 pixels. The 1-st, 5-th, 10-th, 25-th, 75-th, 90-th and 99-th percentiles are 34, 58, 70, 87, 121, 161 and 297 pixels.
- ▷ The images are of subjects from the United States.
- ▷ The images are of adults.
- ▷ The images are all live capture.
- ▷ When these images are input to the algorithm, they are labelled as being of type ”mugshot” - see Table 4 of the FRVT API.

2.5 Webcam images

- ▷ The number of images is on the order of 10^6.
- ▷ The number of subjects is on the order of 10^6.
- ▷ All subjects have a webcam image, and a portrait image.
- ▷ The portrait images are in poor conformance with the ISO/IEC 19794-5 Full Frontal image type.
- ▷ The webcam images are taken with at camera oriented by an attendant toward a cooperating subject. This is done under time constraints so there are role, pitch and yaw angle variation. Also background illumination is sometimes strong, so the face is under exposed. There is sometimes perspective distortion due to close range images.
- ▷ The images have mean IOD of 38 pixels.
- ▷ The images are all live capture.
- ▷ When these images are input to the algorithm, they are labelled as being of type ”WILD” - see Table 4 of the FRVT API.

FNMR(T) “False non-match rate”
FMR(T) “False match rate”



(a) Visa (b) Mugshot (c) Wild

Figure 3: The figure gives simulated samples of image types used in this report.

2.6 Wild images

- The number of images is on the order of 10^5.
- The number of subjects is on the order of 10^3.
- The number of subjects with two images on the order of 10^3.
- The images include many photojournalism-style images. Images are given to the algorithm using a variable but generally tight crop of the head. Resolution varies very widely. The images are very unconstrained, with wide yaw and pitch pose variation. Faces can be occluded, including hair and hands.
- The images are of adults.
- All of the images are live capture, none are scanned.
- When these images are input to the algorithm, they are labelled as being of type "WILD" - see Table 4 of the FRVT API.

3 Results

3.1 Test goals

- To state overall accuracy.
- To compare algorithms.

3.2 Test design

Method: For visa images:

- The comparisons are of visa photos against visa photos.
- The number of genuine comparisons is on the order of 10^4.
- The number of impostor comparisons is on the order of 10^{10}.
- The comparisons are fully zero-effort, meaning impostors are paired without attention to sex, age or other covariates. However, later analysis is conducted on subsets.

- ▷ The number of persons is on the order of 10^5.
- ▷ The number of images used to make 1 template is 1.
- ▷ The number of templates used to make each comparison score is two corresponding to simple one-to-one verification.

For mugshot images:

- ▷ The comparisons are of mugshot photos against mugshot photos.
- ▷ The number of genuine comparisons is on the order of 10^6.
- ▷ The number of impostor comparisons is on the order of 10^8.
- ▷ The impostors are paired by sex, but not by age or other covariates.
- ▷ The number of persons is on the order of 10^6.
- ▷ The number of images used to make 1 template is 1.
- ▷ The number of templates used to make each comparison score is two corresponding to simple one-to-one verification.

Method: For wild images:

- ▷ The comparisons are of wild photos against wild photos.
- ▷ The number of genuine comparisons is on the order of 10^6.
- ▷ The number of impostor comparisons is on the order of 10^7.
- ▷ The comparisons are fully zero-effort, meaning impostors are paired without attention to sex, age or other covariates.
- ▷ The number of persons is on the order of 10^4.
- ▷ The number of images used to make 1 template is 1.
- ▷ The number of templates used to make each comparison score is two corresponding to simple one-to-one verification.

For child exploitation images:

- ▷ The comparisons are of unconstrained child exploitation photos against others of the same type.
- ▷ The number of genuine comparisons is on the order of 10^4.
- ▷ The number of impostor comparisons is on the order of 10^7.
- ▷ The comparisons are fully zero-effort, meaning impostors are paired without attention to sex, age or other covariates.
- ▷ The number of persons is on the order of 10^3.
- ▷ The number of images used to make 1 template is 1.
- ▷ The number of templates used to make each comparison score is two corresponding to simple one-to-one verification.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

▷ We produce two performance statements. First, is a DET as used for visa and mugshot images. The second is a cumulative match characteristic (CMC) summarizing a simulated one-to-many search process. This is done as follows.

- We regard M enrollment templates as items in a gallery.
- These M templates come from $M > N$ individuals, because multiple images of a subject are present in the gallery under separate identifiers.
- We regard the verification templates as search templates.
- For each search we compute the rank of the highest scoring mate.
- This process should properly be conducted with a 1:N algorithm, such as those tested in NIST IR 8009. We use the 1:1 algorithms in a simulated 1:N mode here to a) better reflect what a child exploitation analyst does, and b) to show algorithm efficacy is better than that revealed in the verification DETs.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

3.3 Failure to enroll

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

	Algorithm	Failure to Enrol Rate[1]							
	Name	CHILD-EXPLOIT		MUGSHOT		VISA		WILD	
1	3divi-003	0.1806	62	0.0007	97	0.0006	91	0.0294	111
2	3divi-004	-	140	0.0008	100	0.0006	93	0.0222	110
3	adera-001	0.1928	65	0.0003	70	0.0005	87	0.0505	122
4	alchera-000	-	140	0.0004	87	0.0014	119	0.0038	79
5	alchera-001	-	140	0.0004	86	0.0014	118	0.0038	78
6	allgovision-000	-	140	0.0026	123	0.0052	137	0.0131	102
7	amplifiedgroup-001	-	140	0.0189	139	0.0279	143	0.1390	134
8	anke-003	-	140	0.0001	49	0.0004	62	0.0006	51
9	anke-004	0.0944	47	0.0001	50	0.0004	71	0.0006	56
10	anyvision-002	0.4866	86	0.0070	134	0.0090	139	0.1146	130
11	anyvision-004	0.1660	59	0.0001	58	0.0004	67	0.0080	91
12	aware-003	0.3314	80	0.0016	118	0.0013	115	0.0745	127
13	aware-004	-	140	0.0002	62	0.0005	77	0.0014	68
14	ayonix-000	0.0000	3	0.0113	136	0.0137	141	0.1194	131
15	bm-001	0.0000	19	0.0000	32	0.0000	13	0.0000	10
16	camvi-002	0.0000	4	0.0000	19	0.0000	21	0.0000	17
17	camvi-004	-	140	0.0000	22	0.0000	24	0.0000	20
18	ceiec-001	-	140	0.0029	126	0.0023	126	0.0068	87
19	ceiec-002	0.2482	74	0.0036	128	0.0031	132	0.0081	92
20	cogent-003	-	140	0.0001	47	0.0004	65	0.0009	64
21	cogent-004	0.0000	6	0.0000	3	0.0000	4	0.0000	2
22	cognitec-000	0.6342	90	0.0007	98	0.0007	98	0.0388	118
23	cognitec-001	-	140	0.0008	103	0.0010	101	0.0185	106
24	ctbcbank-000	0.3285	79	0.0011	110	0.0019	123	0.0868	129
25	cyberextruder-001	0.5338	88	0.0024	121	0.0029	130	0.0597	125
26	cyberextruder-002	0.2672	77	0.0027	124	0.0028	129	0.0335	116
27	cyberlink-001	-	140	0.0073	135	0.0005	79	0.0008	58
28	cyberlink-002	0.1463	58	0.0004	79	0.0004	75	0.0007	57
29	dahua-001	0.0000	23	0.0000	30	0.0000	32	0.0000	27
30	dahua-002	-	140	0.0024	122	0.0022	125	0.0009	61
31	deepglint-001	0.0000	20	0.0000	12	0.0000	14	0.0000	11
32	deepsea-001	0.0000	8	0.0000	5	0.0000	6	0.0000	4
33	dermalog-005	0.1796	60	0.0013	114	0.0041	134	0.0163	104
34	dermalog-006	0.1797	61	0.0013	113	0.0041	135	0.0163	105
35	digitalbarriers-002	-	140	0.0028	125	0.0027	128	0.0071	88
36	dsk-000	0.0000	14	0.0000	9	0.0000	10	0.0000	7
37	everai-002	-	140	0.0002	65	0.0004	48	0.0004	47
38	everai-paravision-003	0.0705	43	0.0002	61	0.0004	55	0.0004	45
39	f8-001	0.2026	67	0.0035	127	0.0030	131	0.0087	95
40	facesoft-000	0.0000	26	0.0000	31	0.0000	33	0.0000	28
41	glory-000	0.0000	17	0.0053	132	0.0013	116	0.1565	135
42	glory-001	0.0000	11	0.0051	131	0.0010	102	0.1651	136
43	gorilla-002	0.1347	54	0.0003	78	0.0004	76	0.0117	98
44	gorilla-003	0.1347	53	0.0003	77	0.0004	74	0.0043	82
45	hik-001	-	140	0.0000	24	0.0000	26	0.0000	22
46	hr-000	-	140	0.0003	73	0.0008	99	0.0034	77
47	hr-001	0.1198	52	0.0001	42	0.0004	56	0.0003	41
48	id3-003	0.3032	78	0.0016	119	0.0011	112	0.0317	114
49	id3-004	-	140	0.0015	117	0.0011	111	-	140
50	idemia-003	0.0481	33	0.0000	34	0.0004	49	0.0042	81
51	idemia-004	-	140	0.0000	37	0.0004	52	0.0003	42
52	iit-000	-	140	0.0007	96	0.0011	106	0.0836	128
53	iit-001	0.0843	46	0.0001	60	0.0004	68	0.0104	96
54	imagus-000	0.1107	50	0.0010	109	0.0012	114	0.0347	117
55	imperial-000	-	140	0.0000	14	0.0000	16	0.0000	13
56	imperial-001	-	140	0.0000	28	0.0000	30	0.0000	25
57	incode-003	-	140	0.0004	91	0.0007	95	0.0014	67
58	incode-004	0.2202	68	0.0004	90	0.0007	94	0.0014	66
59	innovatrics-004	0.1170	51	0.0000	40	0.0004	70	0.0041	80
60	innovatrics-005	-	140	0.0000	41	0.0004	69	0.0006	52

Table 8: FTE is the proportion of failed template generation attempts. Failures can occur because the software throws an exception, or because the software electively refuses to process the input image. This would typically occur if a face is not detected. FTE is measured as the number of function calls that give EITHER a non-zero error code OR that give a "small" template. This is defined as one whose size is less than 0.3 times the median template size for that algorithm. This second rule is needed because some algorithms incorrectly fail to return a non-zero error code when template generation fails.

[1] *The effects of FTE are included in the accuracy results of this report by regarding any template comparison involving a failed template to produce a low similarity score. Thus higher FTE results in higher FNMR and lower FMR.*

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

	Algorithm	Failure to Enrol Rate[1]							
	Name	CHILD-EXPLOIT		MUGSHOT		VISA		WILD	
61	intellivision-001	0.5495	89	0.0048	130	0.0042	136	0.1358	132
62	intsysmsu-000	-	140	0.0004	84	0.0012	113	0.0031	76
63	iqface-000	0.0000	9	0.0000	23	0.0000	25	0.0000	21
64	isityou-000	0.4714	84	0.0023	120	0.0010	104	0.0663	126
65	isystems-001	0.1421	56	0.0010	107	0.0007	96	0.0128	100
66	isystems-002	0.1421	57	0.0010	108	0.0007	97	0.0128	101
67	itmo-005	0.1353	55	0.0005	93	0.0002	35	0.0075	89
68	itmo-006	-	140	0.0004	89	0.0004	66	0.0006	55
69	kakao-001	-	140	0.0002	66	0.0005	81	0.0310	112
70	kakao-002	0.2494	75	0.0002	67	0.0005	85	0.0310	113
71	kedacom-000	0.0000	18	0.0000	11	0.0000	12	0.0000	9
72	kneron-003	0.4883	87	0.0044	129	0.0016	122	0.1823	137
73	lookman-002	-	140	0.0000	21	0.0000	23	0.0000	19
74	lookman-004	0.0000	1	0.0000	18	0.0000	20	0.0000	16
75	megvii-001	0.0274	31	0.0007	99	0.0004	54	0.0152	103
76	megvii-002	0.0274	30	0.0054	133	0.0004	53	0.0126	99
77	meiya-001	-	140	0.0004	92	0.0010	105	0.0025	73
78	microfocus-001	0.0791	45	0.0008	102	0.0016	121	0.0220	109
79	microfocus-002	0.0791	44	0.0008	101	0.0016	120	0.0220	108
80	mt-000	0.1043	48	0.0002	64	0.0004	72	0.0004	43
81	neurotechnology-005	-	140	0.0004	82	0.0004	58	0.0018	69
82	neurotechnology-006	0.1068	49	0.0004	83	0.0004	59	0.0018	70
83	nodeflux-000	-	140	0.0001	51	0.0002	36	0.0003	37
84	nodeflux-001	-	140	0.0001	52	0.0002	37	0.0003	38
85	notiontag-000	0.0000	24	0.0000	15	0.0000	17	0.0000	14
86	ntechlab-006	-	140	0.0000	33	0.0004	46	0.0003	36
87	ntechlab-007	0.0682	42	0.0001	43	0.0004	50	0.0005	50
88	pixelall-002	0.0001	27	0.0000	8	0.0000	9	0.0001	33
89	psl-001	0.0000	21	0.0000	29	0.0000	31	0.0000	26
90	psl-002	-	140	0.0000	10	0.0000	11	0.0000	8
91	rankone-006	-	140	0.0000	27	0.0000	29	0.0000	24
92	rankone-007	0.3518	82	0.0003	72	0.0004	73	0.0043	83
93	realnetworks-002	-	140	0.0004	81	0.0003	40	0.0004	44
94	realnetworks-003	0.0076	28	0.0004	80	0.0003	39	0.0004	46
95	remarkai-000	-	140	0.0000	2	0.0000	2	0.0000	31
96	remarkai-001	-	140	0.0000	17	0.0000	19	0.0000	32
97	saffe-001	0.0000	22	0.0000	13	0.0000	15	0.0000	12
98	saffe-002	-	140	0.0000	26	0.0000	28	0.0000	23
99	sensetime-001	0.0631	41	0.0000	36	0.0004	61	0.0003	39
100	sensetime-002	0.3345	81	0.0011	111	0.0005	88	0.0218	107
101	shaman-000	0.0000	5	0.0000	20	0.0000	22	0.0000	18
102	shaman-001	0.0000	2	0.0000	1	0.0000	1	0.0000	29
103	shu-001	0.1822	63	0.0010	106	0.0006	90	0.0499	121
104	siat-002	0.0616	38	0.0000	39	0.0004	64	0.0048	85
105	siat-004	-	140	0.0000	38	0.0004	63	0.0003	40
106	smilart-002	0.2422	71	0.0003	76	0.0011	108	0.0575	124
107	smilart-003	-	140	0.0014	115	0.0013	117	0.0555	123
108	starhybrid-001	0.2340	70	0.0009	105	0.0023	127	0.0044	84
109	synesis-004	-	140	0.0164	138	0.0035	133	0.0485	120
110	synesis-005	0.1862	64	0.0001	48	0.0005	78	0.0021	71
111	tech5-001	0.0000	15	0.0004	85	0.0003	42	0.0409	119
112	tech5-002	-	140	0.0001	46	0.0003	38	0.0000	30
113	tevian-003	0.2430	73	0.0003	69	0.0005	89	0.0076	90
114	tevian-004	-	140	0.0002	63	0.0005	86	0.0057	86
115	tiger-002	0.0619	39	0.0001	55	0.0004	60	0.0082	94
116	tiger-003	0.0619	40	0.0001	53	0.0004	57	0.0082	93
117	tongyi-005	0.0000	7	0.0000	4	0.0000	5	0.0000	3
118	toshiba-002	0.0000	13	0.0000	7	0.0000	8	0.0000	6
119	toshiba-003	-	140	0.0001	56	0.0001	34	0.0002	35
120	uluface-002	0.0000	25	0.0000	16	0.0000	18	0.0000	15

Table 9: FTE is the proportion of failed template generation attempts. Failures can occur because the software throws an exception, or because the software electively refuses to process the input image. This would typically occur if a face is not detected. FTE is measured as the number of function calls that give EITHER a non-zero error code OR that give a "small" template. This is defined as one whose size is less than 0.3 times the median template size for that algorithm. This second rule is needed because some algorithms incorrectly fail to return a non-zero error code when template generation fails.

[1] *The effects of FTE are included in the accuracy results of this report by regarding any template comparison involving a failed template to produce a low similarity score. Thus higher FTE results in higher FNMR and lower FMR.*

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

	Algorithm	Failure to Enrol Rate[1]							
	Name	CHILD-EXPLOIT		MUGSHOT		VISA		WILD	
121	upc-001	0.0450	32	0.0003	68	0.0003	44	0.0011	65
122	vd-001	-	140	0.0004	88	0.0009	100	0.0024	72
123	veridas-001	-	140	0.0001	54	0.0005	82	0.0006	53
124	veridas-002	-	140	0.0001	57	0.0005	84	0.0006	54
125	via-000	0.0000	10	0.0000	25	0.0000	27	0.0001	34
126	videonetics-001	0.4799	85	0.0015	116	0.0010	103	0.0112	97
127	vigilantsolutions-006	-	140	0.0001	45	0.0004	51	0.0005	49
128	vigilantsolutions-007	0.2538	76	0.0001	44	0.0004	47	0.0005	48
129	vion-000	0.6388	91	0.0130	137	0.0078	138	0.1389	133
130	visionbox-000	-	140	0.0005	95	0.0011	110	0.0028	75
131	visionbox-001	-	140	0.0005	94	0.0011	109	0.0028	74
132	visionlabs-006	-	140	0.0003	75	0.0005	83	0.0009	63
133	visionlabs-007	0.1939	66	0.0003	74	0.0005	80	0.0008	60
134	vocord-006	-	140	0.0003	71	0.0003	43	0.0008	59
135	vocord-007	0.0000	16	0.0001	59	0.0004	45	0.0009	62
136	winsense-000	0.0000	12	0.0000	6	0.0000	7	0.0000	5
137	yisheng-004	0.4279	83	0.0013	112	0.0006	92	0.0321	115
138	yitu-003	-	140	0.0009	104	0.0000	3	0.0000	1

Table 10: FTE is the proportion of failed template generation attempts. Failures can occur because the software throws an exception, or because the software electively refuses to process the input image. This would typically occur if a face is not detected. FTE is measured as the number of function calls that give EITHER a non-zero error code OR that give a "small" template. This is defined as one whose size is less than 0.3 times the median template size for that algorithm. This second rule is needed because some algorithms incorrectly fail to return a non-zero error code when template generation fails.

[1] *The effects of FTE are included in the accuracy results of this report by regarding any template comparison involving a failed template to produce a low similarity score. Thus higher FTE results in higher FNMR and lower FMR.*

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

3.4 Recognition accuracy

Core algorithm accuracy is stated via:

- **Cooperative subjects**
  - The summary table of Figure 7;
  - The visa image DETs of Figure 23;
  - The mugshot DETs of Figure 30;
  - The mugshot ageing profiles of Figure 112;
  - The human-difficult pairs of Figure 9
- **Non-cooperative subjects**
  - The photojournalism DET of Figure 36
  - The child-exploitation DET of Figure 40;
  - The child-exploitation CMC of Figure 43.

Figure 91 shows dependence of false match rate on algorithm score threshold. This allows a deployer to set a threshold to target a particular false match rate appropriate to the security objectives of the application.

Figure 77 likewise shows FMR(T) but for mugshots, and specially four subsets of the population.

Note that in both the mugshot and visa sets false match rates vary with the ethnicity, age, and sex, of the enrollee and impostor - see section 3.6. For example figure 51 summarizes FMR for impostors paired from four groups black females, black males, white females, white males.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

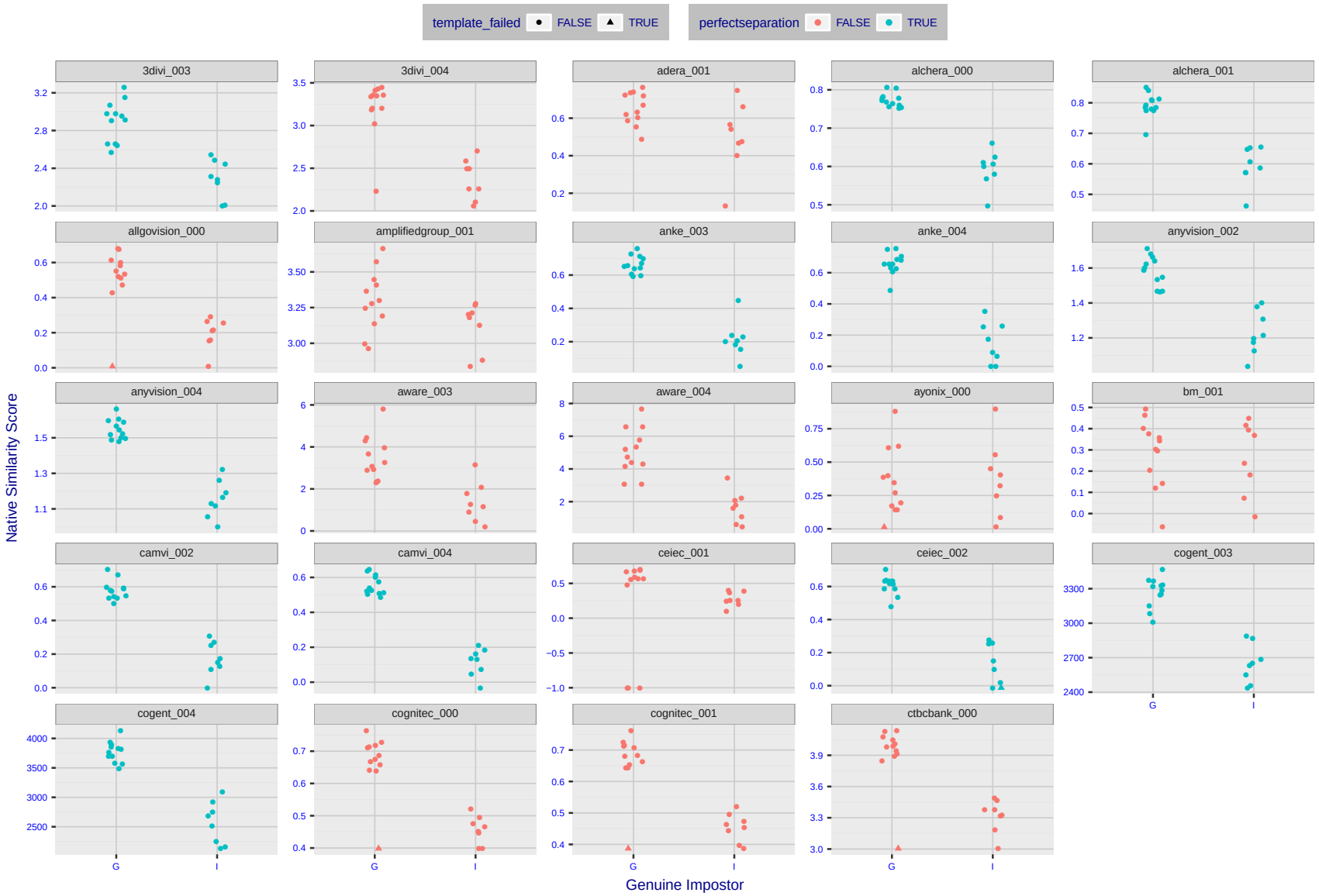


Figure 4: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

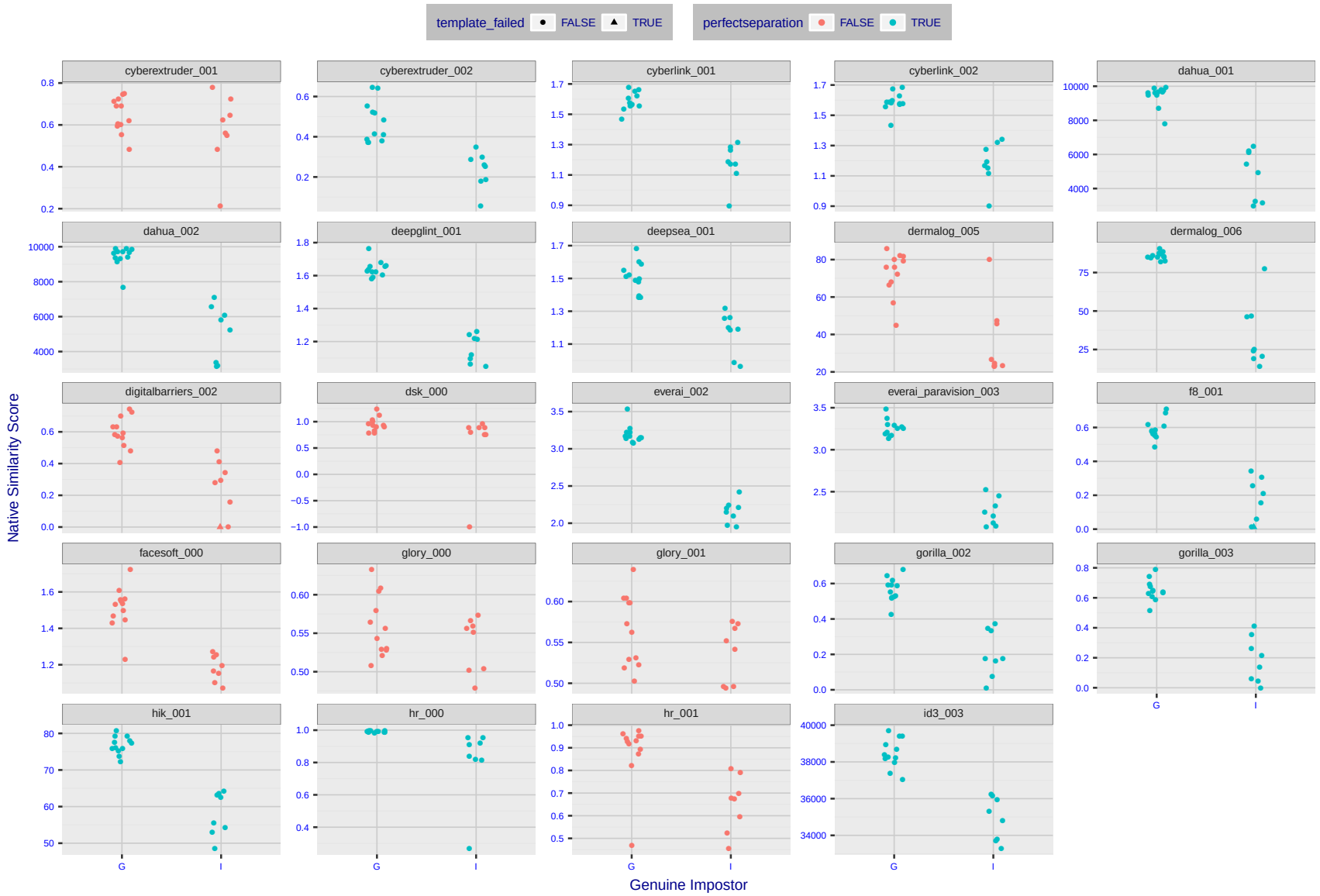


Figure 5: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

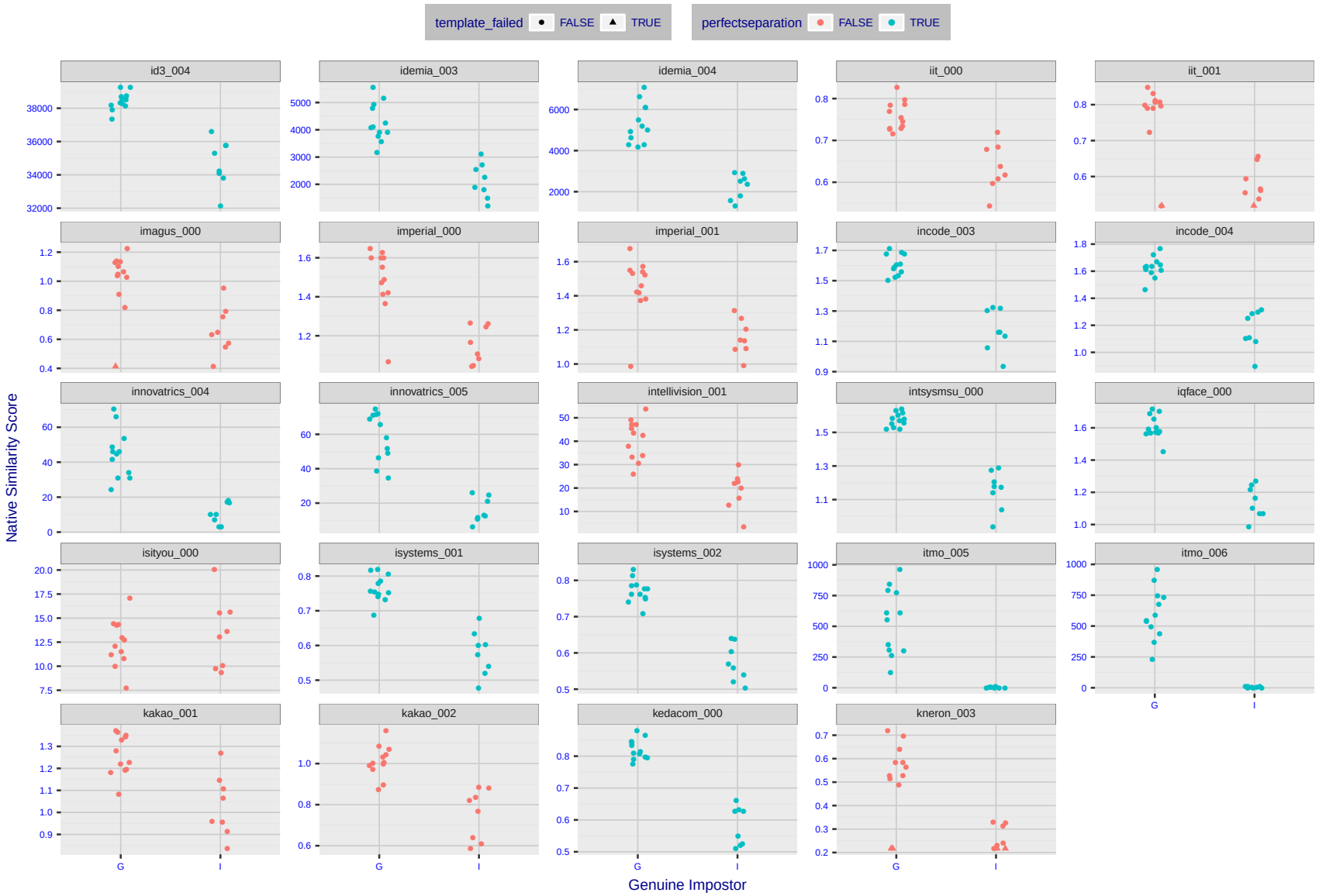


Figure 6: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

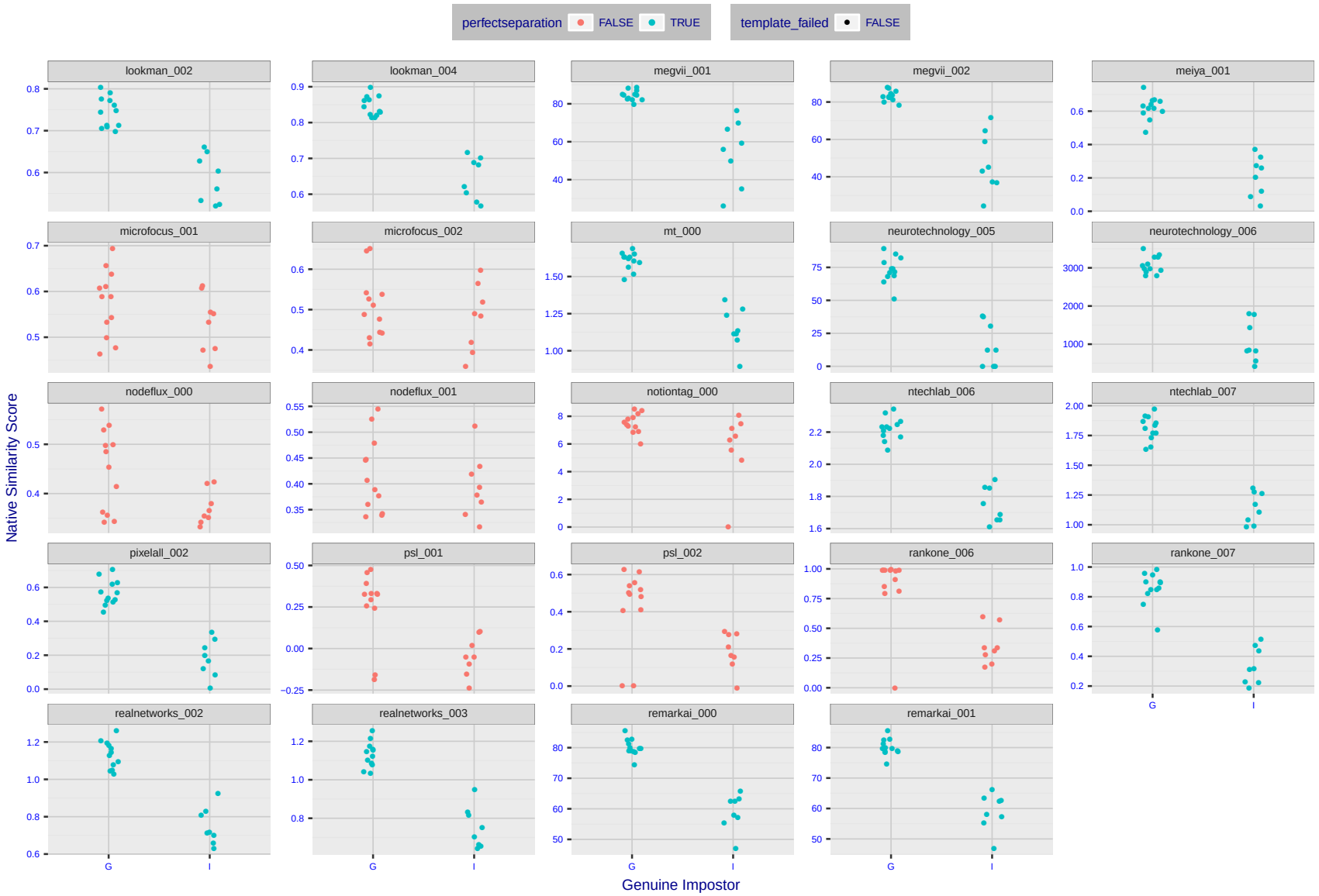


Figure 7: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

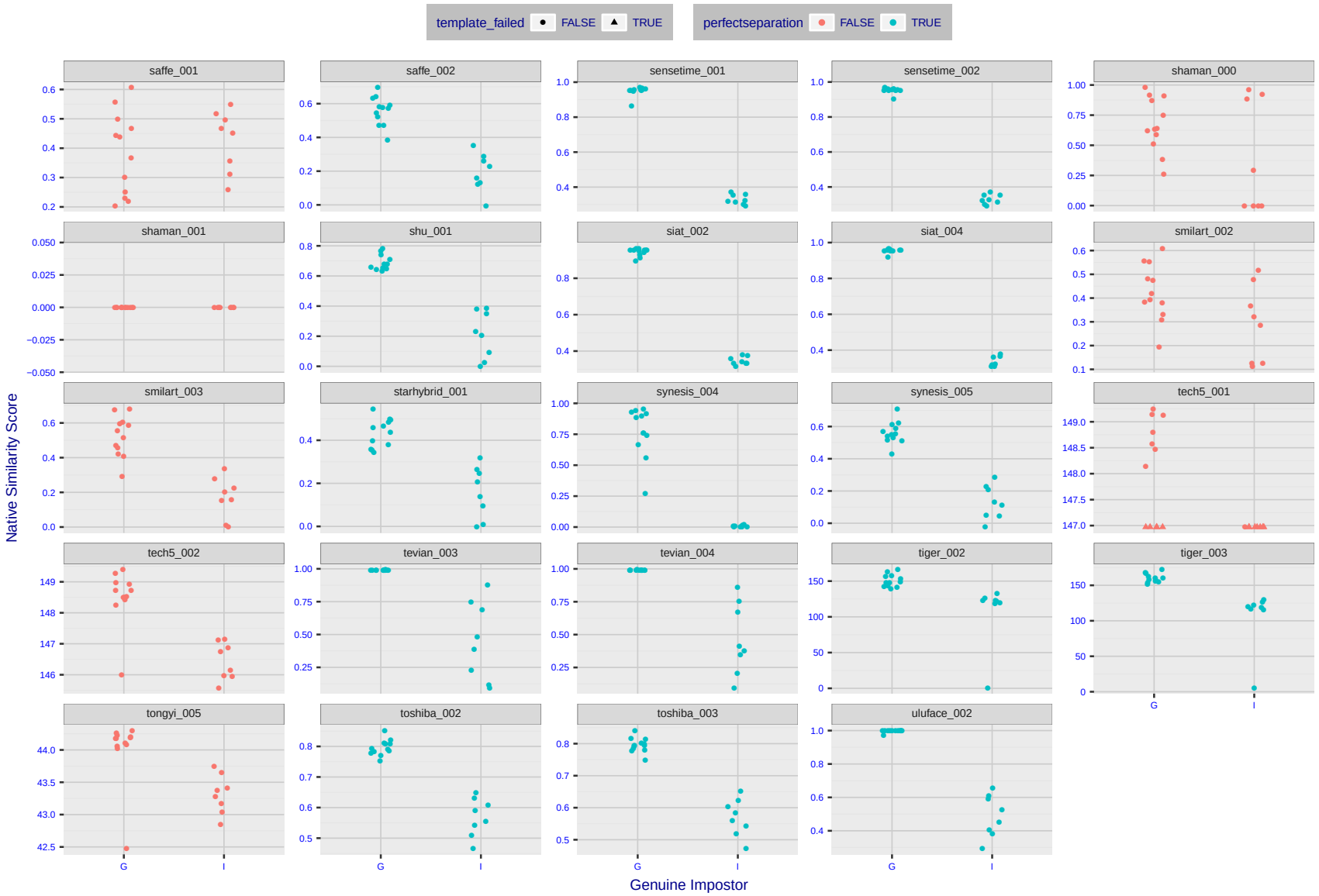


Figure 8: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

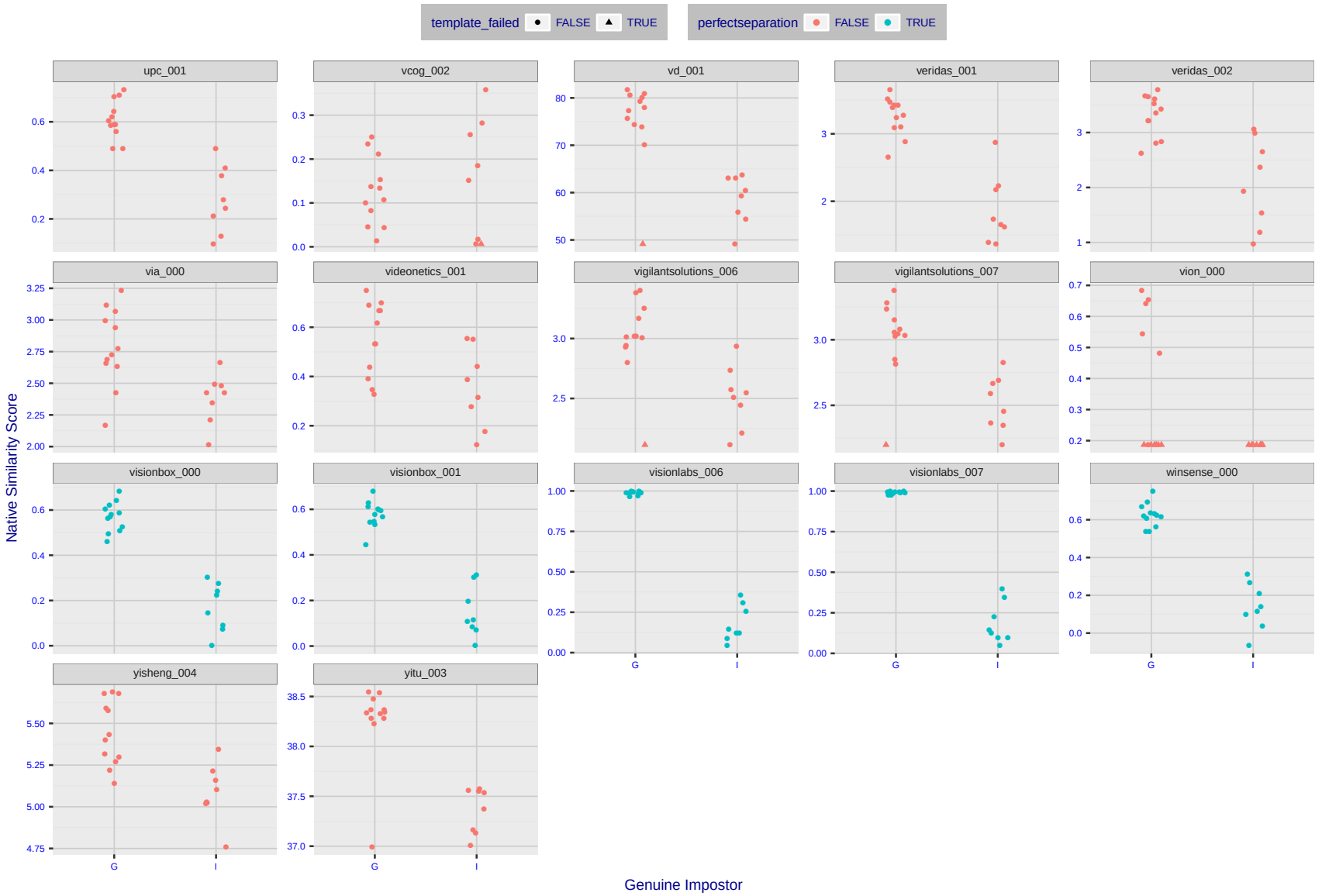


Figure 9: The Figure shows, in blue, algorithms that correctly separate the 12 genuine and 8 impostor pairs used in the May 2018 paper Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms *(Phillips et al. [1]). In red are algorithms that are imperfect. Some algorithms fail only because they failed to make a template e.g. due to face detection failure (shown as a triangle). Others fail because the pairs were selected for that study because they had been difficult for three leading algorithms used in FRVT 2006. Caution: Given the small sample size (n=20) the figure may change substantially if larger or different sets were used. The images can be downloaded from the* Supplemental Information *page provided with that publication.*

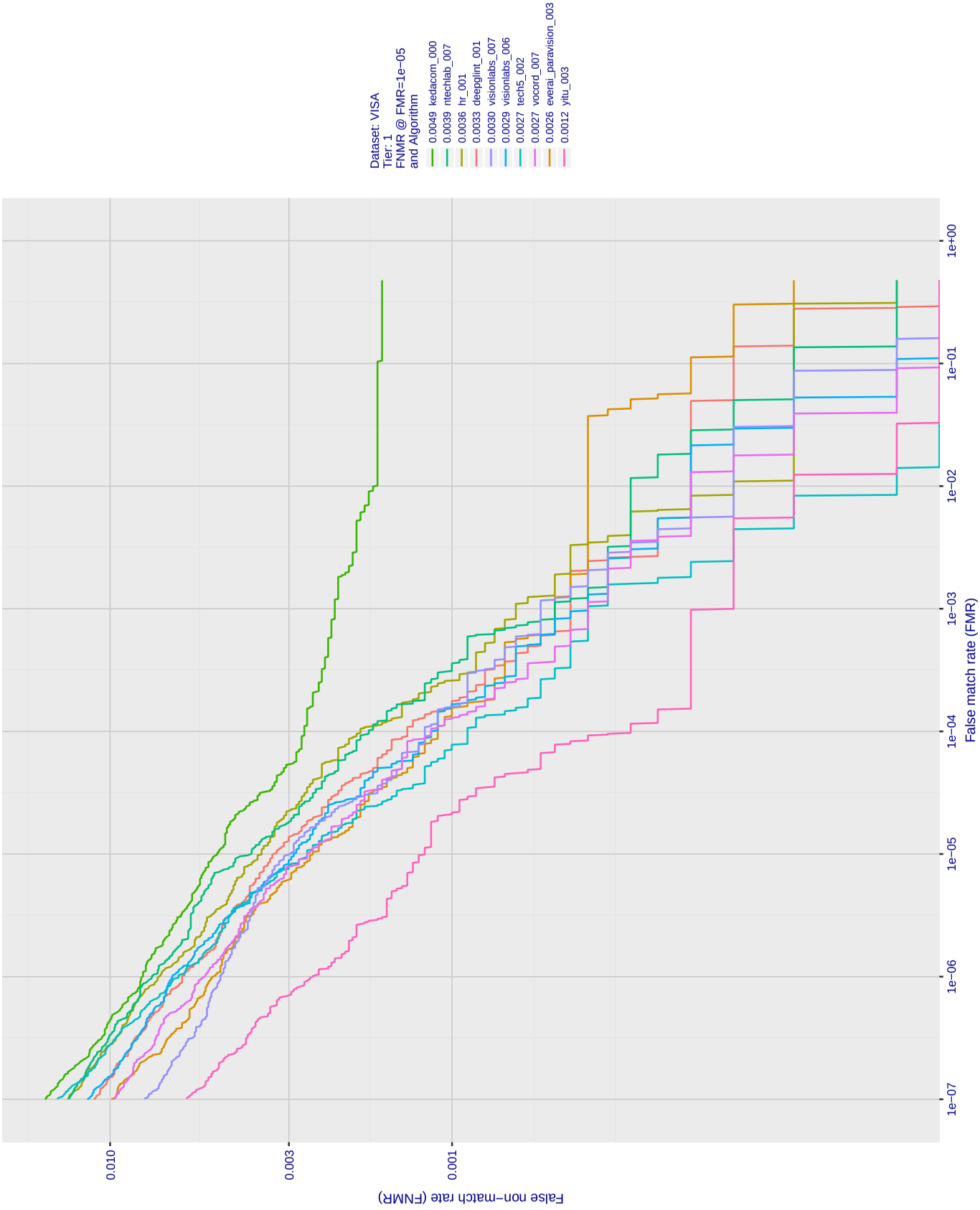


Figure 10: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

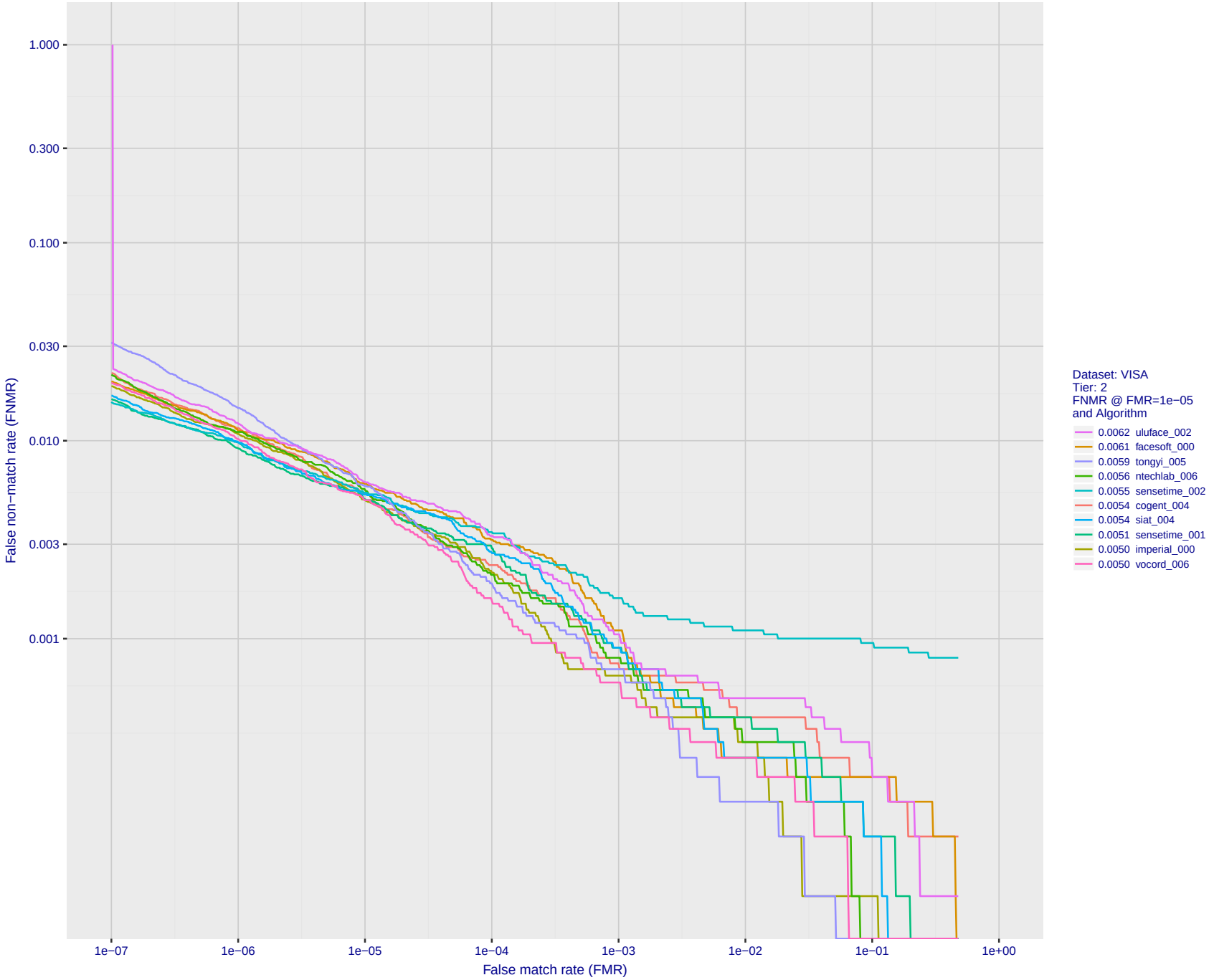


*Figure 11: For the visa images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR*.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

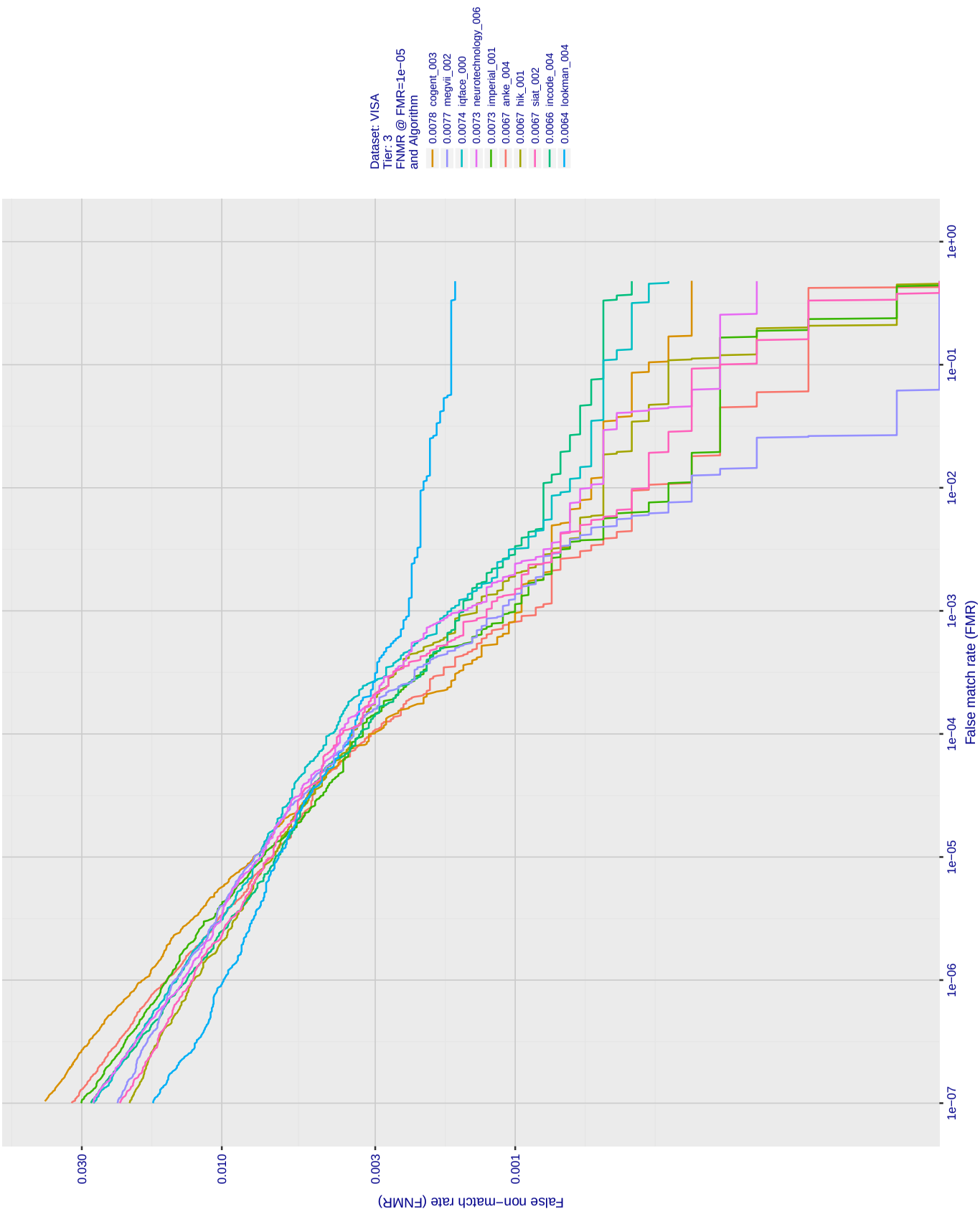


Figure 12: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

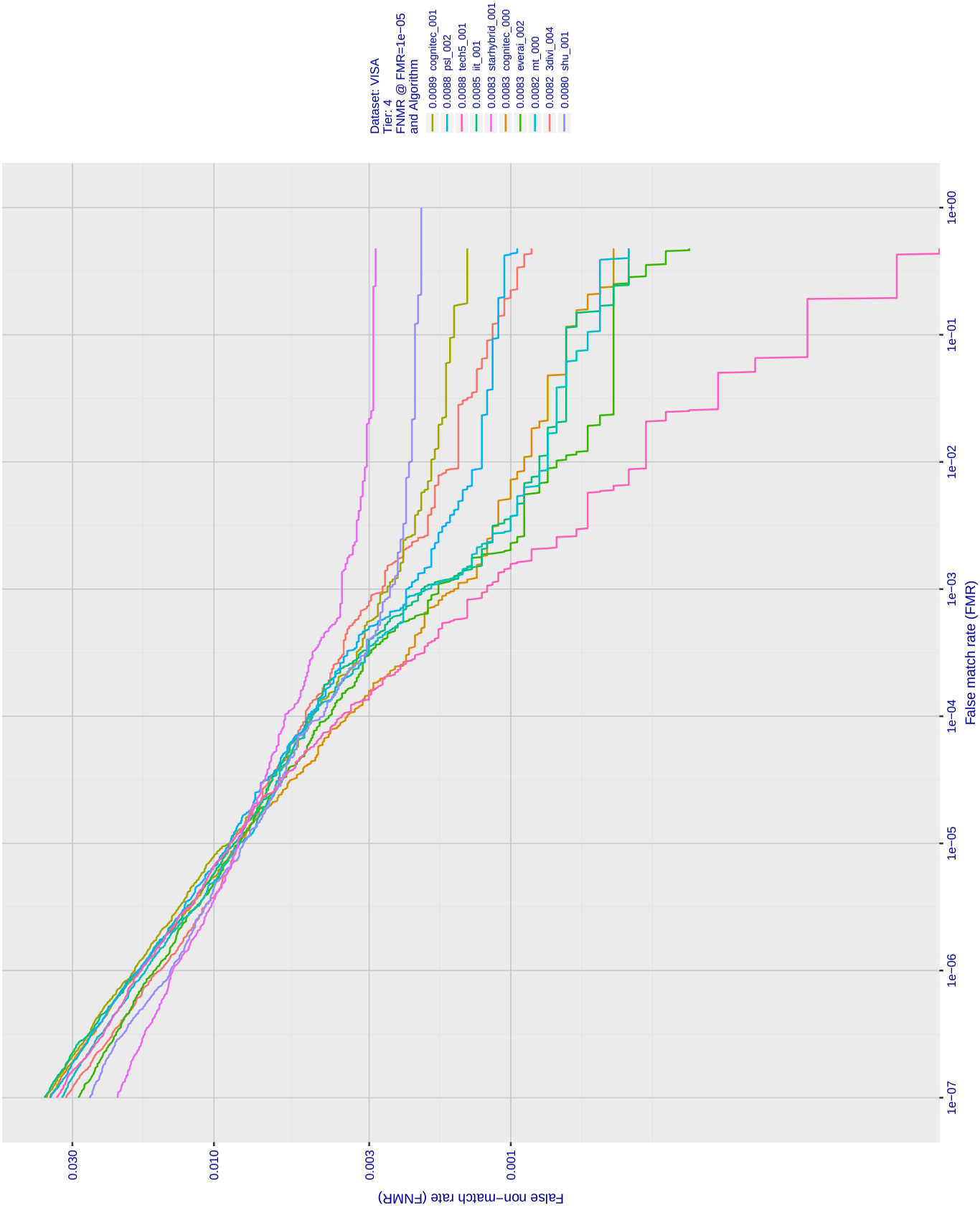


Figure 13: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

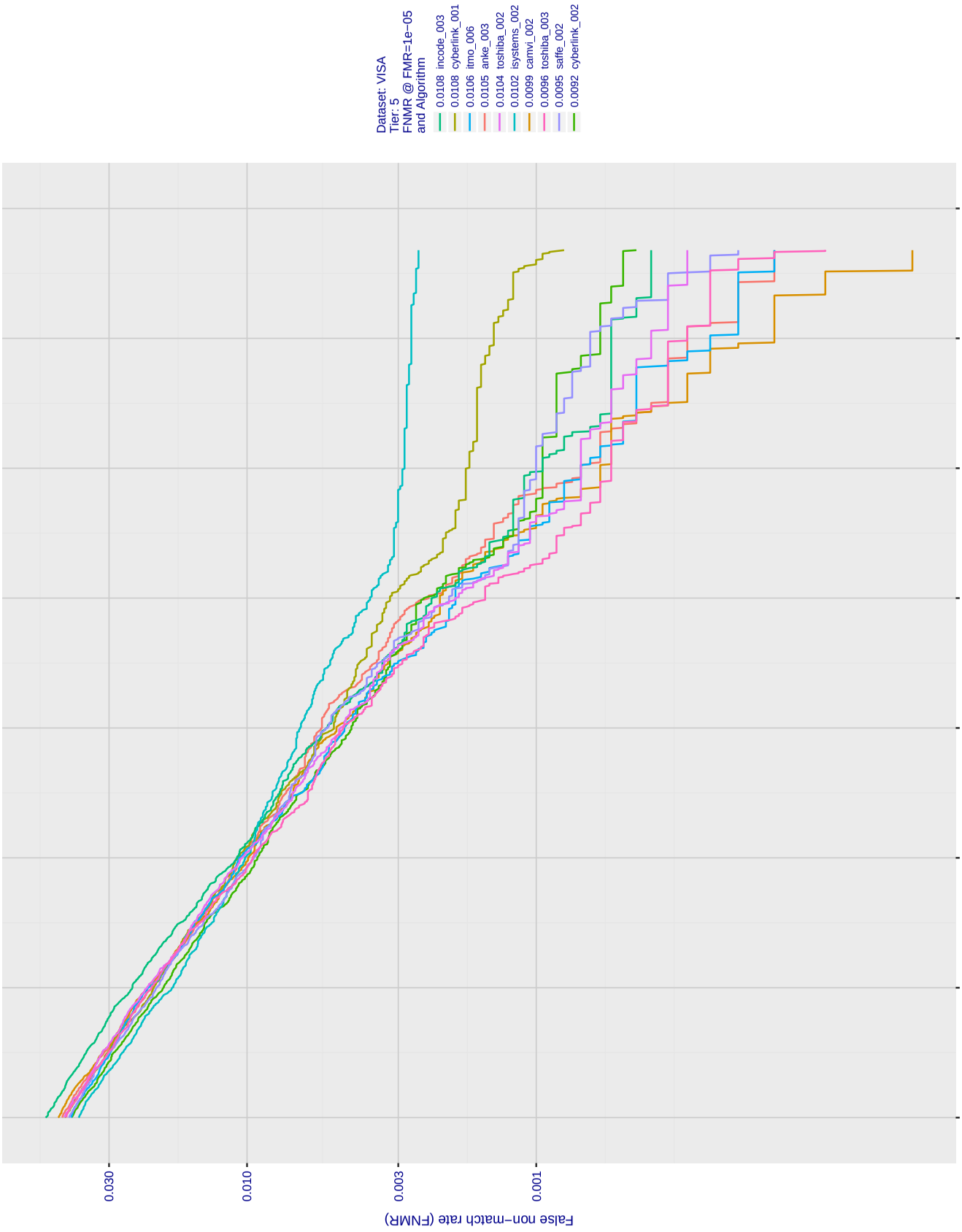


Figure 14: For the visa images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

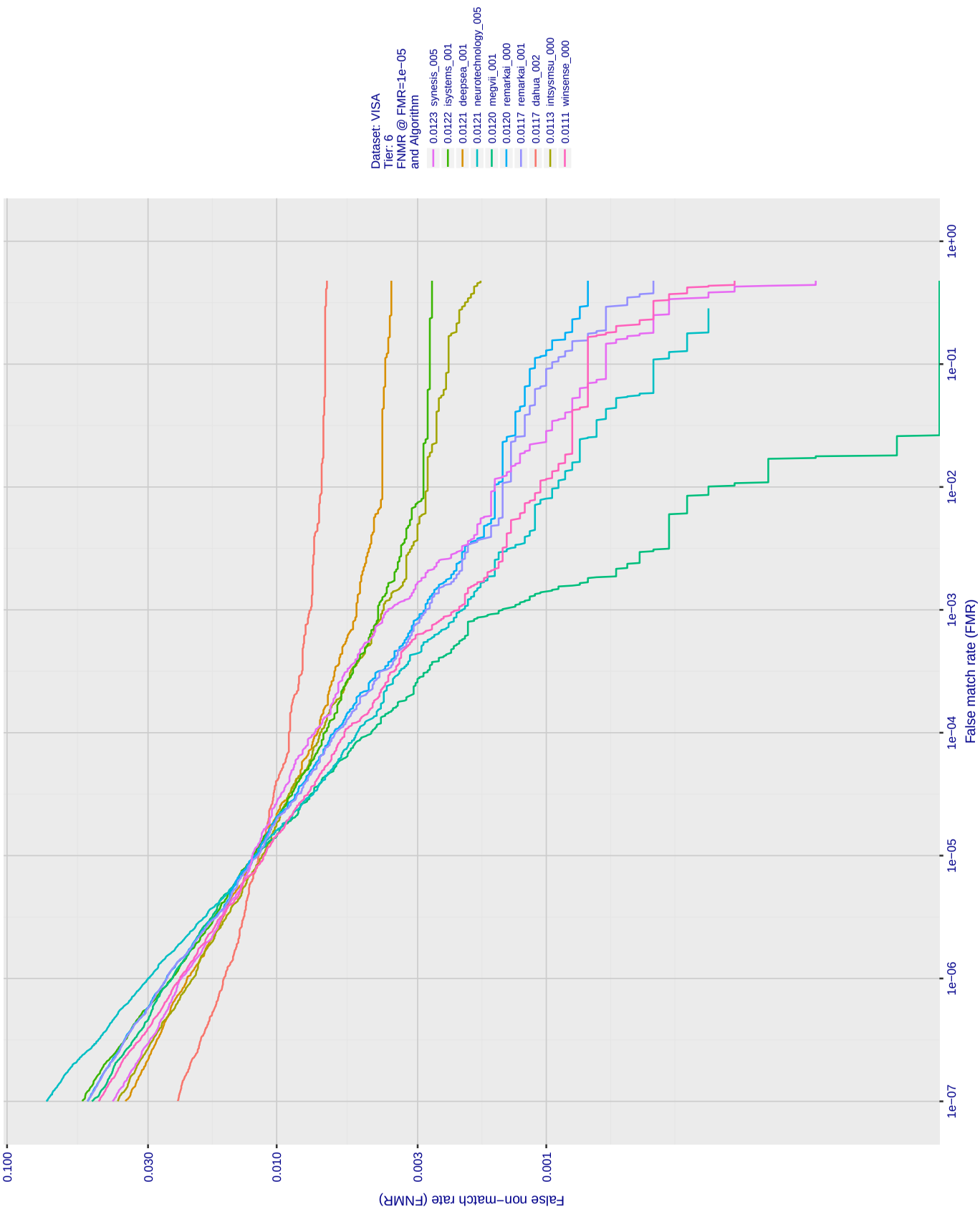


Figure 15: For the visa images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

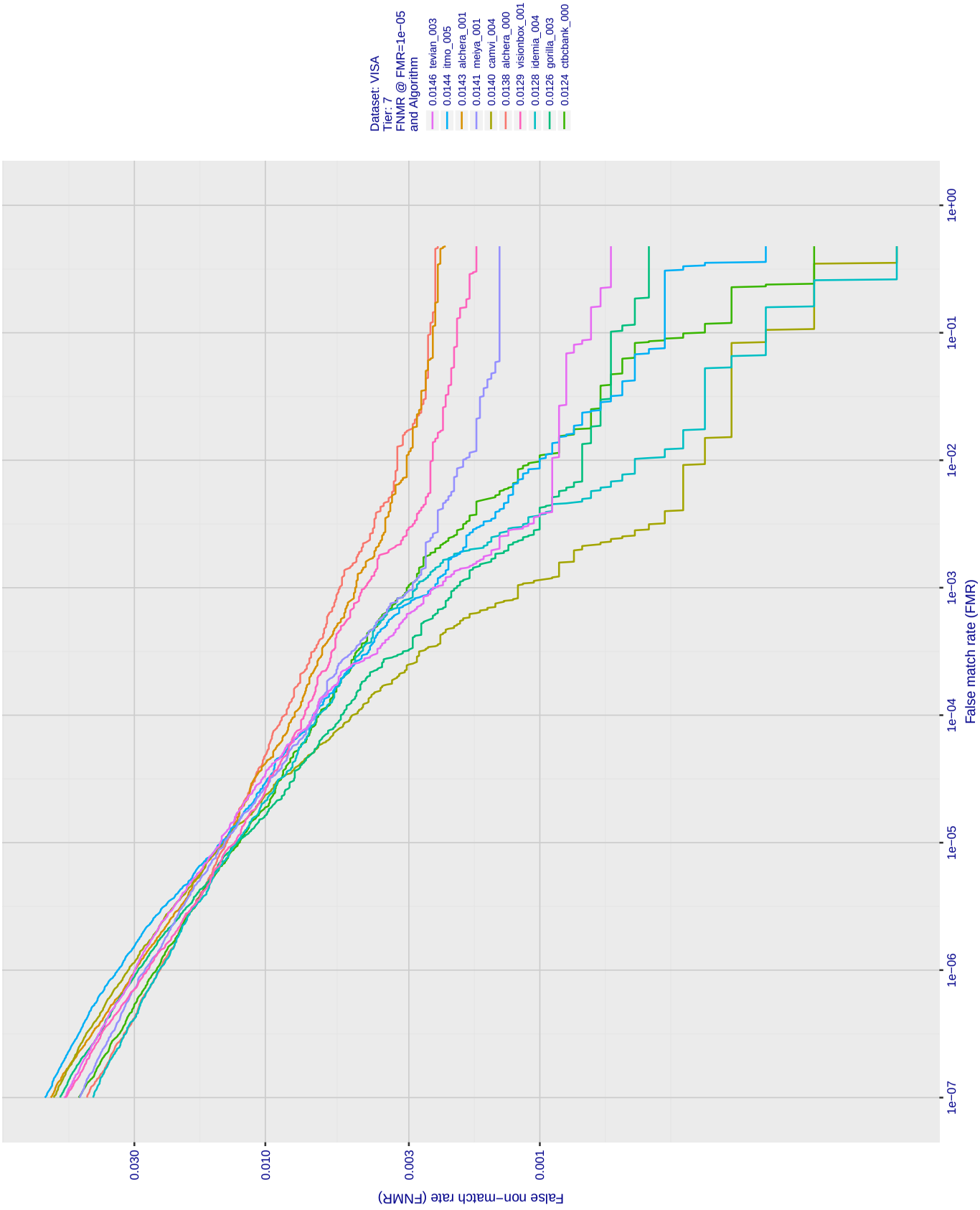


Figure 16: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

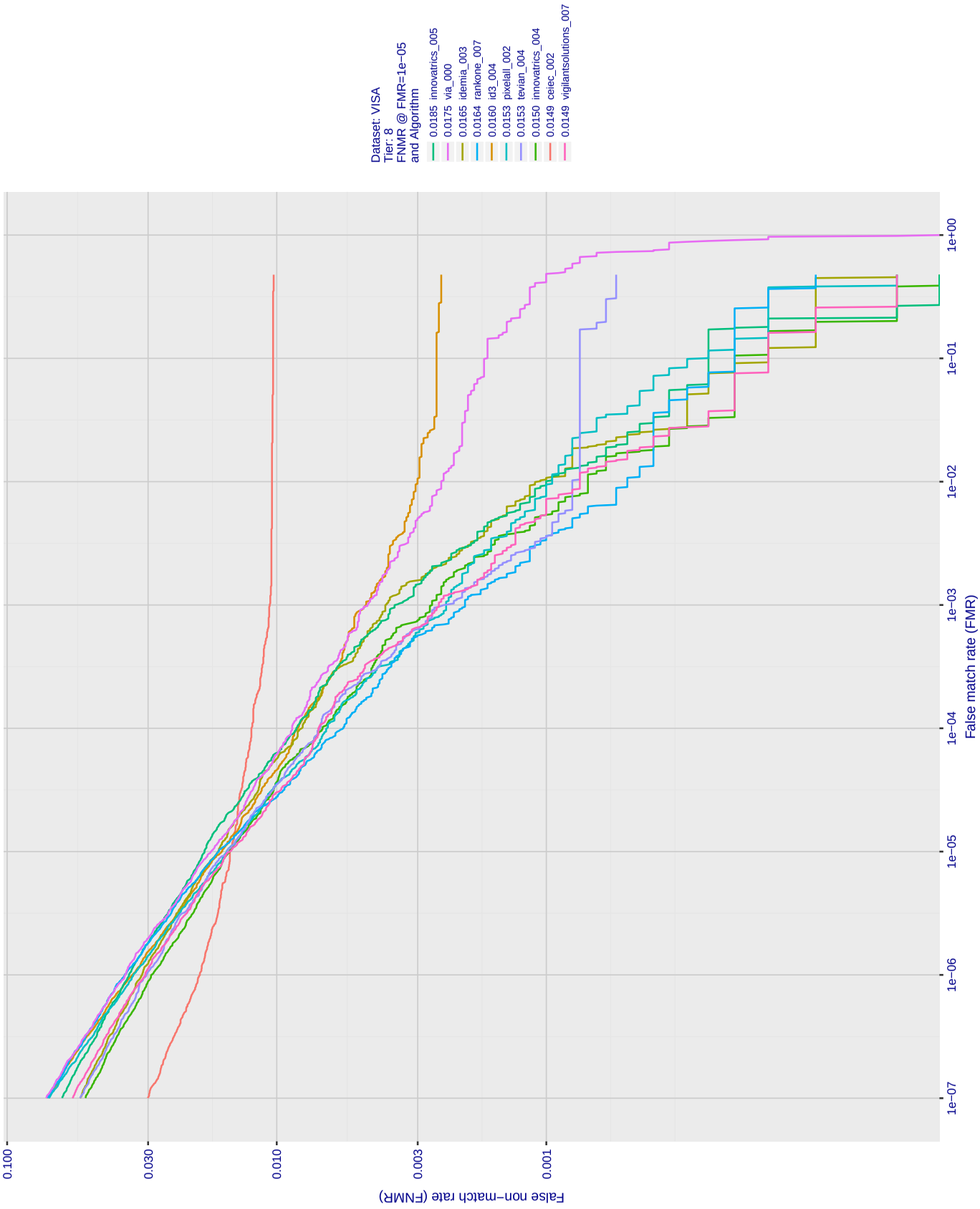


Figure 17: For the visa images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

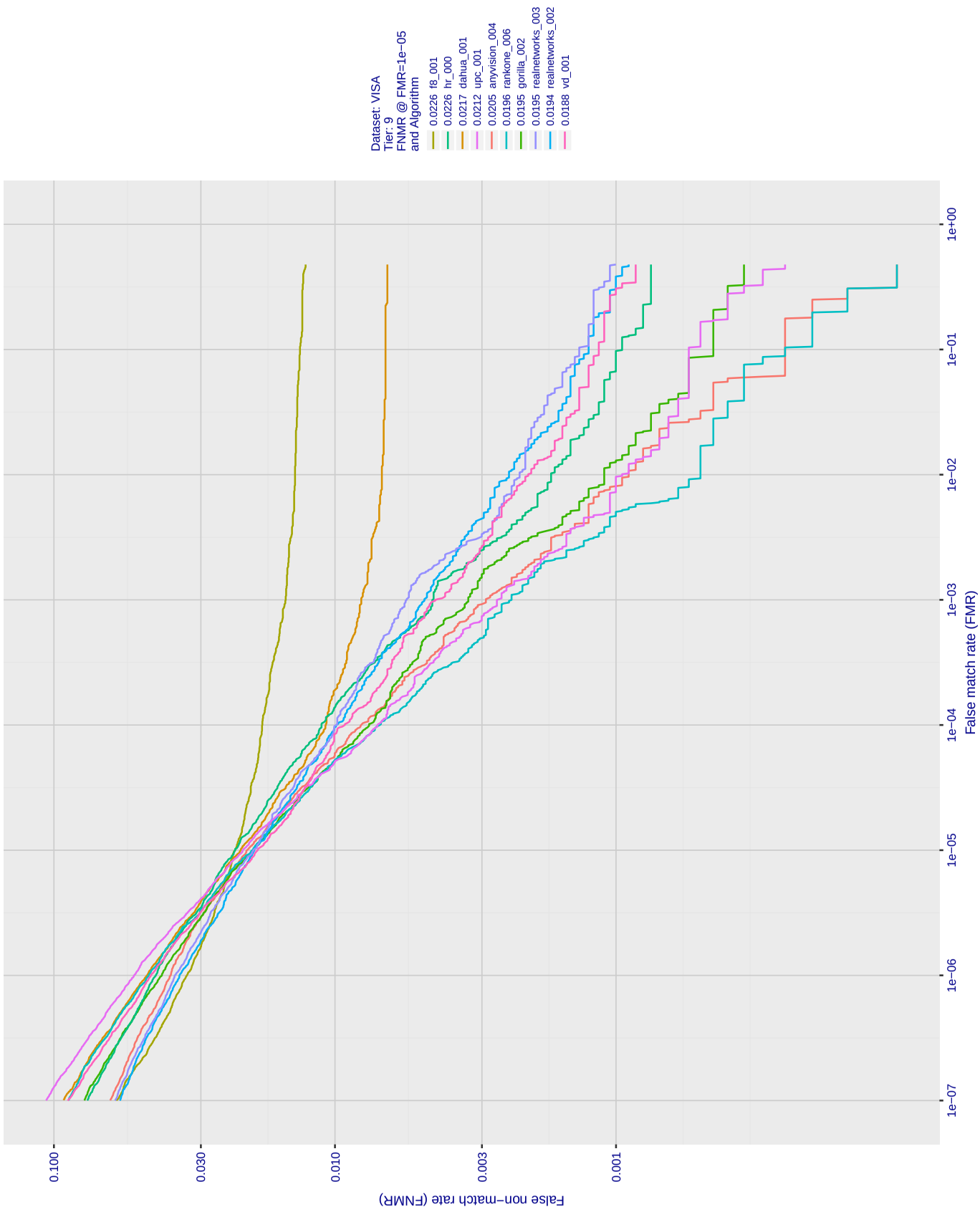


Figure 18: For the visa images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

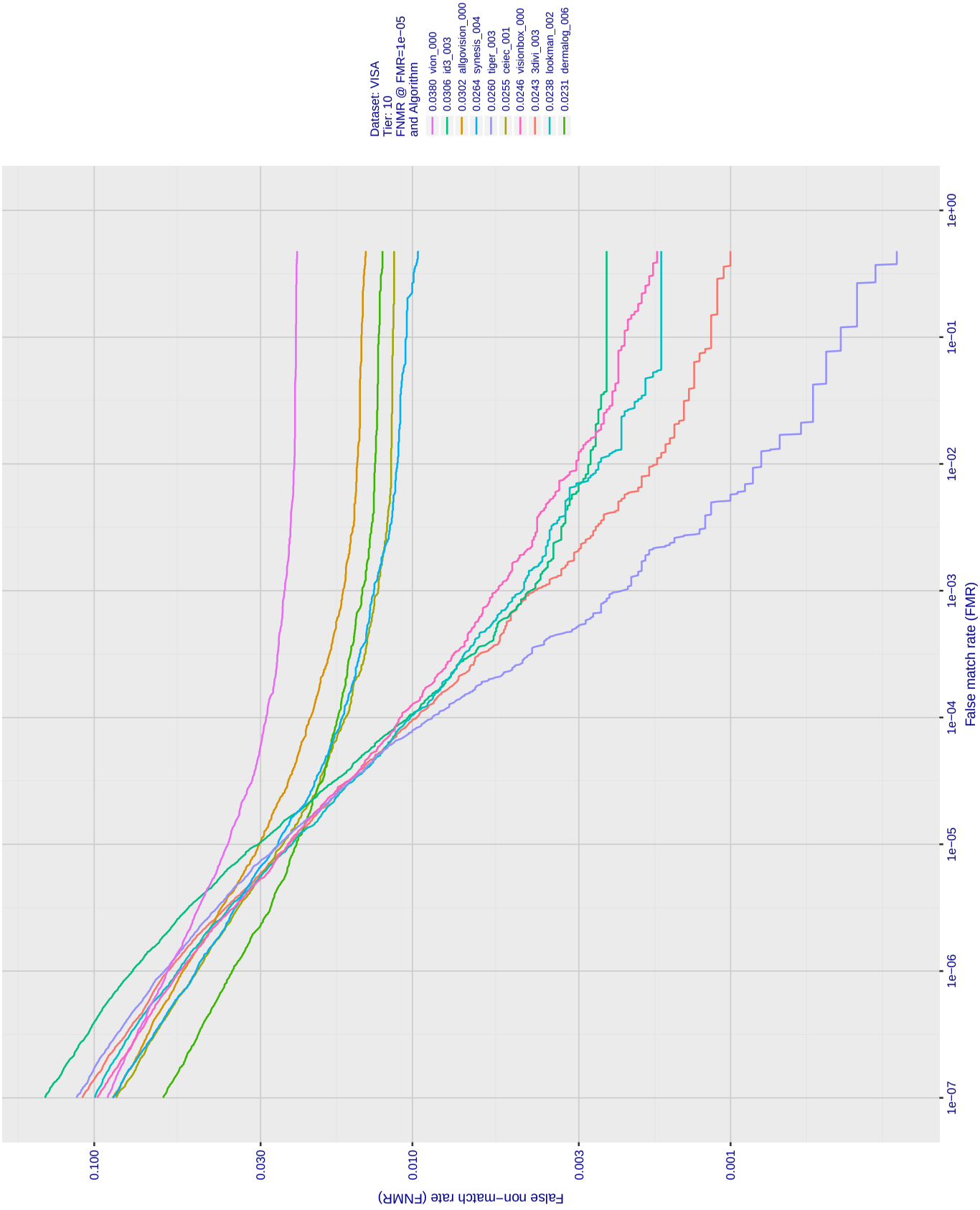


Figure 19: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

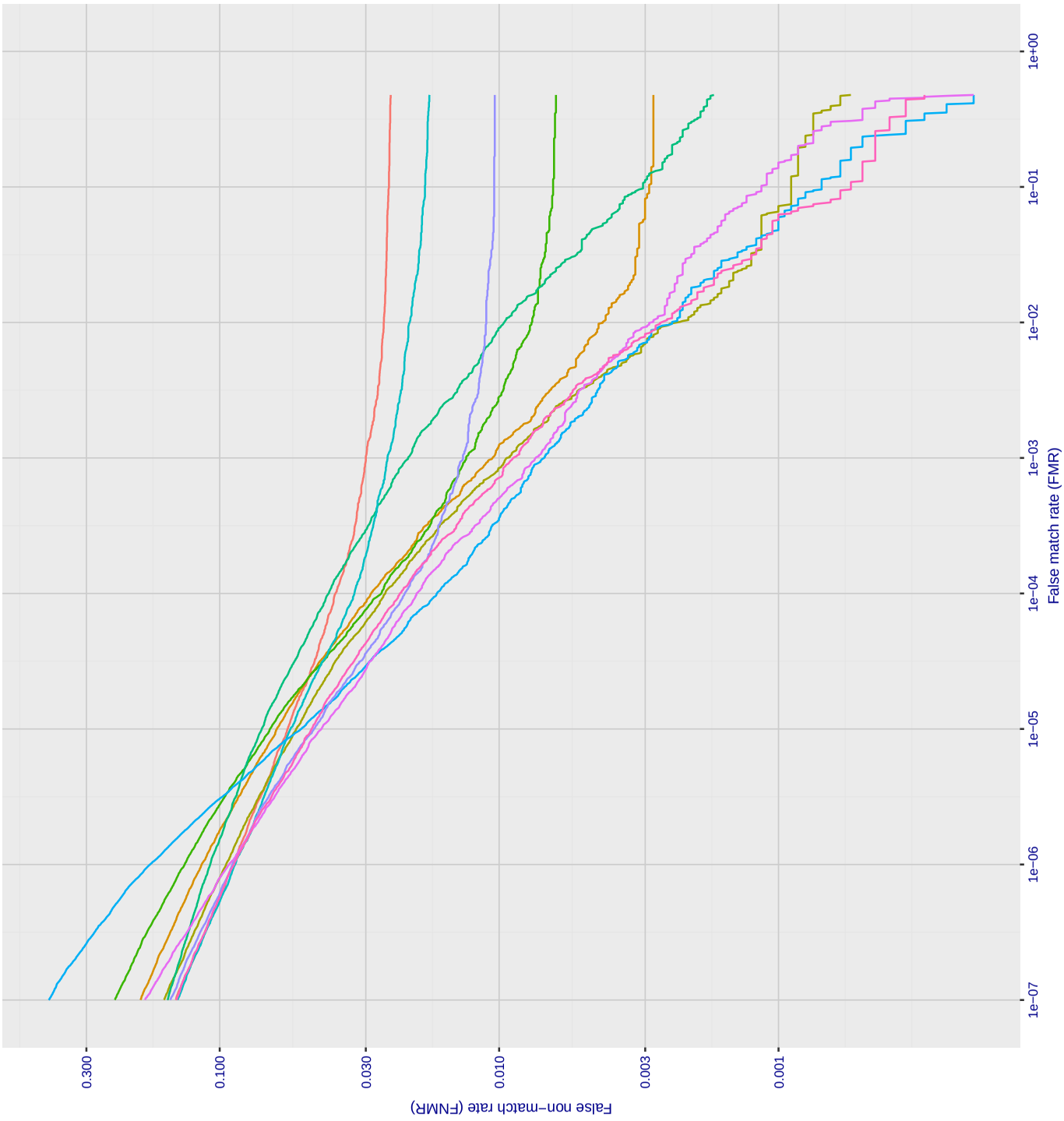


Figure 20: For the visa images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

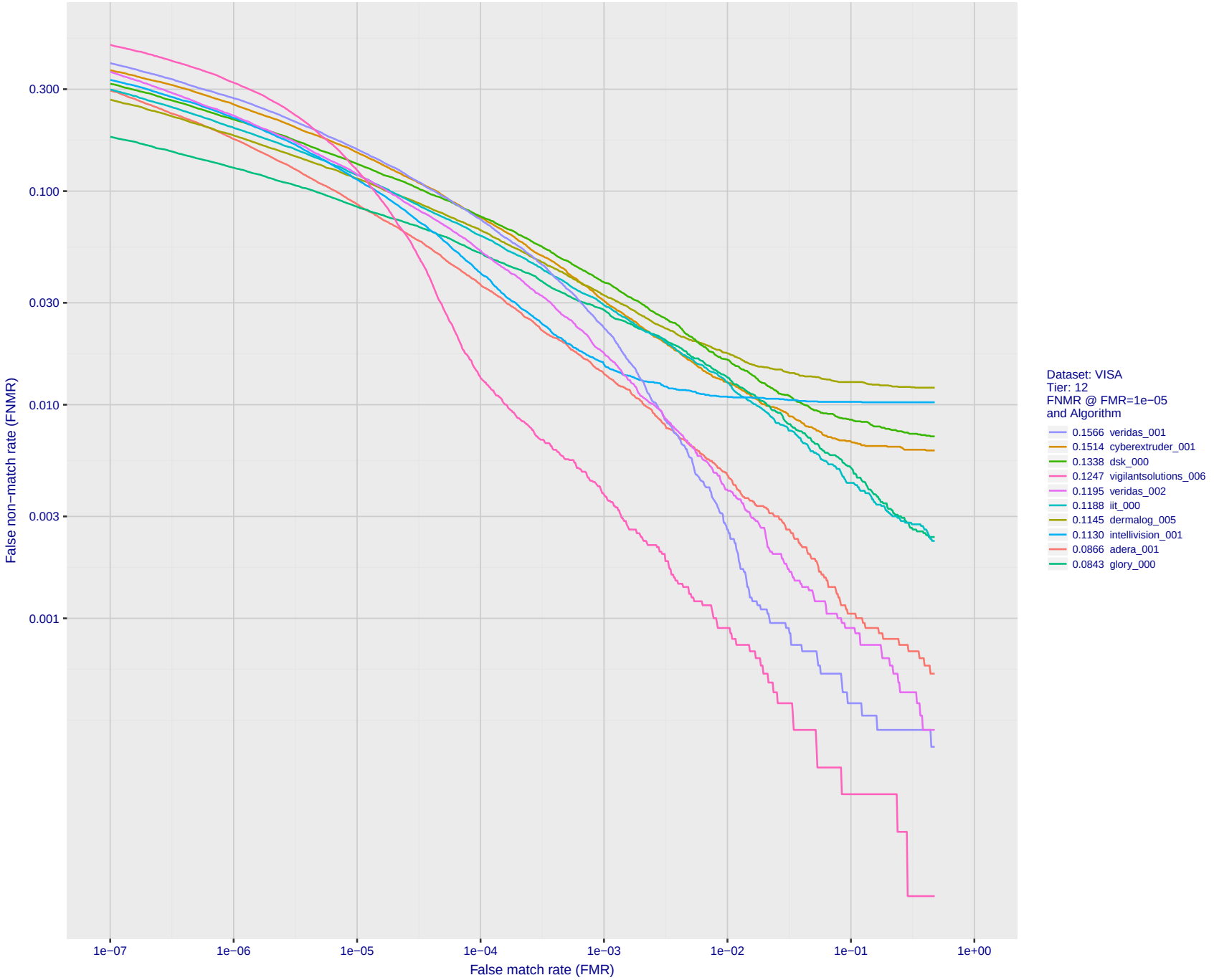


Figure 21: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

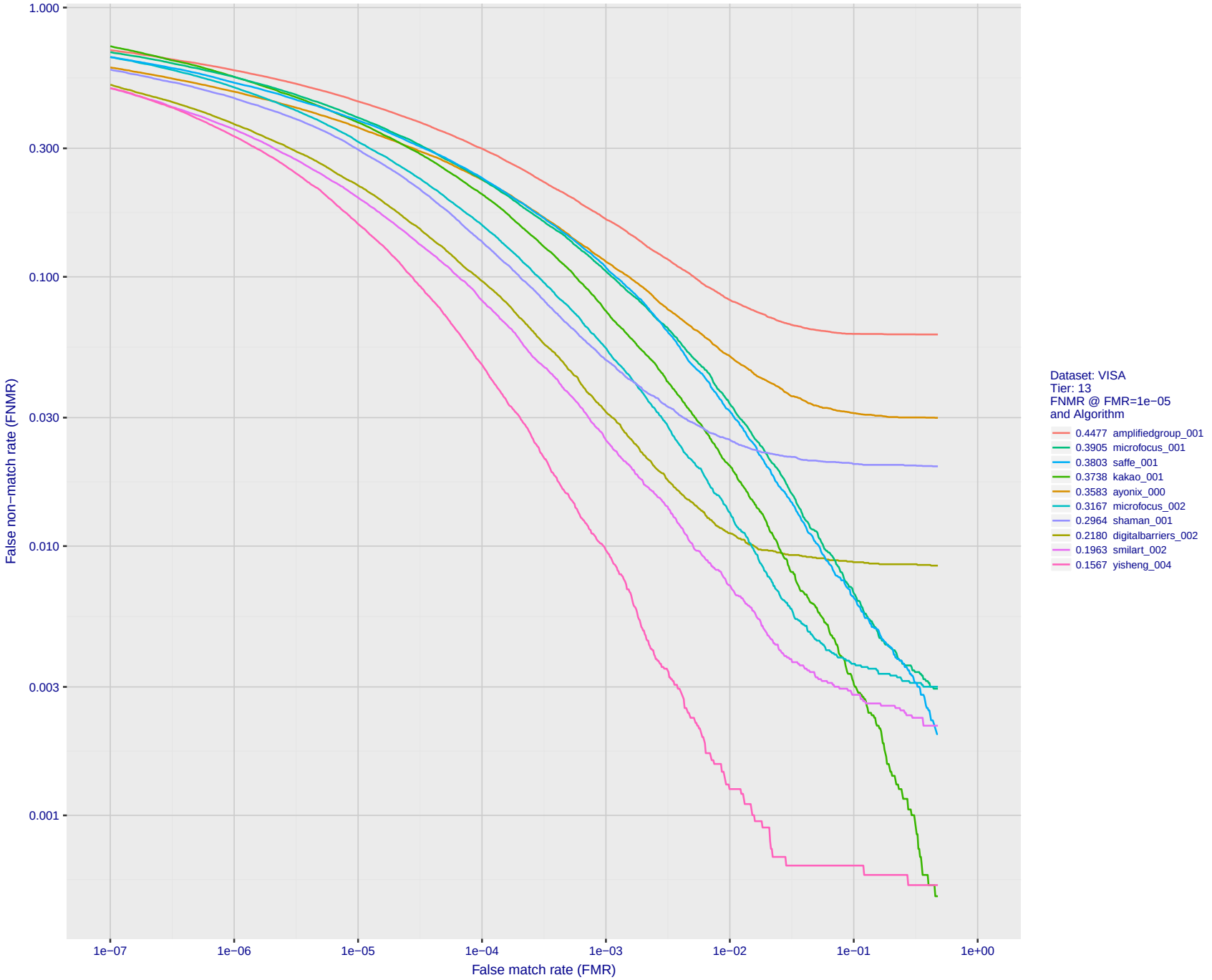


*Figure 22: For the visa images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR*.*

2019/07/31 13:10:02 "False non-match rate" FNMR(T) "False match rate" FMR(T)

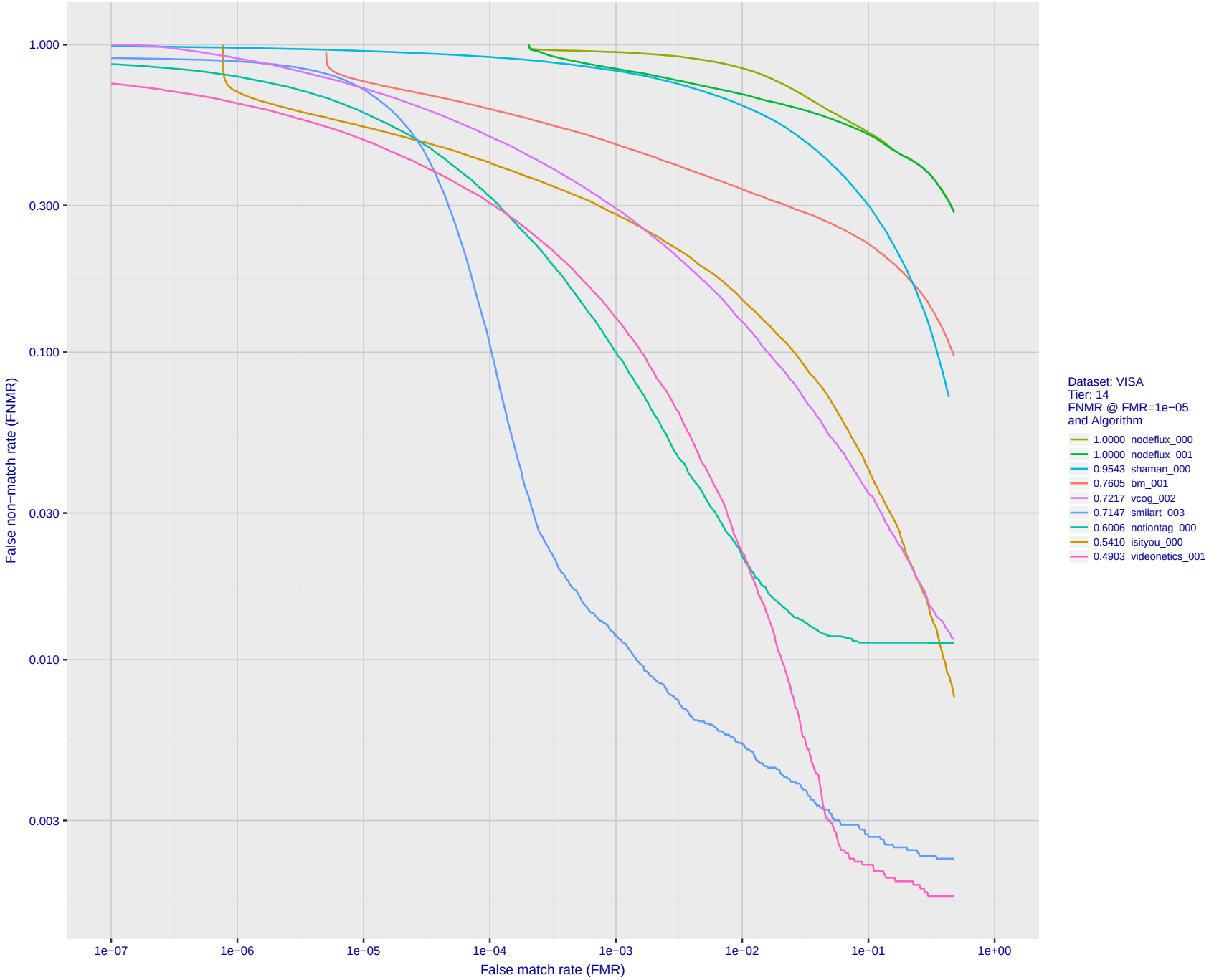


Figure 23: For the visa images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

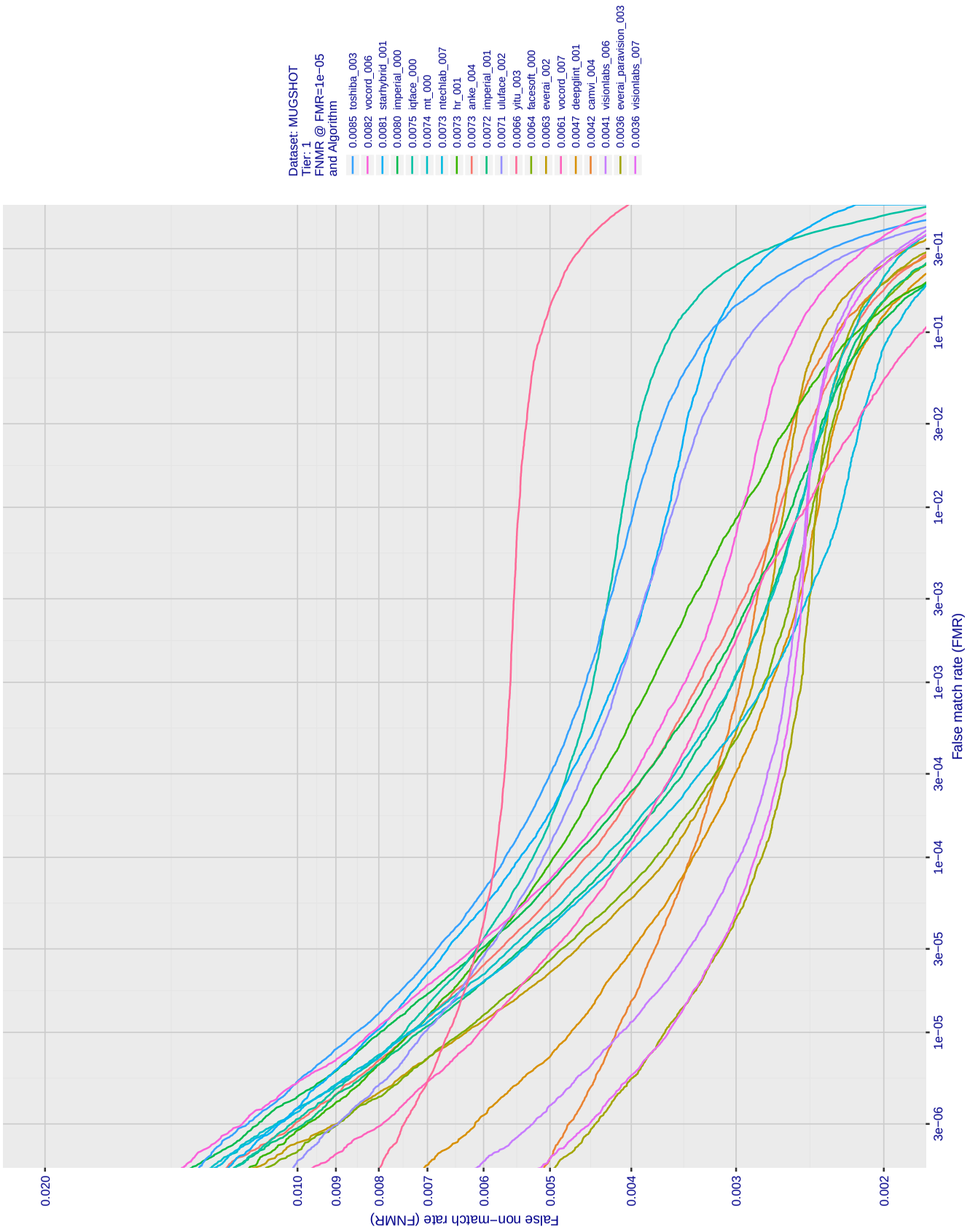


Figure 24: For the mugshot images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

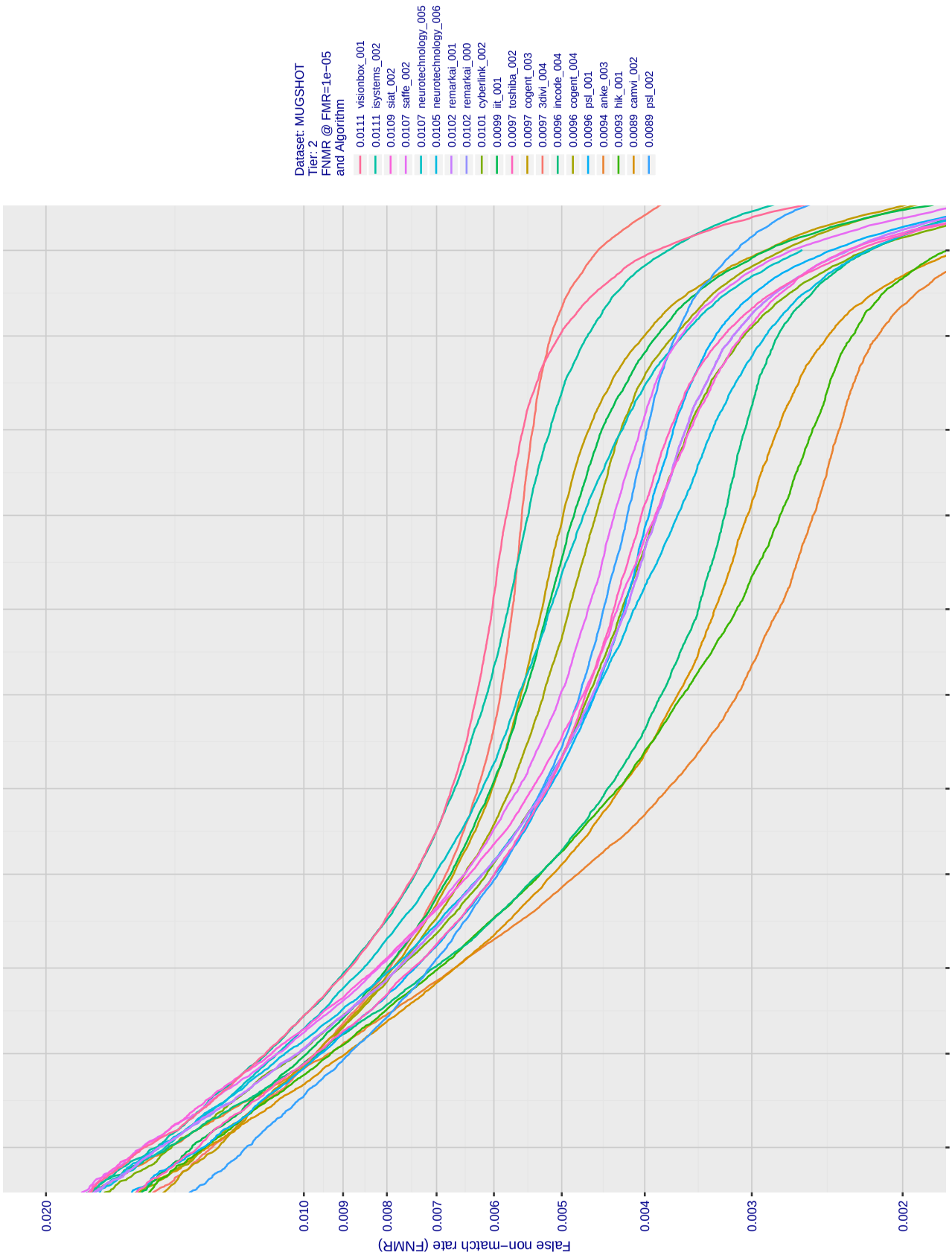


Figure 25: For the mugshot images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

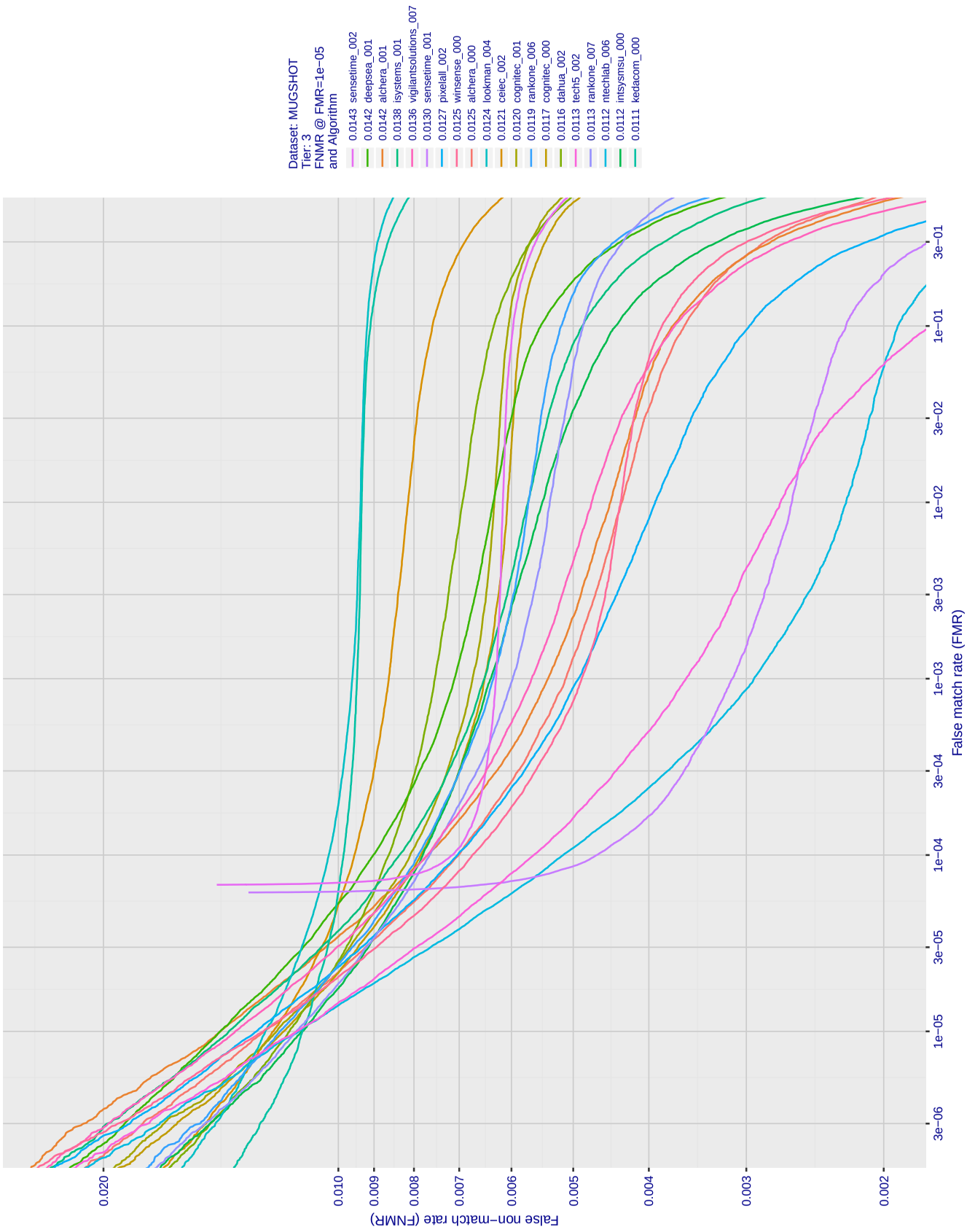


Figure 26: For the mugshot images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

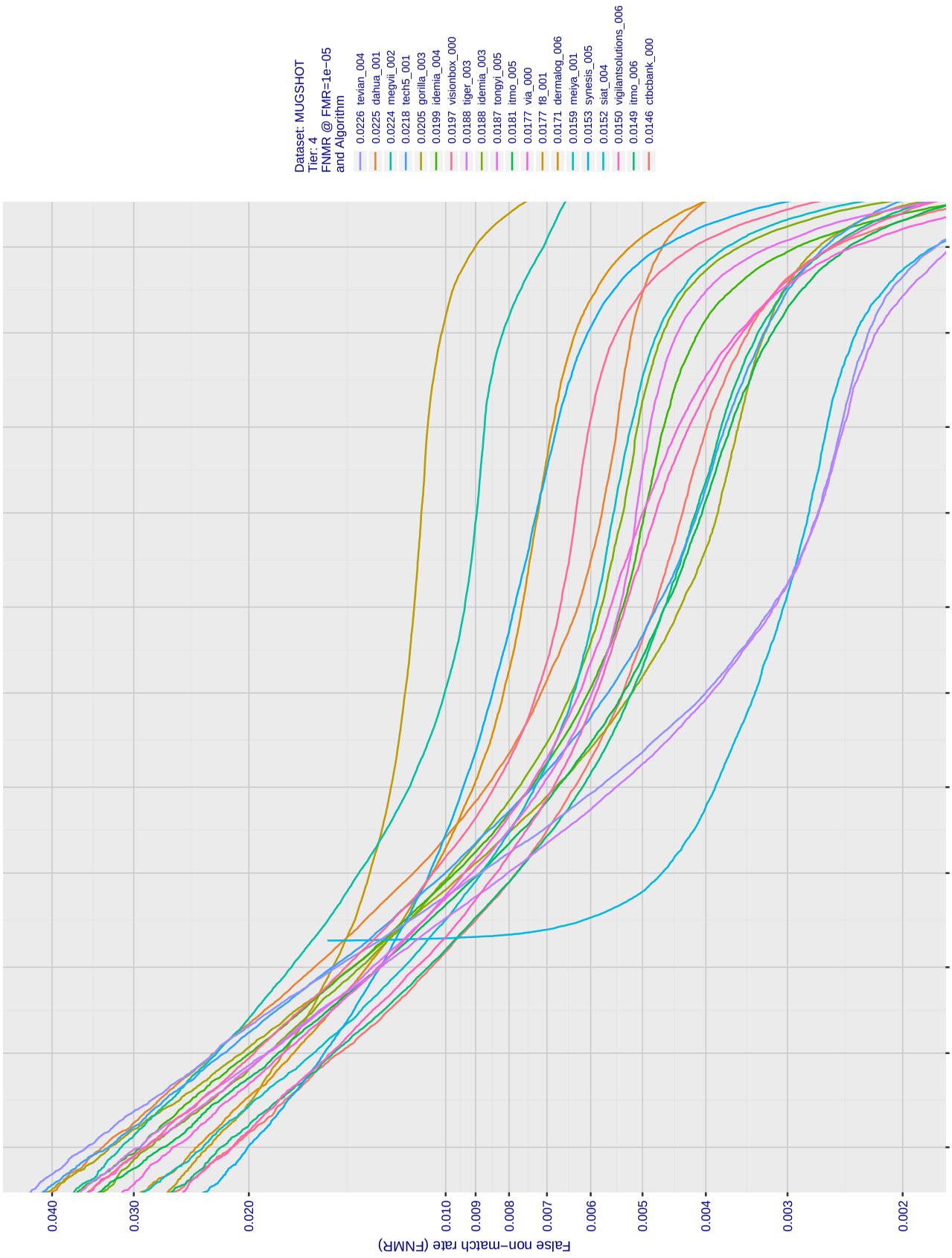


Figure 27: For the mugshot images, detection error tradeoff (DET) *characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

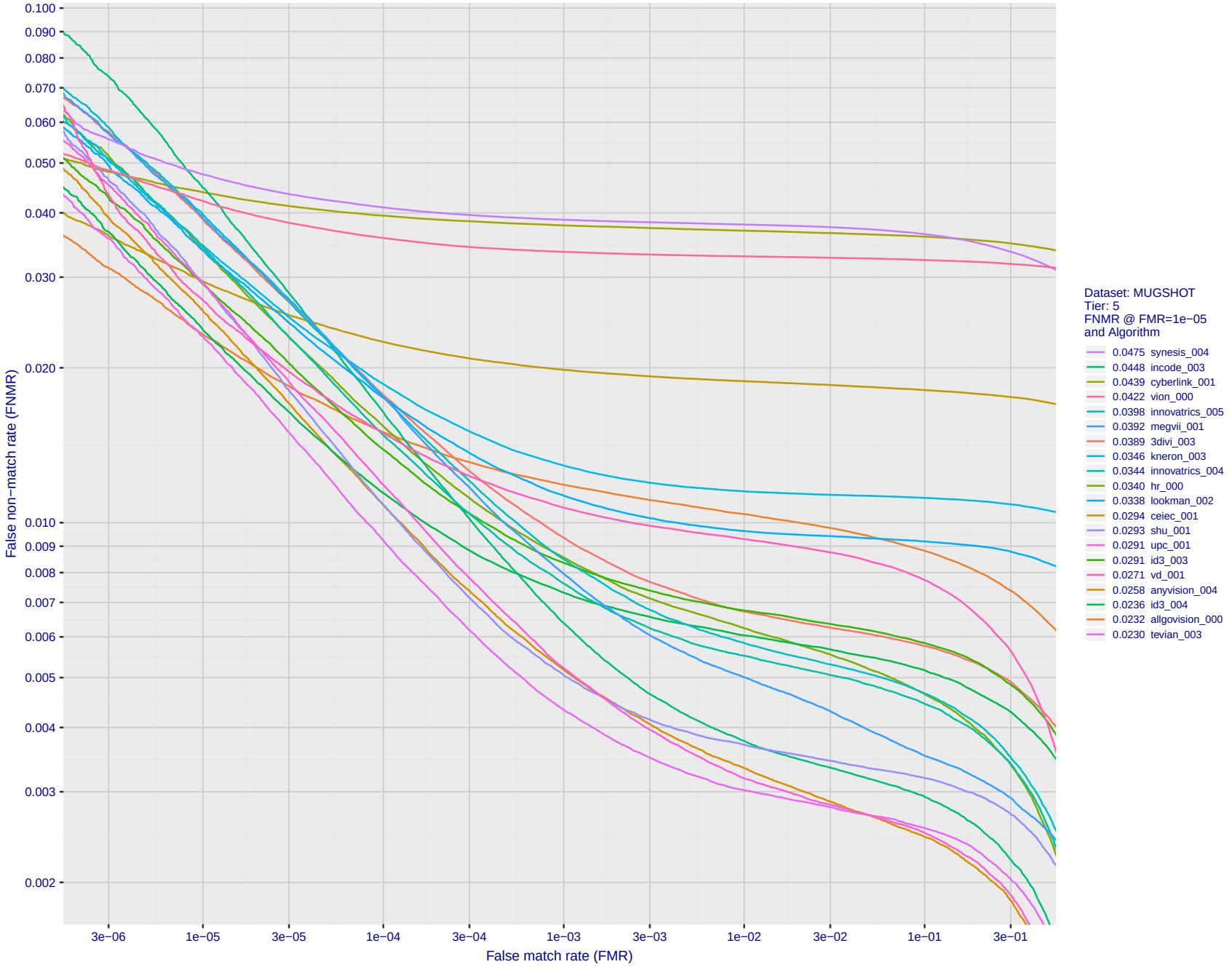


*Figure 28: For the mugshot images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

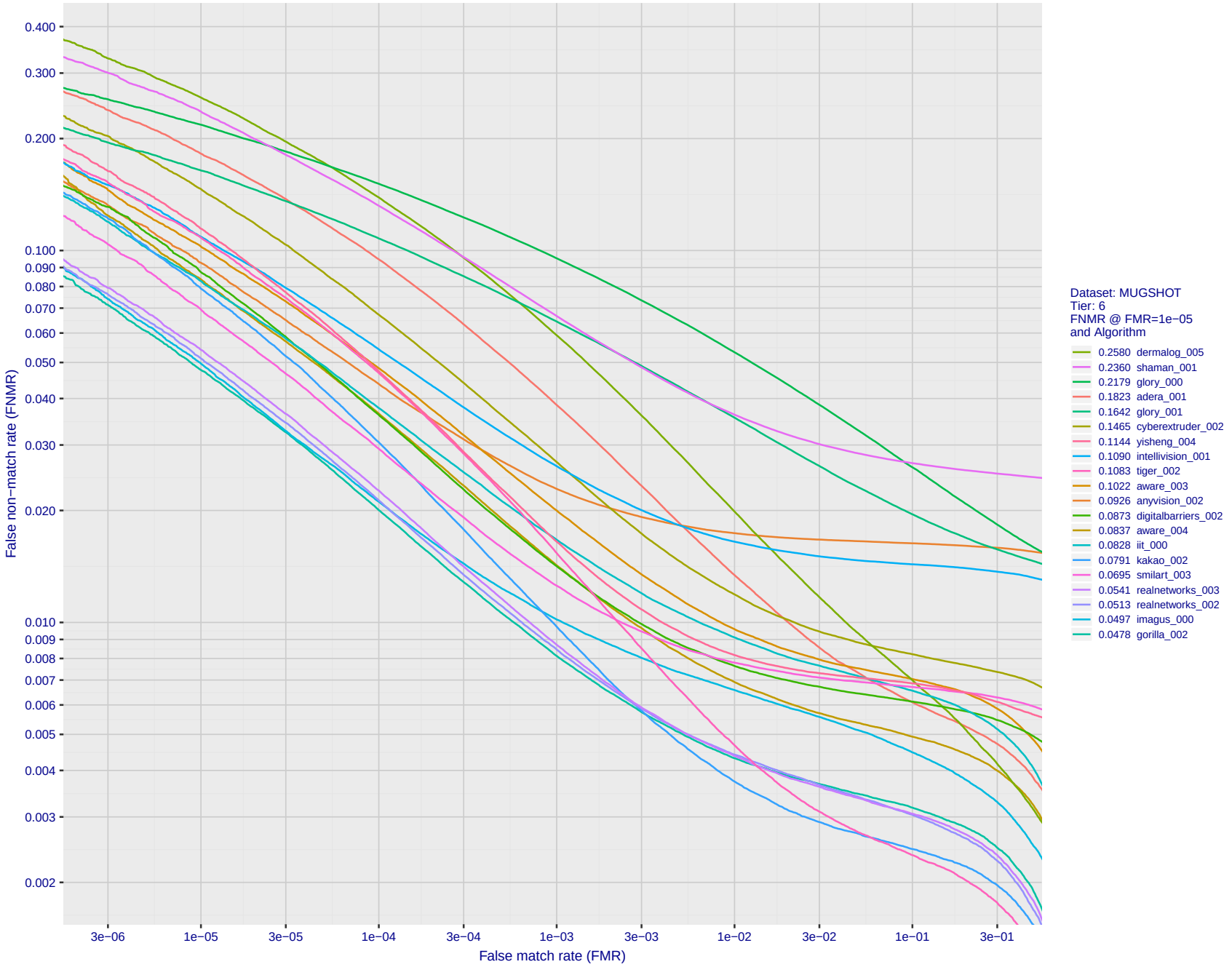


*Figure 29: For the mugshot images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of* FMR*.*

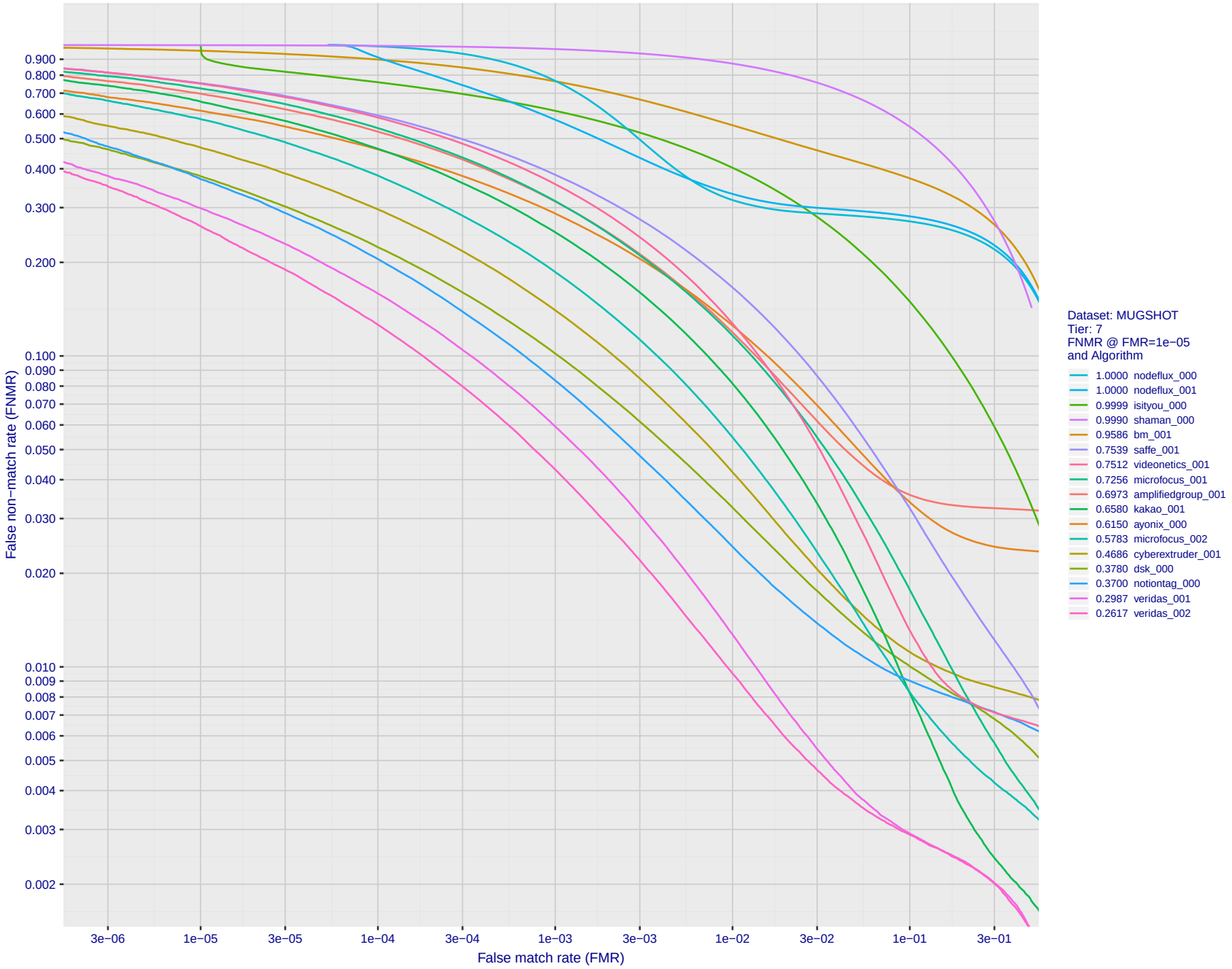


Figure 30: For the mugshot images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show decades of FMR.

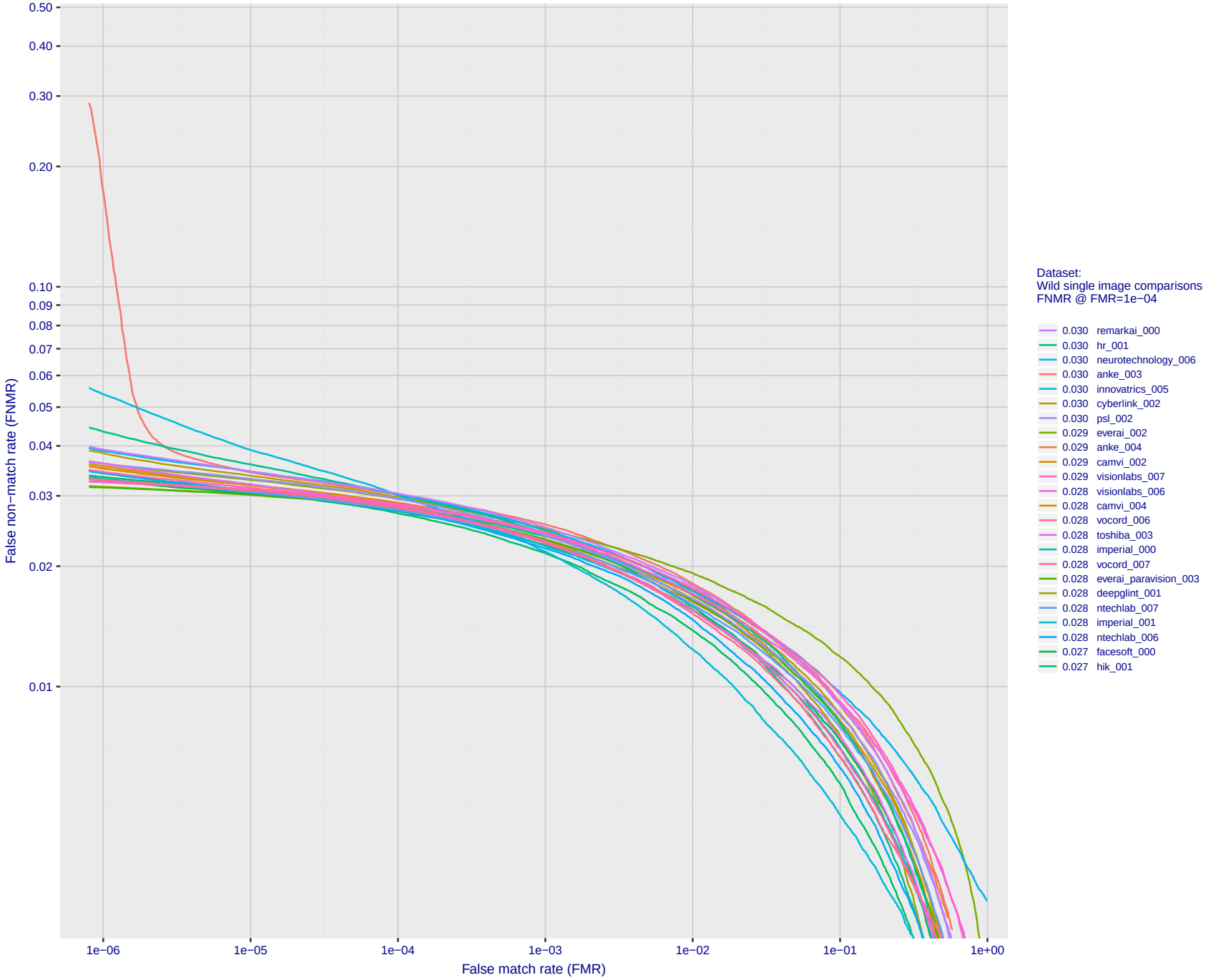


*Figure 31: For the 2018 wild image comparisons, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of* FMR*.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

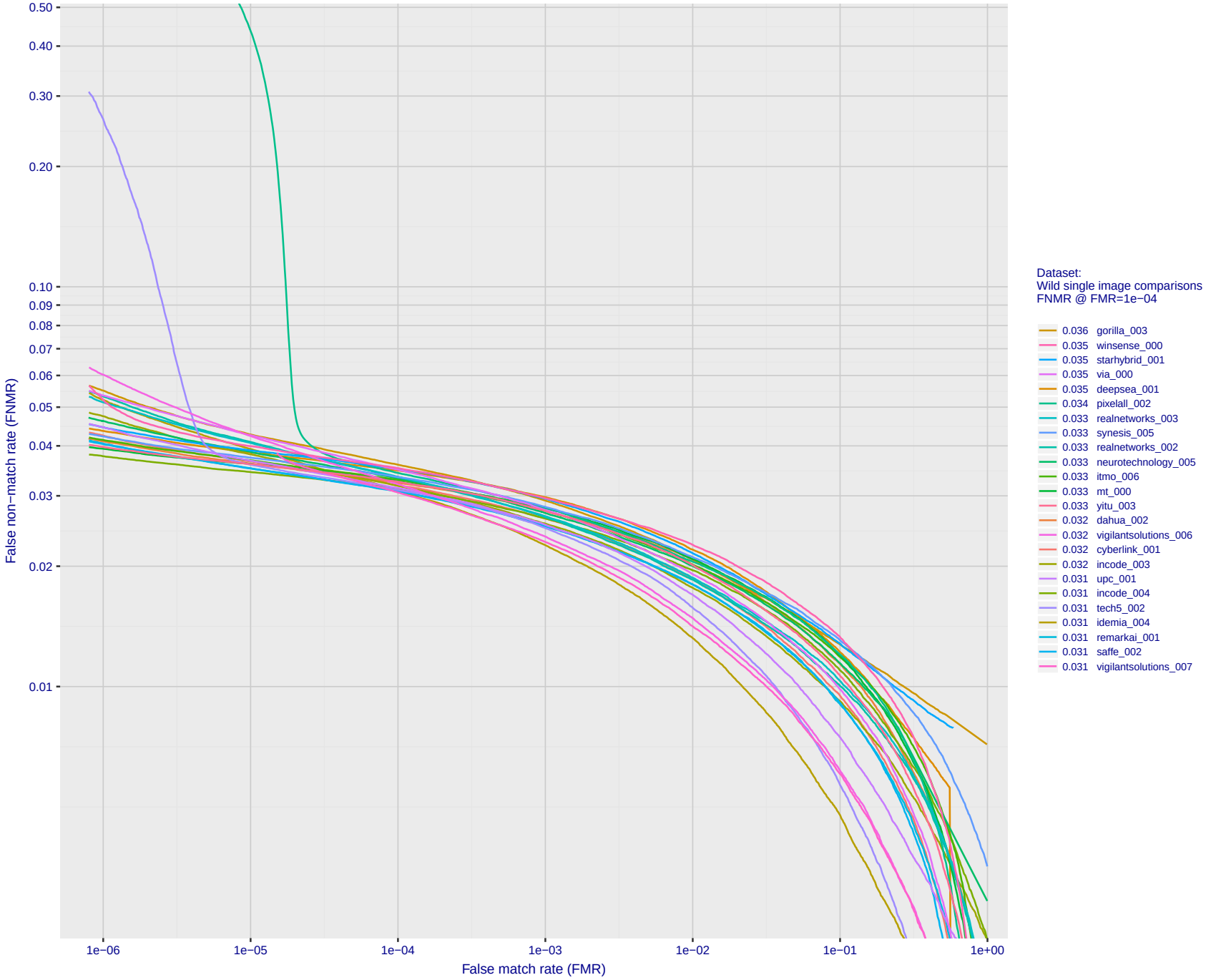


*Figure 32: For the 2018 wild image comparisons, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of* FMR.

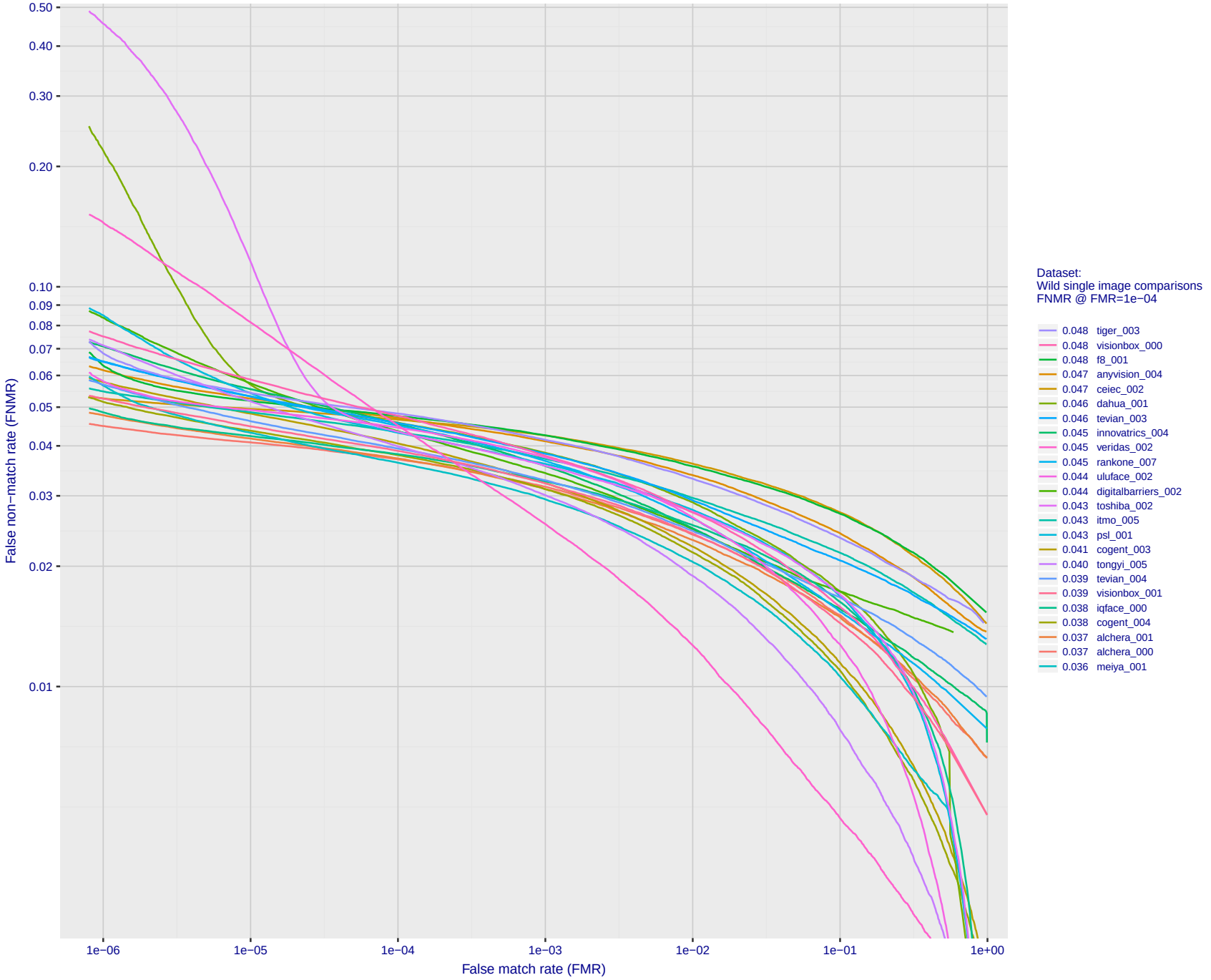


*Figure 33: For the 2018 wild image comparisons, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

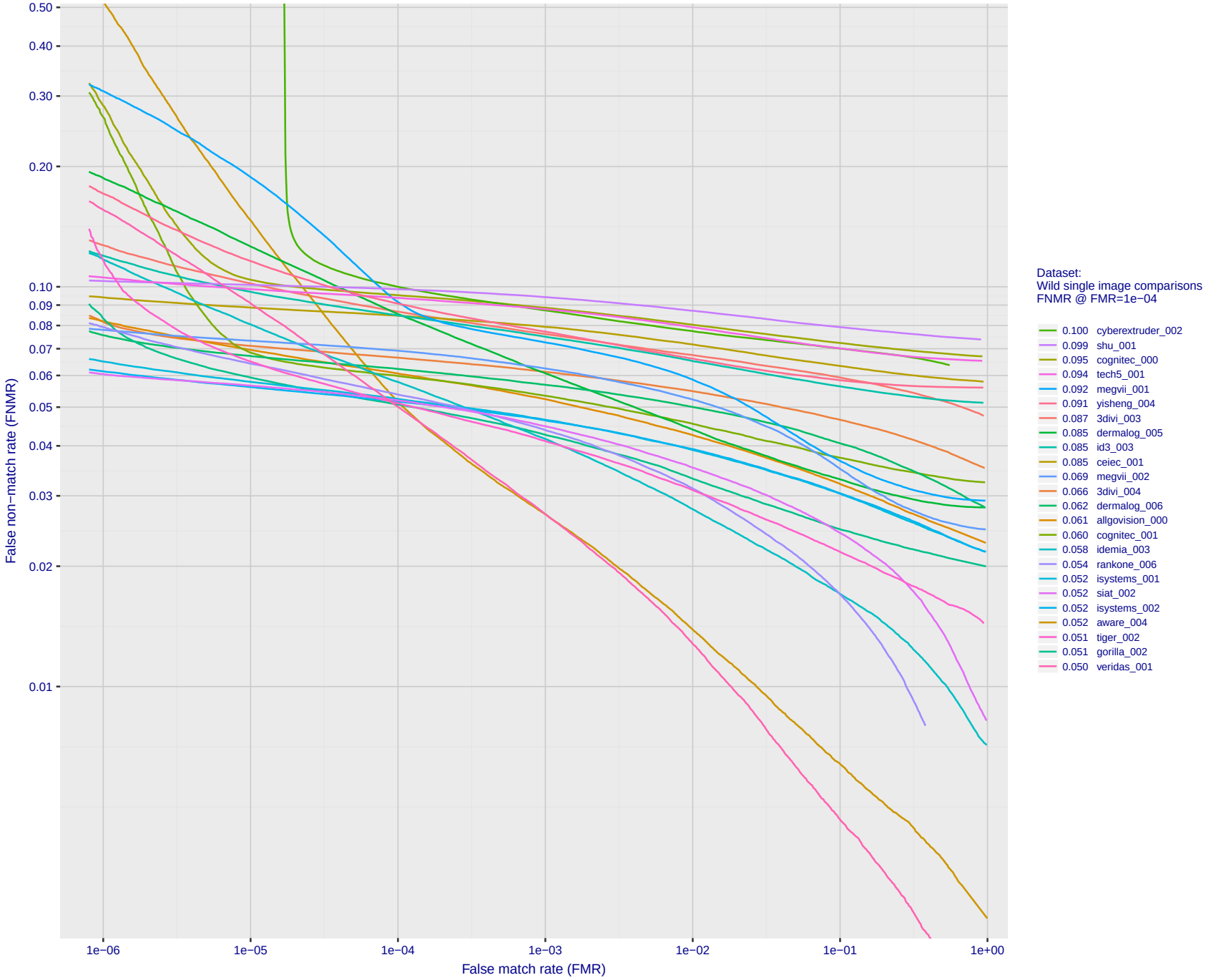


*Figure 34: For the 2018 wild image comparisons, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of* FMR.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

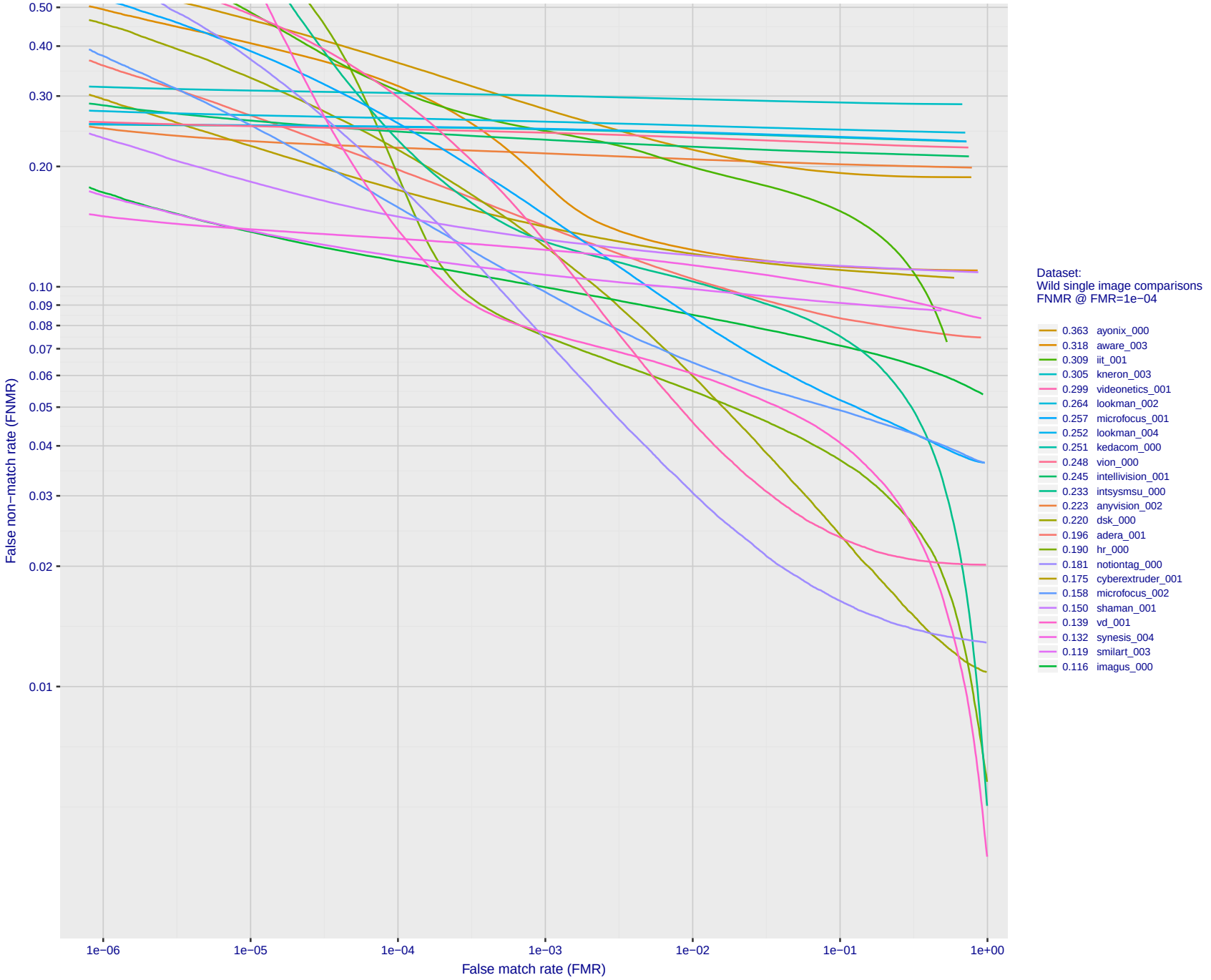


Figure 35: For the 2018 wild image comparisons, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of FMR.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

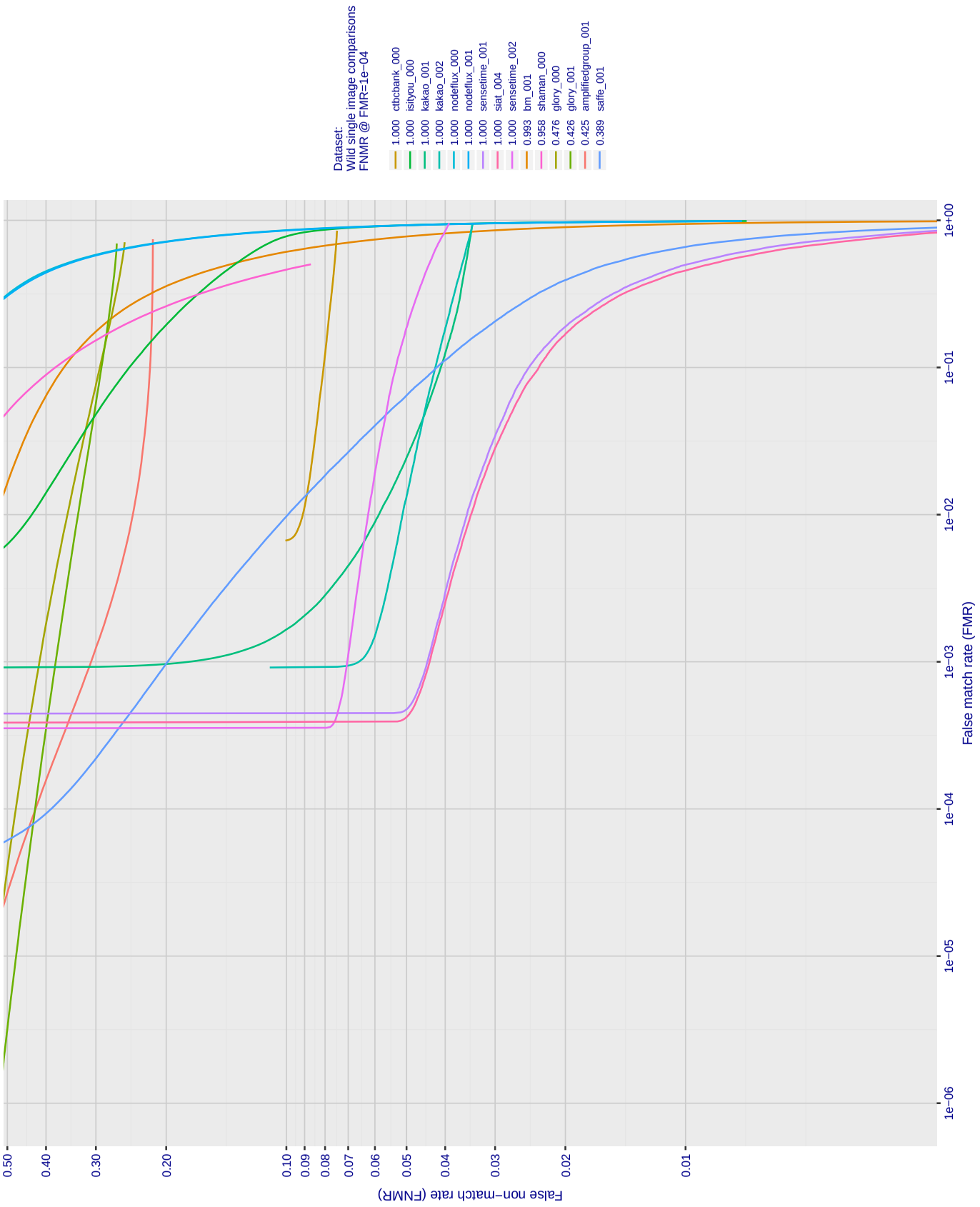


Figure 36: For the 2018 wild image comparisons, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show several decades of FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

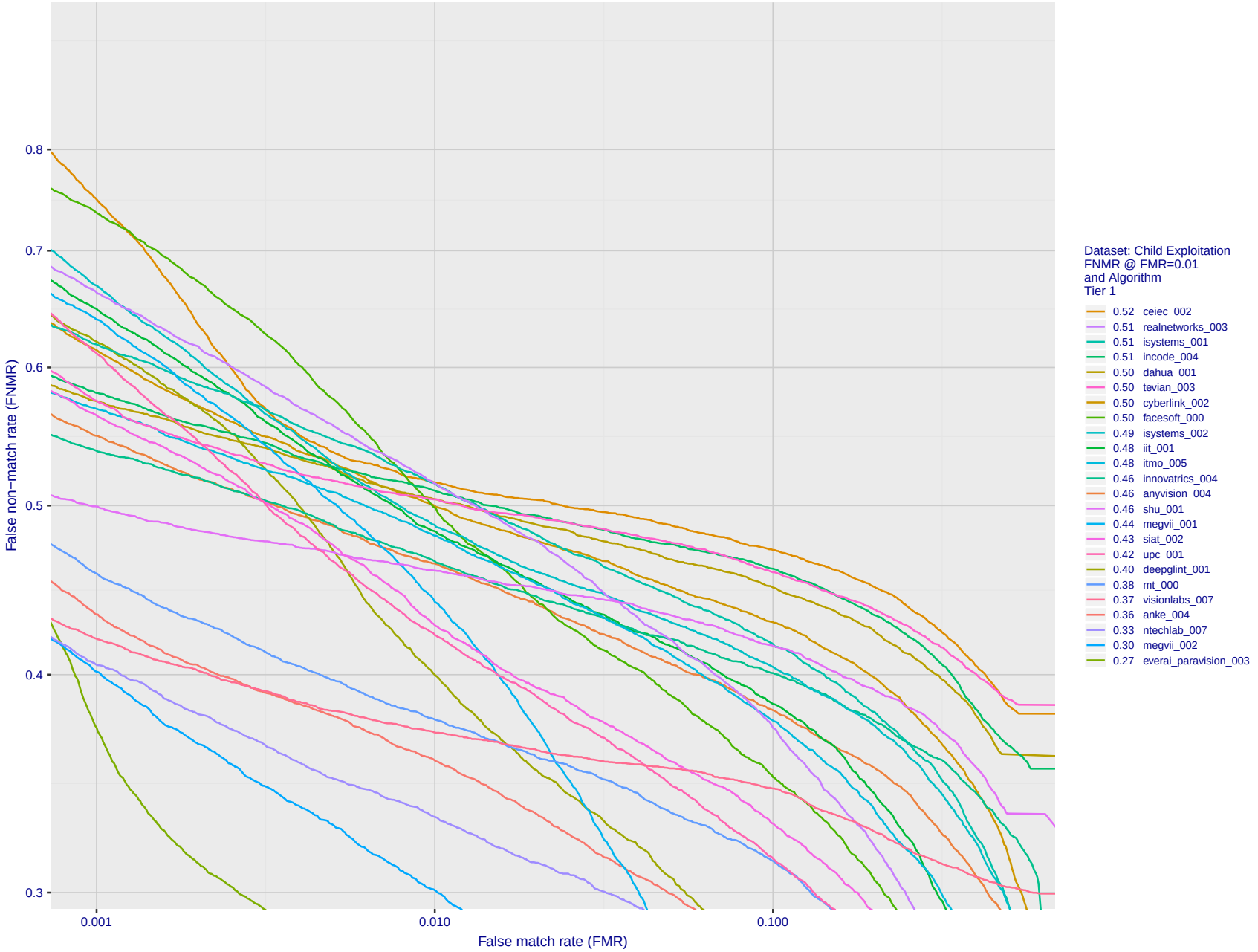


*Figure 37: For child exploitation images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR*. Accuracy is poor because many images have adverse quality characteristics, and because detection and enrollment fails.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

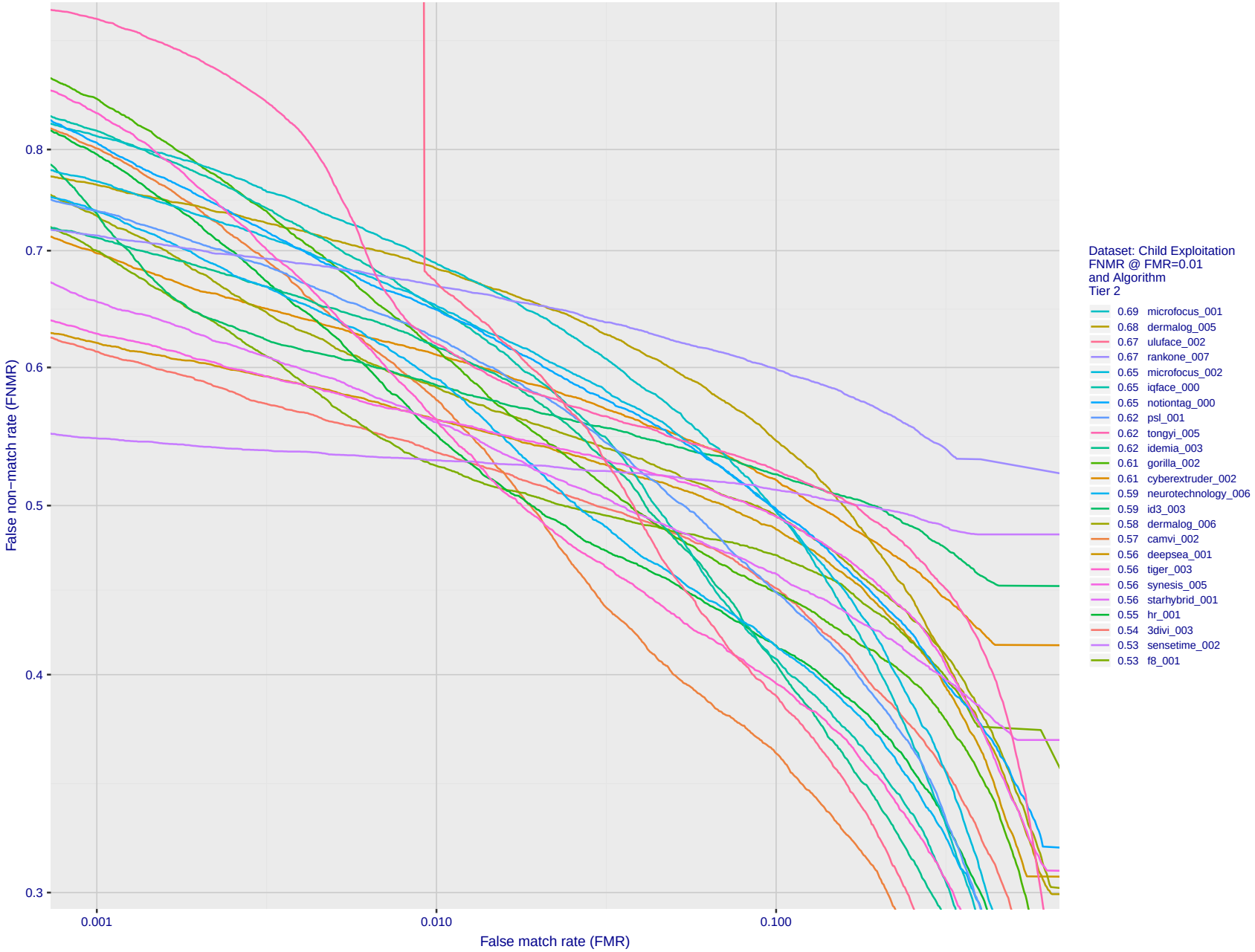


*Figure 38: For child exploitation images, detection error tradeoff (*DET*) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of* FMR*. Accuracy is poor because many images have adverse quality characteristics, and because detection and enrollment fails.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

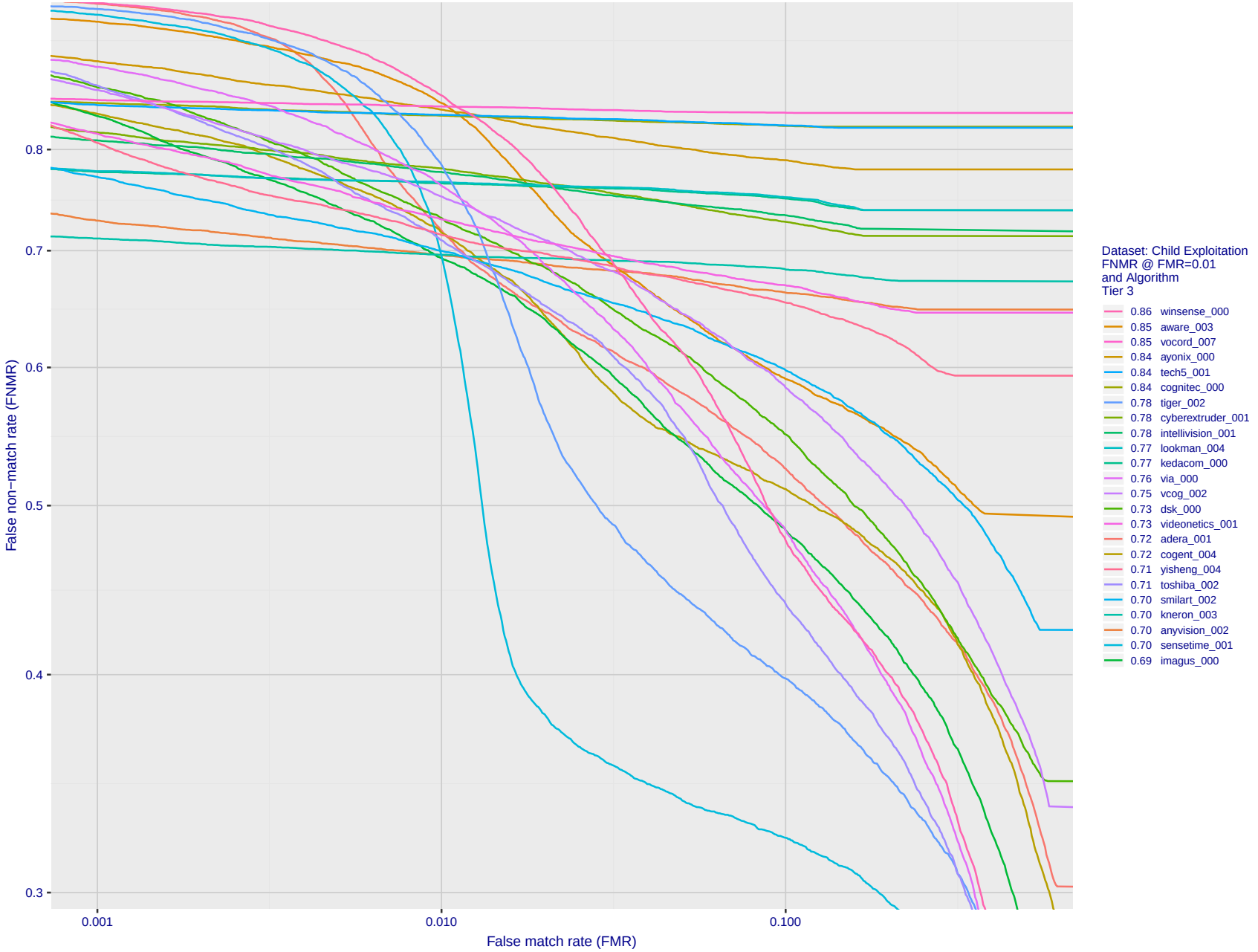


Figure 39: For child exploitation images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR. Accuracy is poor because many images have adverse quality characteristics, and because detection and enrollment fails.

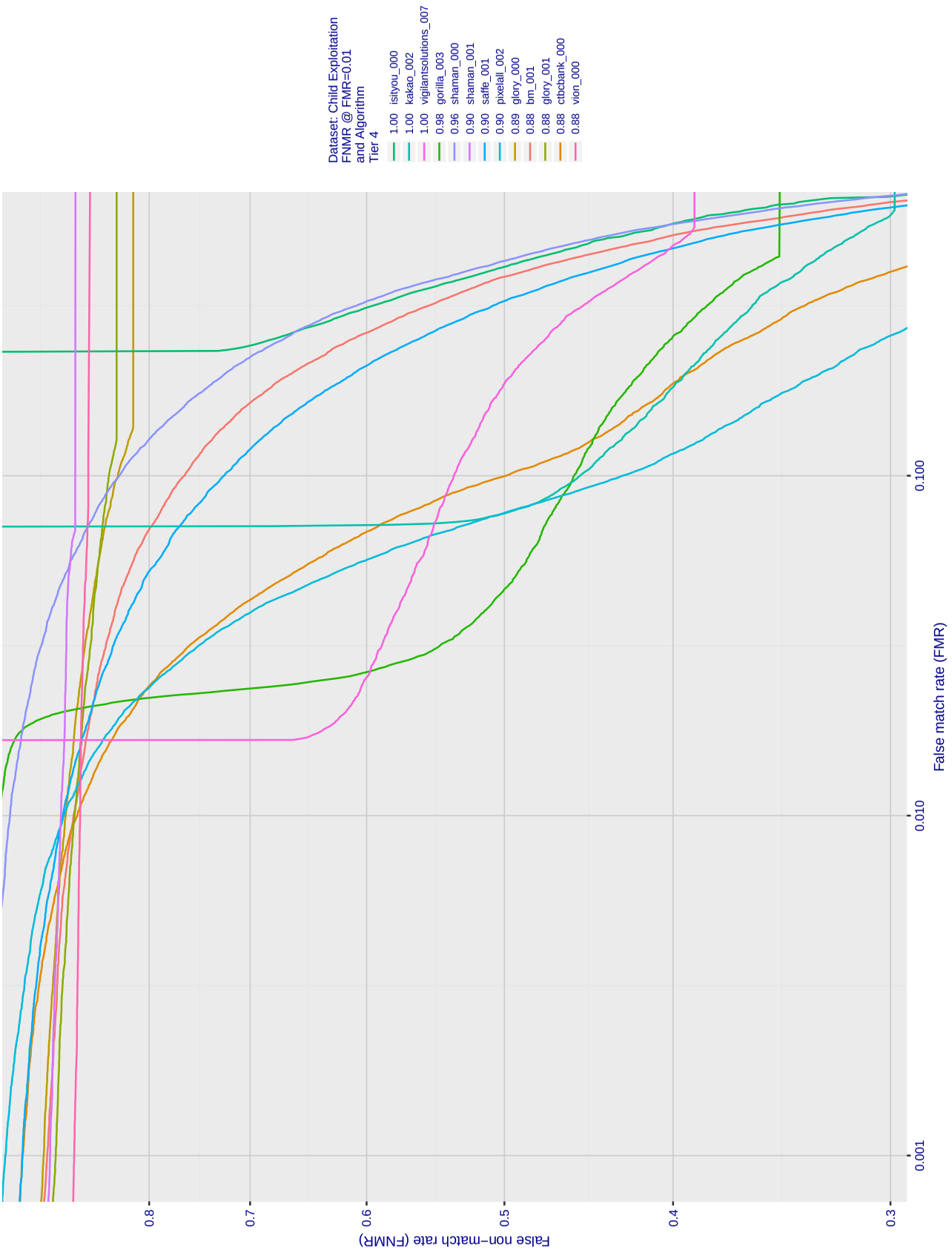


Figure 40: For child exploitation images, detection error tradeoff (DET) characteristics showing false non-match rate vs. false match rate plotted parametrically on threshold, T. The scales are logarithmic in order to show many decades of FMR. Accuracy is poor because many images have adverse quality characteristics, and because detection and enrollment fails.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

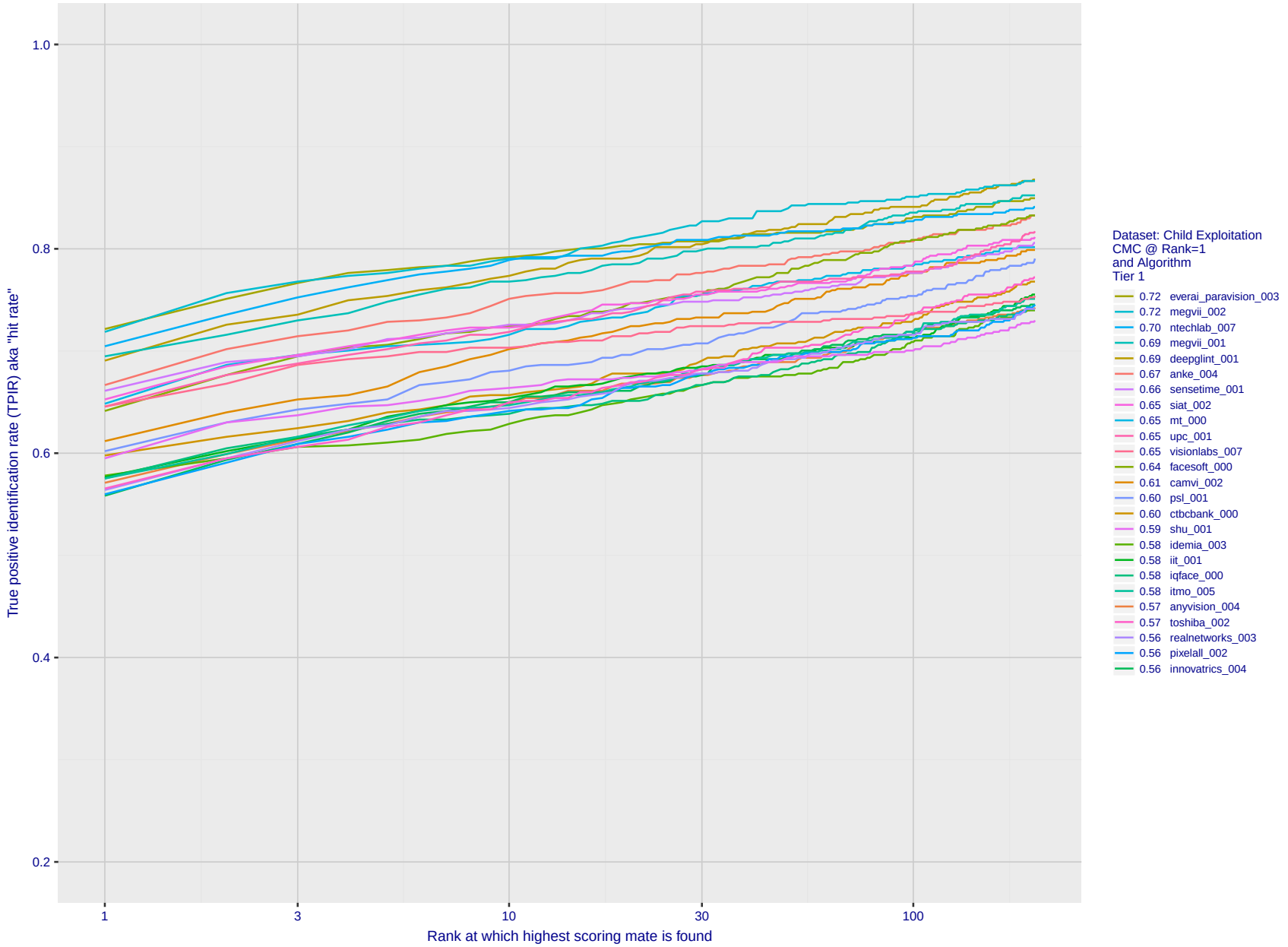


Figure 41: For child exploitation images, cumulative match characteristics (CMC) showing true positive identification rate vs. rank. This is simulation of a one-to-many search experiment - see discussion in section 3.2. The scales are logarithmic in order to show the effect of long candidate lists. Accuracy is poor but much improved relative to the 1:1 DETs of Fig. 40 because a search can succeed if any *of a subject's several enrolled images matches the search image with a high score.*

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

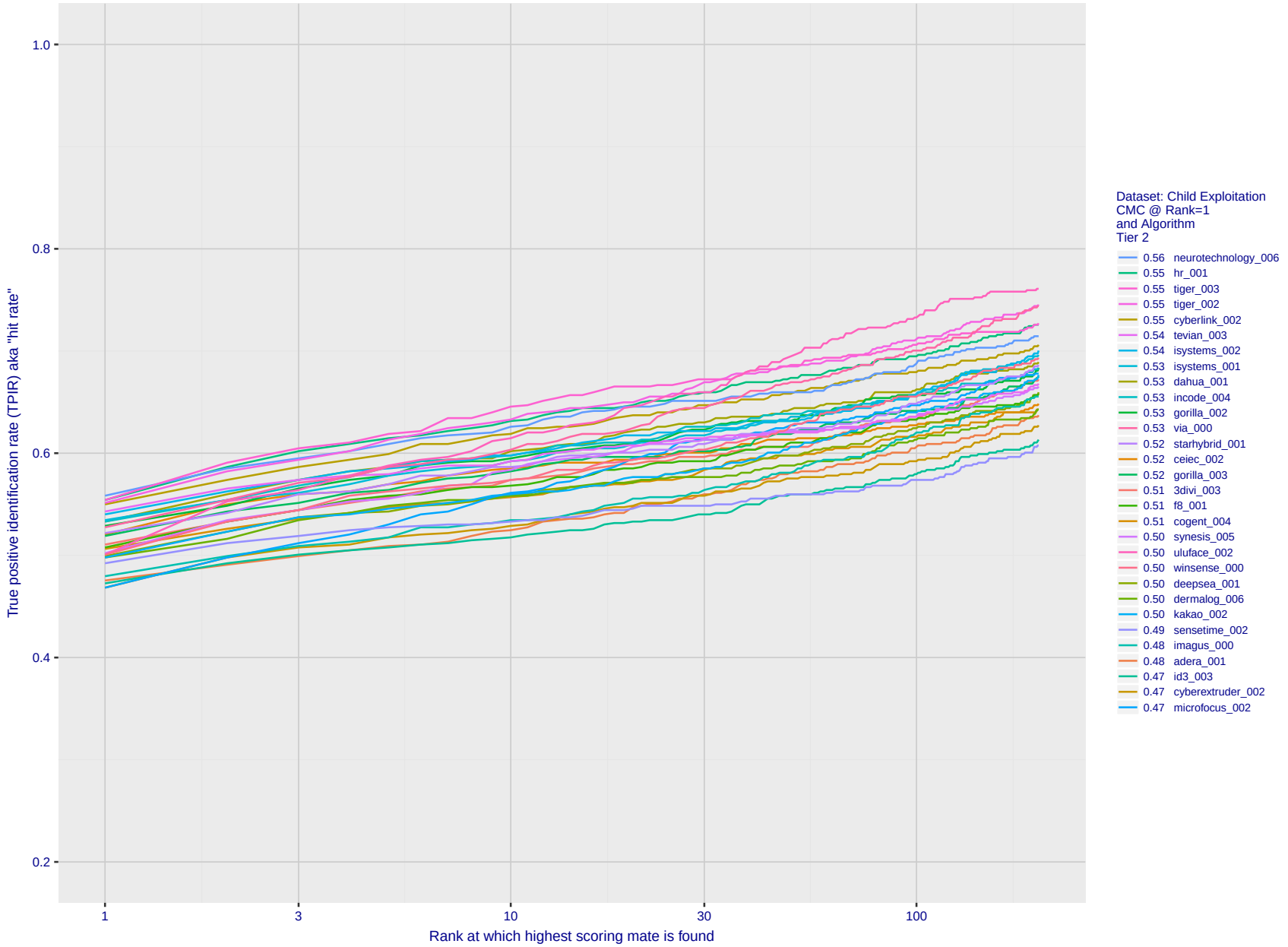


Figure 42: For child exploitation images, cumulative match characteristics (CMC) showing true positive identification rate vs. rank. This is simulation of a one-to-many search experiment - see discussion in section 3.2. The scales are logarithmic in order to show the effect of long candidate lists. Accuracy is poor but much improved relative to the 1:1 DETs of Fig. 40 because a search can succeed if any *of a subject's several enrolled images matches the search image with a high score.*

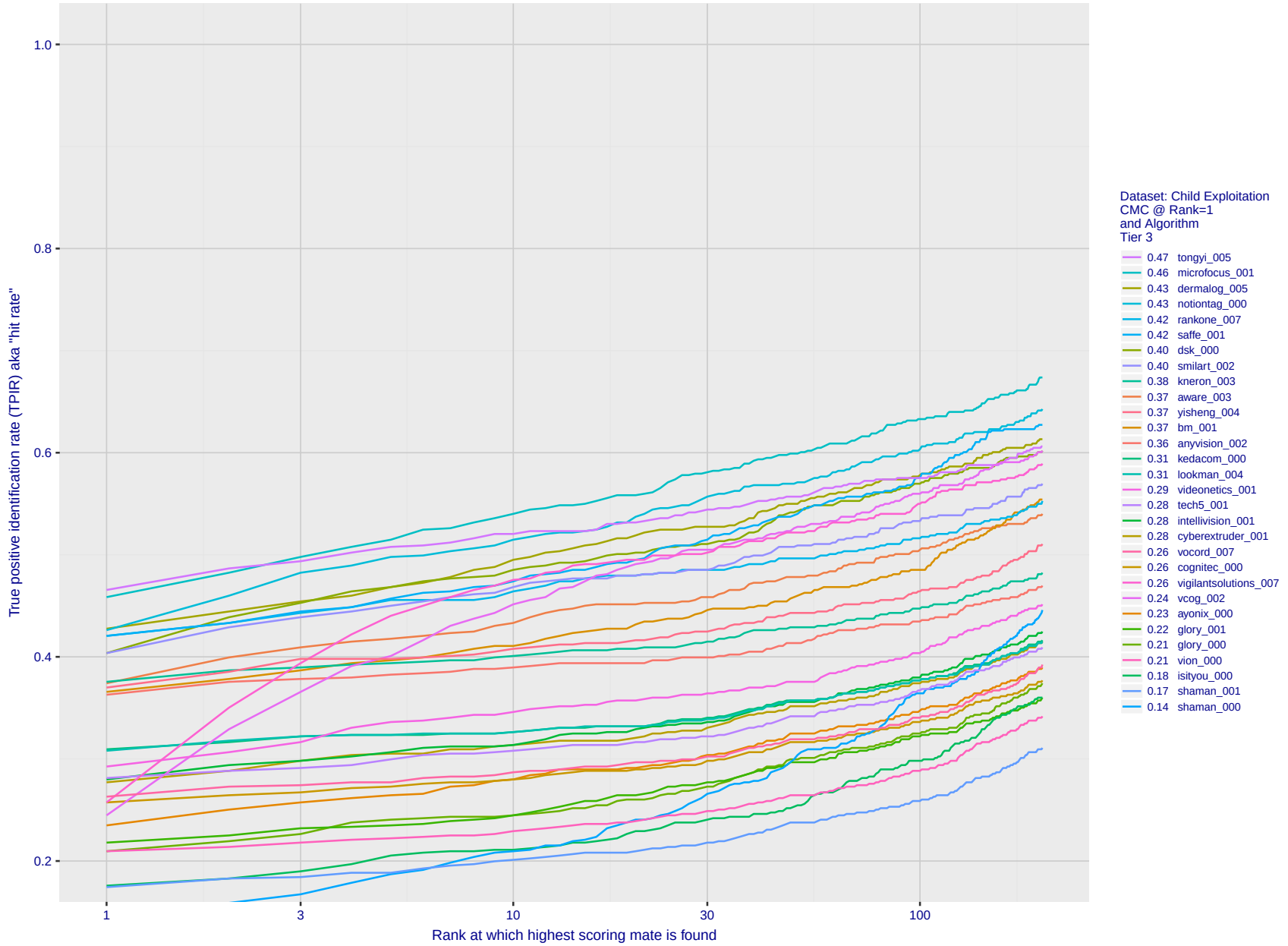


Figure 43: For child exploitation images, cumulative match characteristics (CMC) showing true positive identification rate vs. rank. This is simulation of a one-to-many search experiment - see discussion in section 3.2. The scales are logarithmic in order to show the effect of long candidate lists. Accuracy is poor but much improved relative to the 1:1 DETs of Fig. 40 because a search can succeed if any of a subject's several enrolled images matches the search image with a high score.

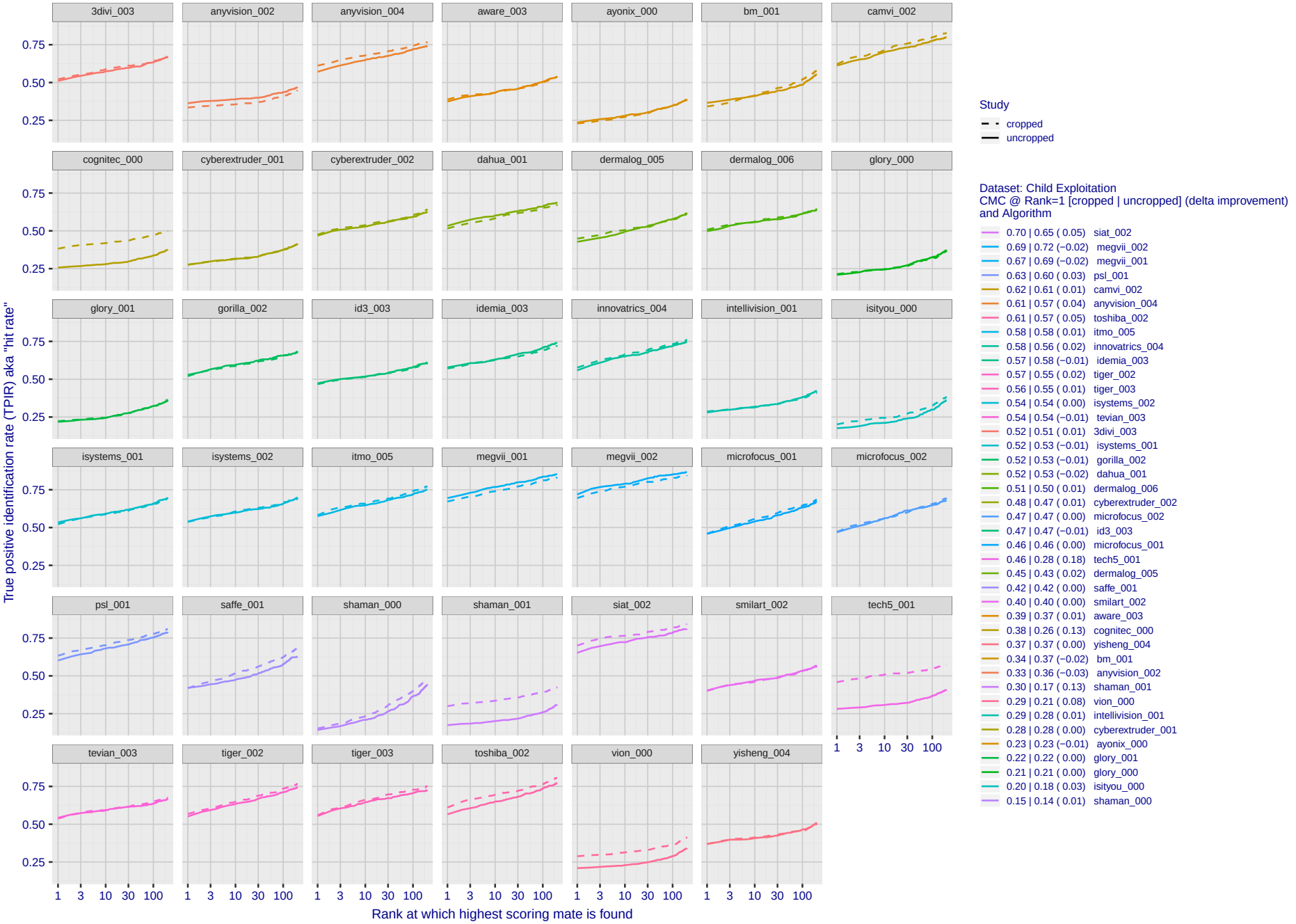


Figure 44: For child exploitation images, cumulative match characteristics (CMC) showing true positive identification rate vs. rank for two cases: 1. Whole image provided to the algorithm; 2. Human annotated rectangular region, cropped and provided to the algorithm. The difference between the traces is associated with detection of difficult faces, and fine localization.

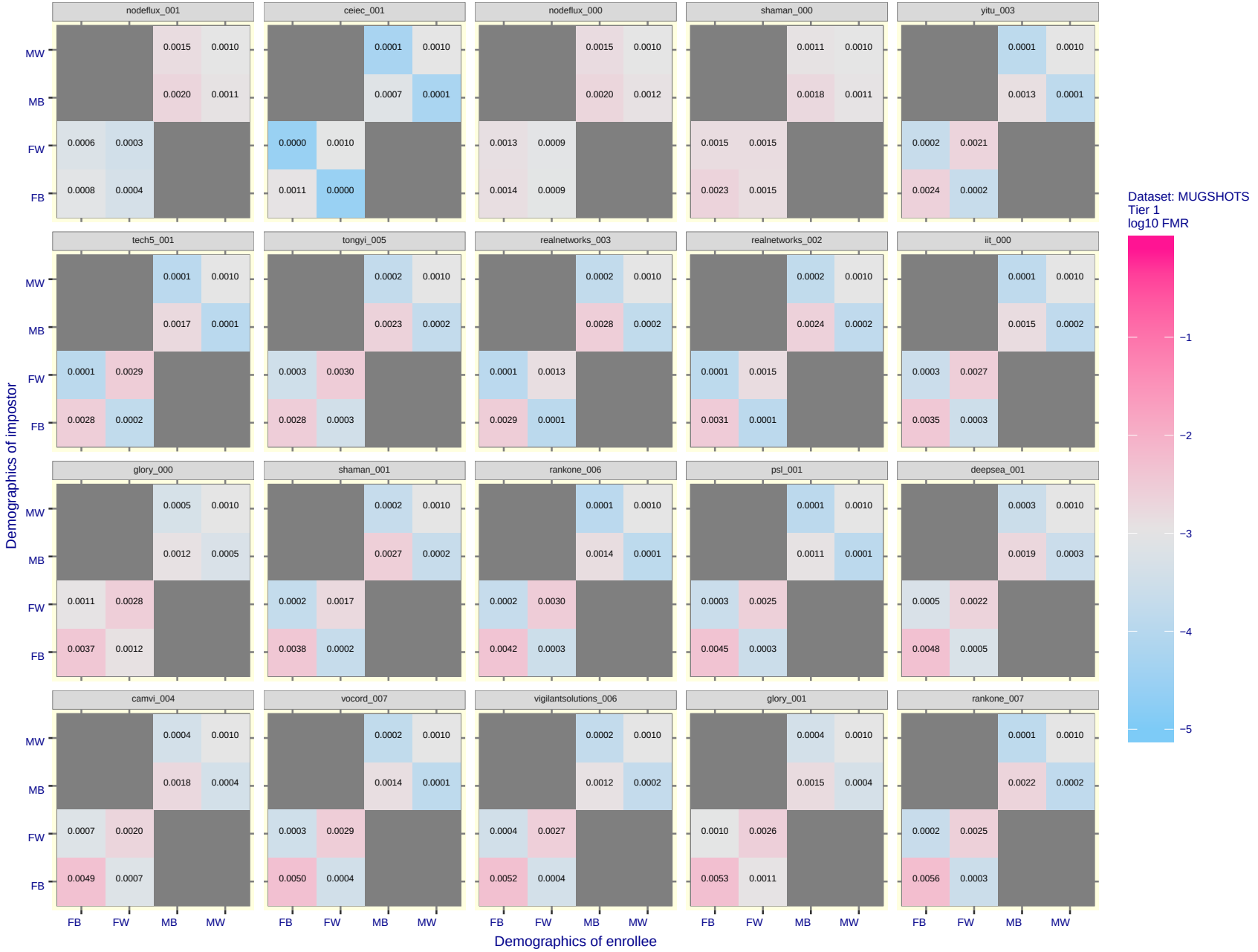


Figure 45: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

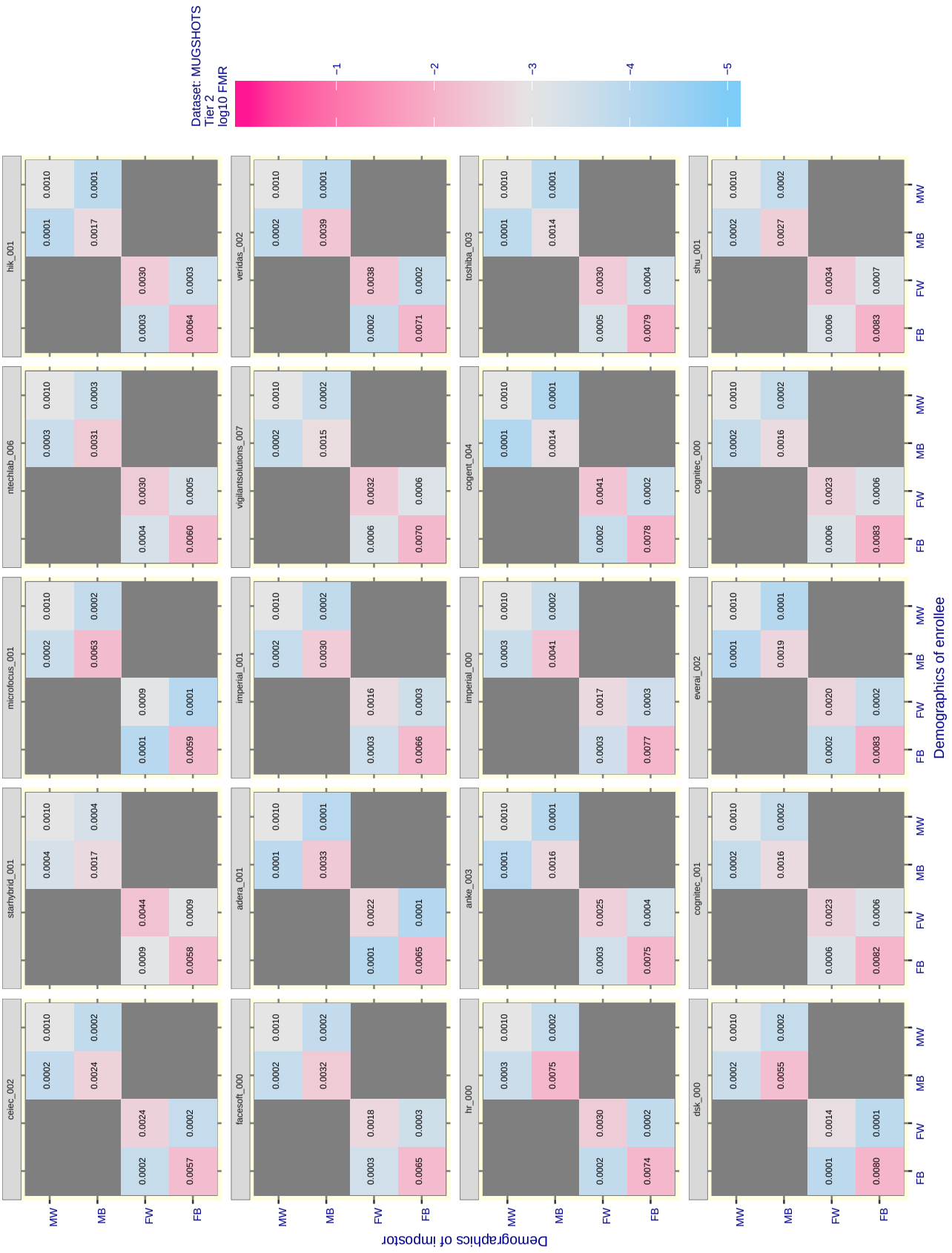


Figure 46: For the mugshot images, FMR for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give FMR = 0.001 for white males which is the demographic that usually gives the lowest FMR. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of FMR on black females, which is the demographic that usually gives the highest FMR.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

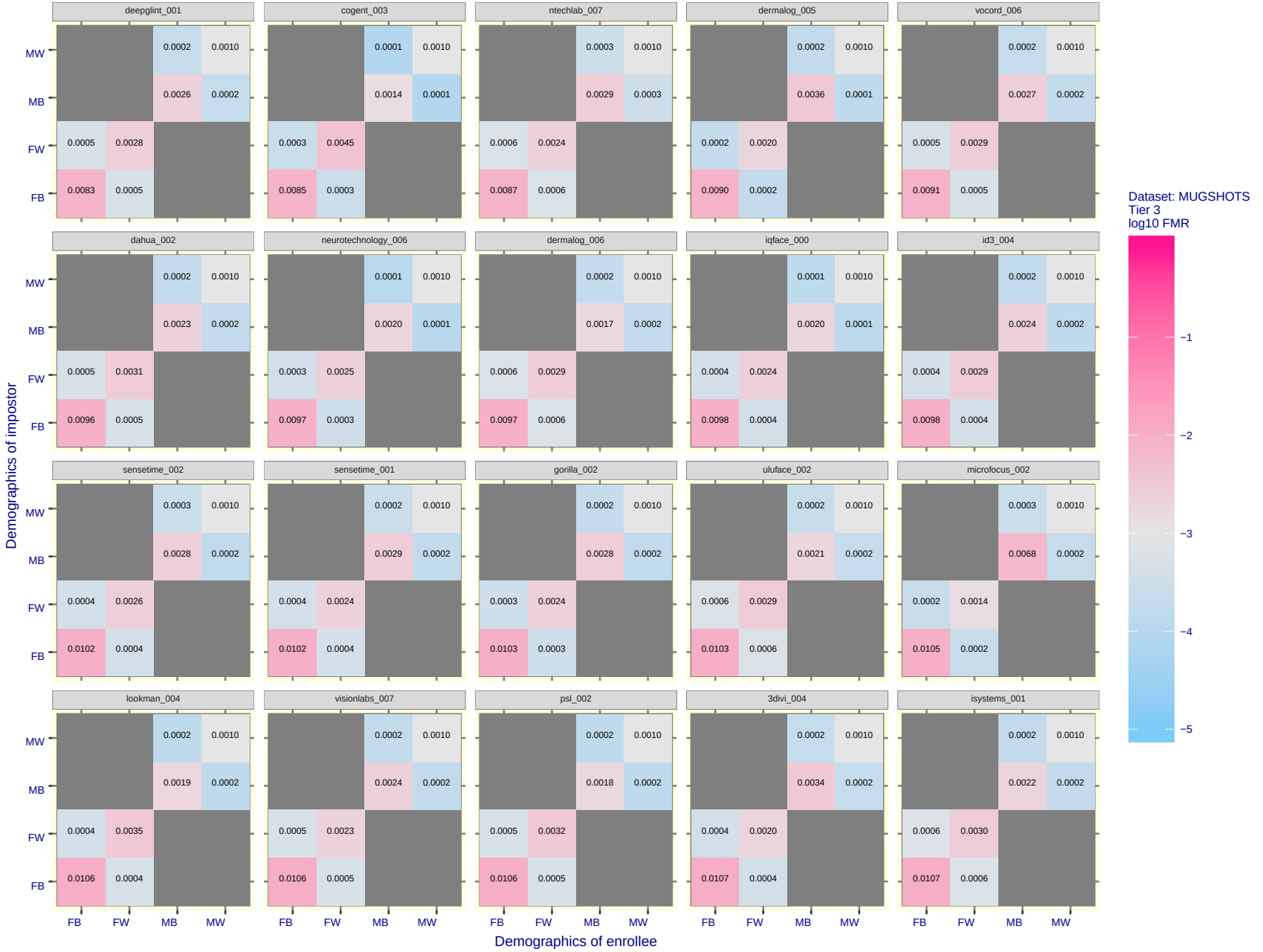


Figure 47: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

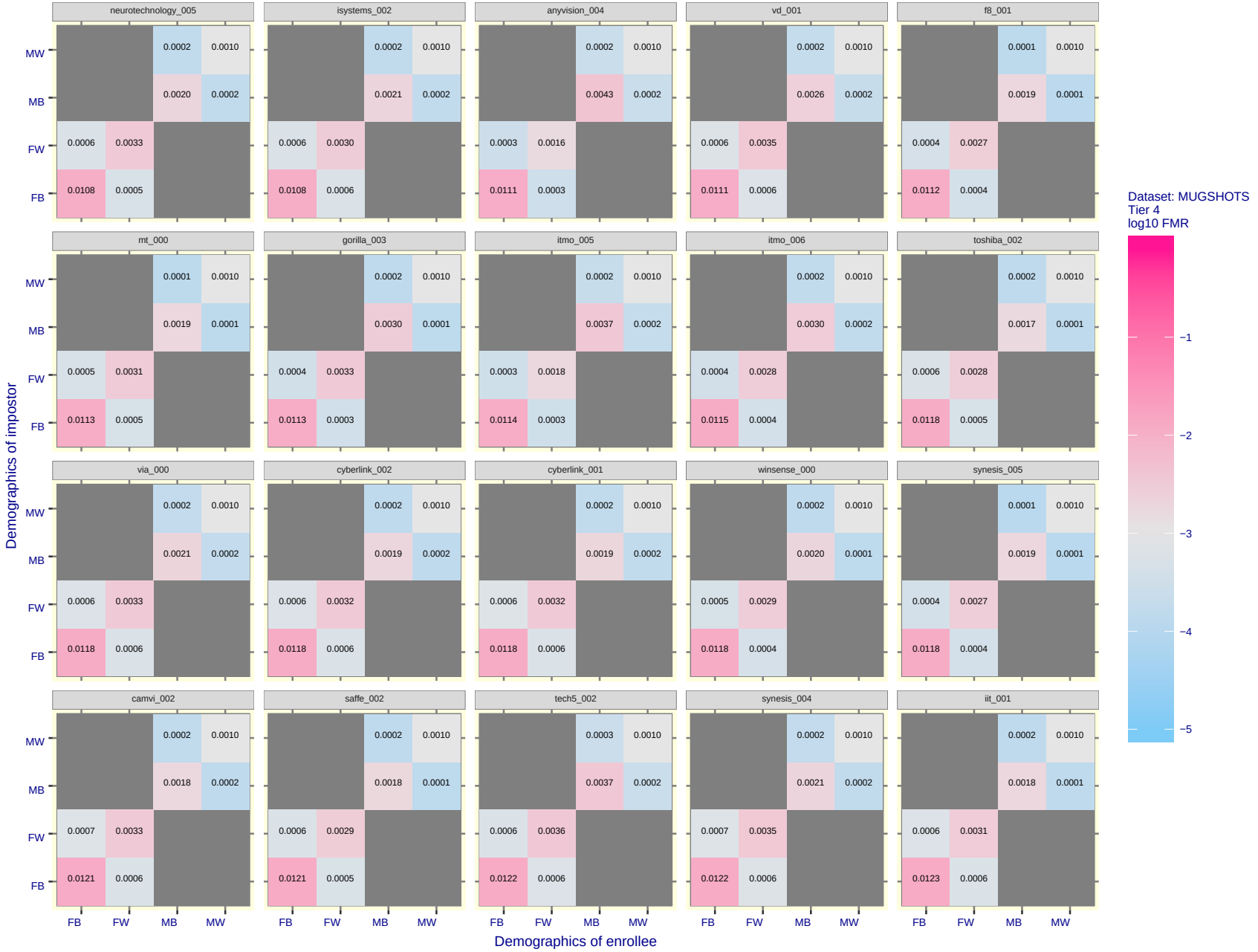


Figure 48: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

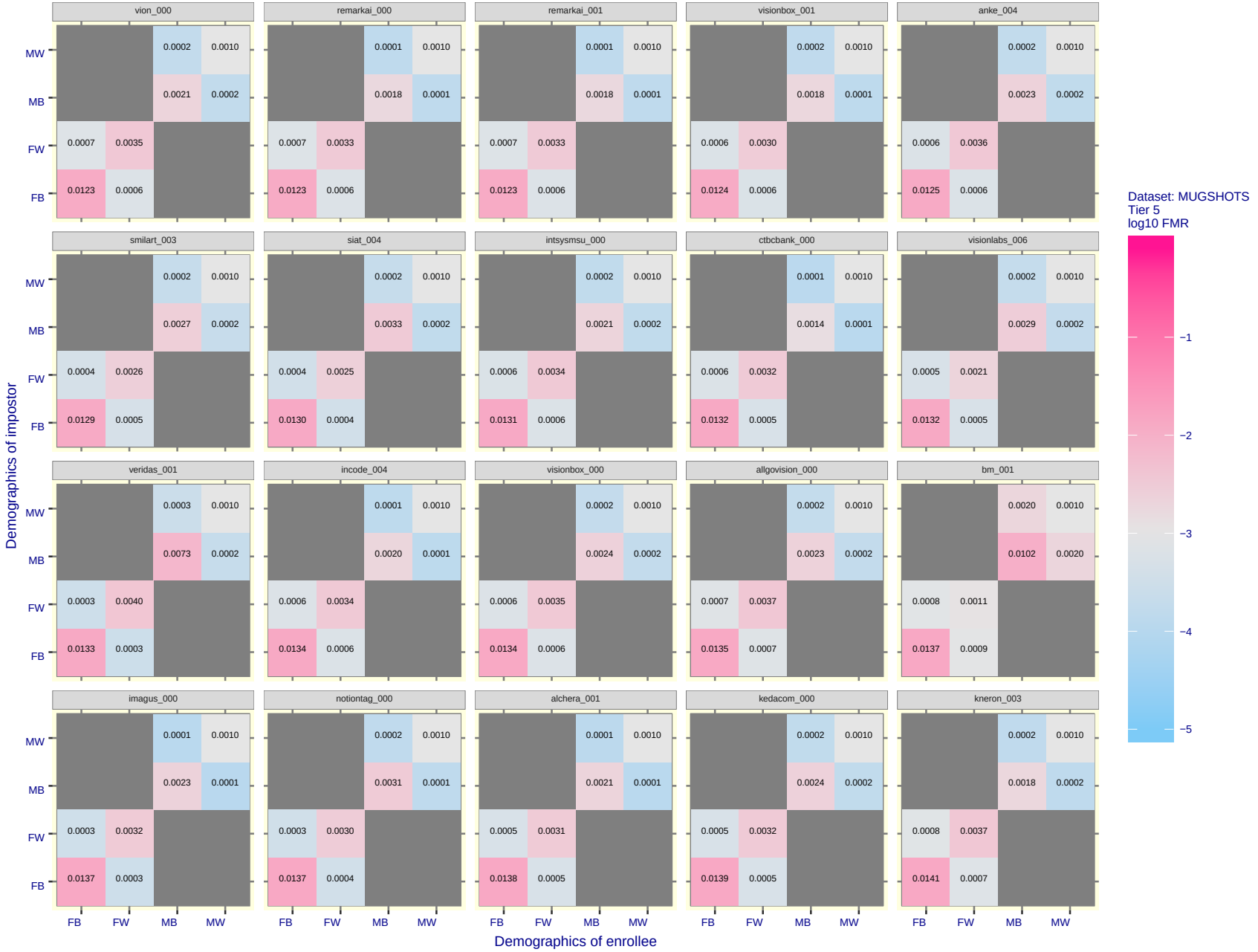


Figure 49: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

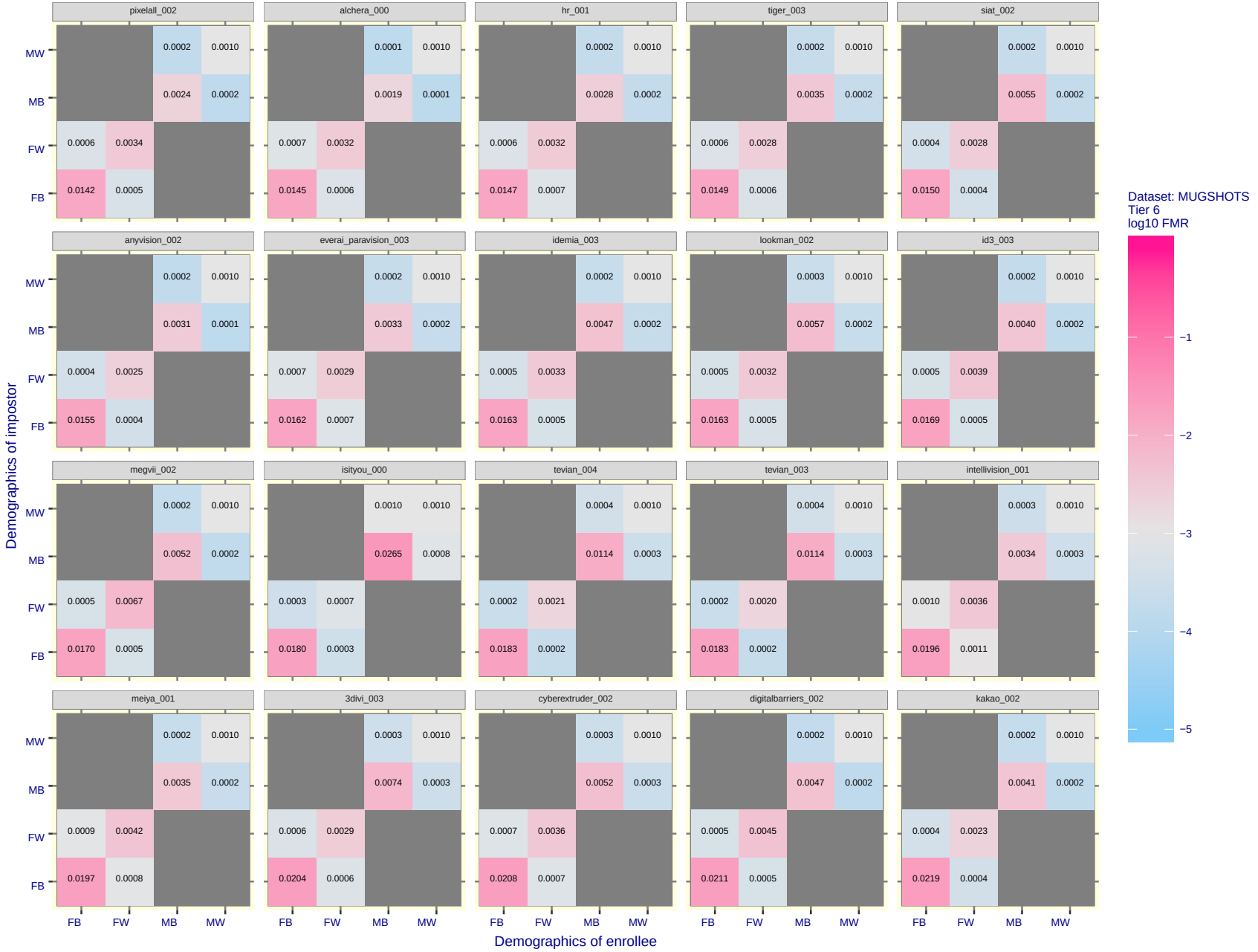


Figure 50: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

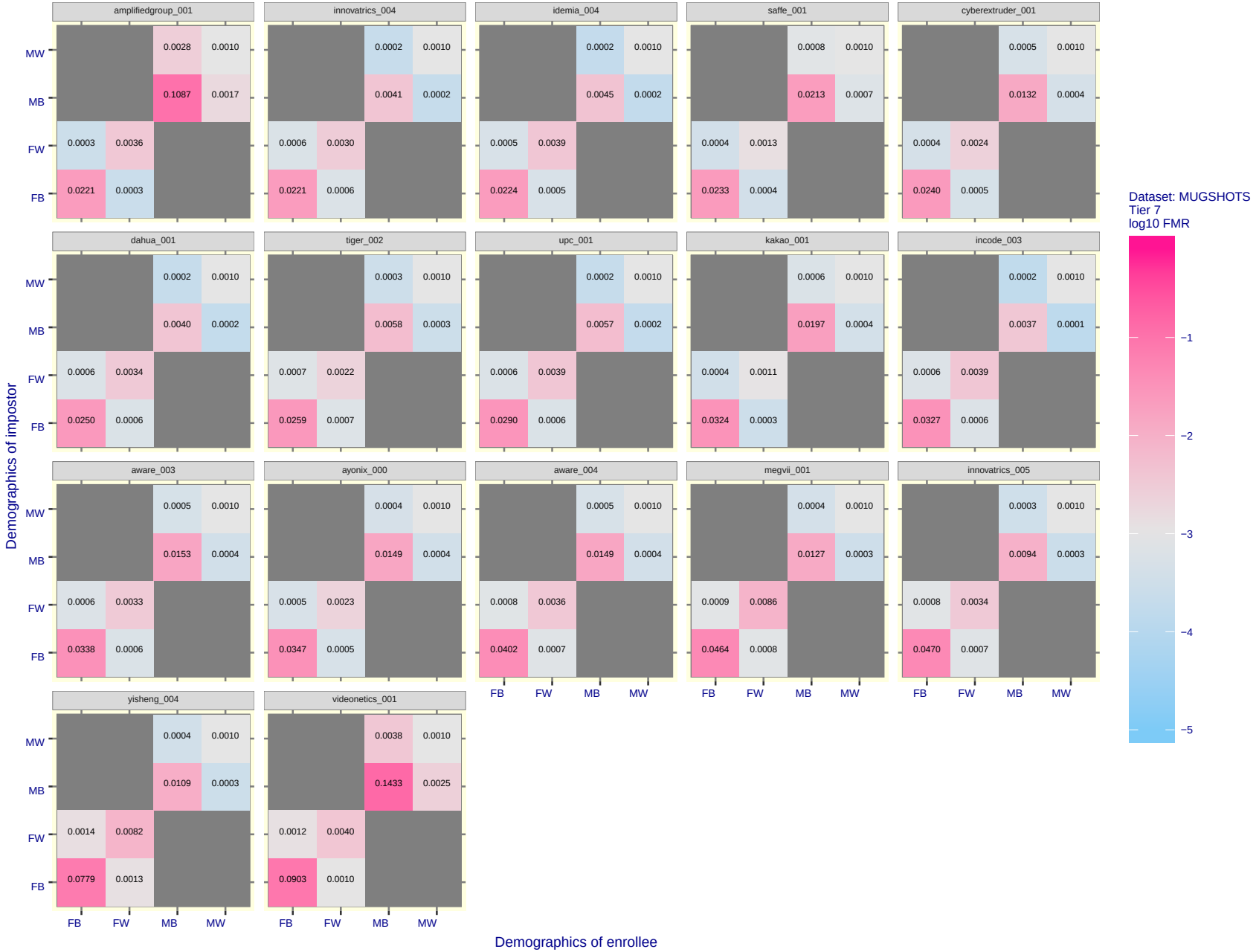


Figure 51: For the mugshot images, FMR *for same-sex impostor pairs of images annotated with codes for black female, black male, white female, white male. The threshold is set for each algorithm to give* FMR *= 0.001 for white males which is the demographc that usually gives the lowest* FMR*. This means the top right box is the same color in all panels. The panels are sorted over multiple pages in order of* FMR *on black females, which is the demographc that usually gives the highest* FMR*.*

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

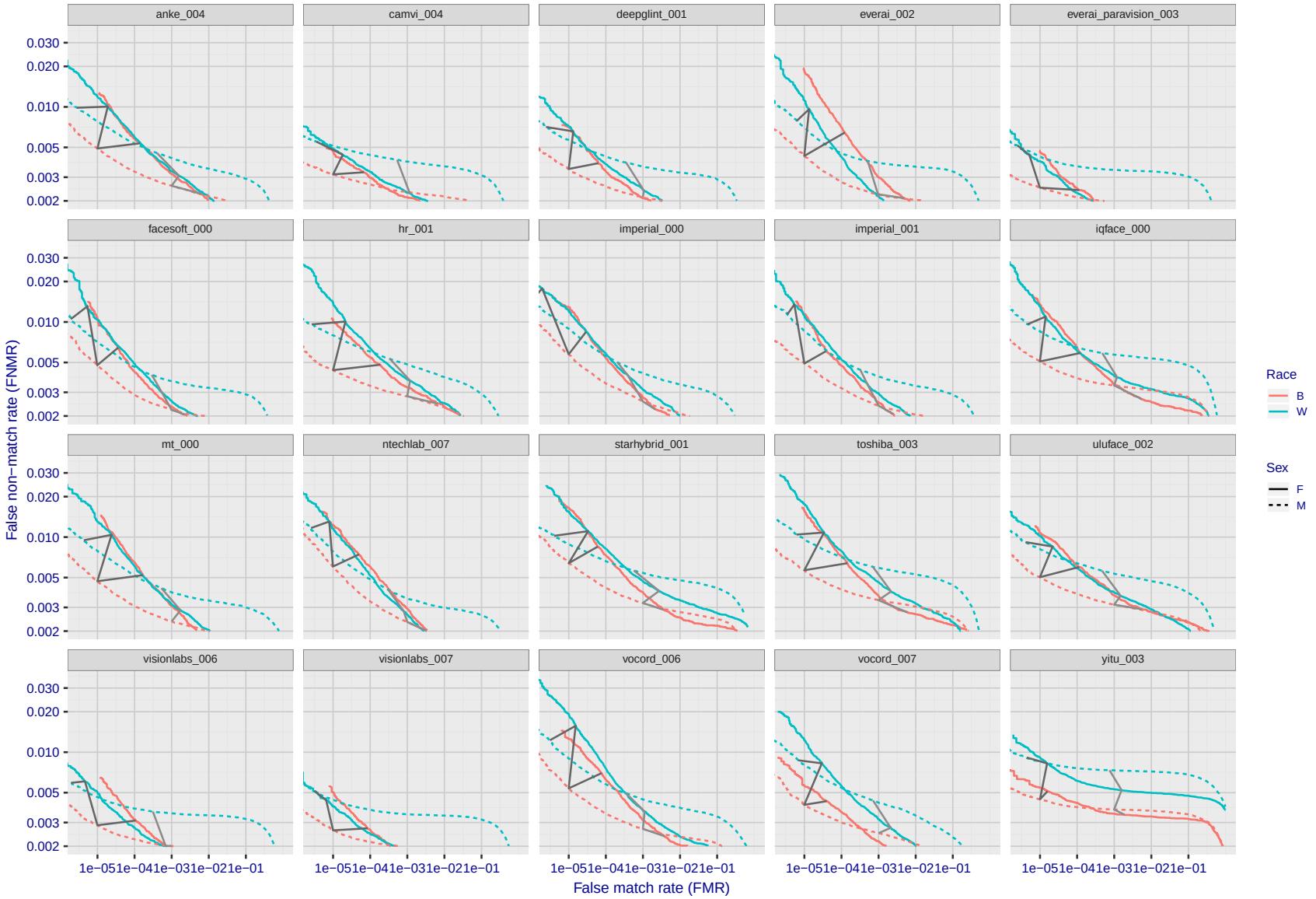


Figure 52: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

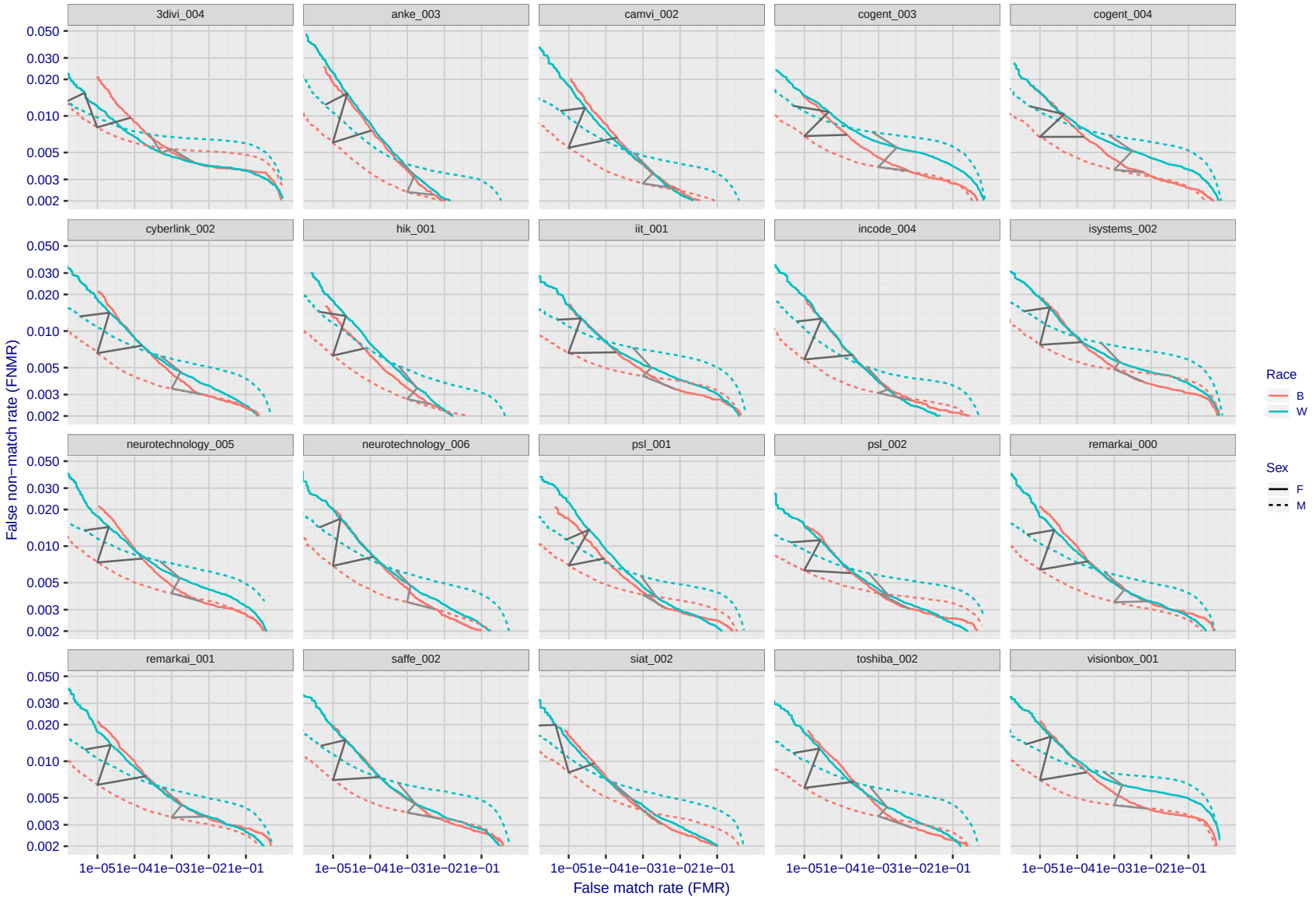


Figure 53: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

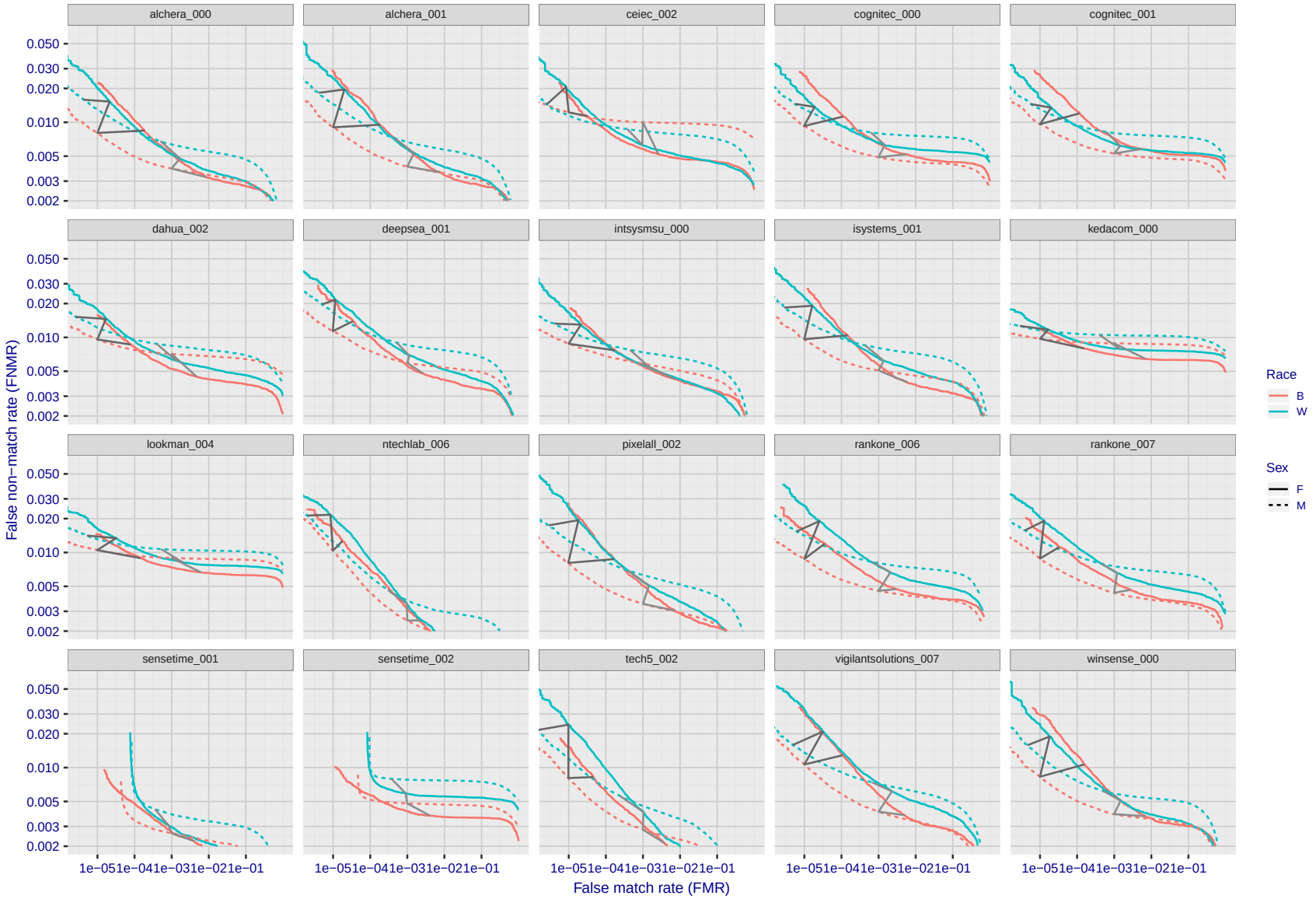


Figure 54: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

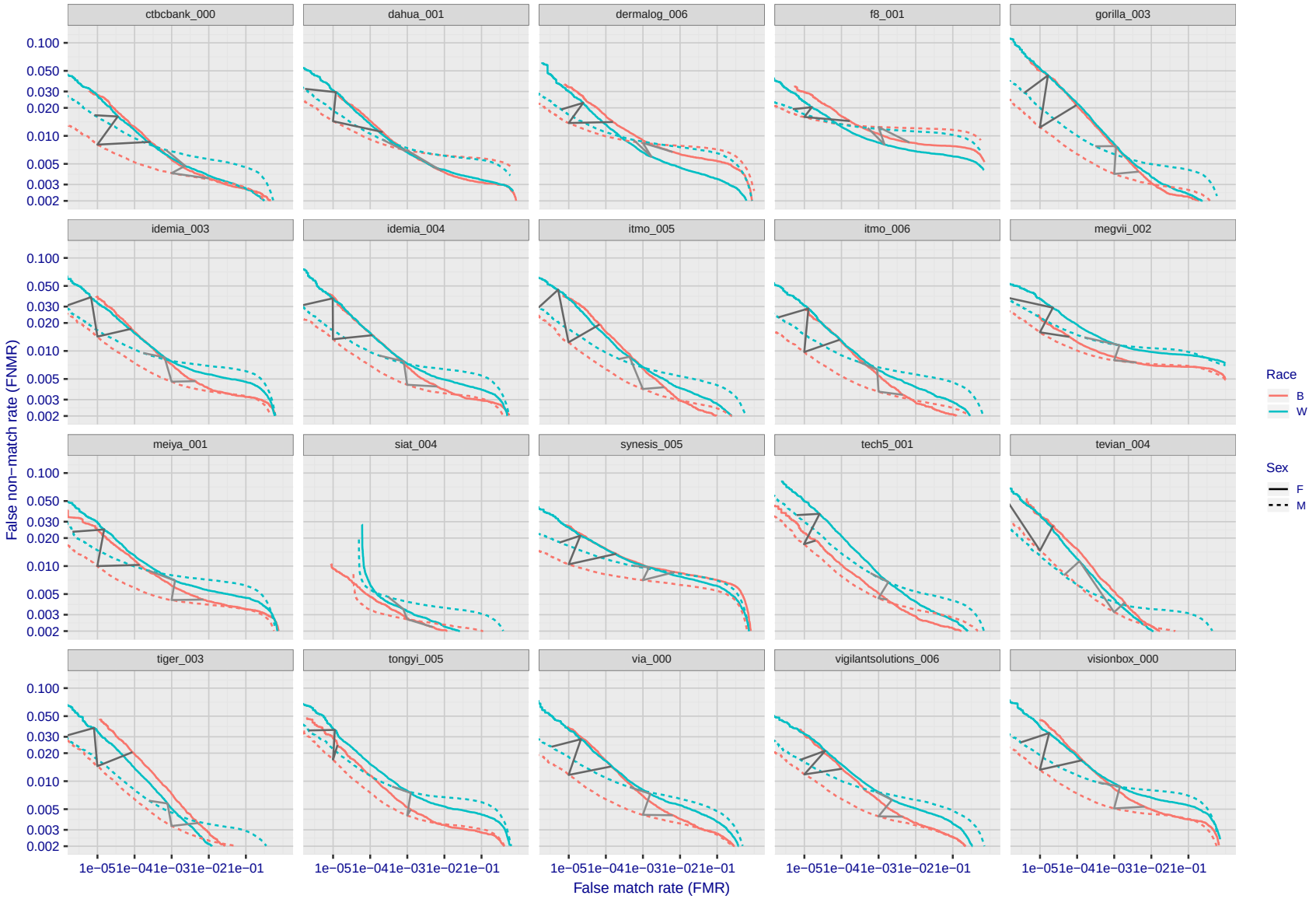


Figure 55: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

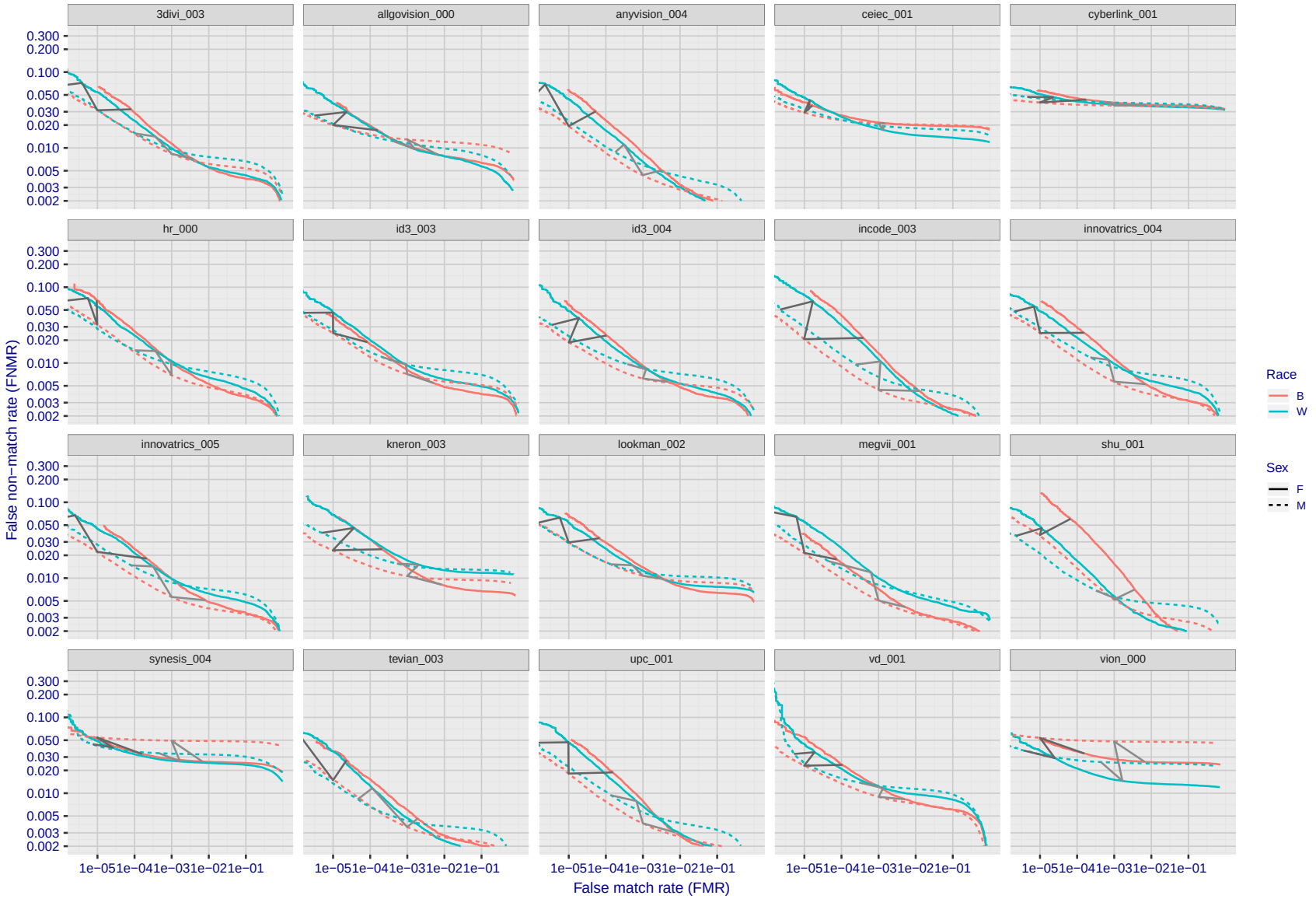


Figure 56: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

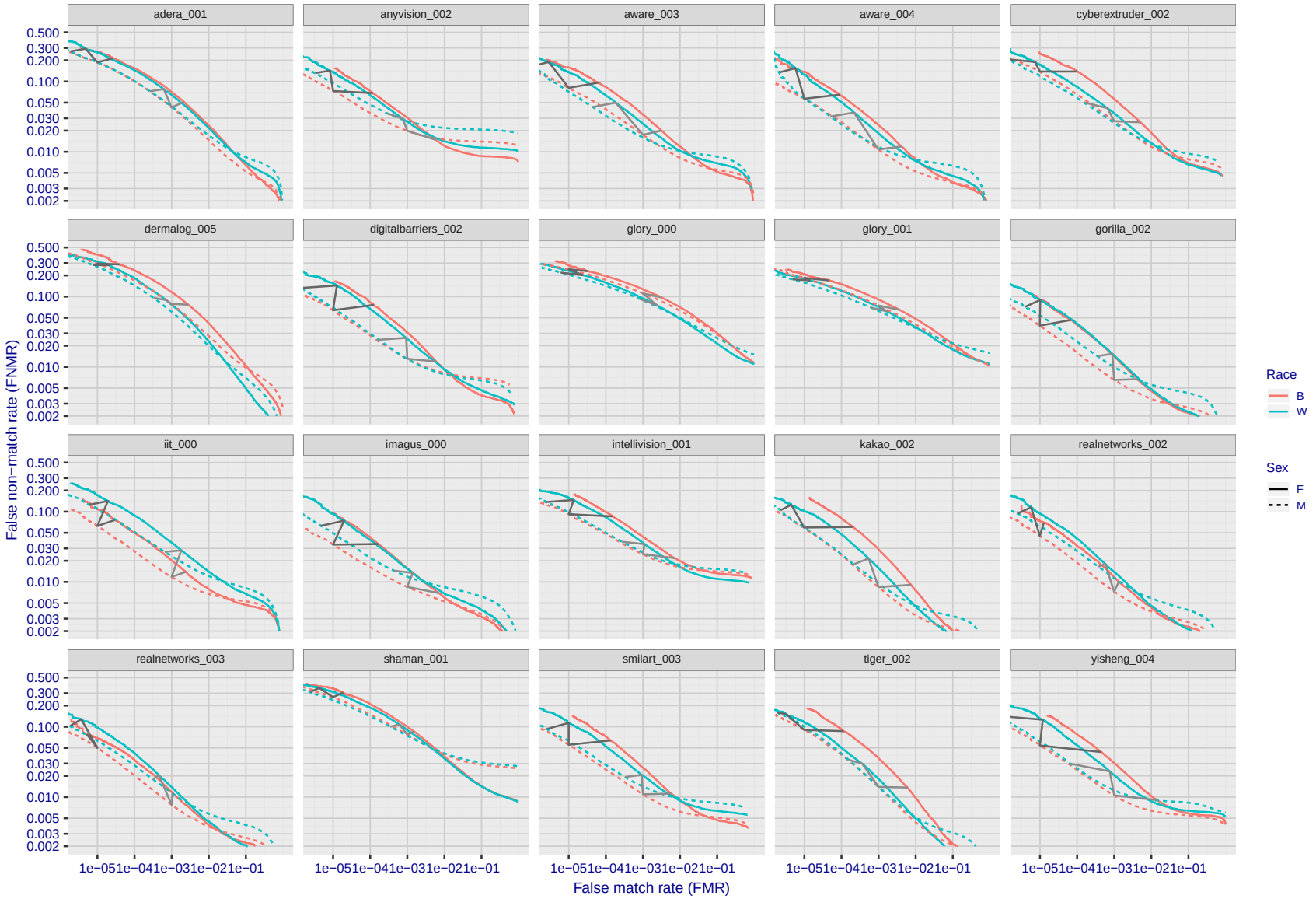


Figure 57: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

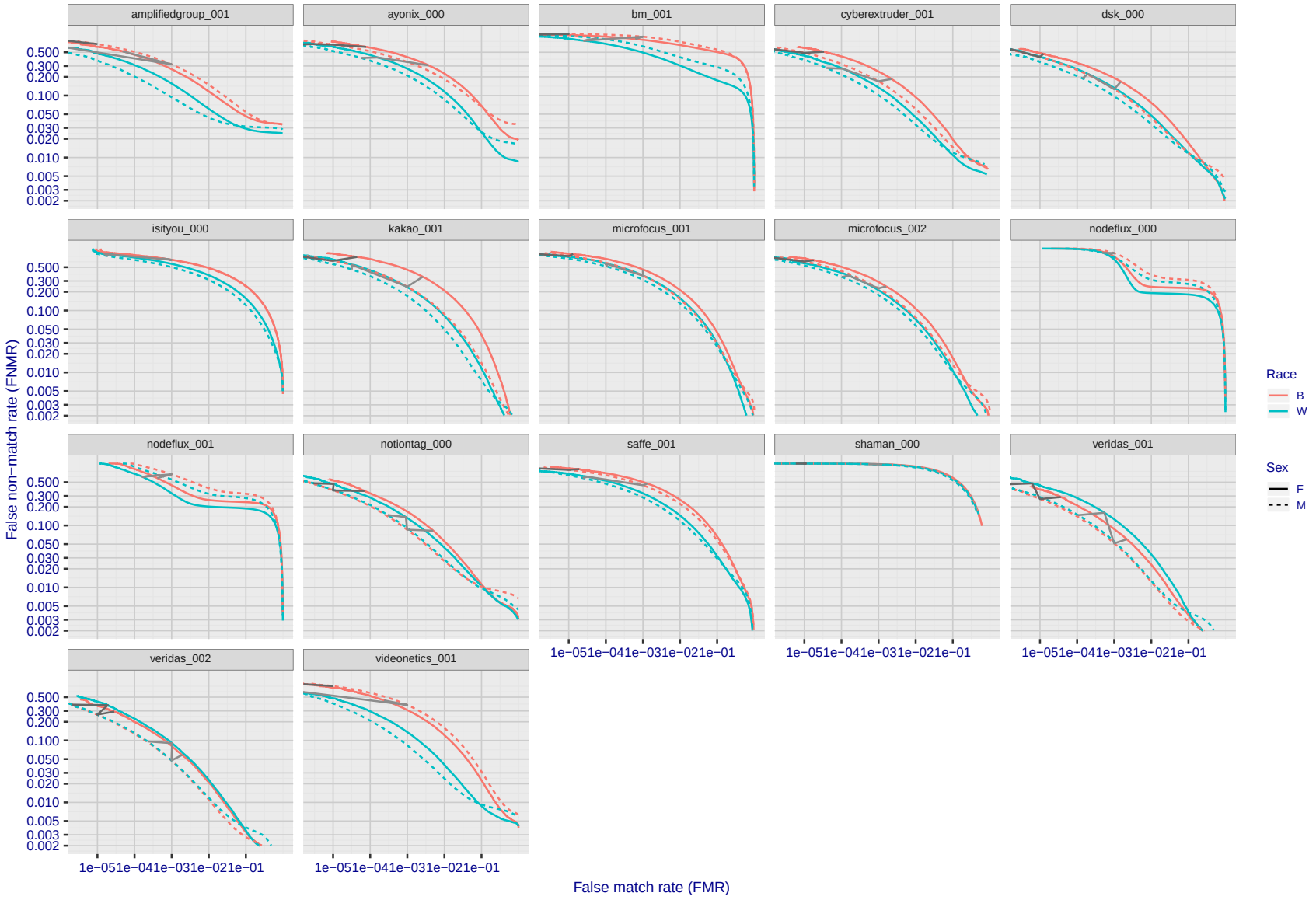


Figure 58: For the mugshot images, error tradeoff characteristics for white females, black females, black males and white males. The Z-shaped grey lines correspond to fixed thresholds, showing both *FNMR and FMR vary at one T value. Note: Many of the plots will naively be read as saying women gives worse error rates than men because the solid traces lie above the dotted ones. However, this is misleading and incomplete: The grey lines show the traces reveal horizontal shifts. Thus for the cogent-003 algorithm FNMR for men is* higher *than for women* at a fixed threshold *but, at the same time, FMR is higher for women - see Figure 77. As access control systems almost always operate at a fixed threshold, the naive interpretation is incorrect.*

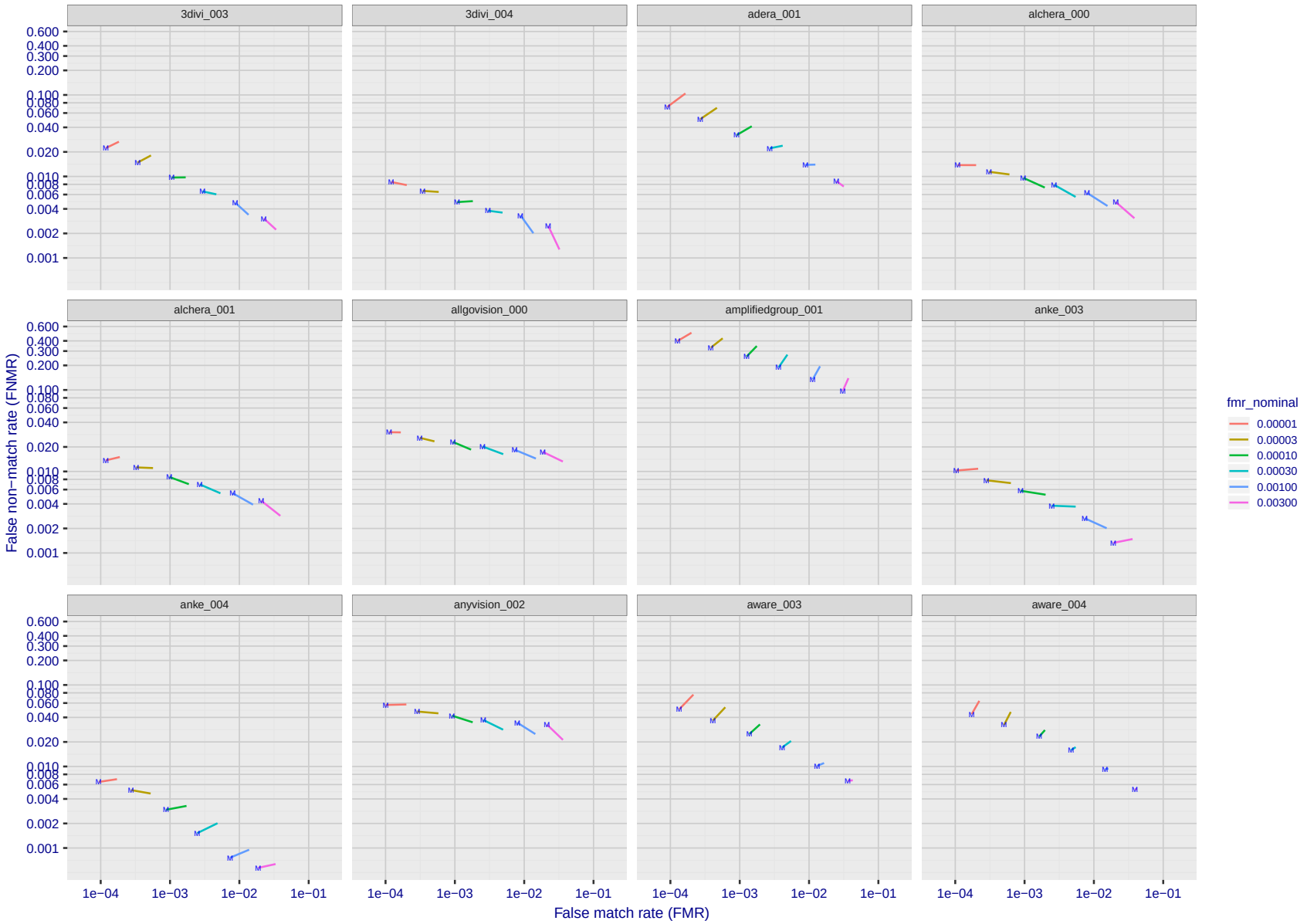


Figure 59: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

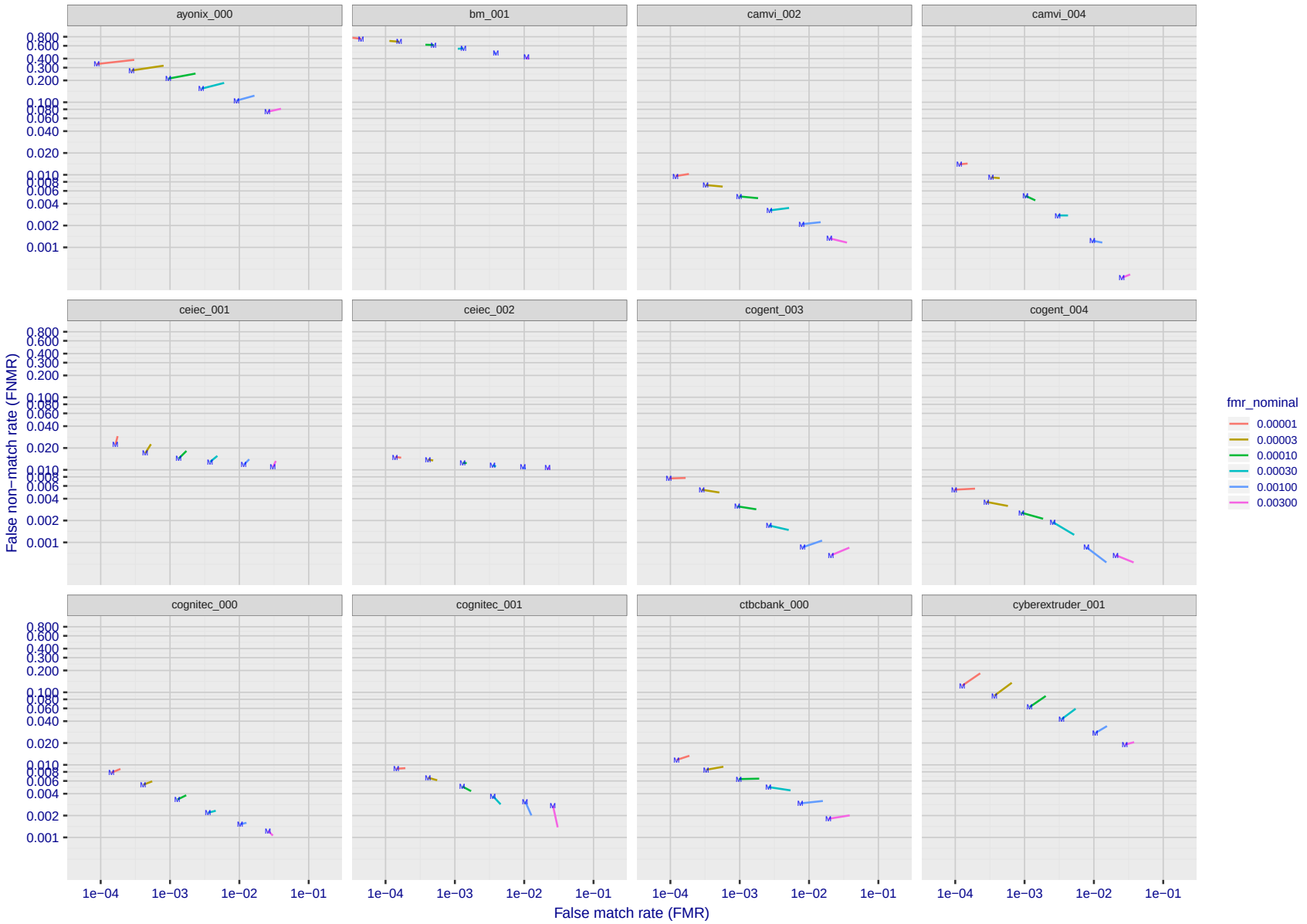


Figure 60: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

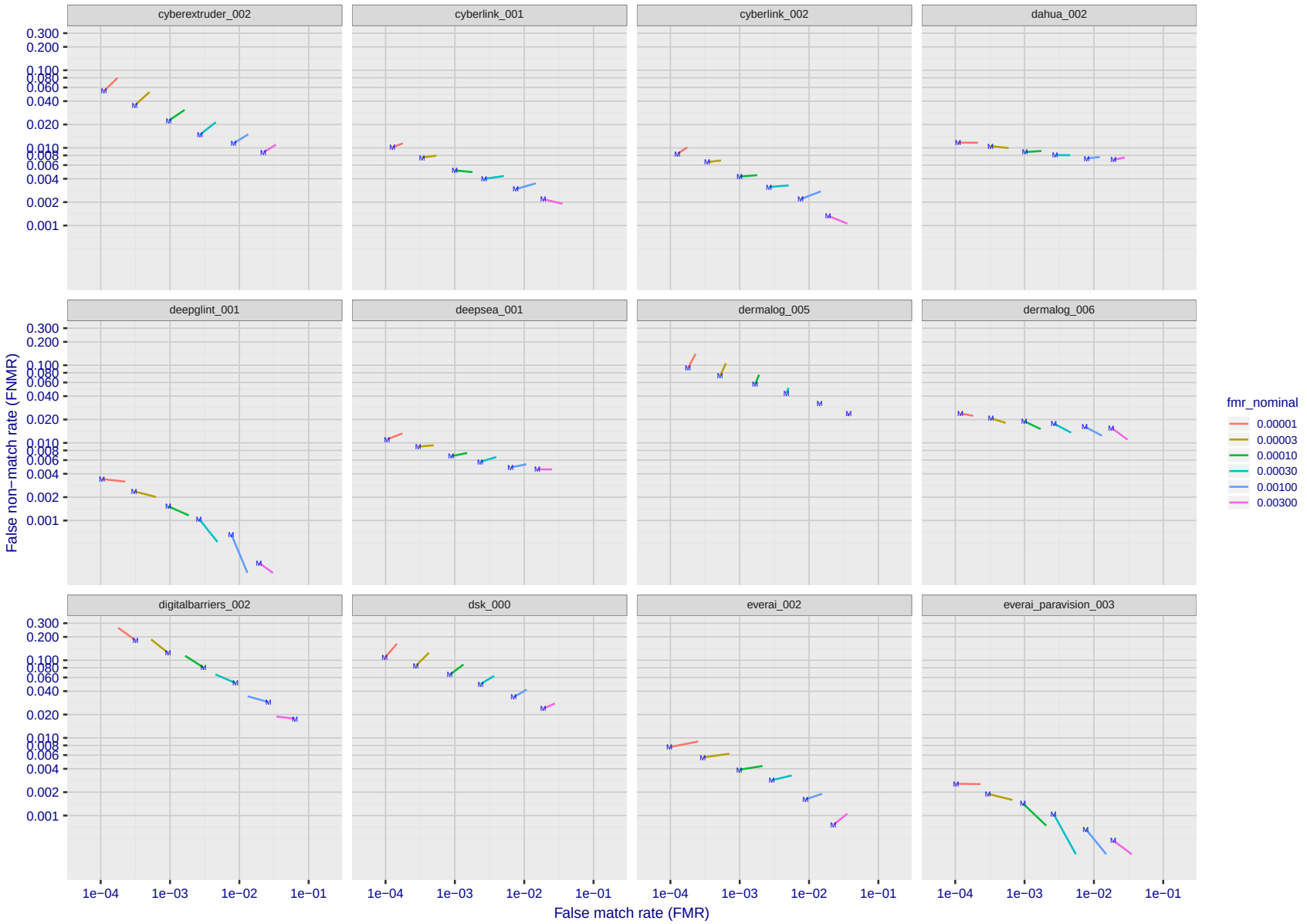


Figure 61: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

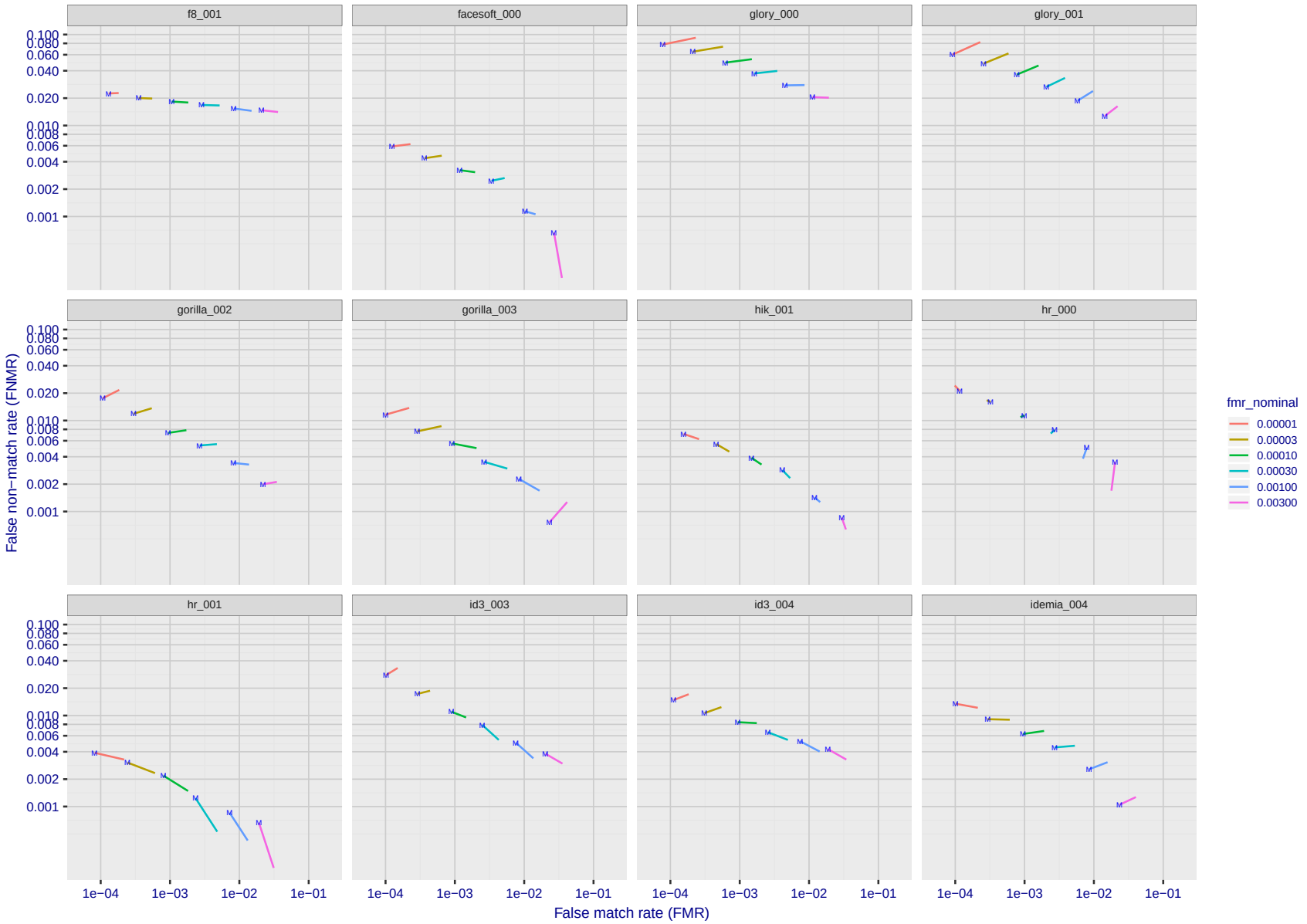


Figure 62: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

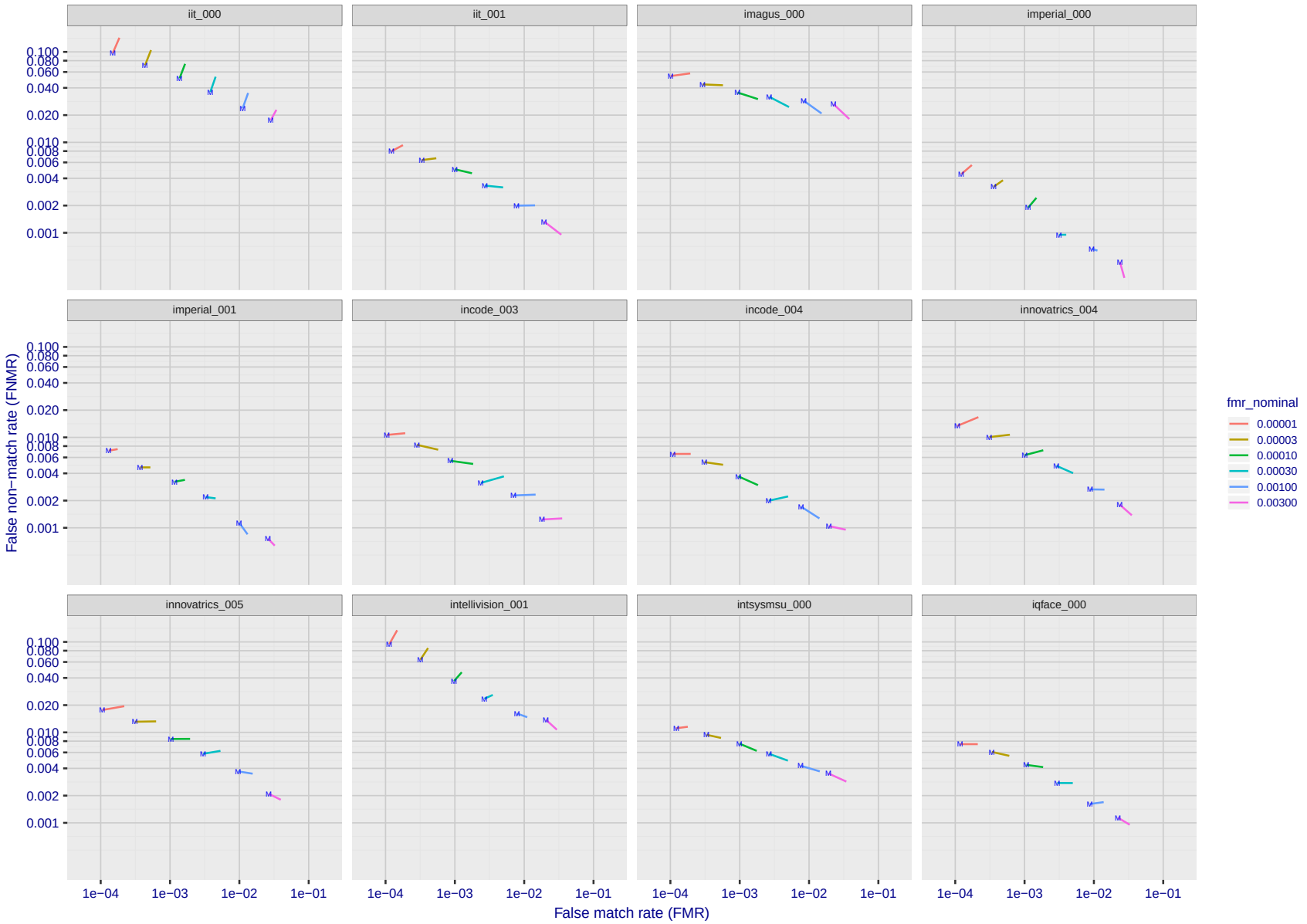


Figure 63: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

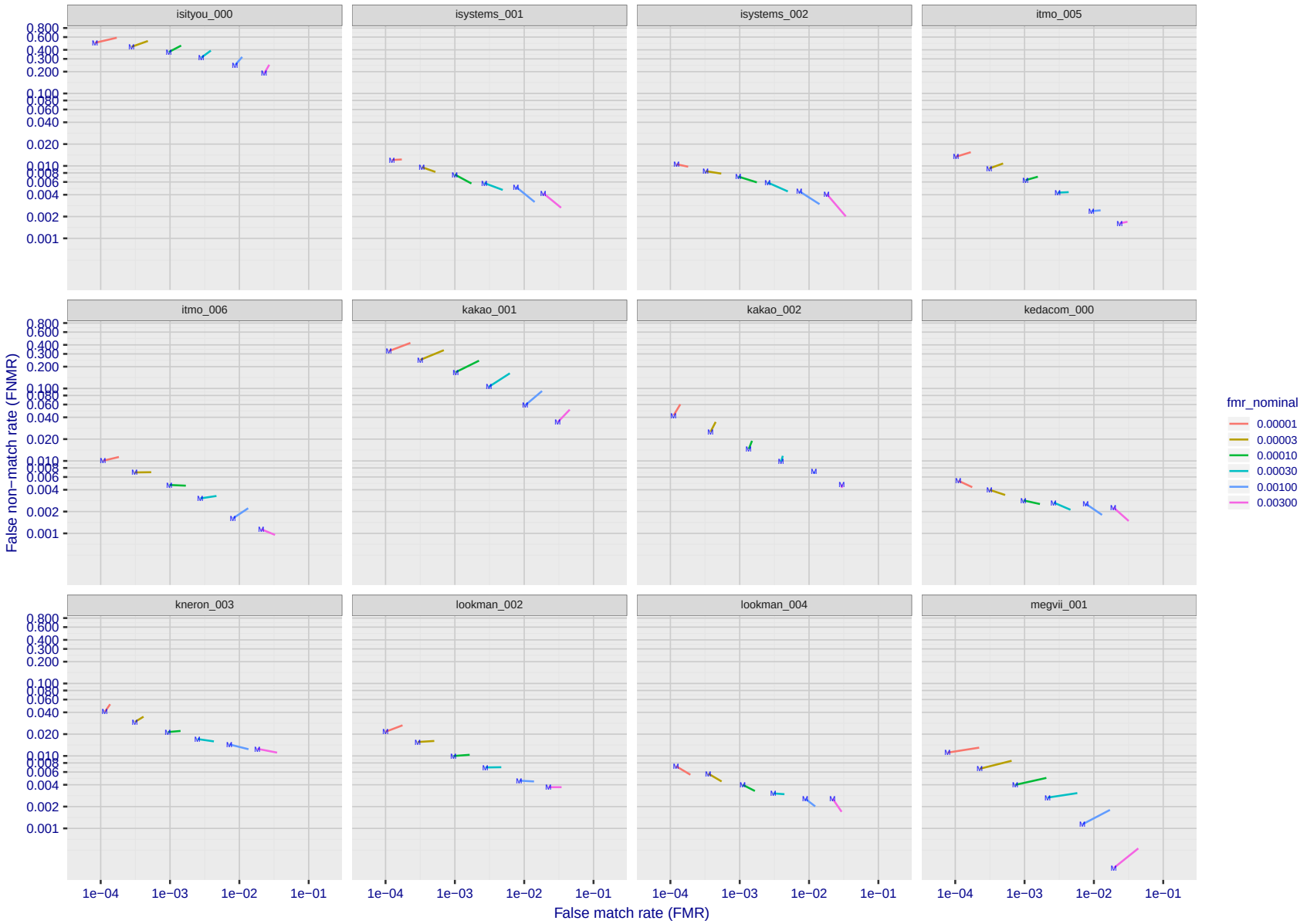


Figure 64: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

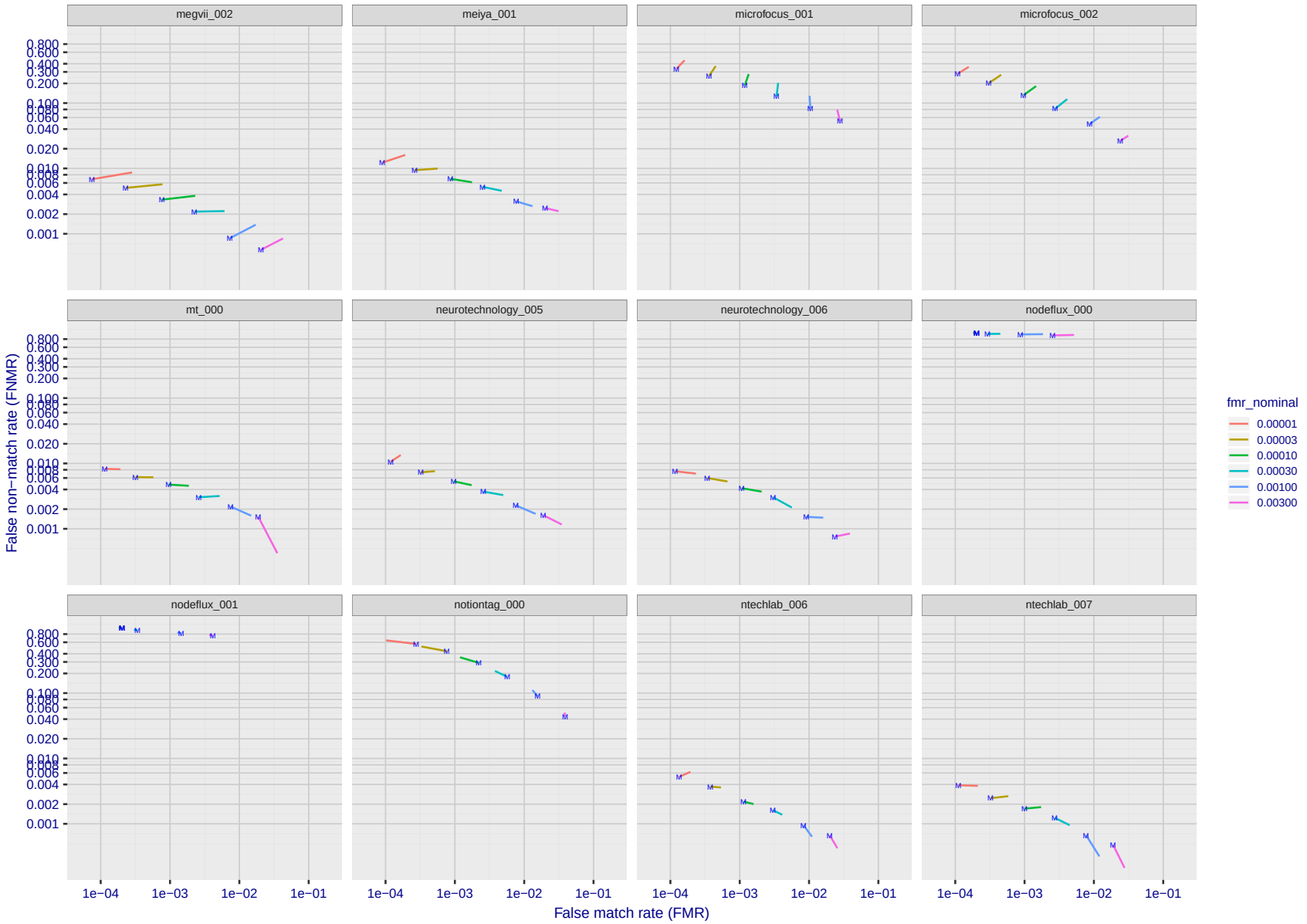


Figure 65: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

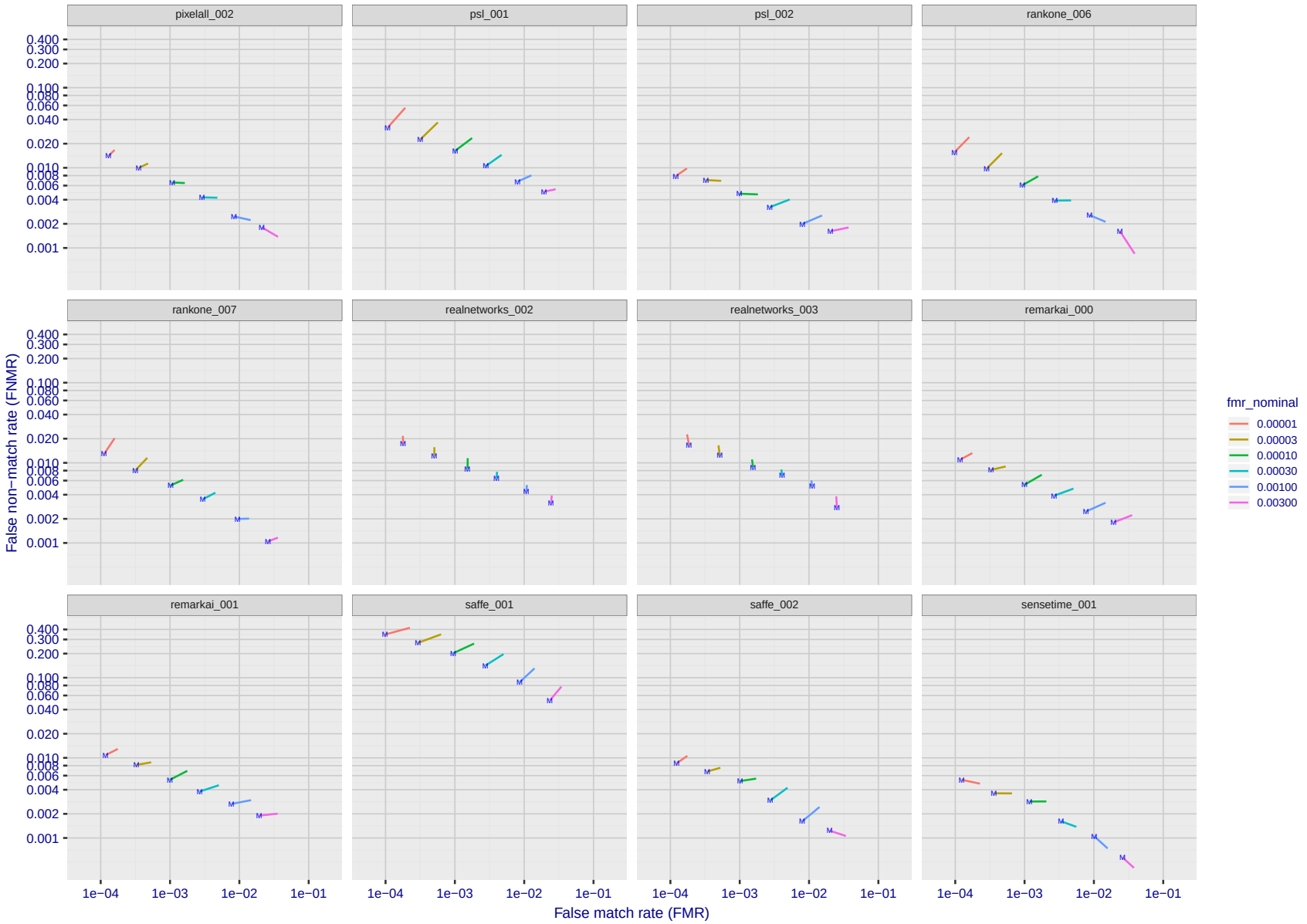


Figure 66: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

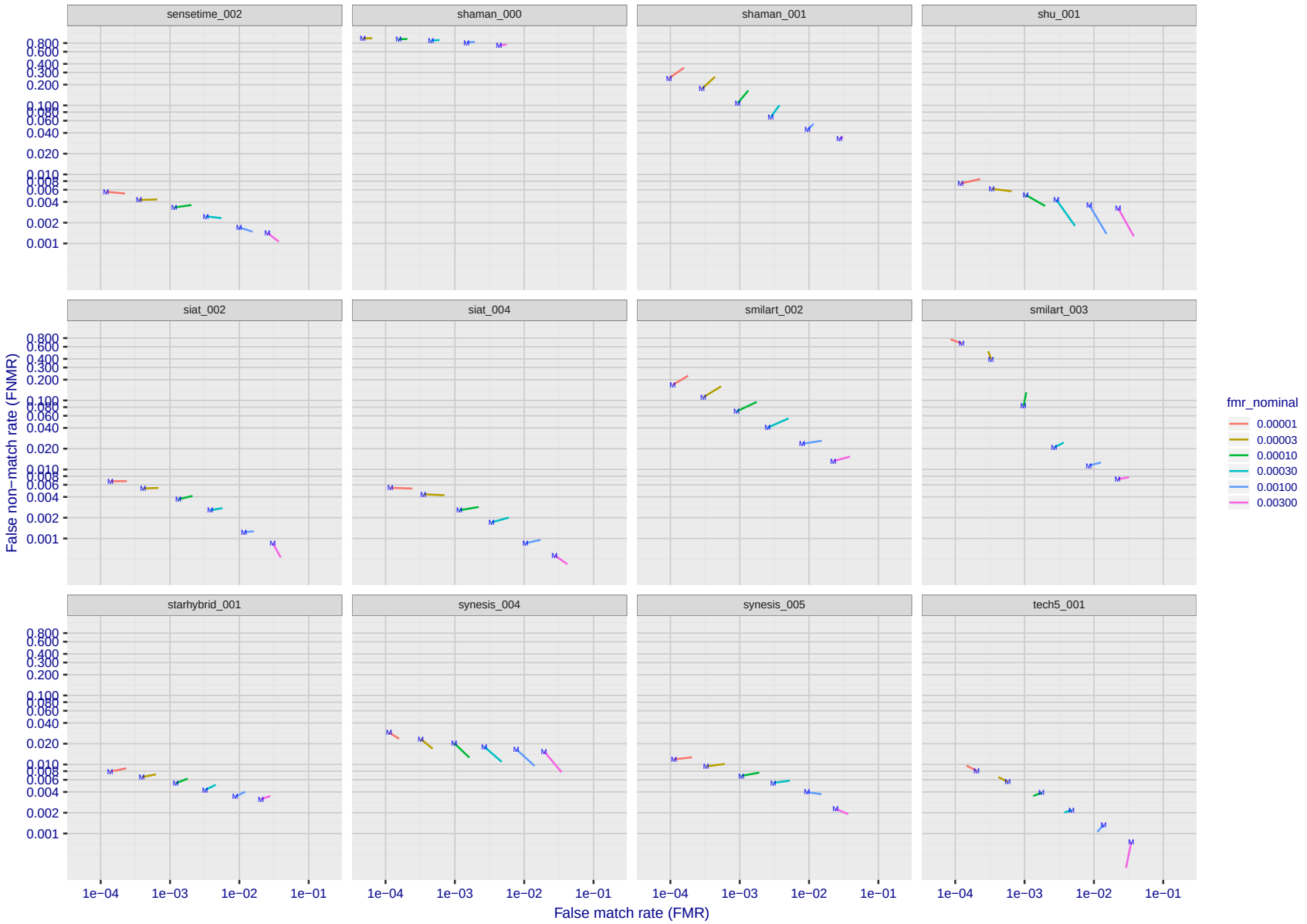


Figure 67: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

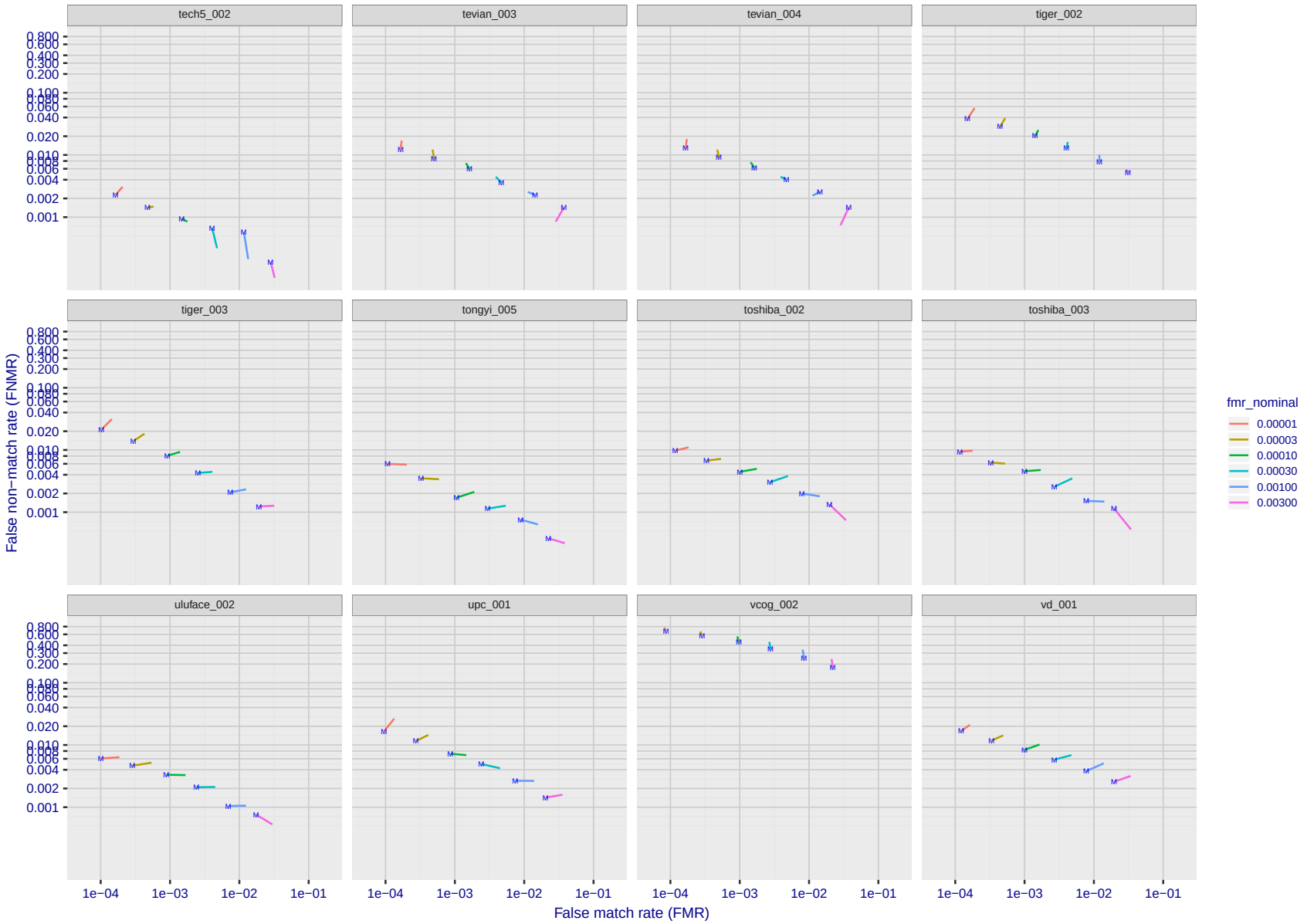


Figure 68: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

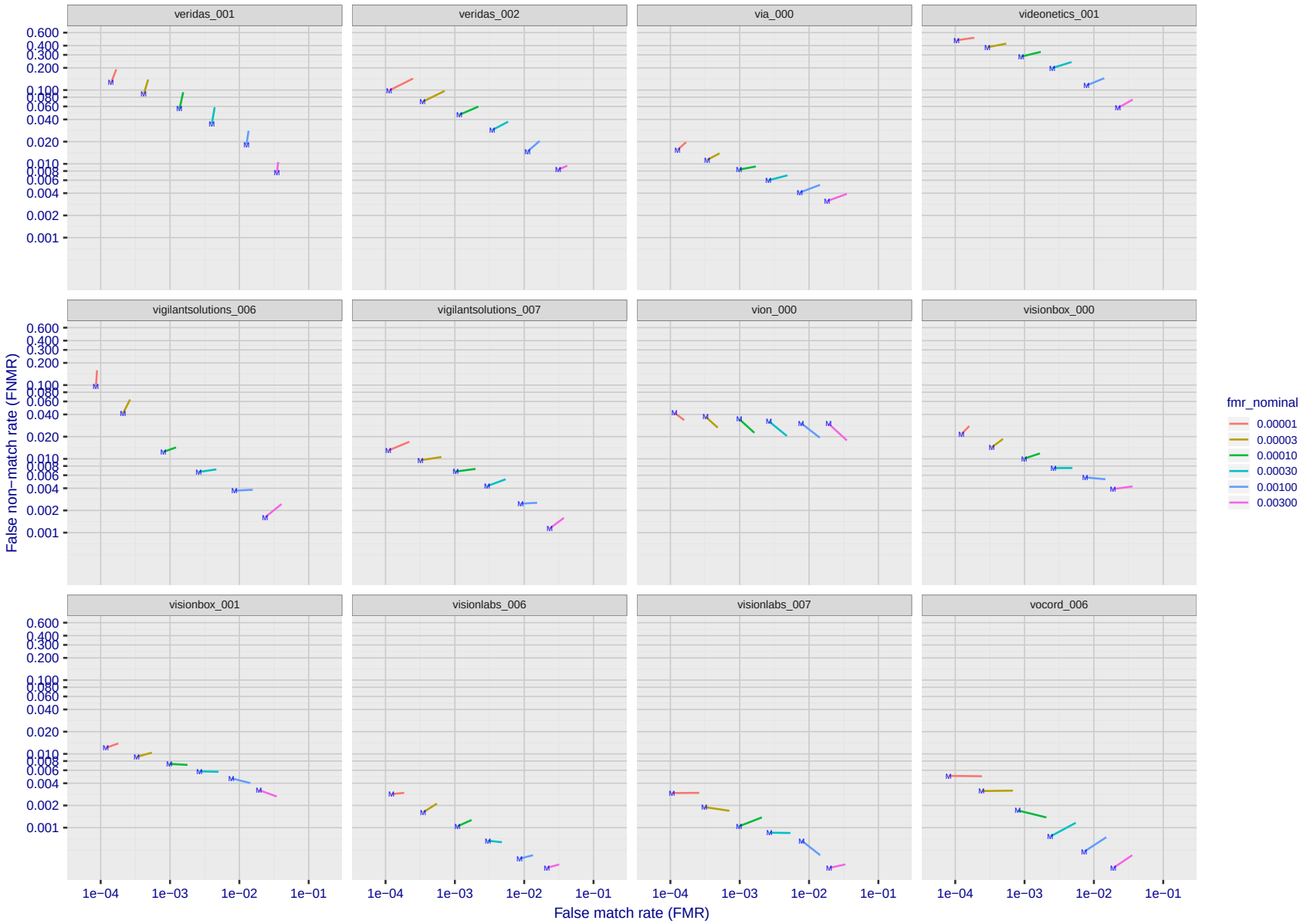


Figure 69: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

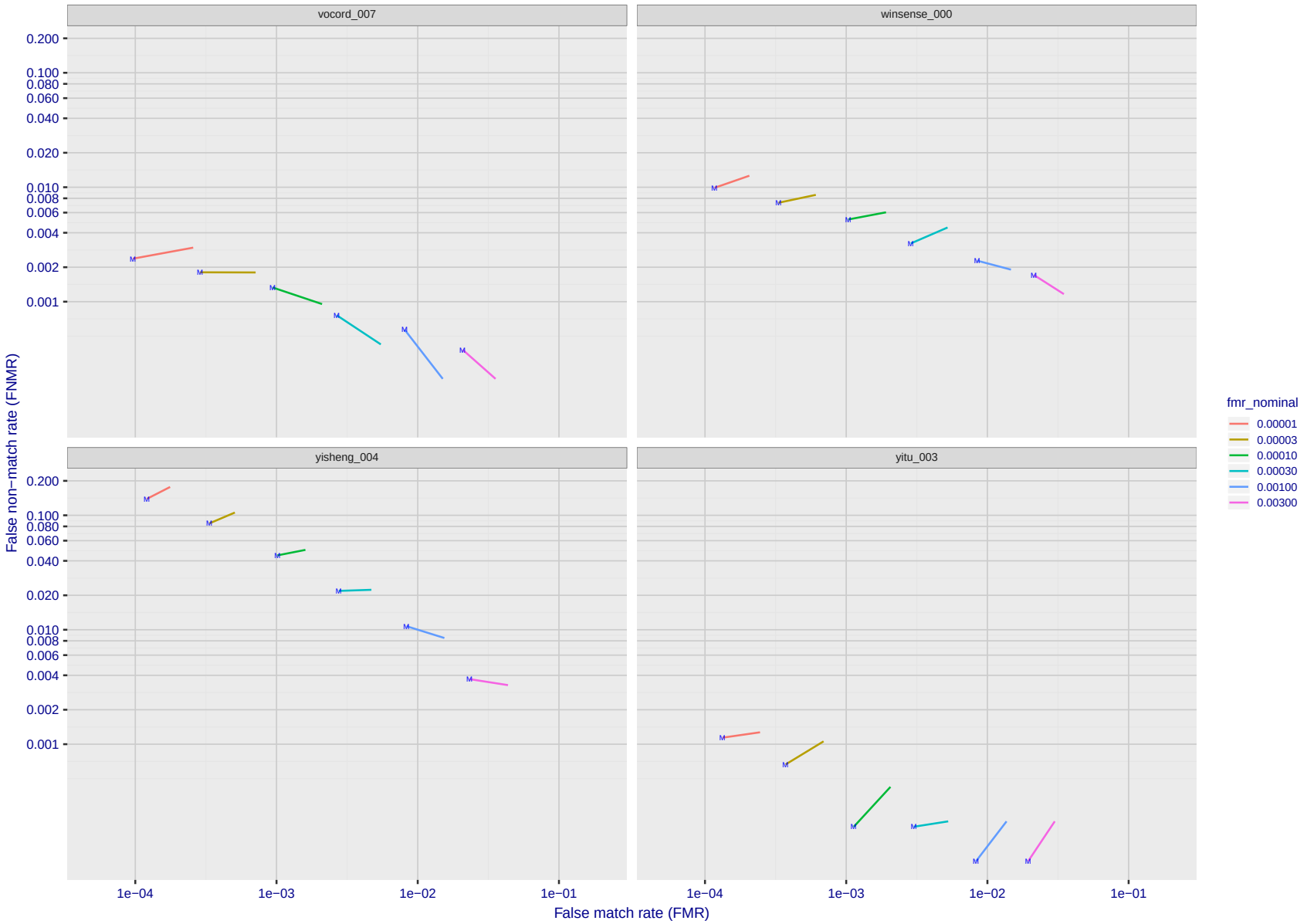


Figure 70: For the visa images, FNMR and FMR at six operating points along the DET characteristic. At each point a line is drawn between (FMR,FNMR)$_{\text{MALE}}$ and (FMR,FNMR)$_{\text{FEMALE}}$ showing how which sex has lower FMR and/or FNMR. The "M" label denotes male, the other end of the line corresponds to female. The six operating thresholds are selected to give the nominal false match rates given in the legend, and are computed over all impostor pairs regardless of age, sex, and place of birth. The plotted FMR values are broadly an order of magnitude larger than the nominal rates because FMR is computed over demographically-matched impostor pairs i.e individuals of the same sex, from the same geographic region (see section 3.6.1), and the same age group (see section 3.6.2).

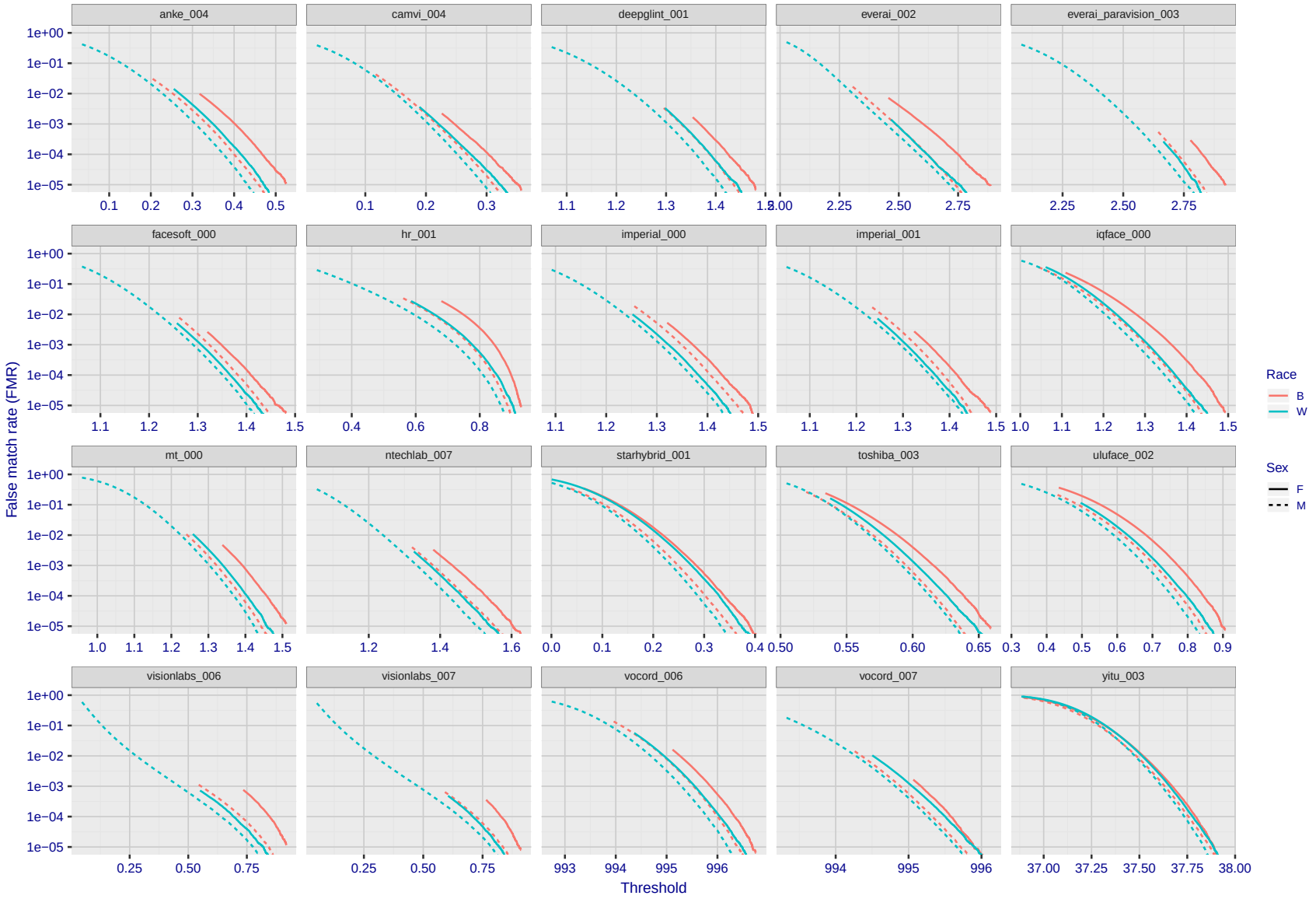


Figure 71: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

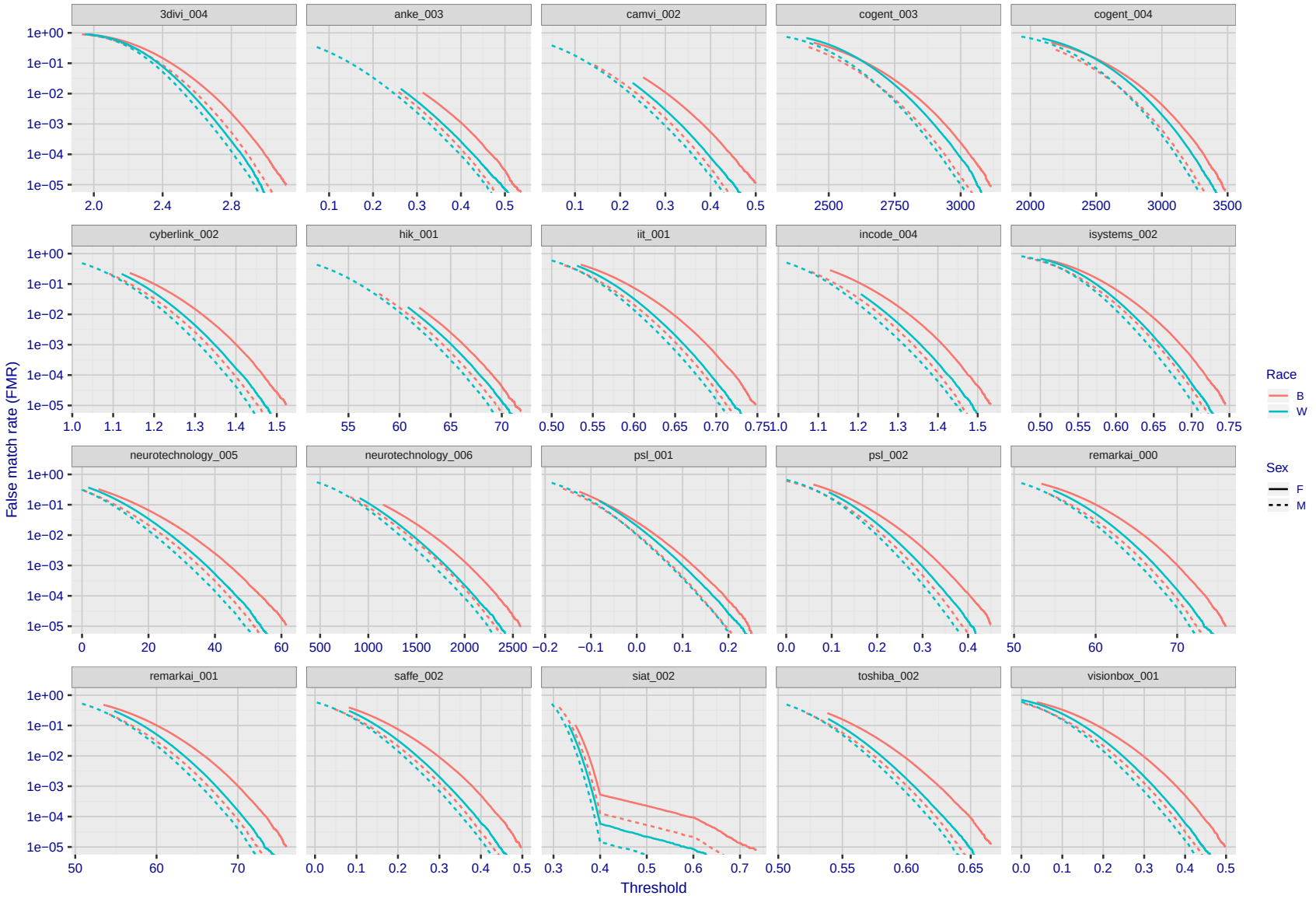


Figure 72: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

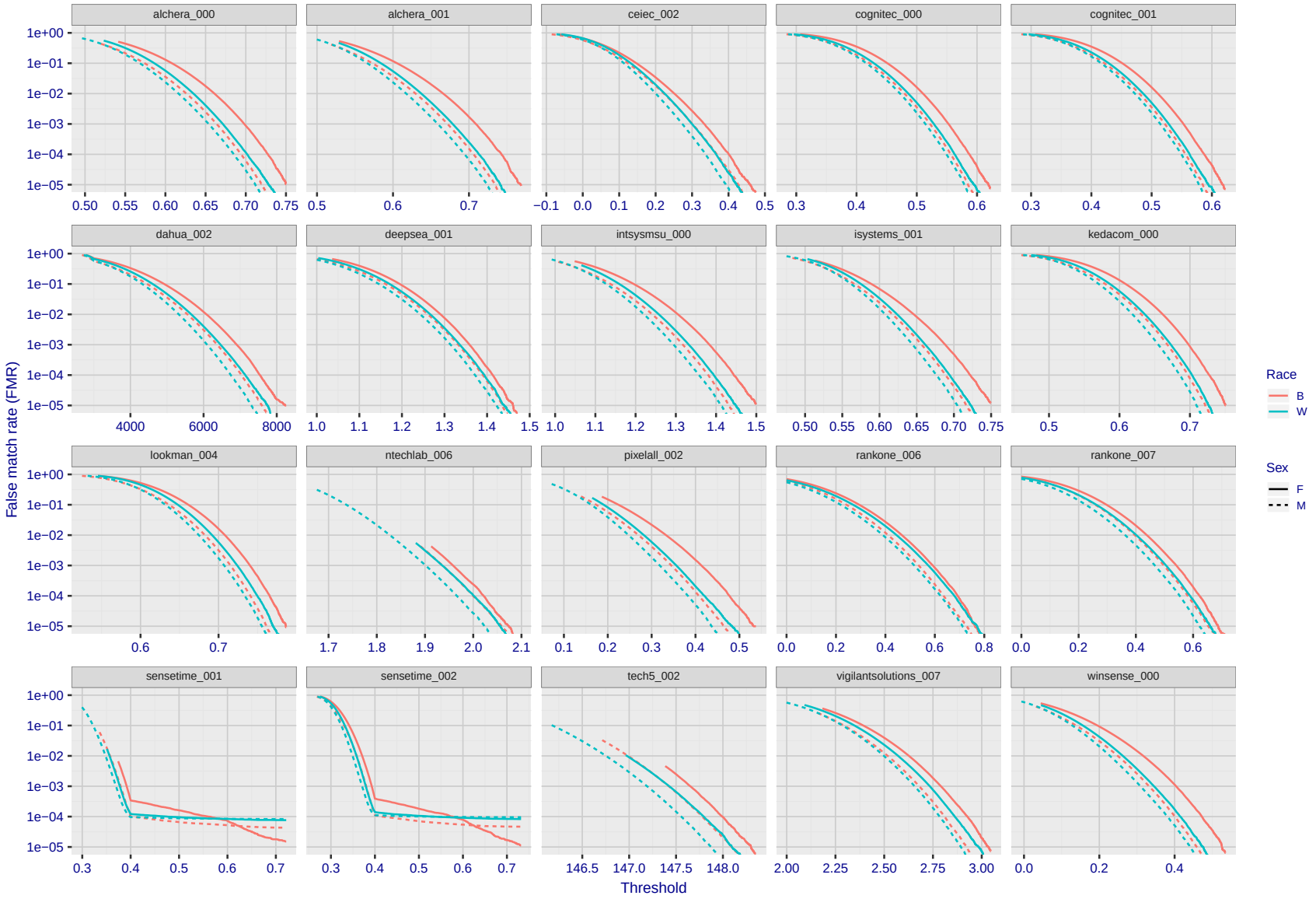


Figure 73: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

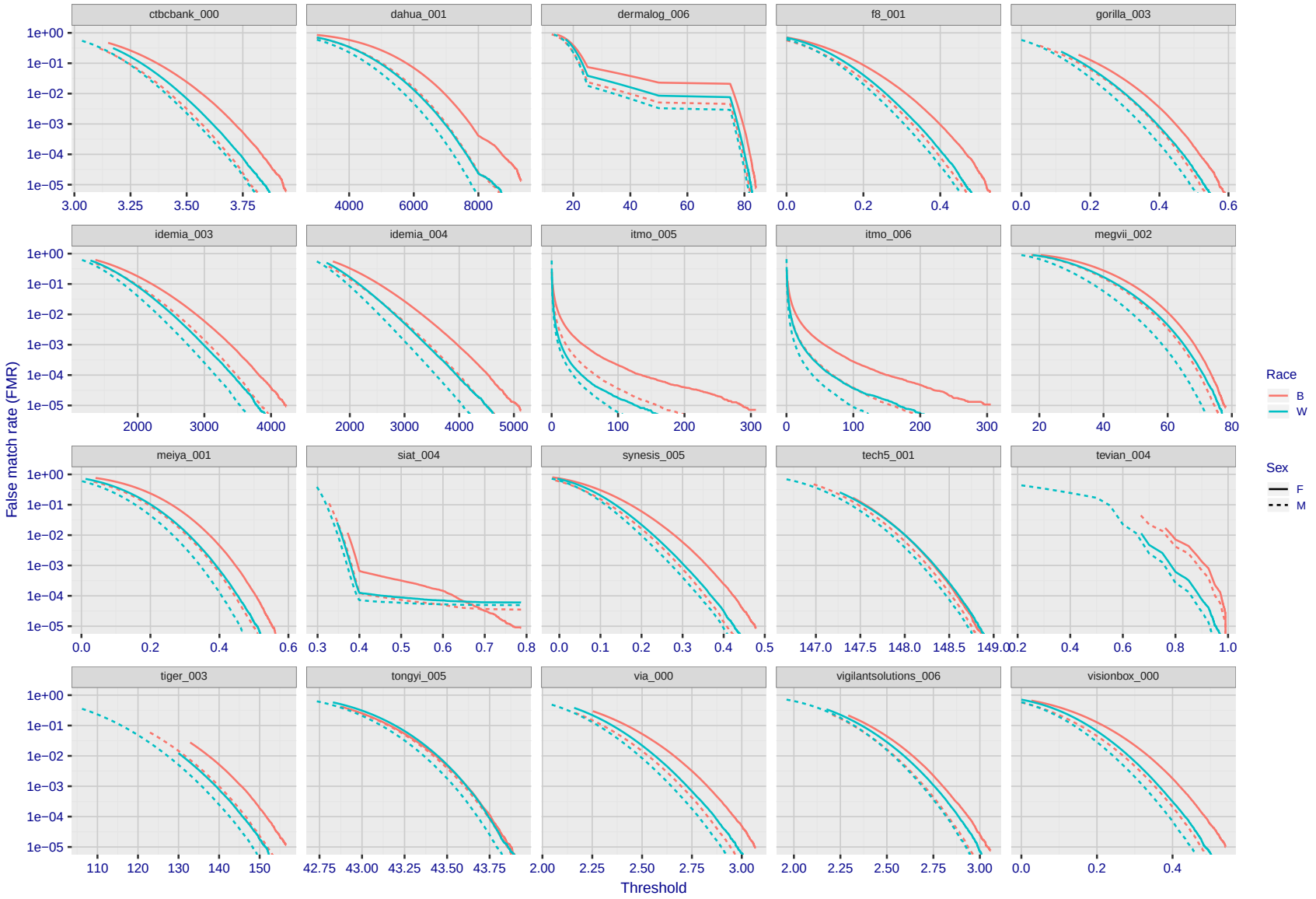


Figure 74: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

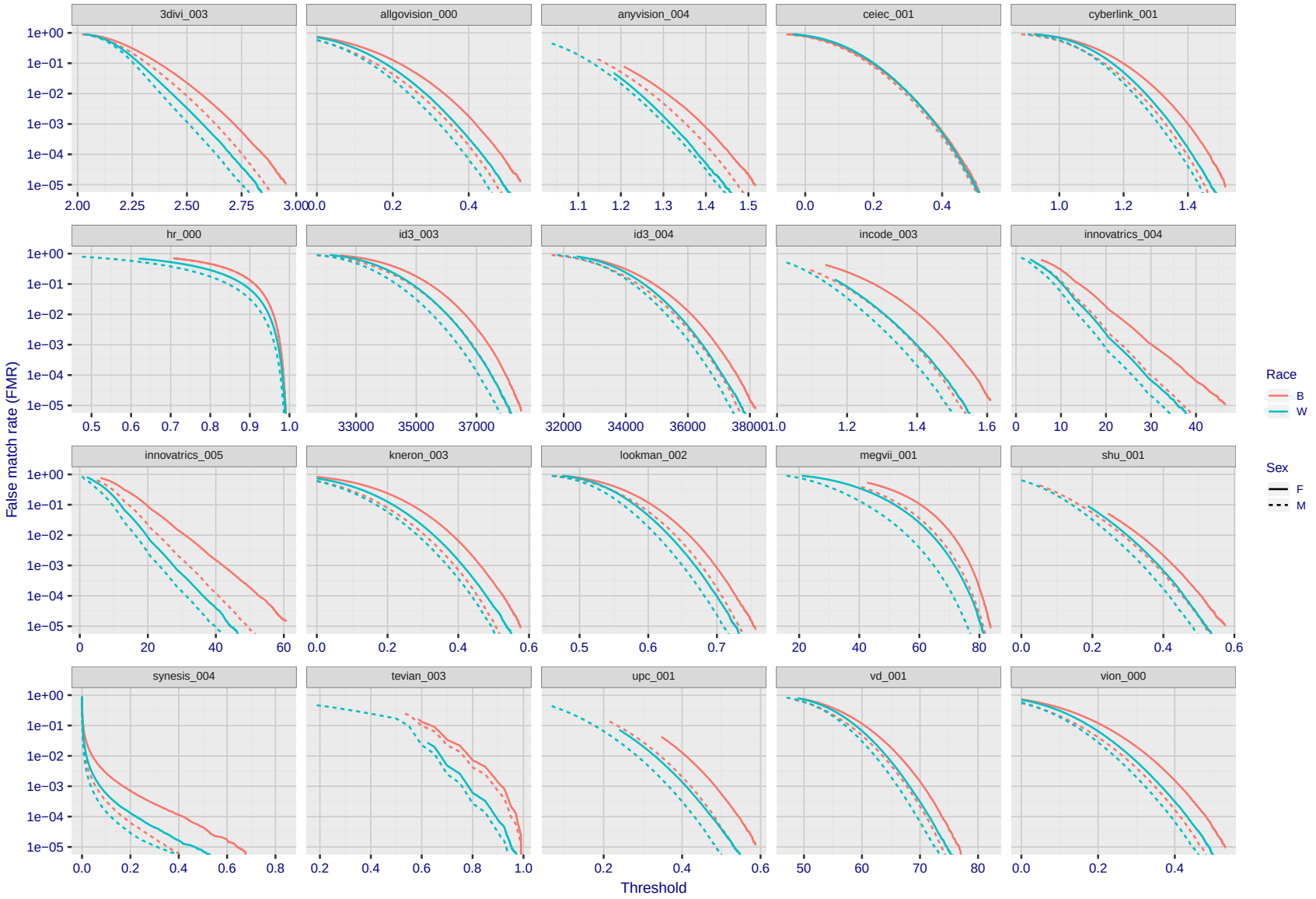


Figure 75: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

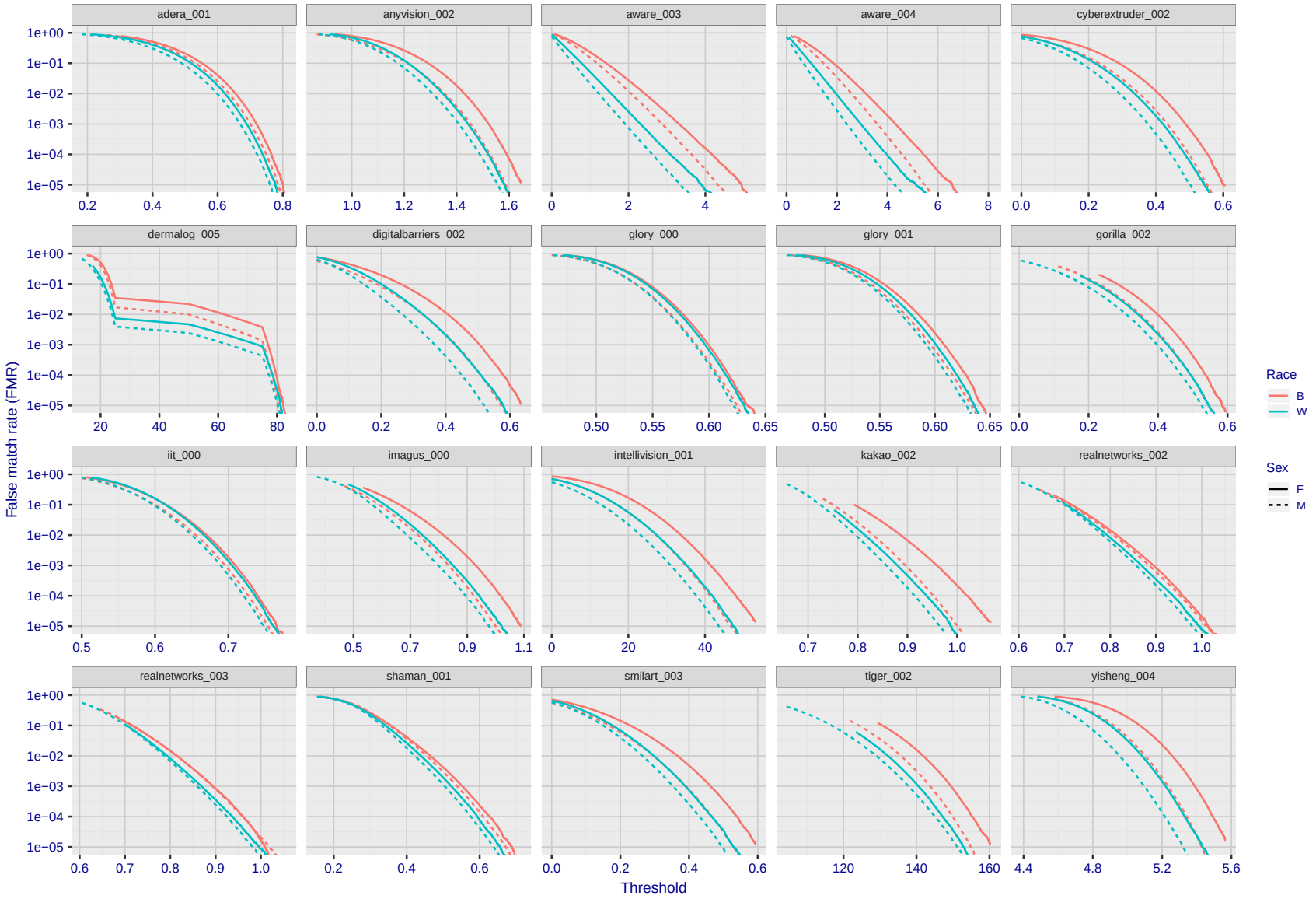


Figure 76: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

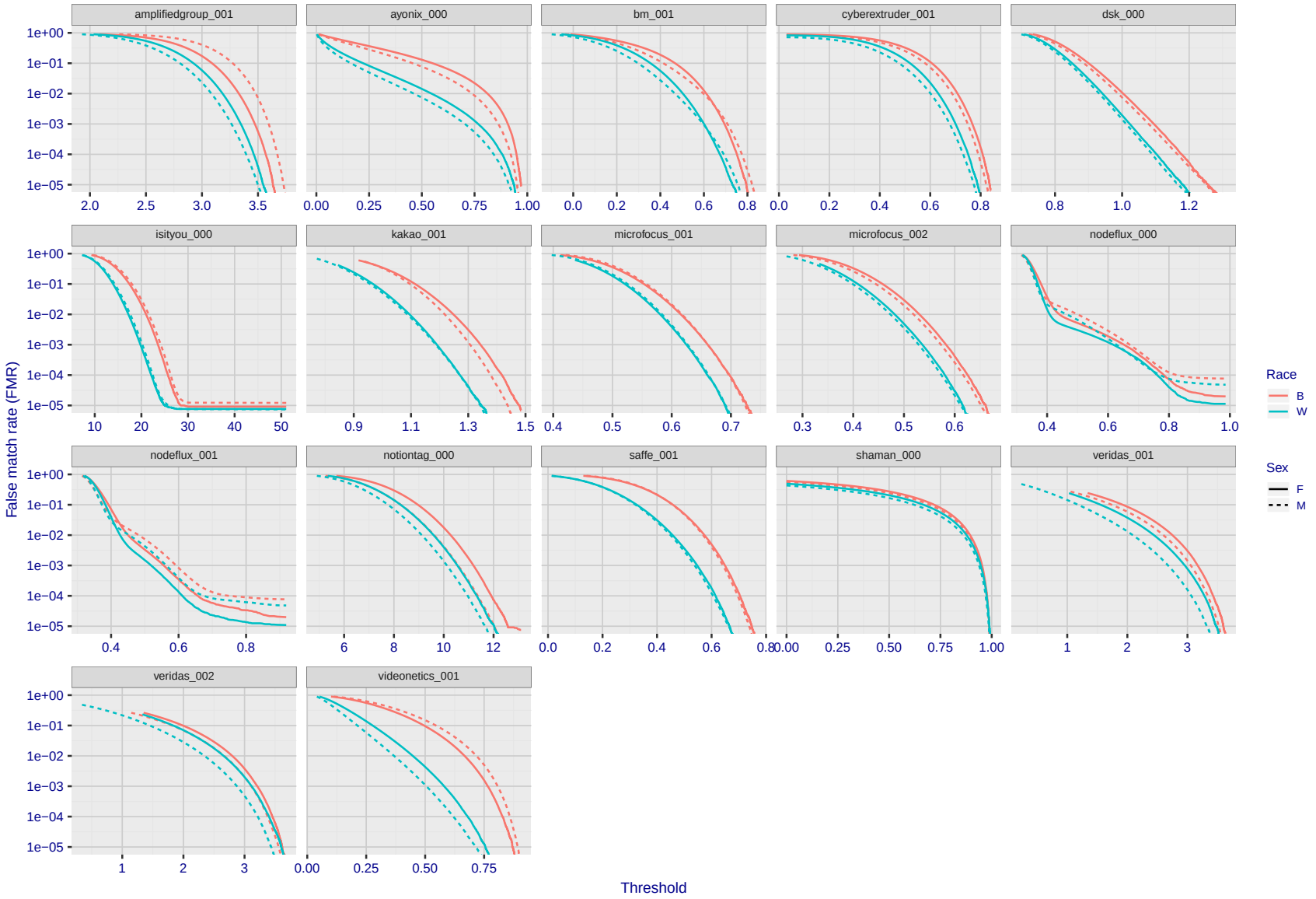


Figure 77: For the mugshot images, the false match calibration curves show false match rate vs. threshold. Separate curves appear for white females, black females, black males and white males.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

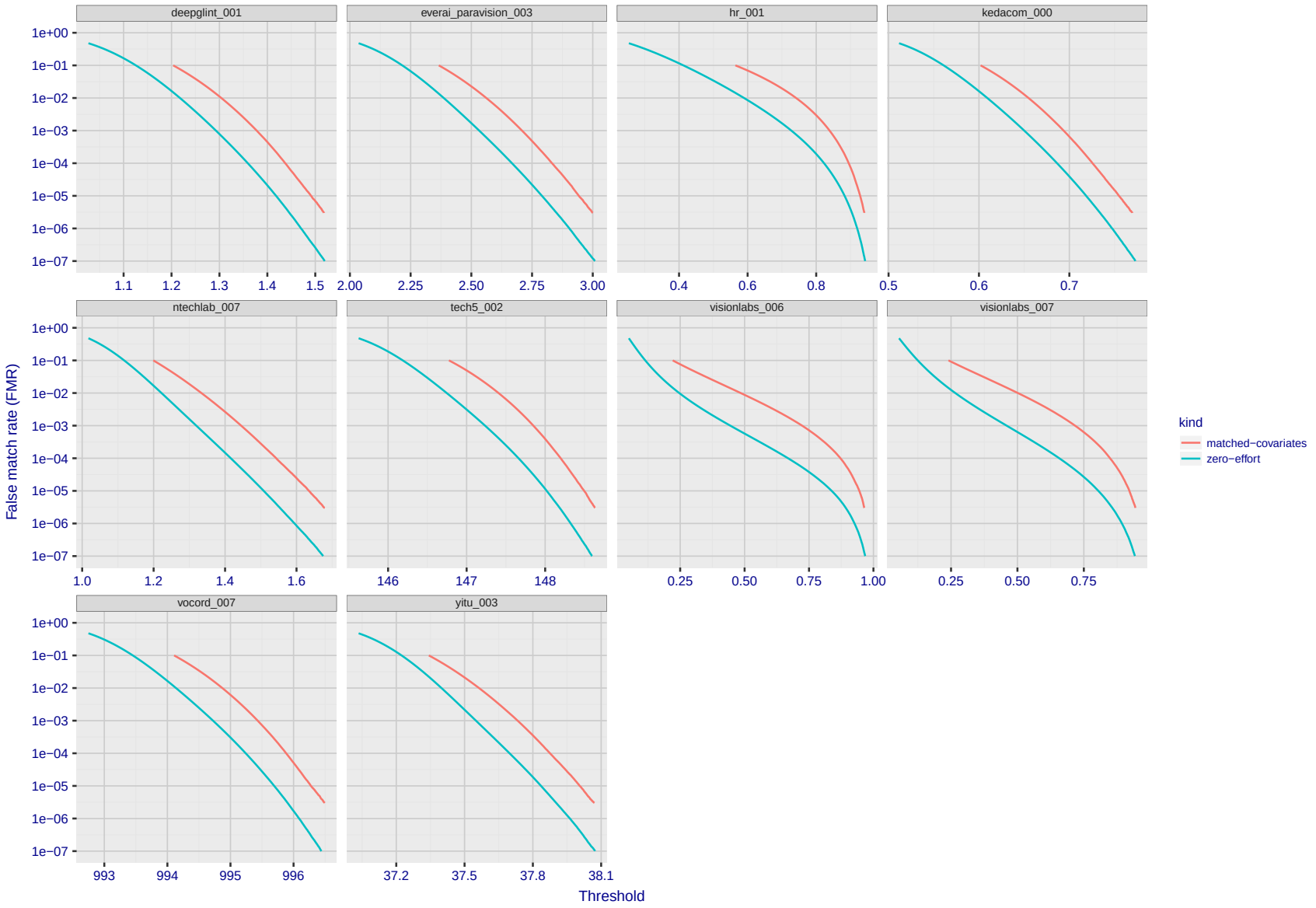


Figure 78: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

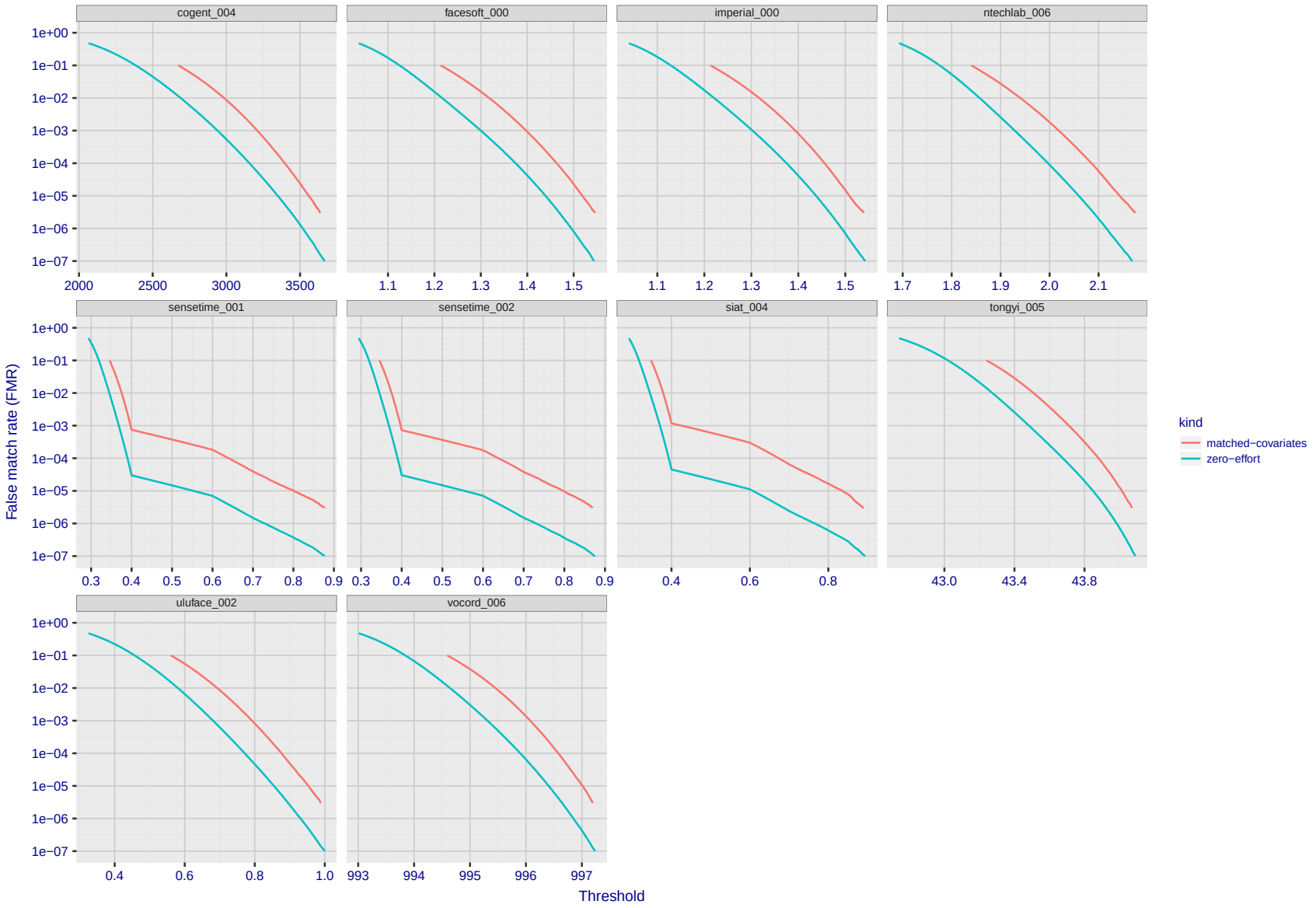


Figure 79: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

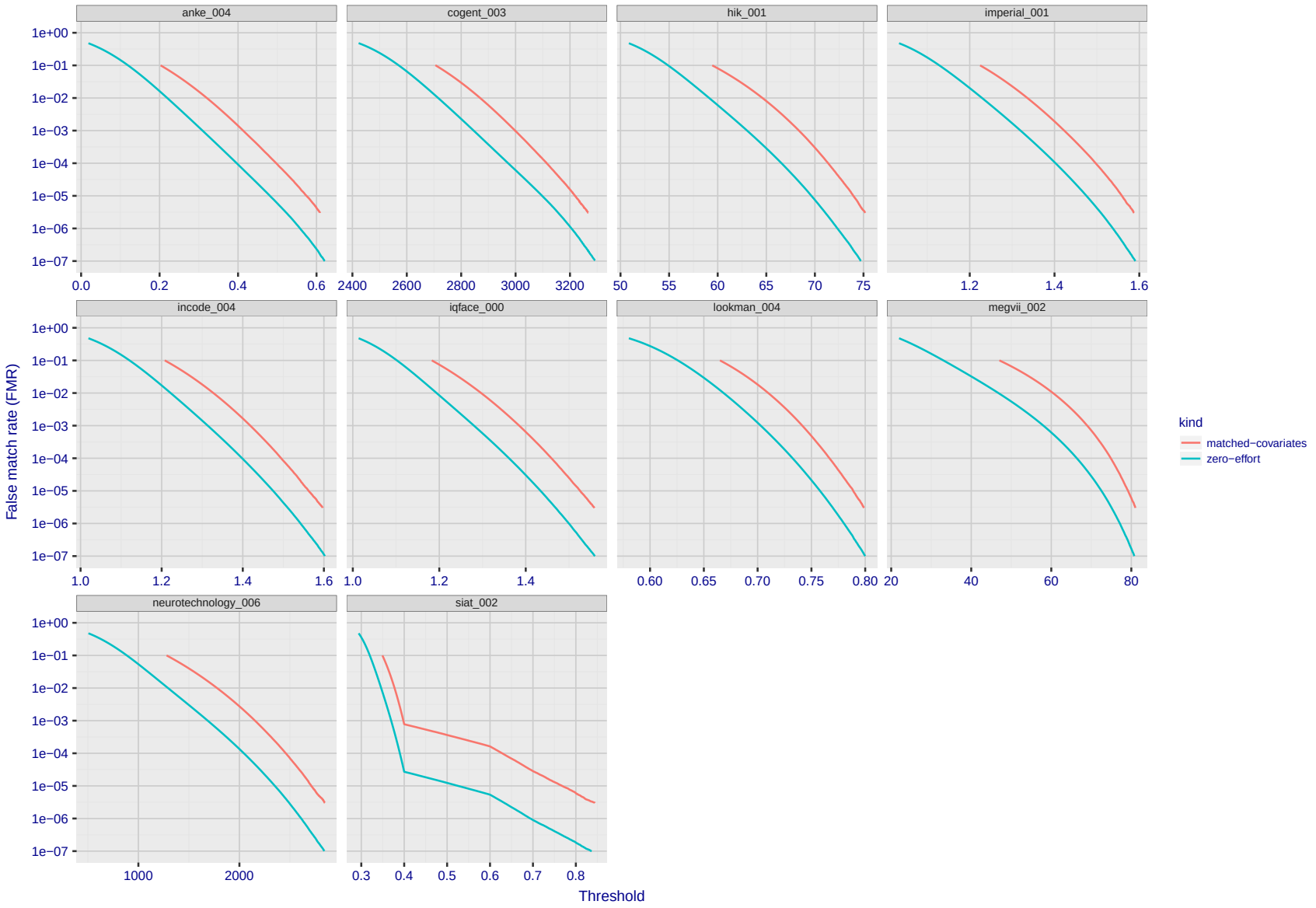


Figure 80: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02
FNMR(T) "False non-match rate"
FMR(T) "False match rate"

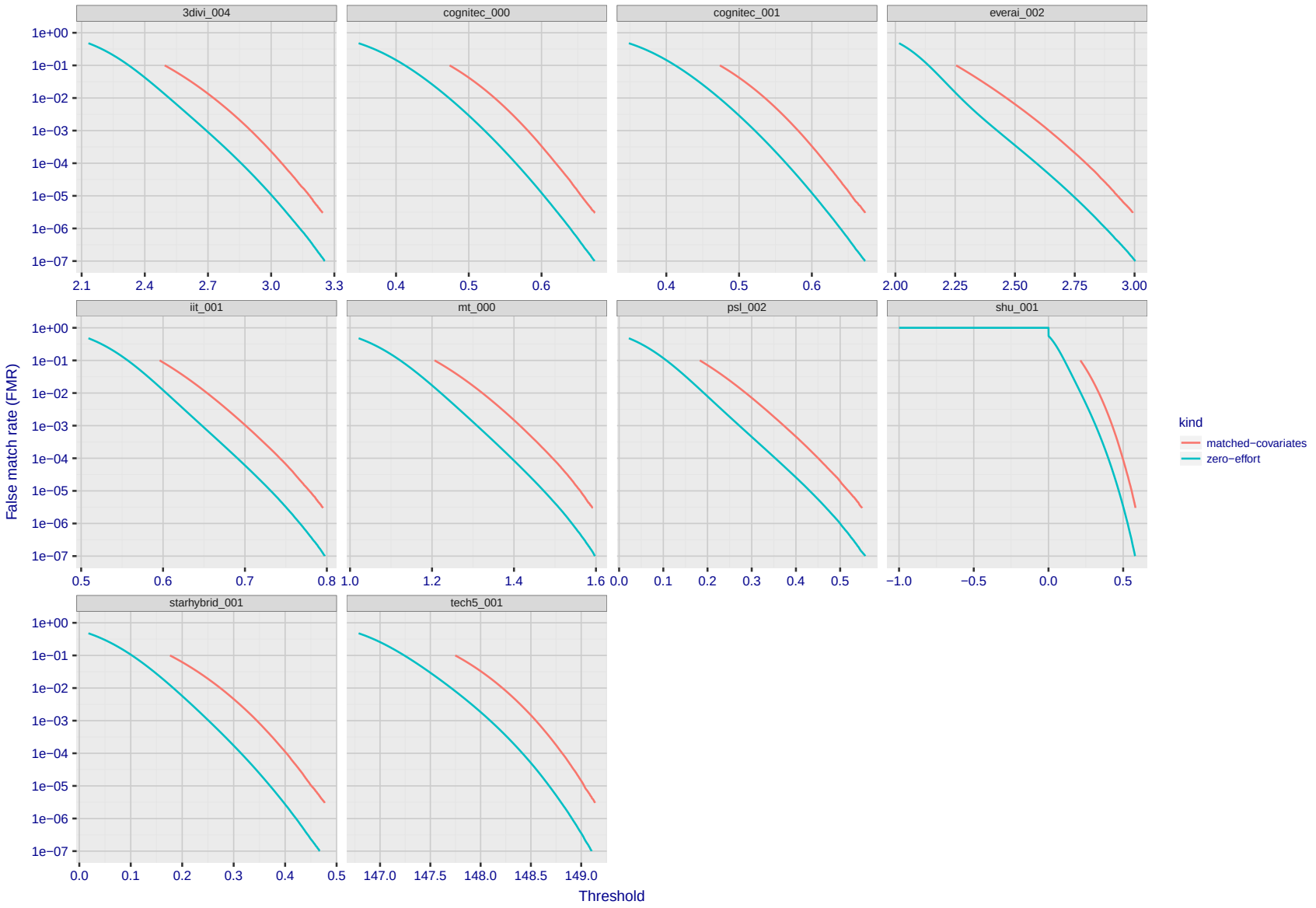


Figure 81: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

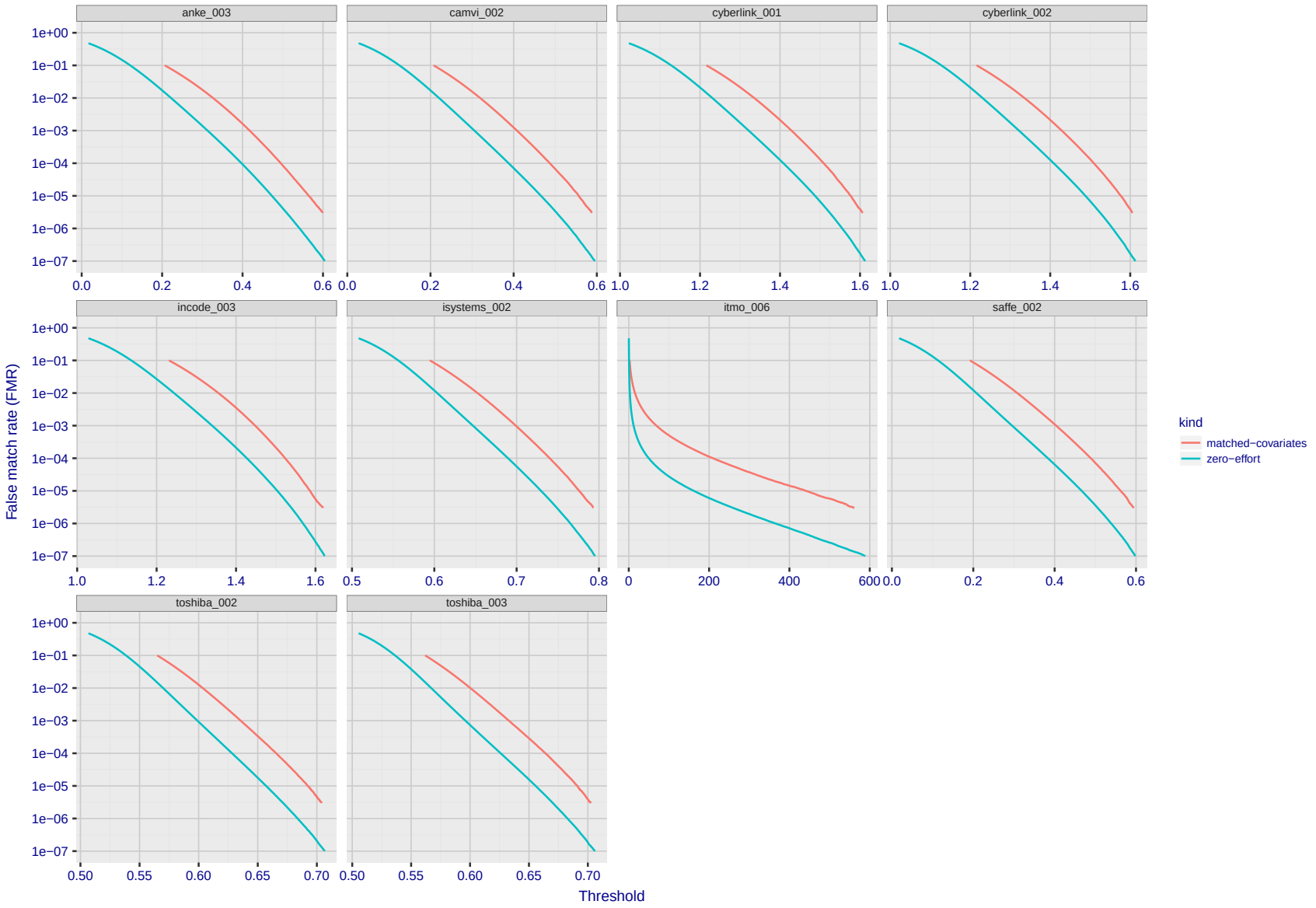


Figure 82: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

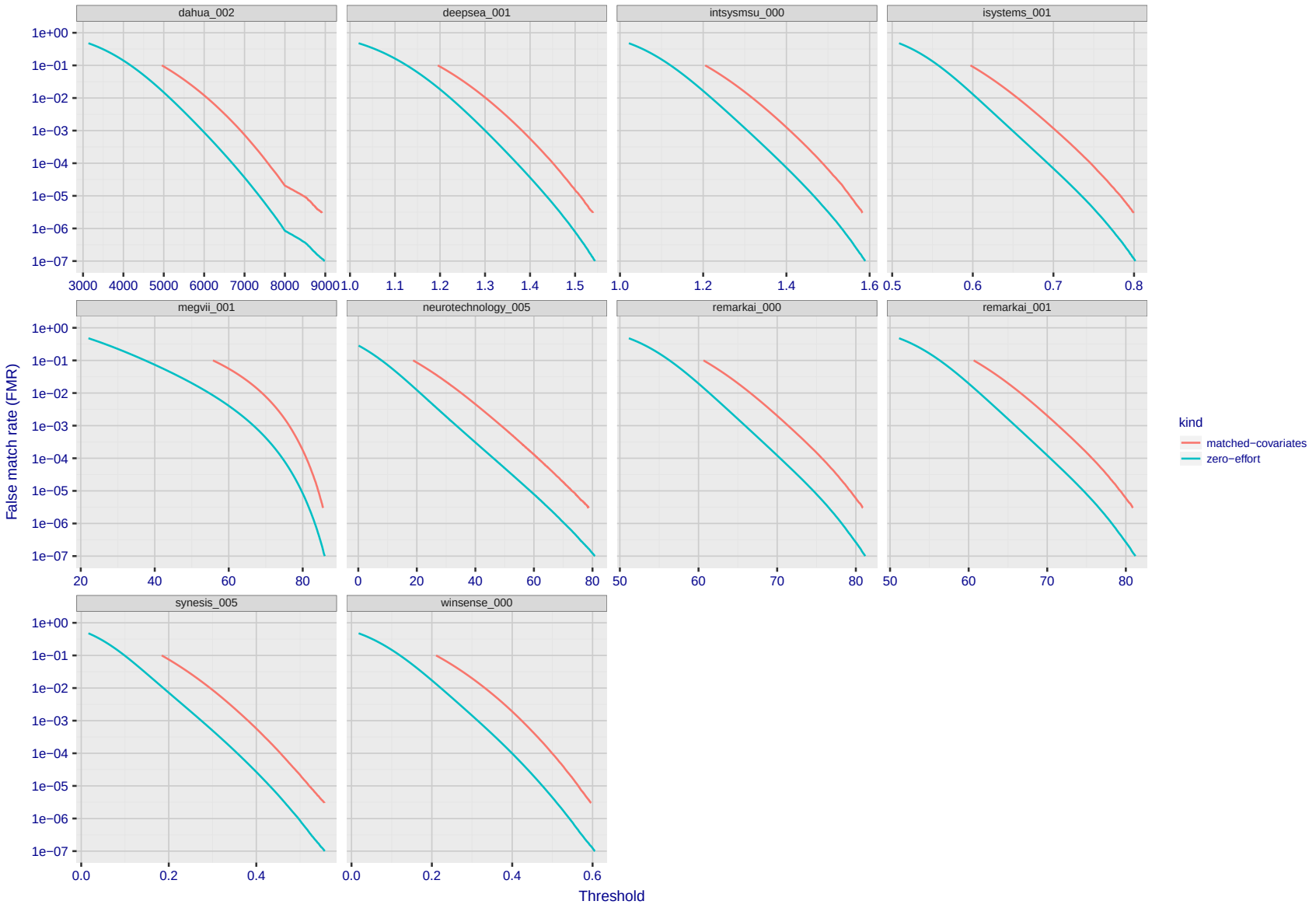


Figure 83: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

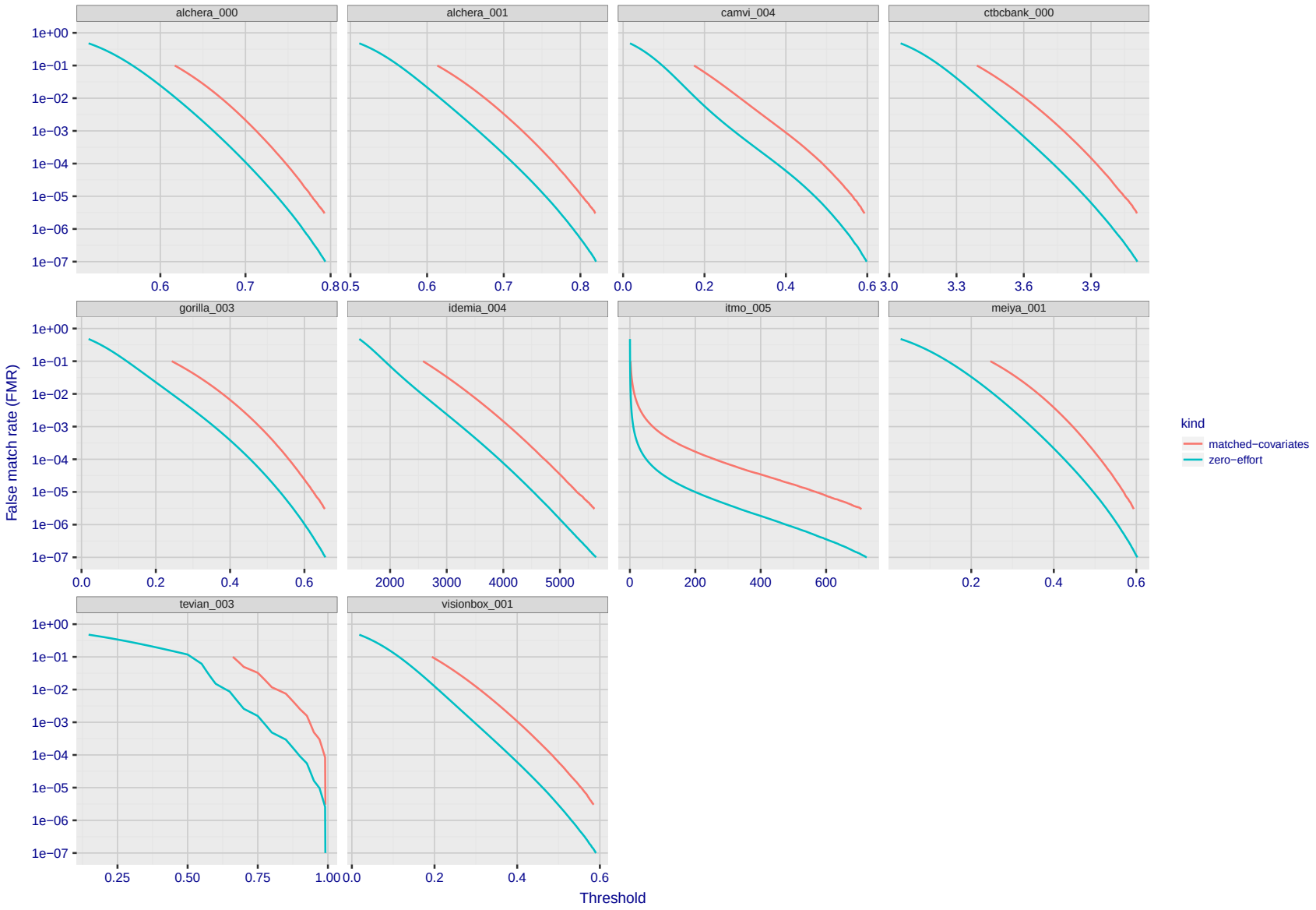


Figure 84: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

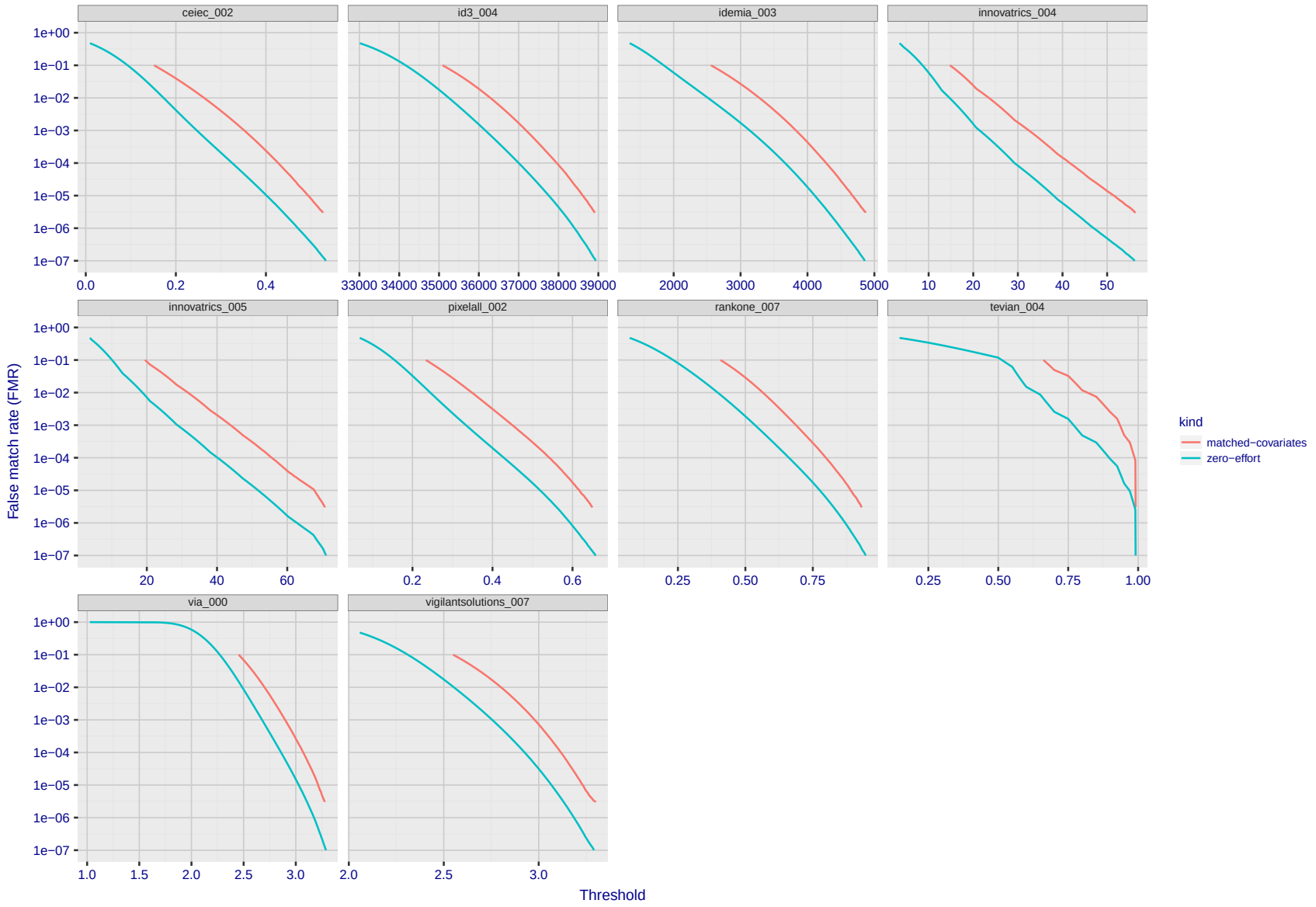


Figure 85: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

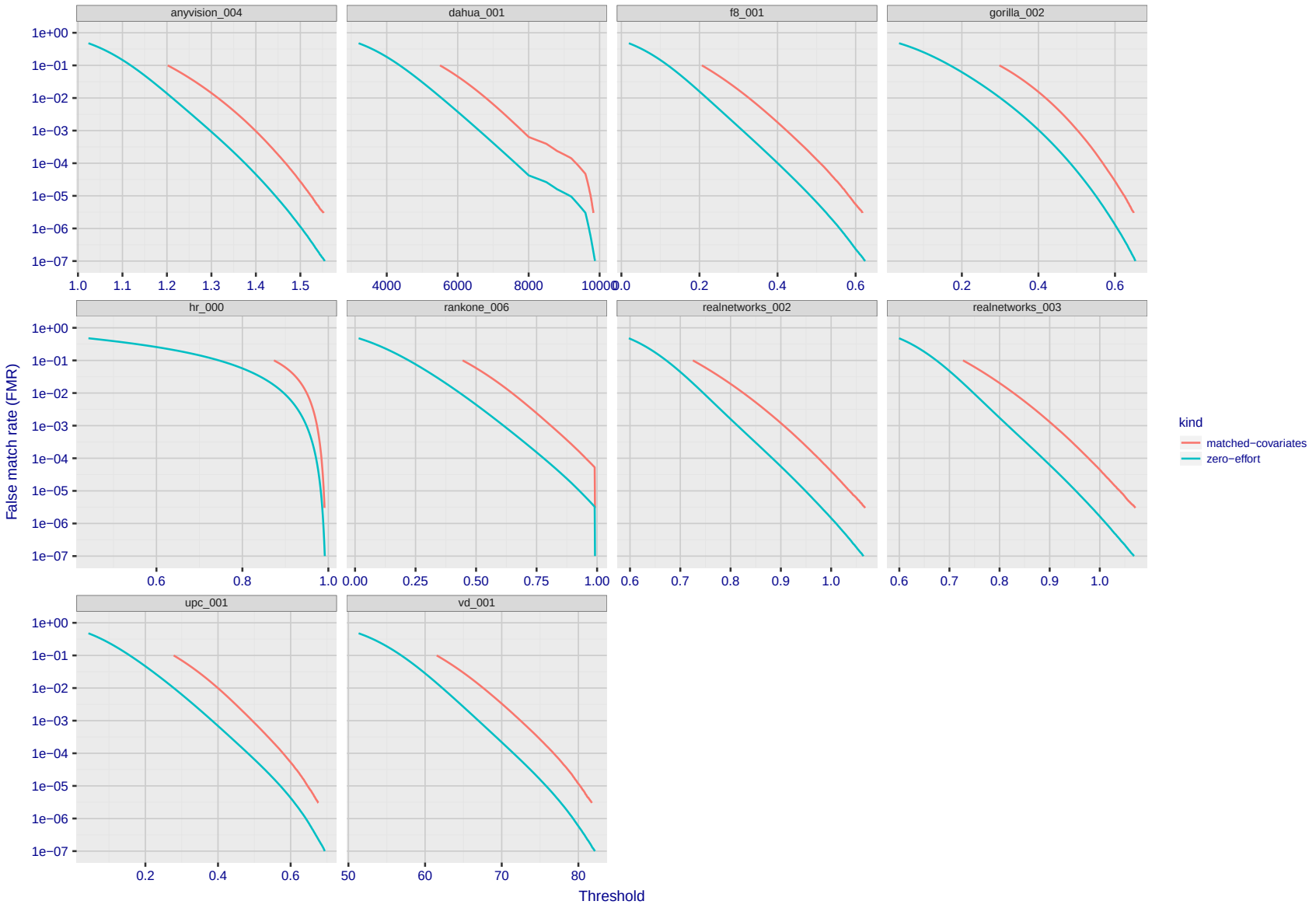


Figure 86: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

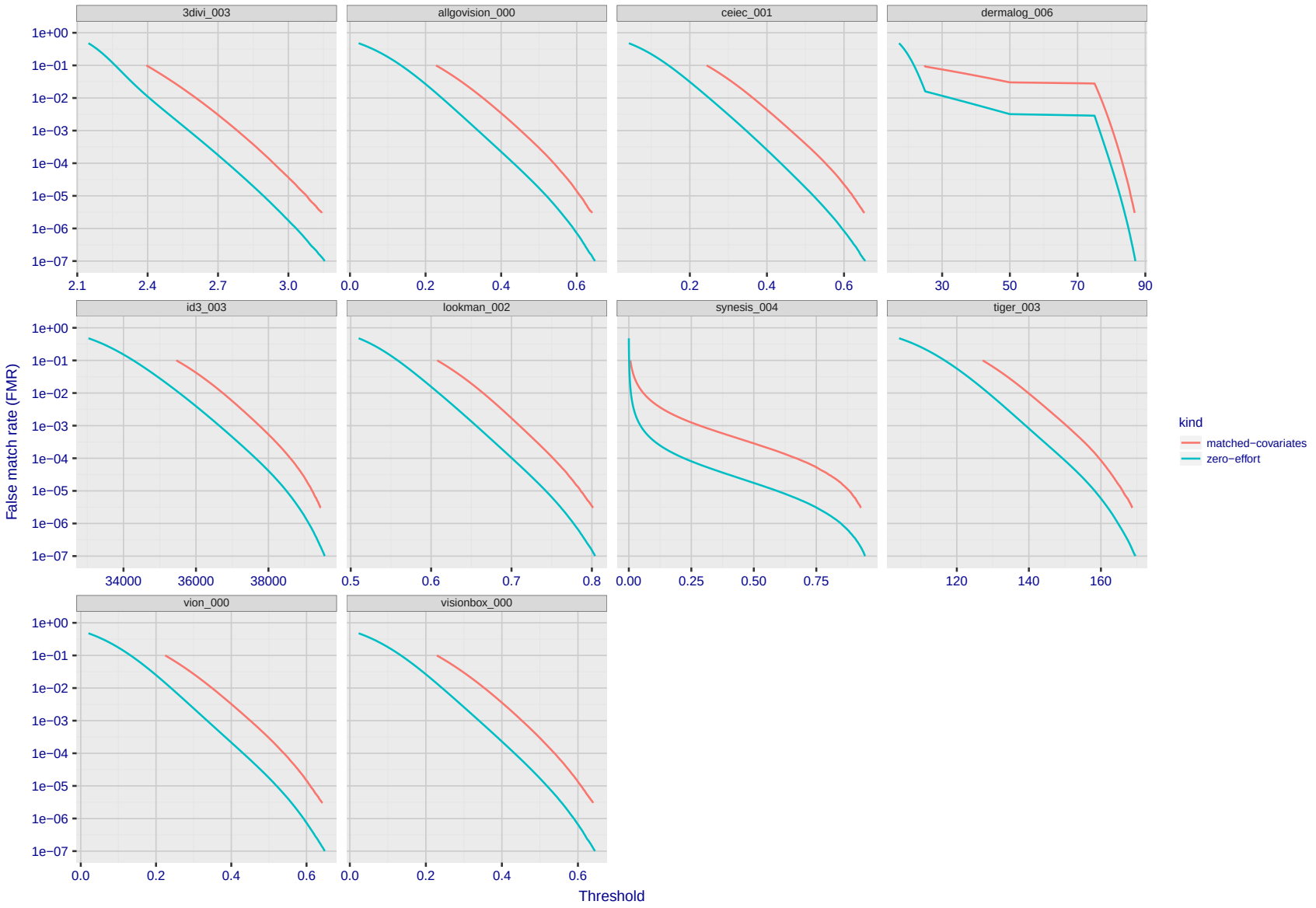


Figure 87: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

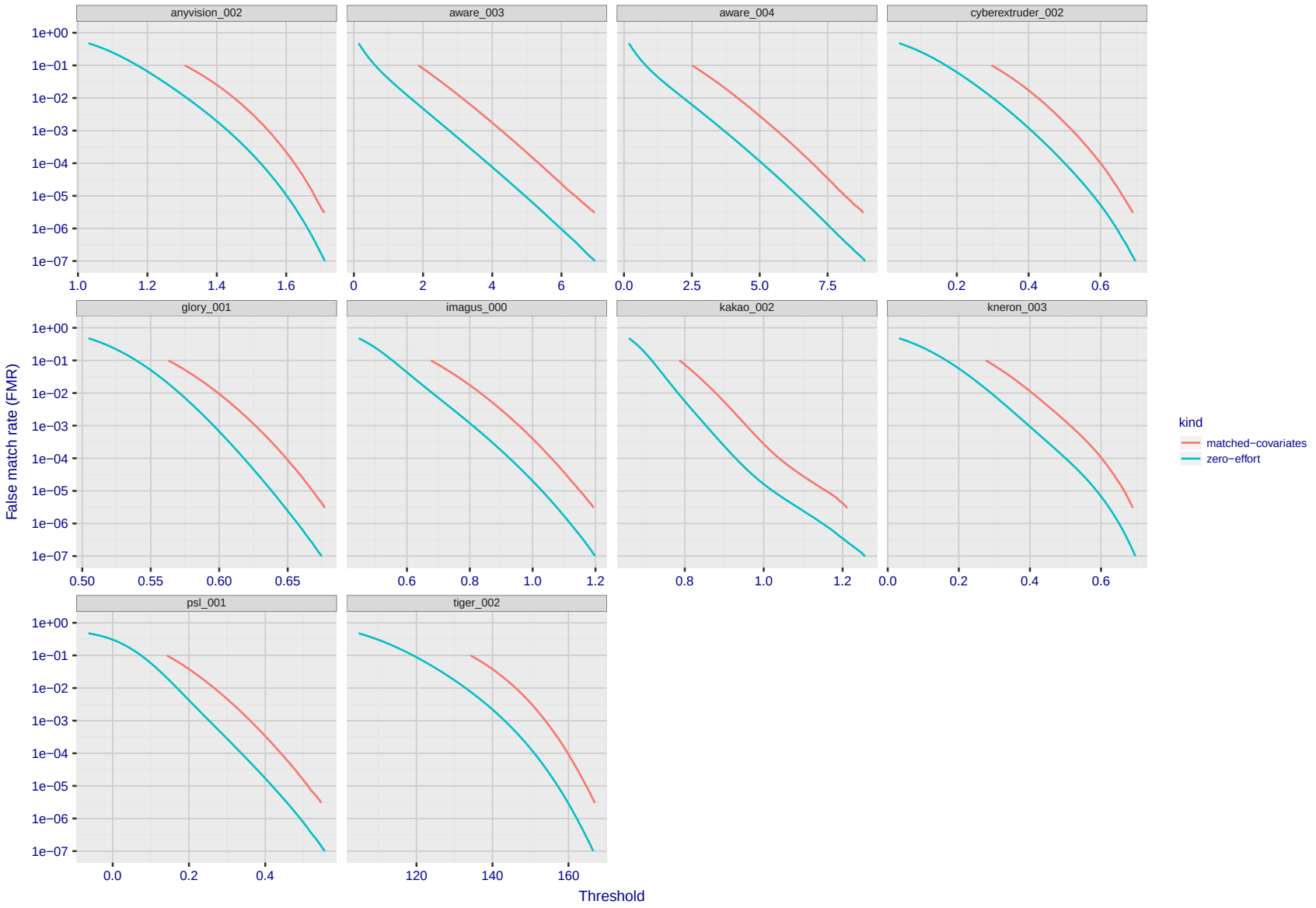


Figure 88: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

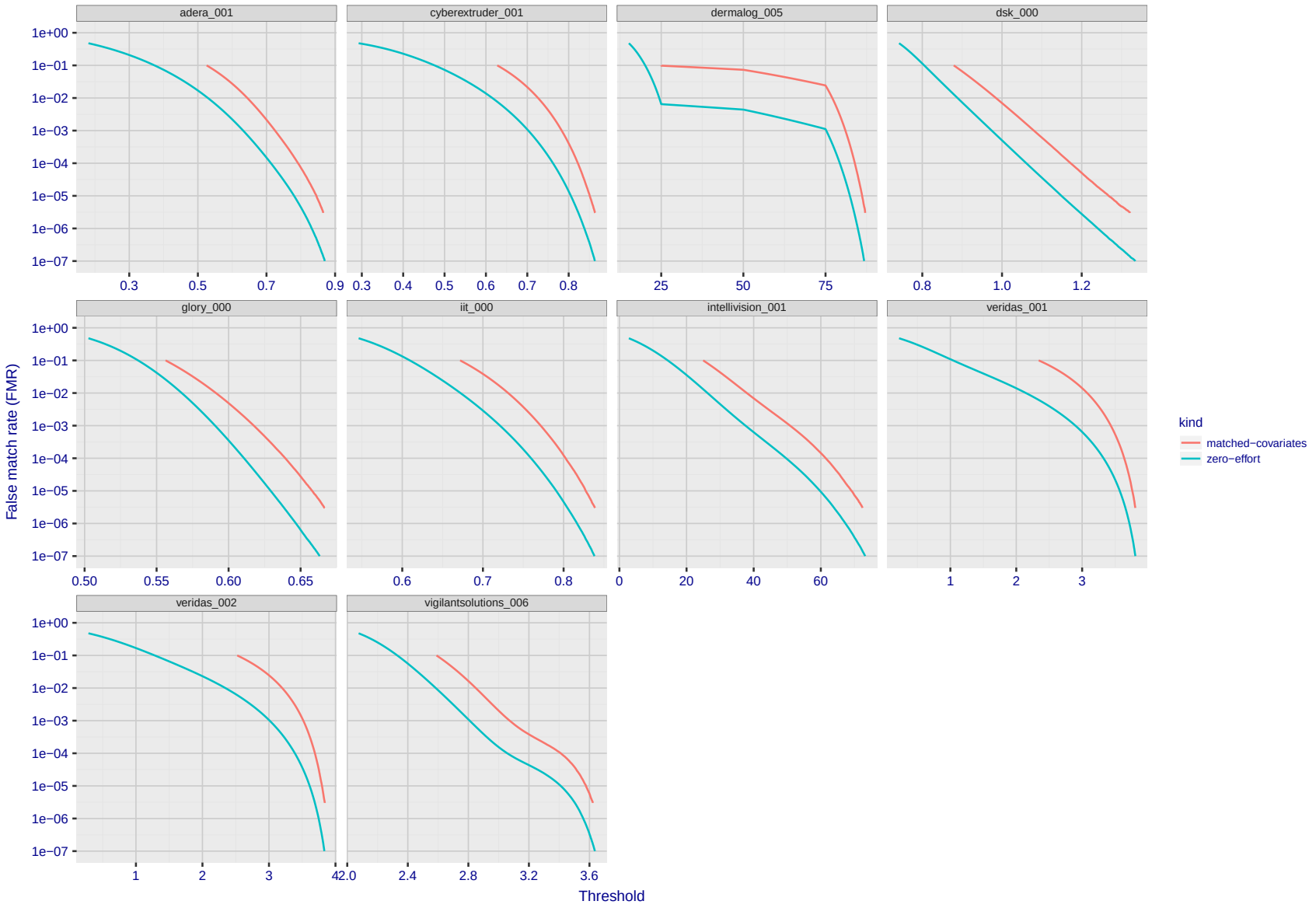


Figure 89: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

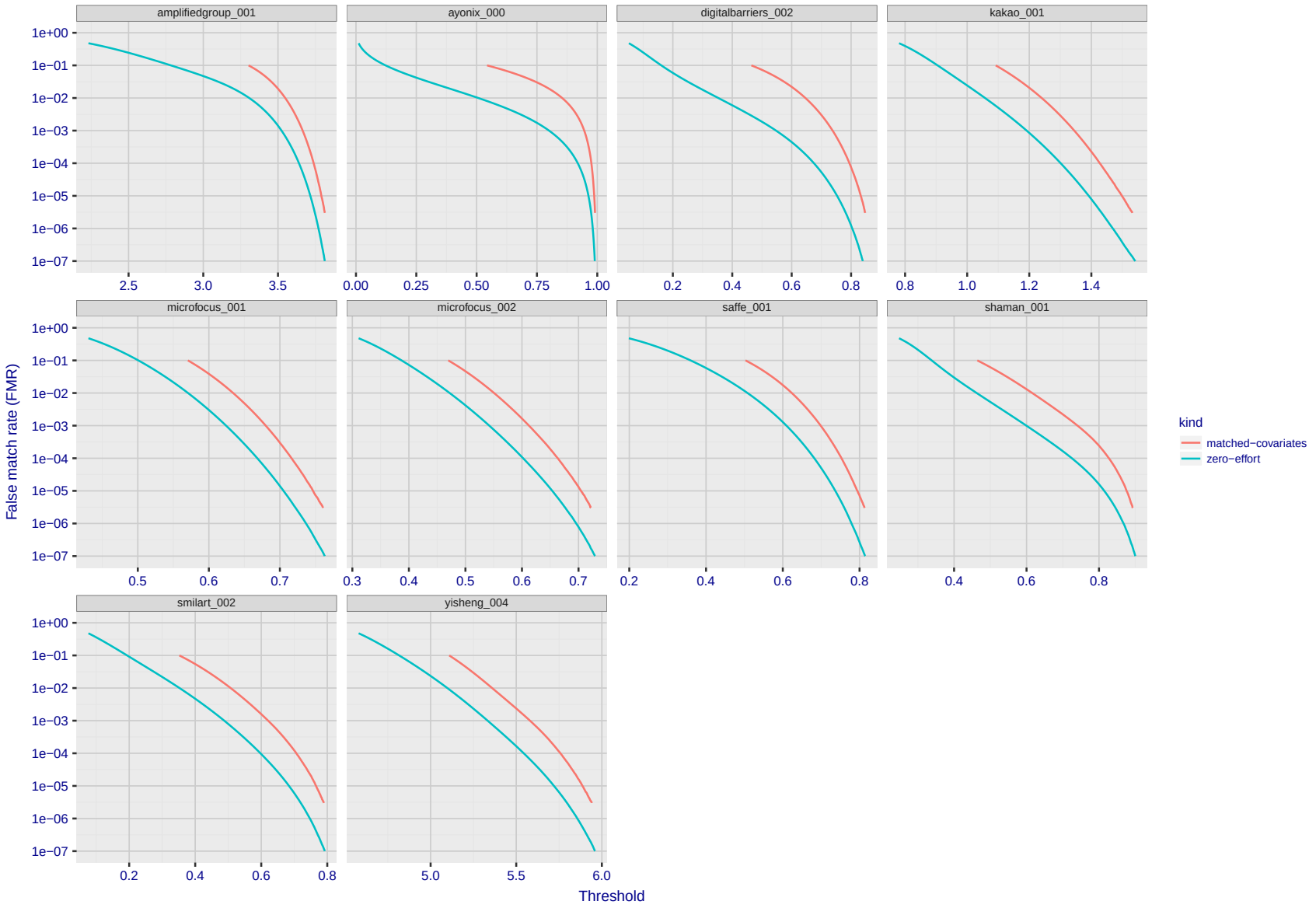


Figure 90: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

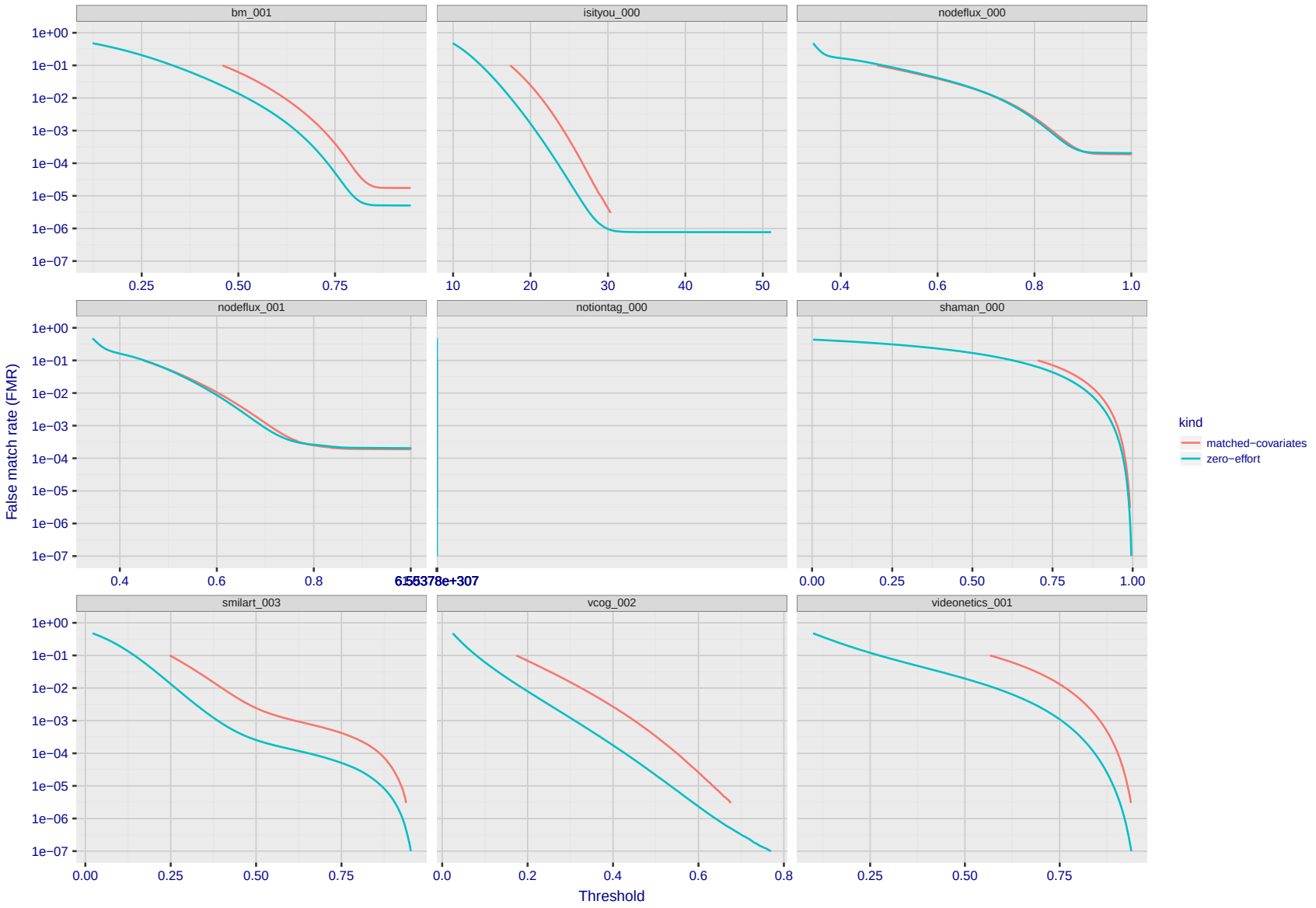


Figure 91: For the visa images, the false match calibration curves show FMR vs. threshold, T. The blue (lower) curves are for zero-effort impostors (i.e. comparing all images against all). The red (upper) curves are for persons of the same-sex, same-age, and same national-origin. This shows that FMR is underestimated (by a factor of 10 or more) by using a zero-effort impostor calculation to calibrate T. As shown later (sec. 3.6), FMR is higher for demographic-matched impostors.

2019/07/31 13:10:02

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

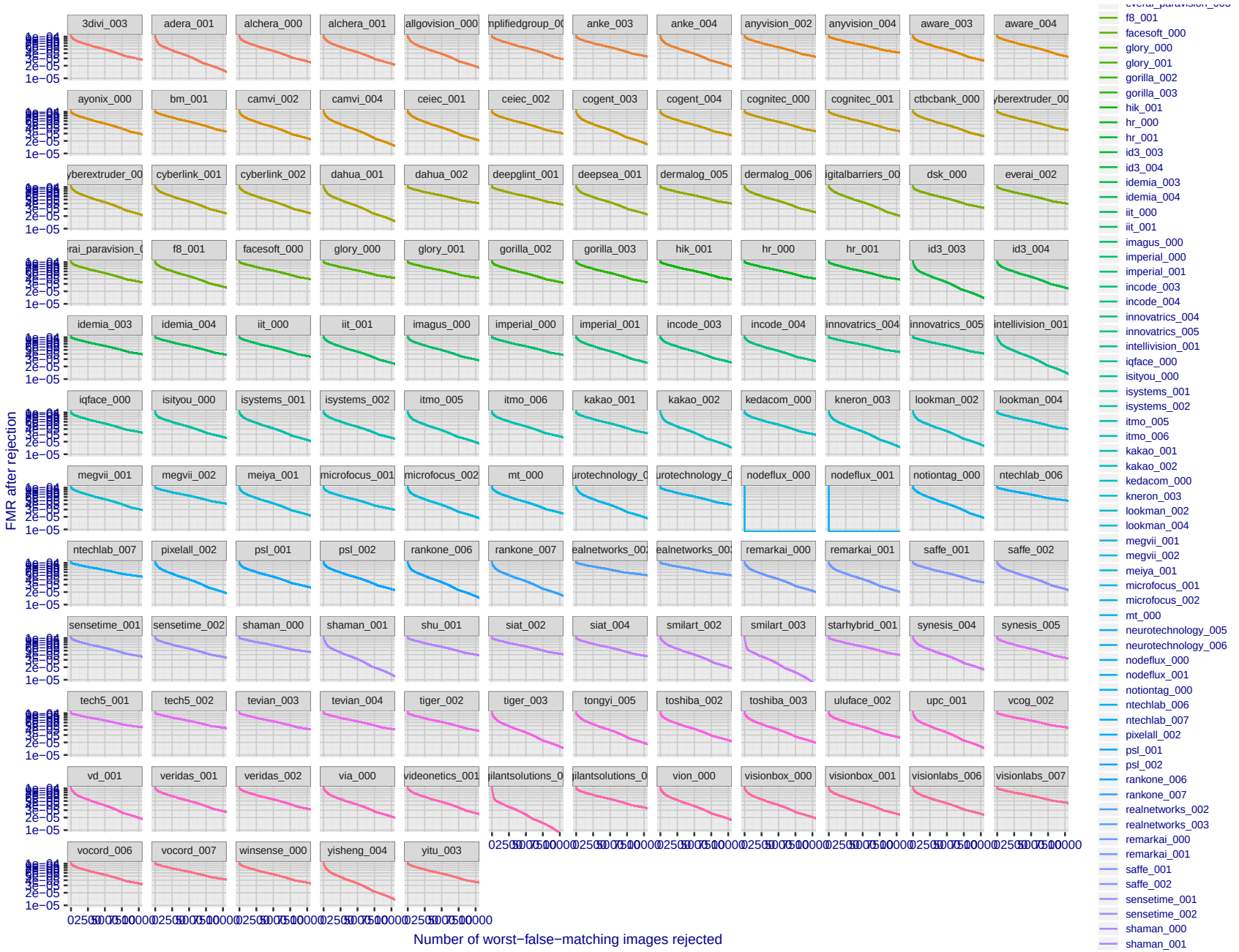


Figure 92: For the visa images, the curves show how false matches are concentrated in certain images. Specifically each line plots FMR(k) with k the number of images rejected in decreasing order of how many false matches that image was involved in. FMR$(0) = 10^{-4}$. In terms of the biometric zoo, the most "wolf-ish" images are rejected first i.e. those enrollment or verification images most often involved in false matches. A flatter response is considered superior. A steeply descending response indicates that certain kinds of images false match against others, e.g. if hypothetically images of men with particular mustaches would falsely match others.

3.5 Genuine distribution stability

3.5.1 Effect of birth place on the genuine distribution

Background: Both skin tone and bone structure vary geographically. Prior studies have reported variations in FNMR and FMR.

Goal: To measure false non-match rate (FNMR) variation with country of birth.

Methods: Thresholds are determined that give FMR = $\{0.001, 0.0001\}$ over the entire impostor set. Then FNMR is measured over 1000 bootstrap replications of the genuine scores. Only those countries with at least 140 individuals are included in the analysis.

Results: Figure 103 shows FNMR by country of birth for the two thresholds.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

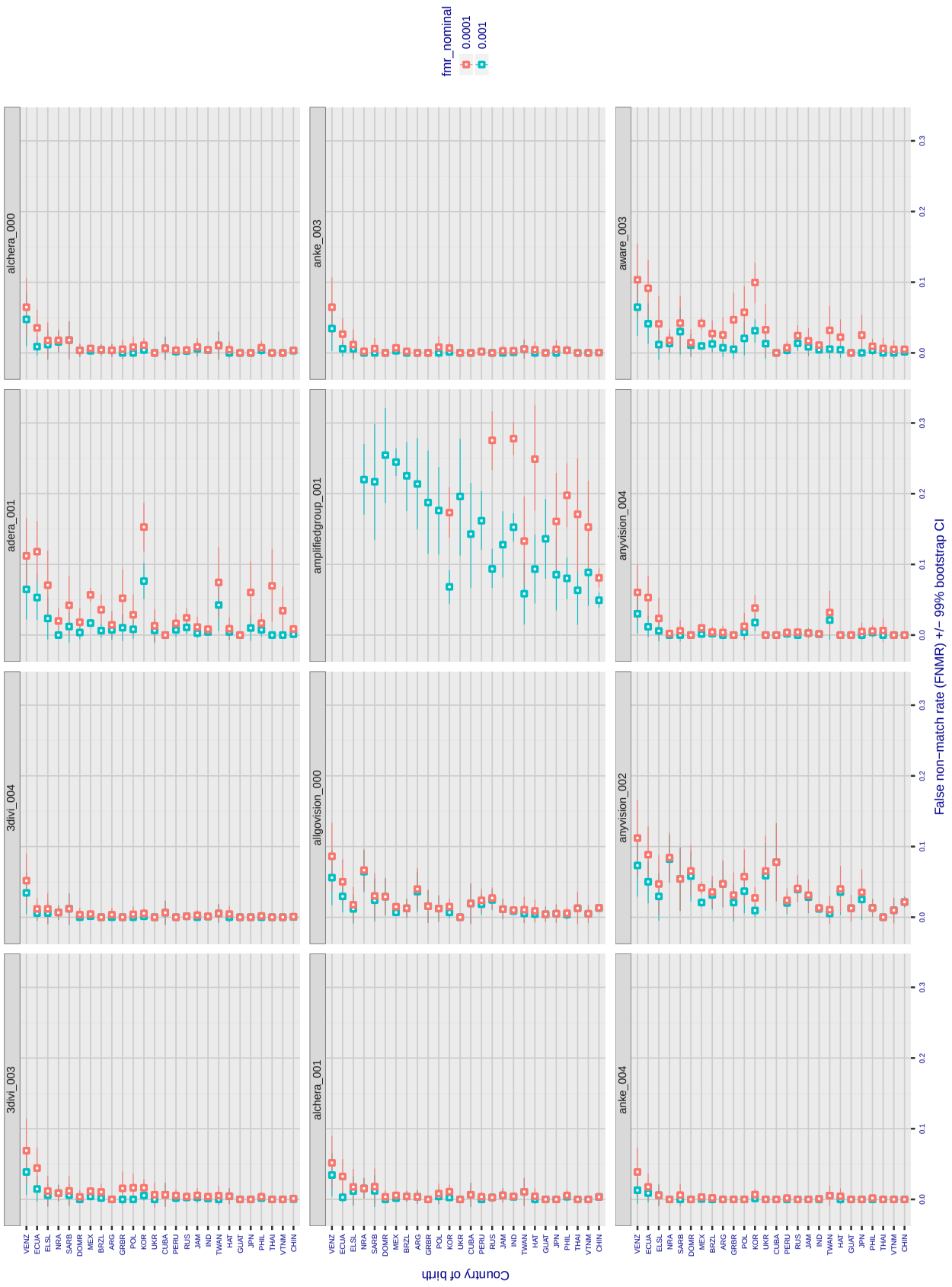


Figure 93: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

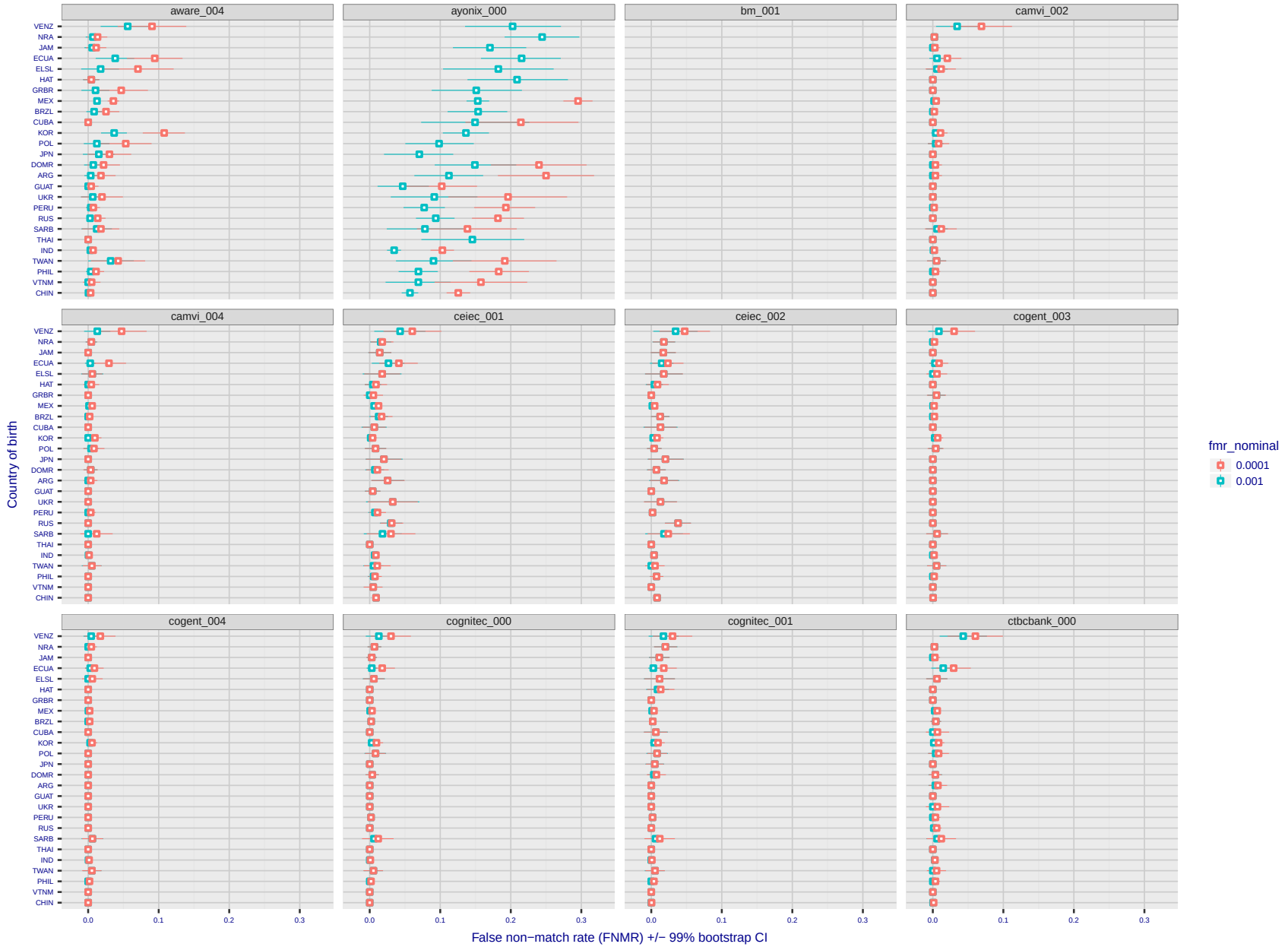


Figure 94: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

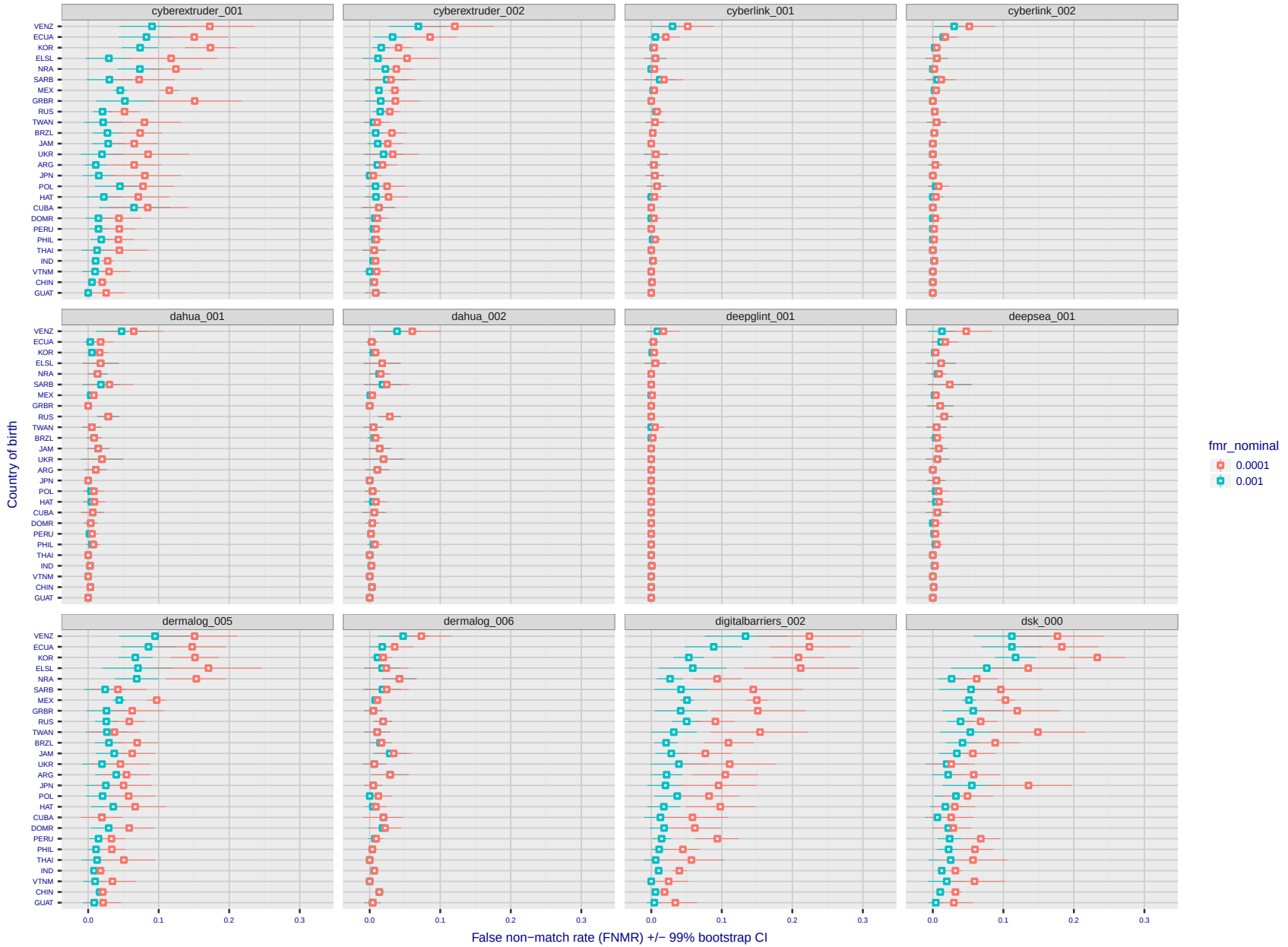


Figure 95: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Figure 96: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

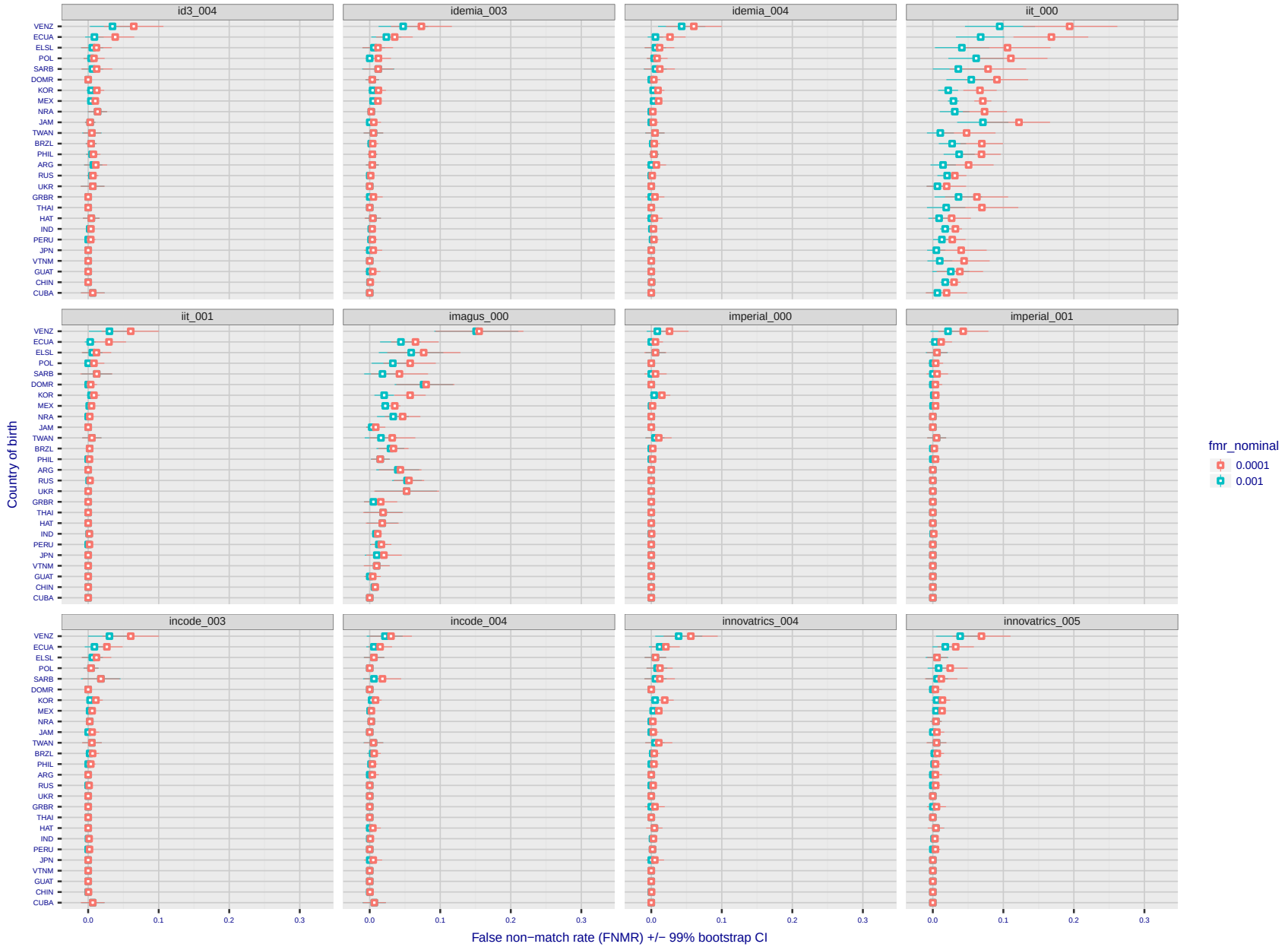


Figure 97: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

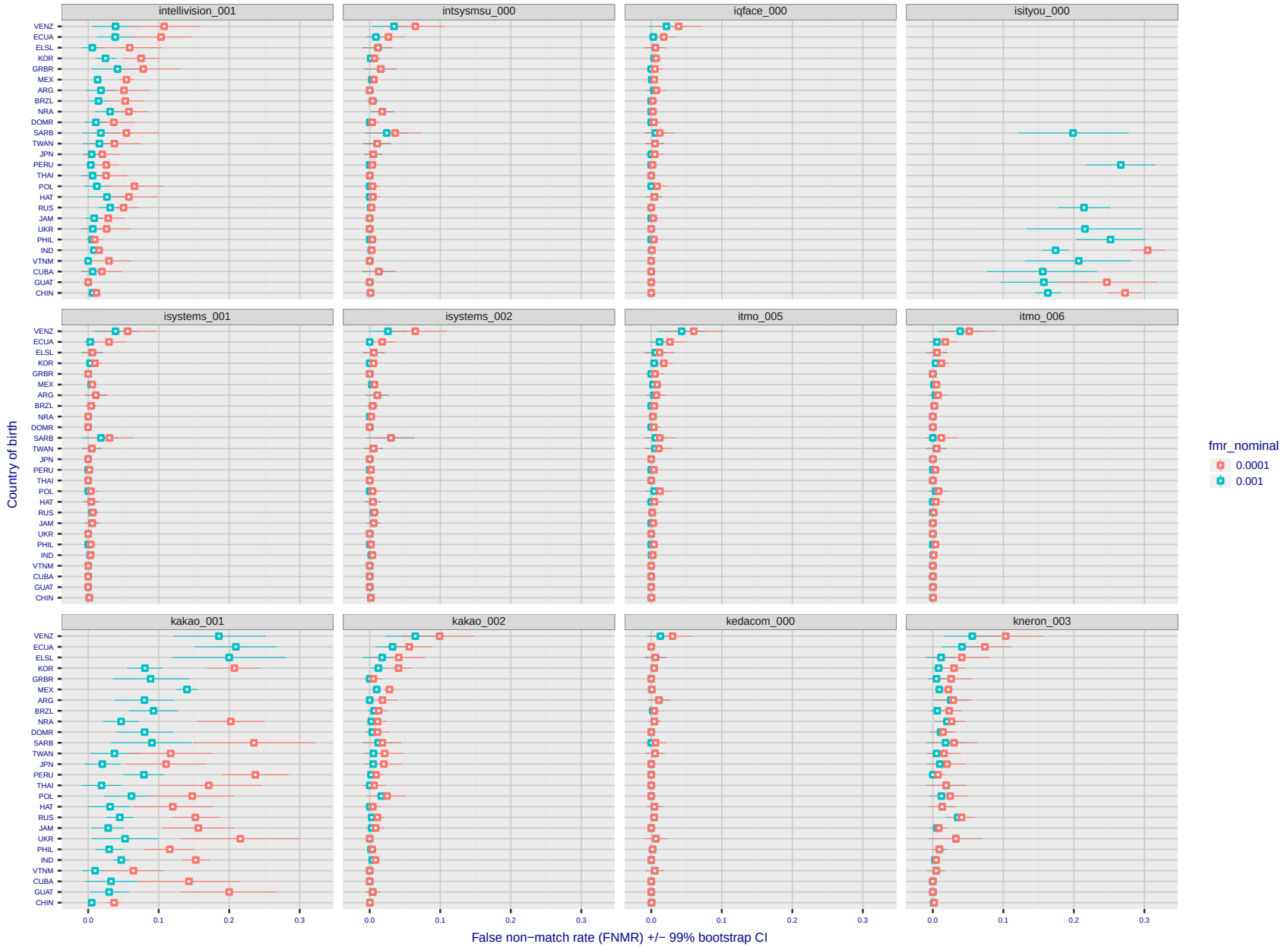


Figure 98: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

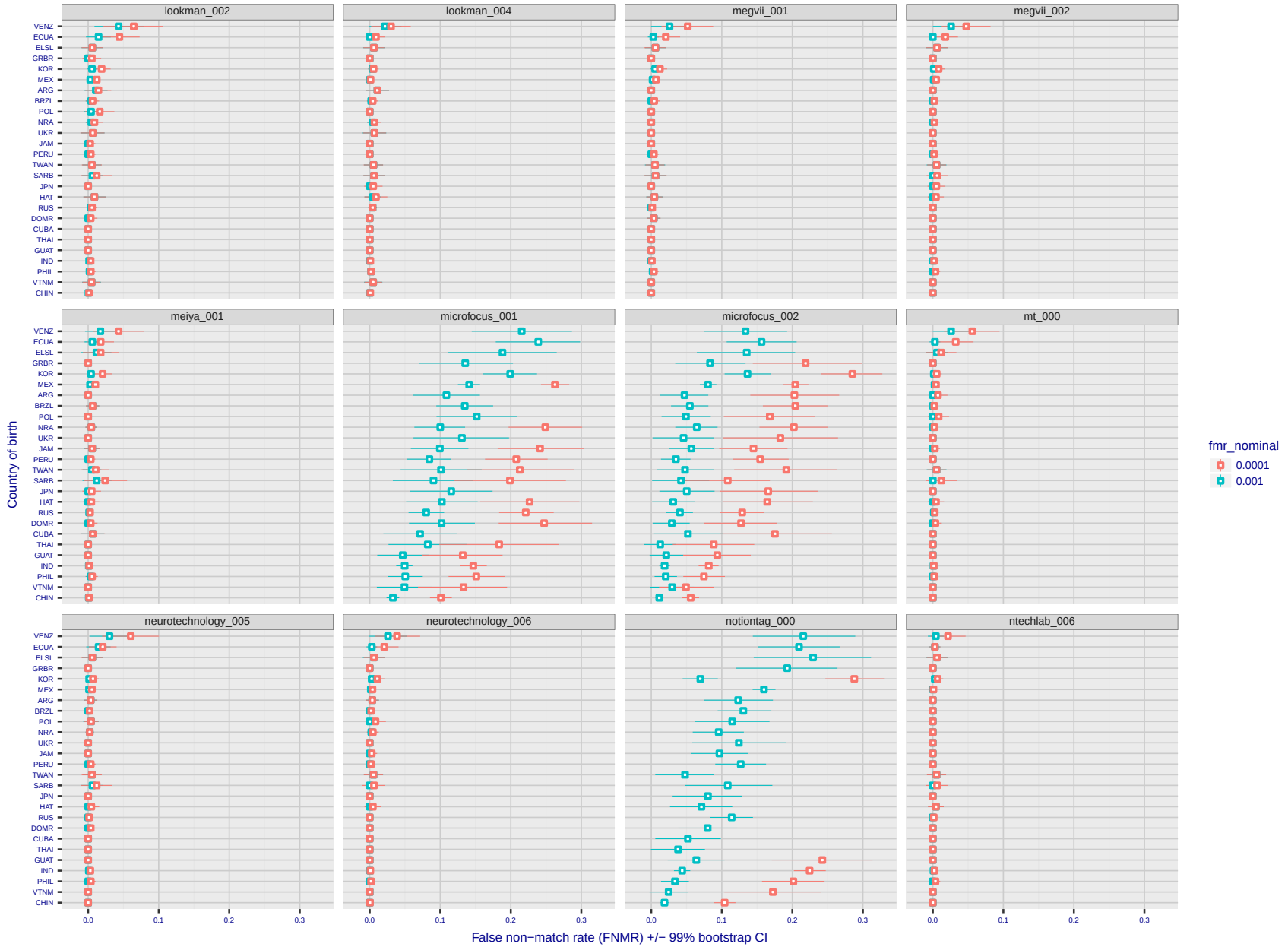


Figure 99: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

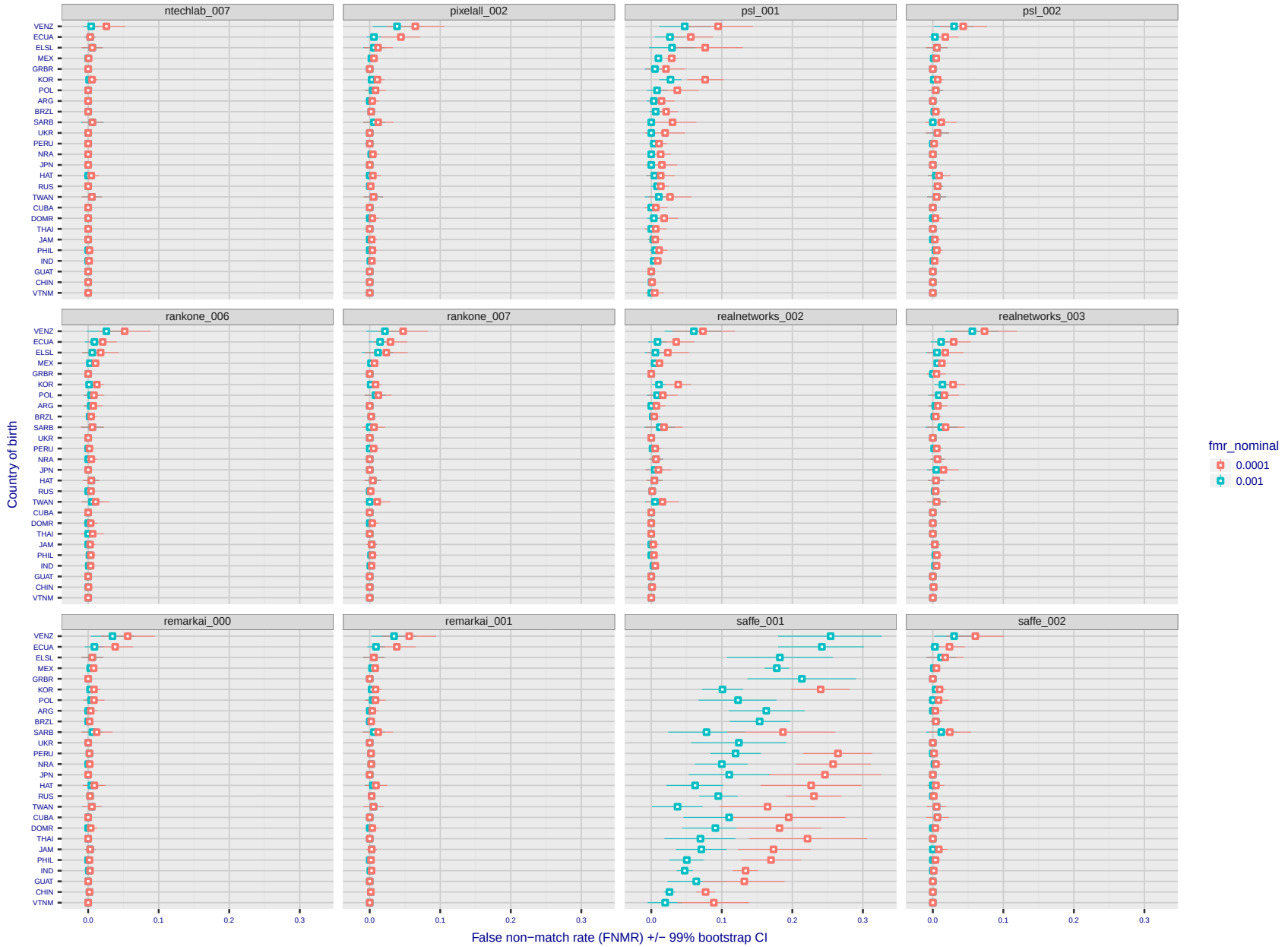


Figure 100: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

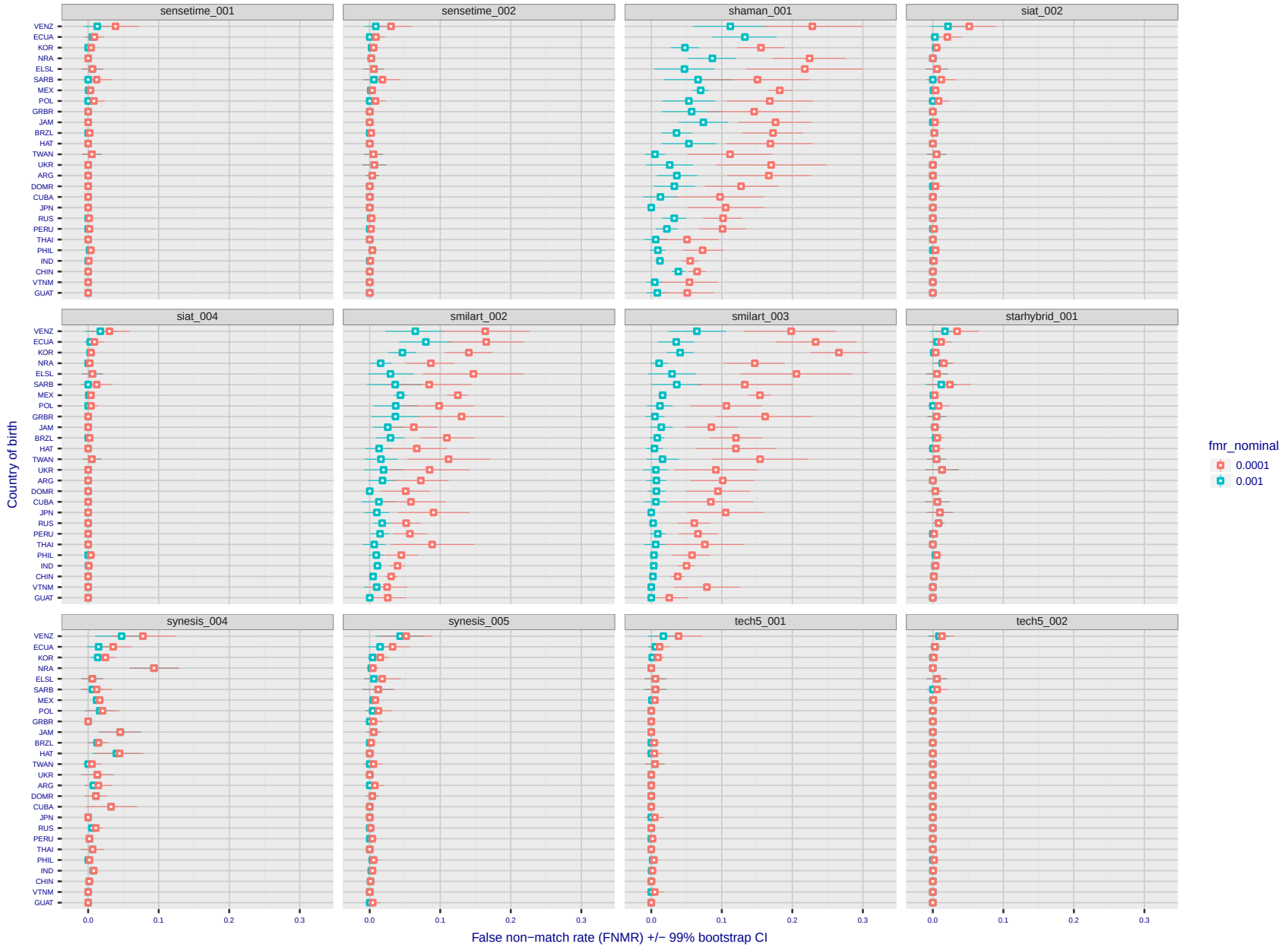


Figure 101: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

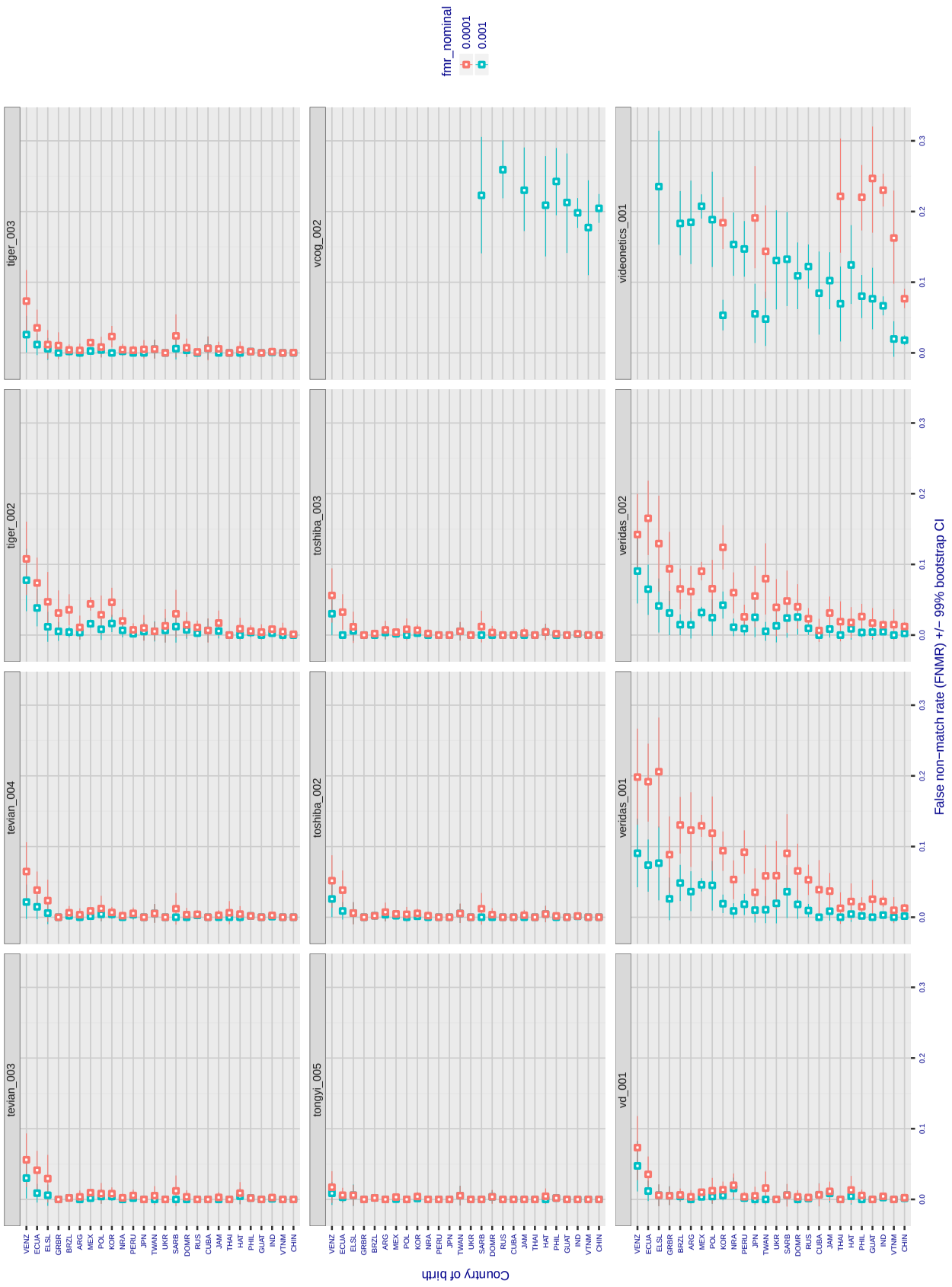


Figure 102: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

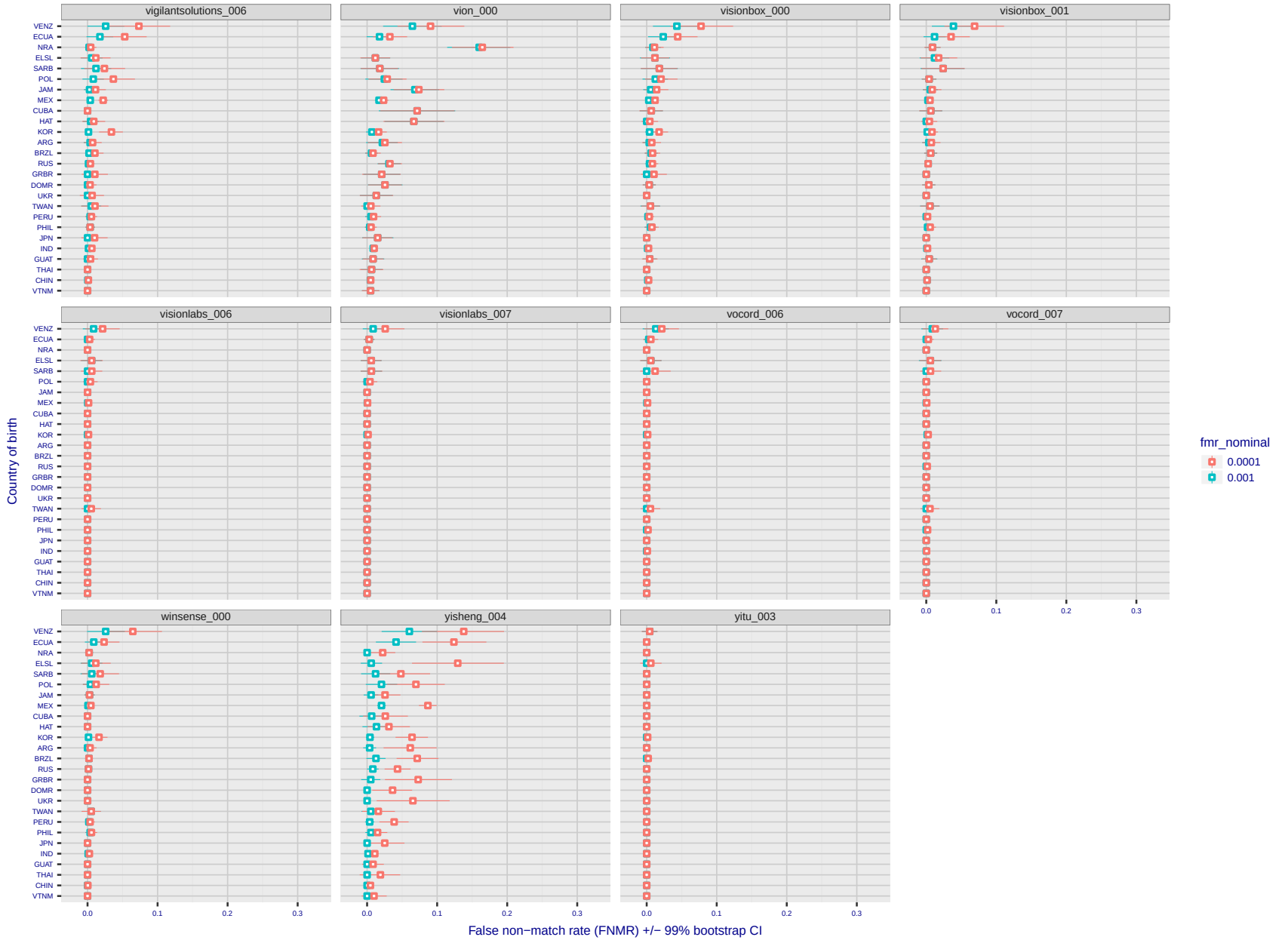


Figure 103: For the visa images, the dots show FNMR by country of birth for two globally set operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.1. The figures shows an order of magnitude variation in FNMR across country of birth; these effects are likely due quality variations, then demographics like age and race. The error rates in some cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Caveats: The results may not relate to subject-specific properties. Instead they could reflect image-specific quality differences, which could occur due to collection protocol or software processing variations.

3.5.2 Effect of ageing

Background: Faces change appearance throughout life. This change gradually reduces similarity of a new image to an earlier image. Face recognition algorithms give reduced similarity scores and more frequent false rejections.

Goal: To quantify false non-match rates (FNMR) as a function of elapsed time in an adult population.

Methods: Using the mugshot images, a threshold is set to give FMR = 0.00001 over the entire impostor set. Then FNMR is measured over 1000 bootstrap replications of the genuine scores.

Results: For the visa images, Figure 112 shows how false non-match rates for genuine users, as a function of age group.

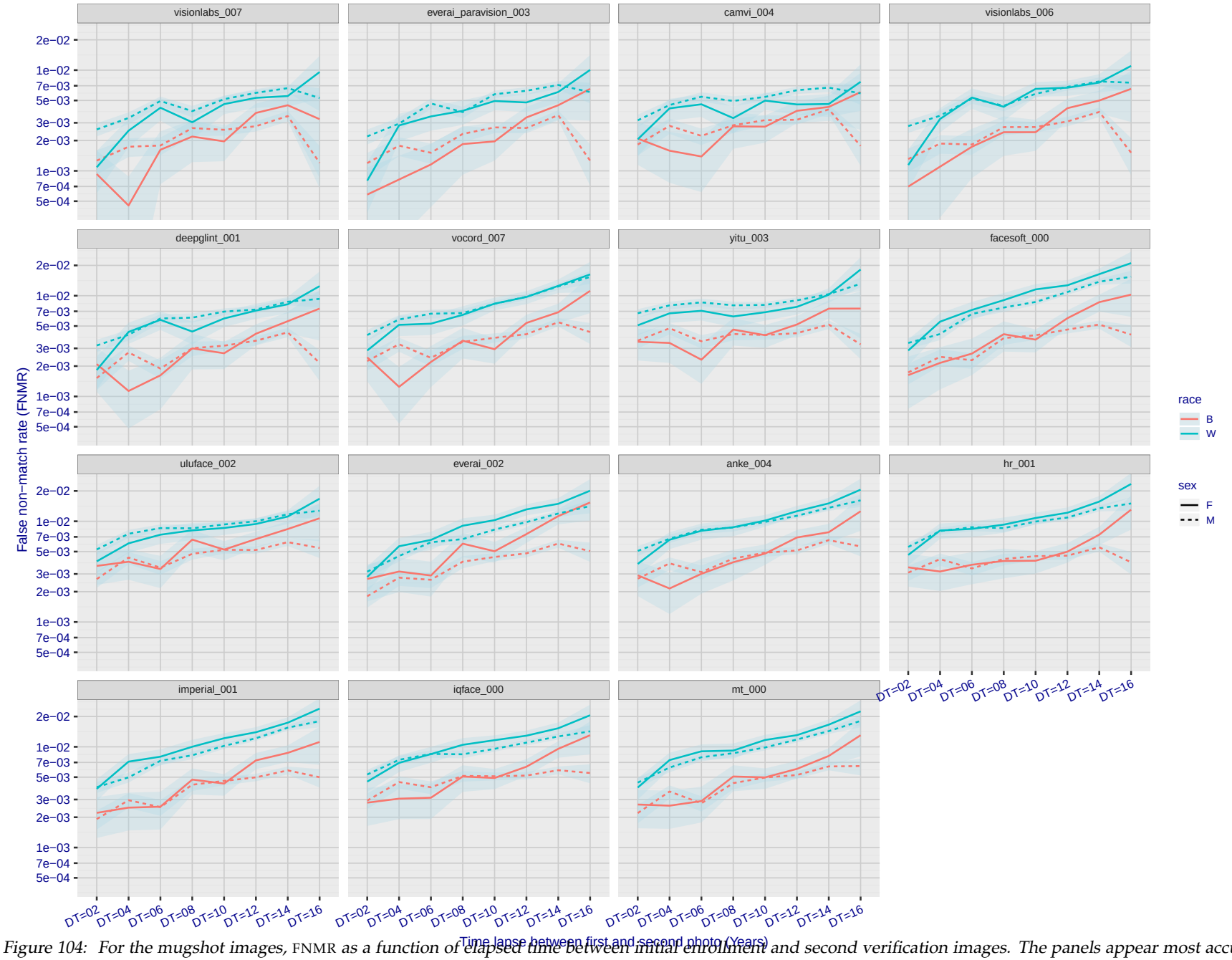


Figure 104: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

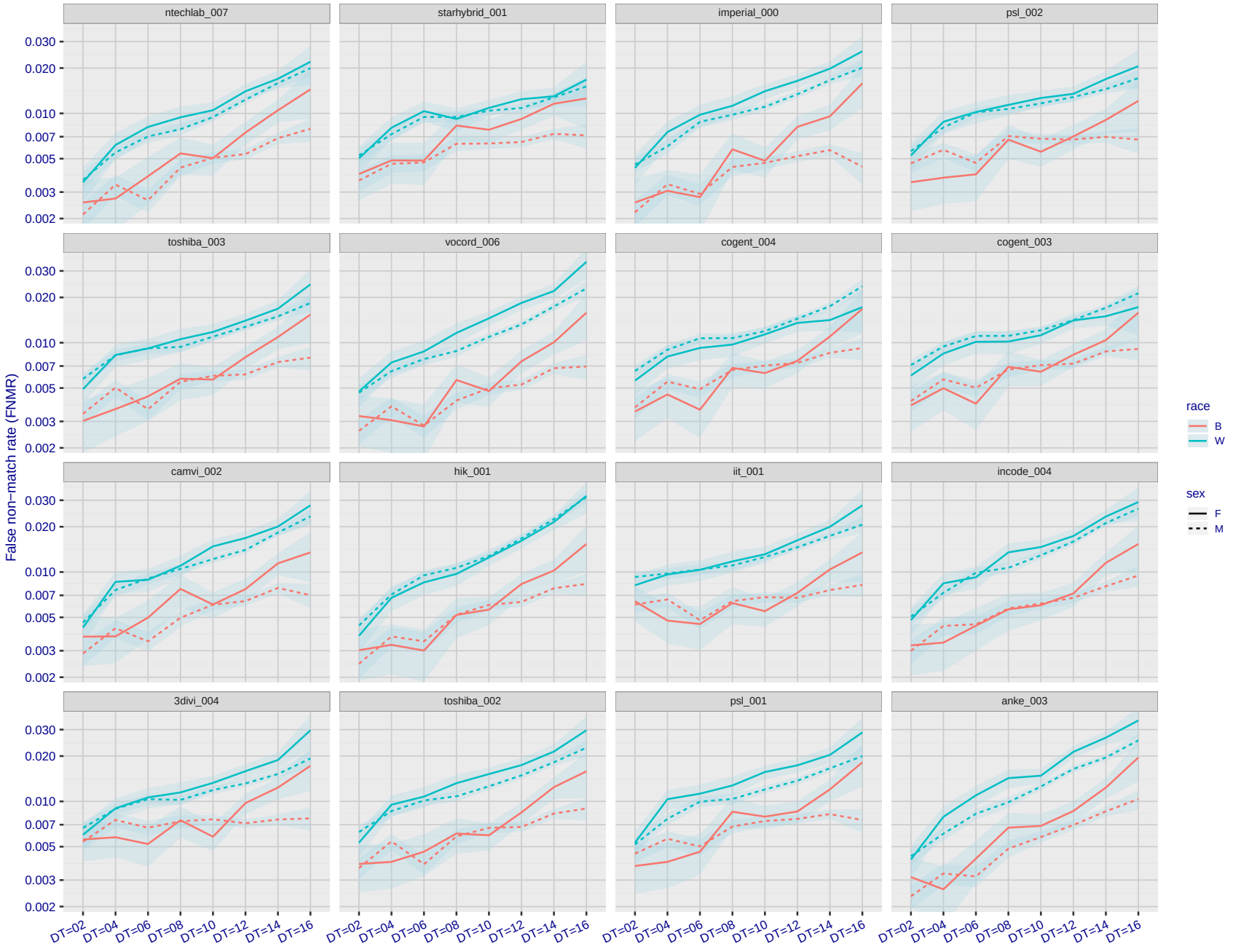


Figure 105: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

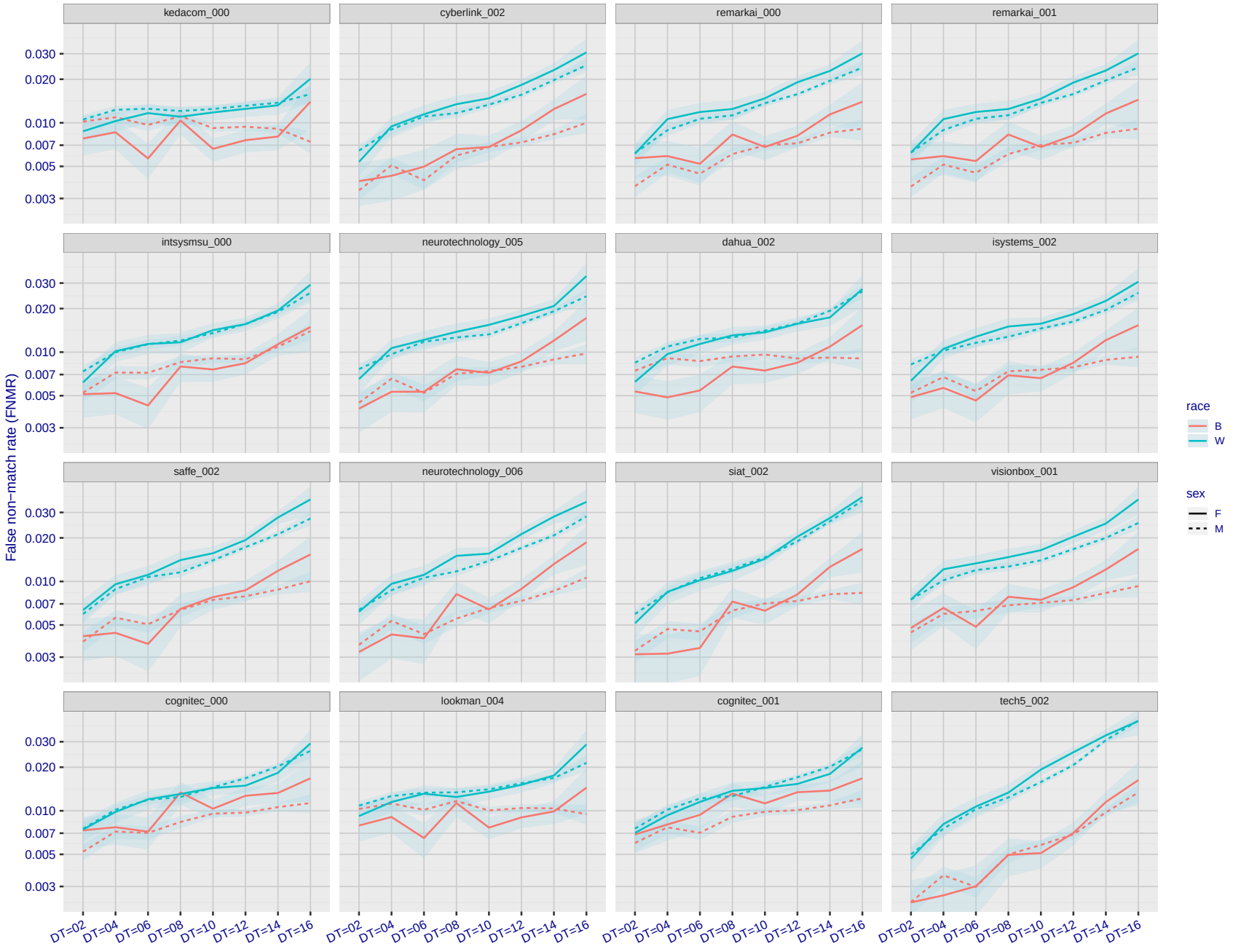


Figure 106: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

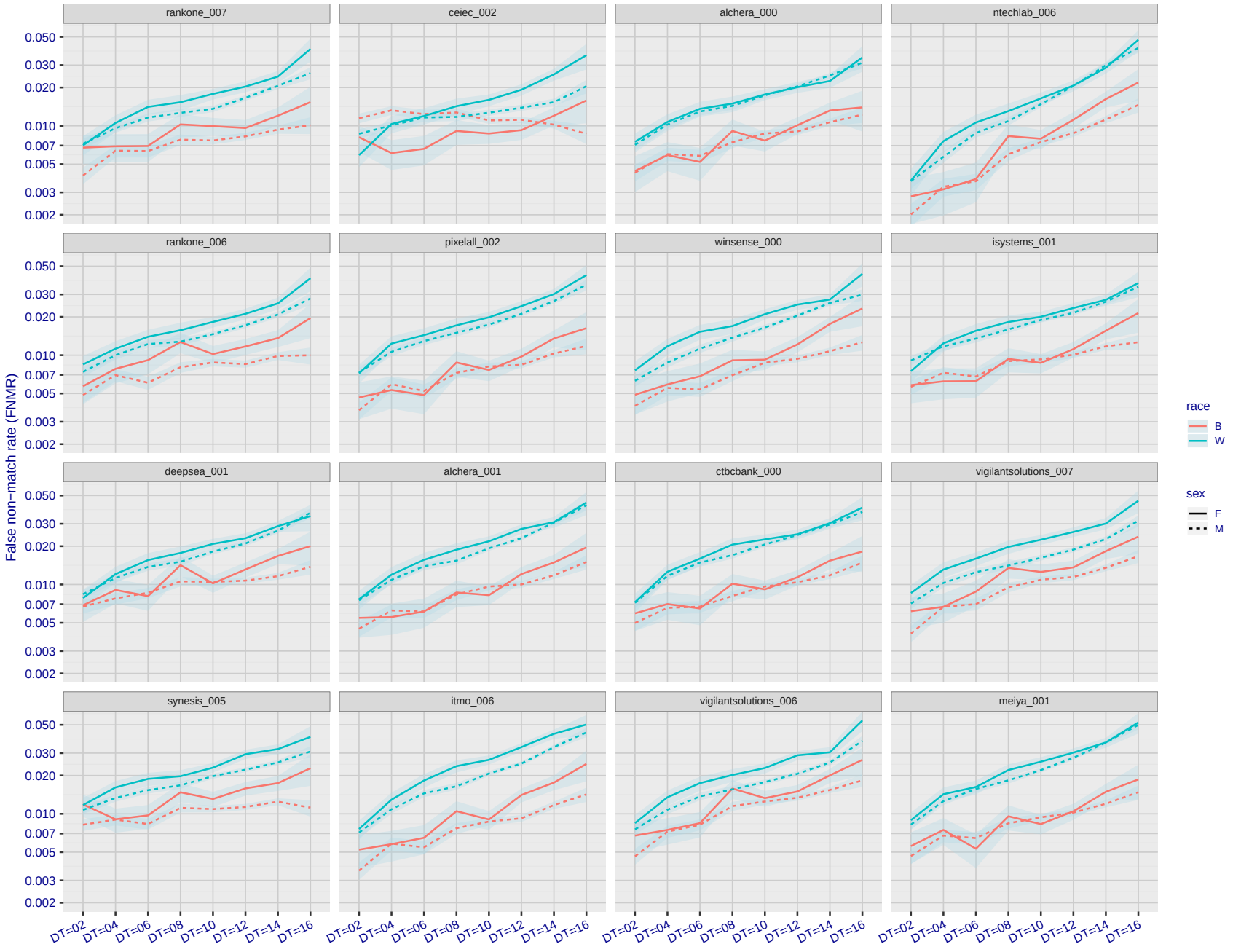


Figure 107: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

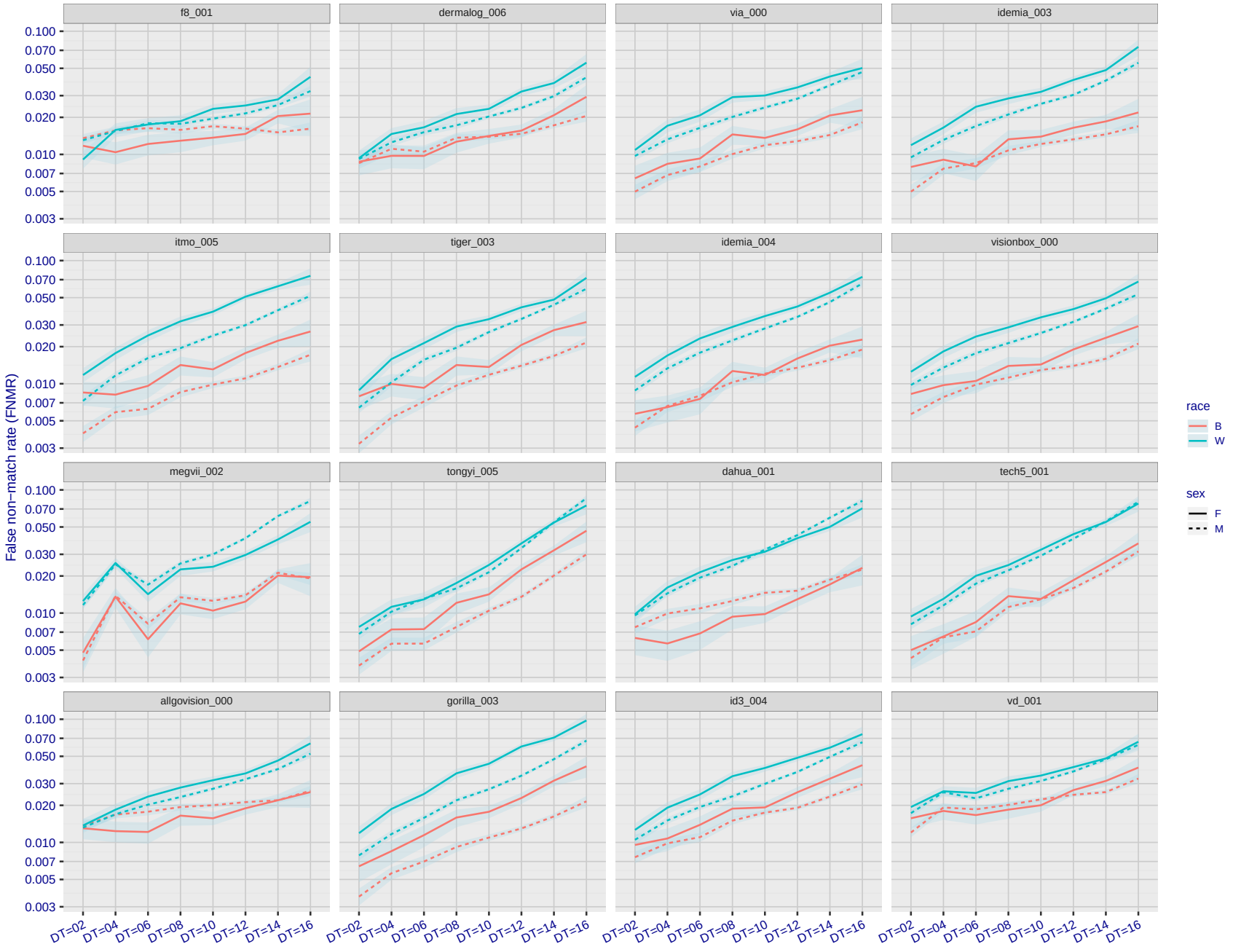


Figure 108: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

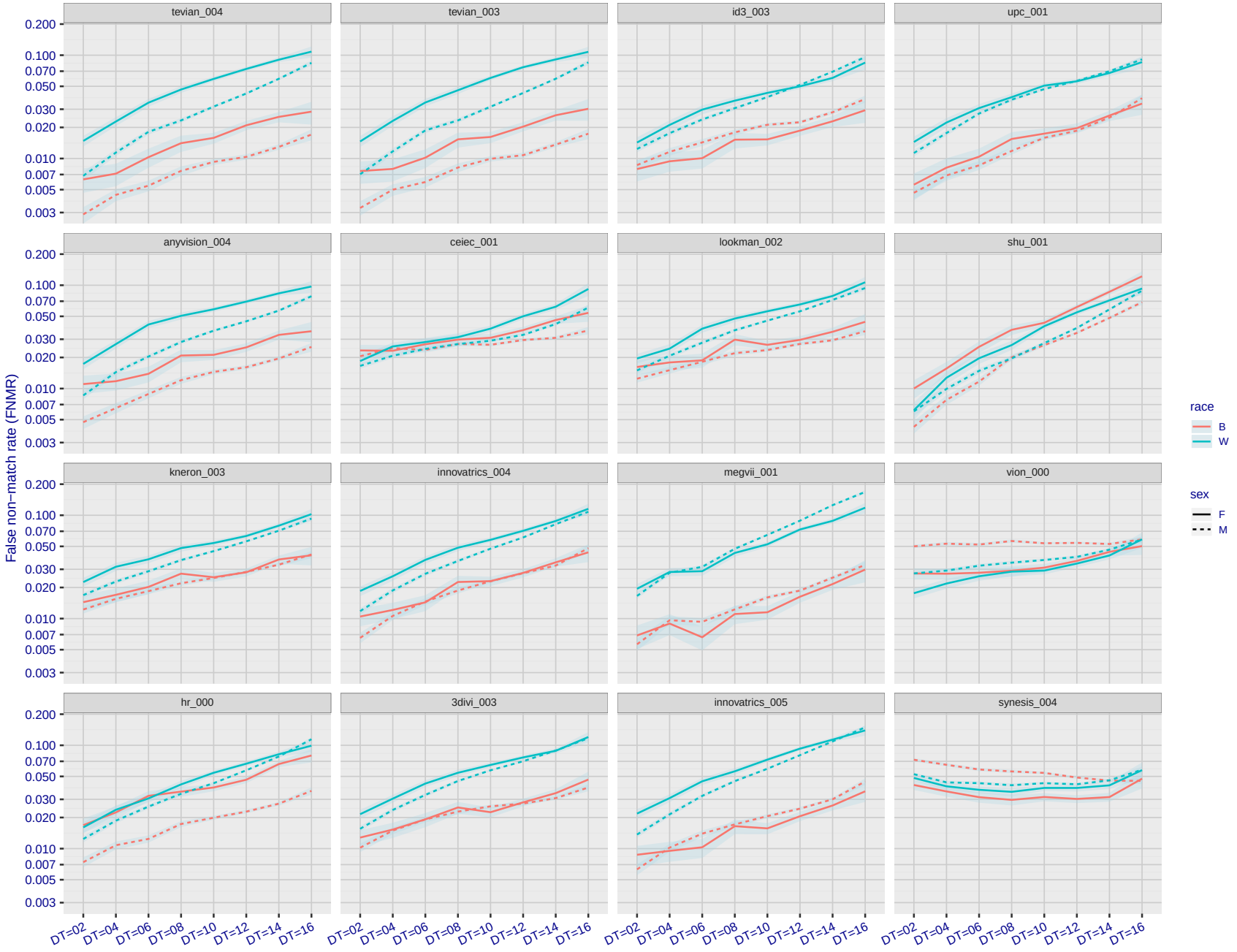


Figure 109: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

2019/07/31 13:10:02 FNMR(T) "False non-match rate" FMR(T) "False match rate"

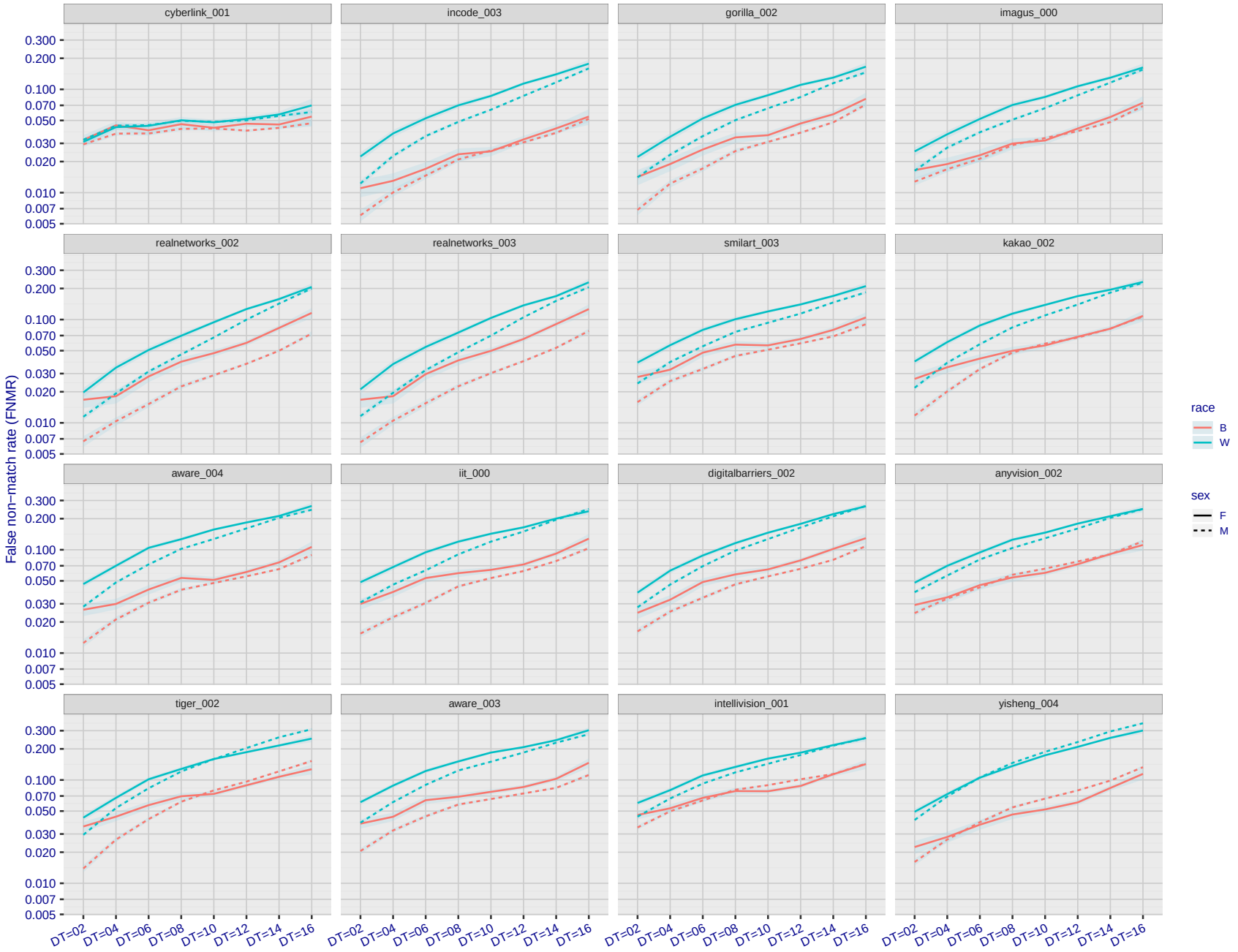


Figure 110: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

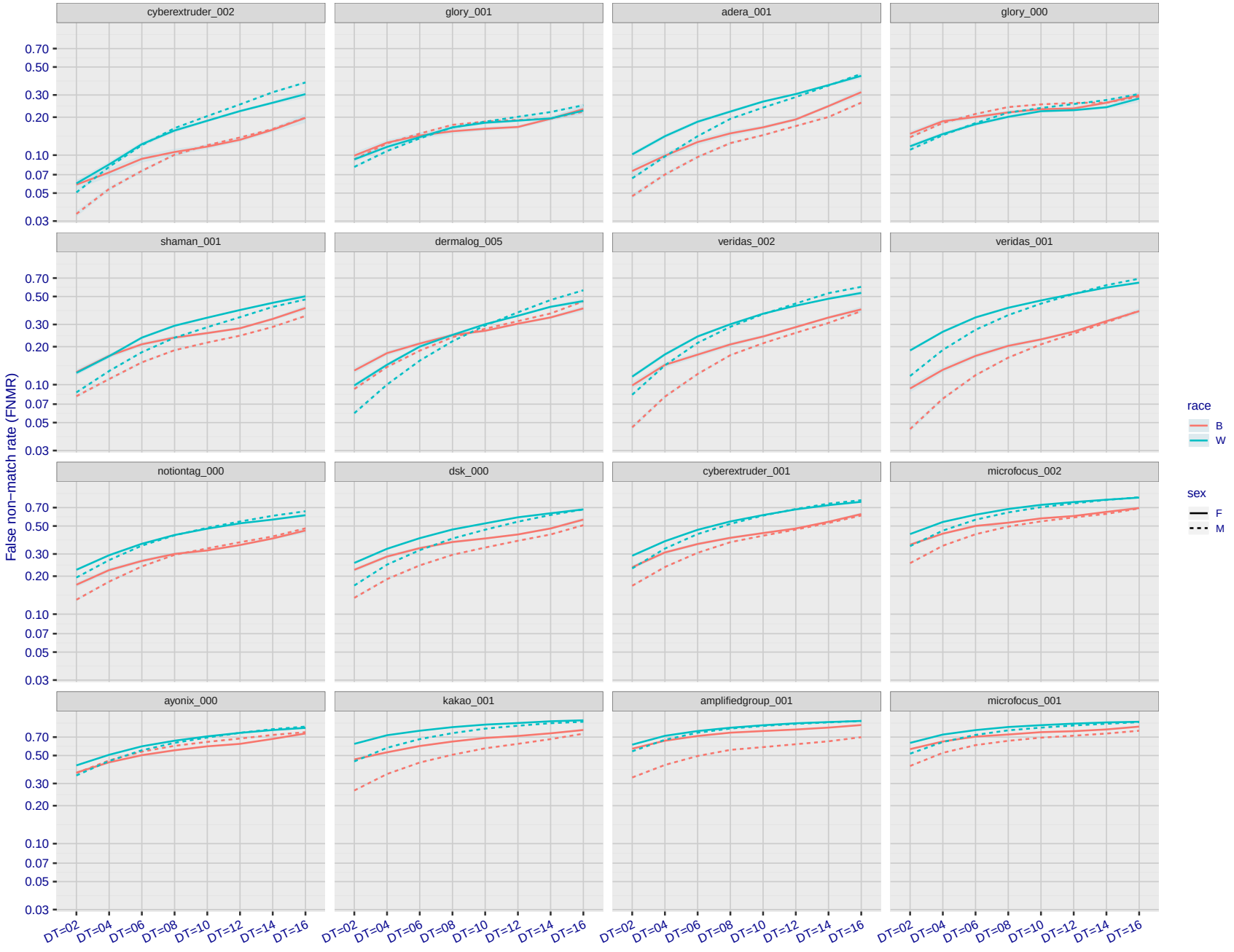


Figure 111: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all (10^8) impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR < 0.001) so that the uncertainty estimates are high.*

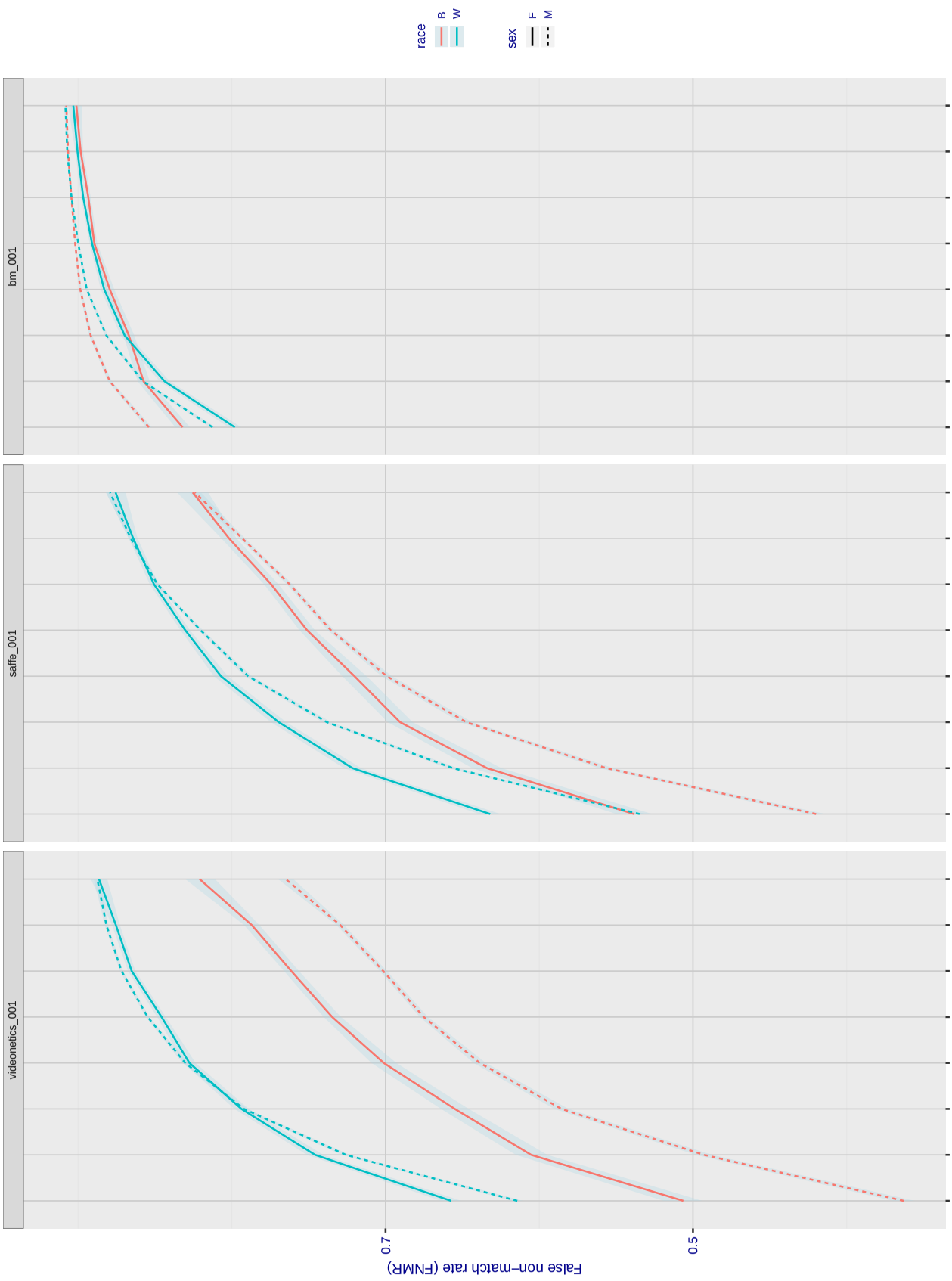


Figure 112: For the mugshot images, FNMR *as a function of elapsed time between initial enrollment and second verification images. The panels appear most accurate first, and vertical scale changes on each page. The four traces correspond to images annotated with codes for black female, black male, white female, white male. The threshold is fixed for each algorithm to give FMR = 0.00001 over all* (10^8) *impostor comparisons. For short time-lapses, the most accurate algorithms give very few errors (FNMR* < 0.001*) so that the uncertainty estimates are high.*

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

3.5.3 Effect of age on genuine subjects

Background: Faces change appearance throughout life. Face recognition algorithms have previously beeen reported to give better accuracy on older individuals (See NIST IR 8009).

Goal: To quantify false non-match rates (FNMR) as a function of age, without an ageing component.

Methods: Using the visa images, which span fewer than five years, thresholds are determined that give FMR = 0.001 and 0.0001 over the entire impostor set. Then FNMR is measured over 1000 bootstrap replications of the genuine scores.

Results: For the visa images, Figure 124 shows how false non-match rates for genuine users, as a function of age group.

The notable aspects are:

- ▷ Younger subjects give considerably higher FNMR. This is likely due to rapid growth and change in facial appearance.
- ▷ FNMR trends down throughout life. The last bin, AGE $>$ 72, contains fewer than 140 mated pairs, and may be affected by small sample size.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

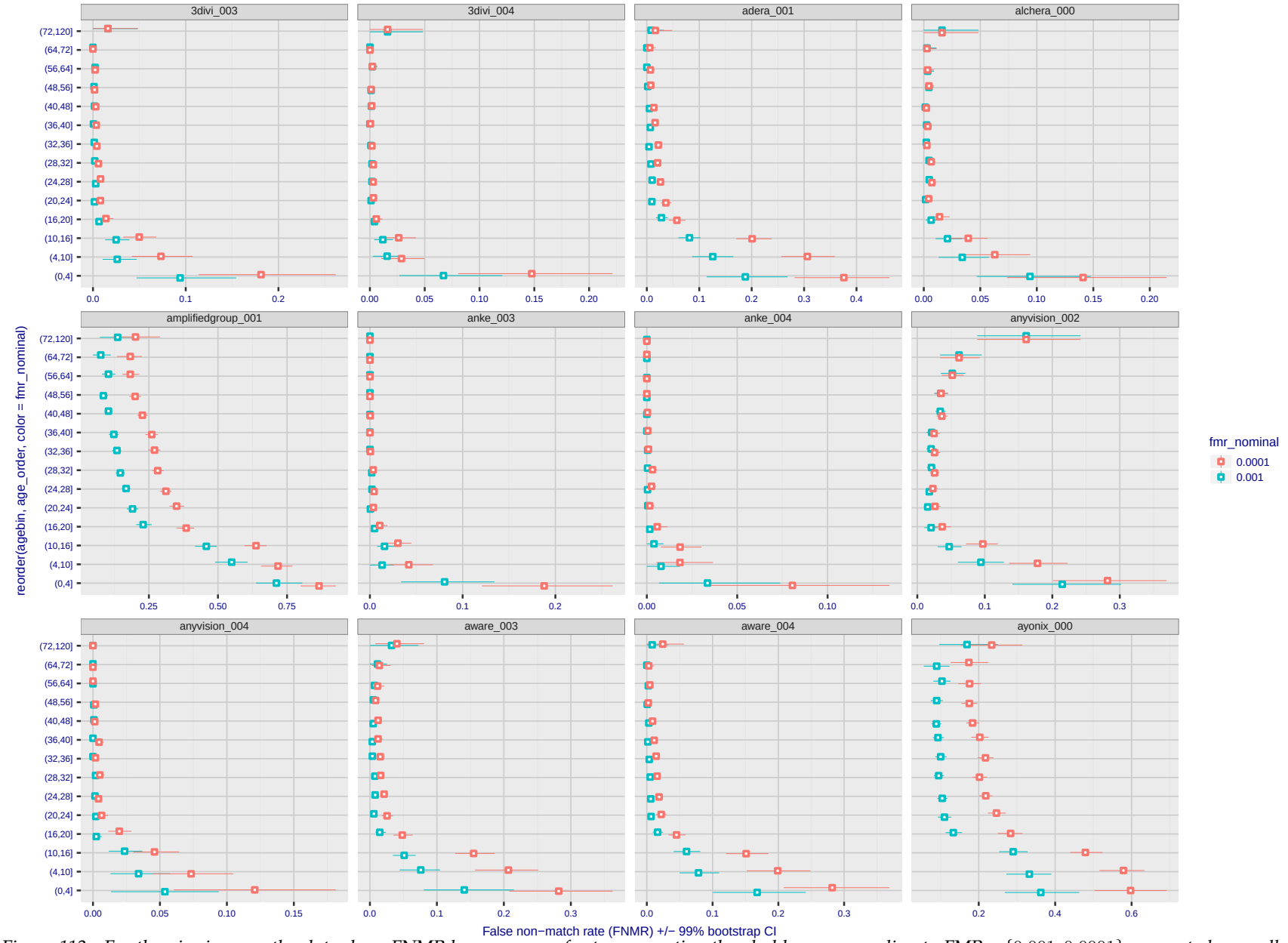


Figure 113: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Figure 114: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Figure 115: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Figure 116: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

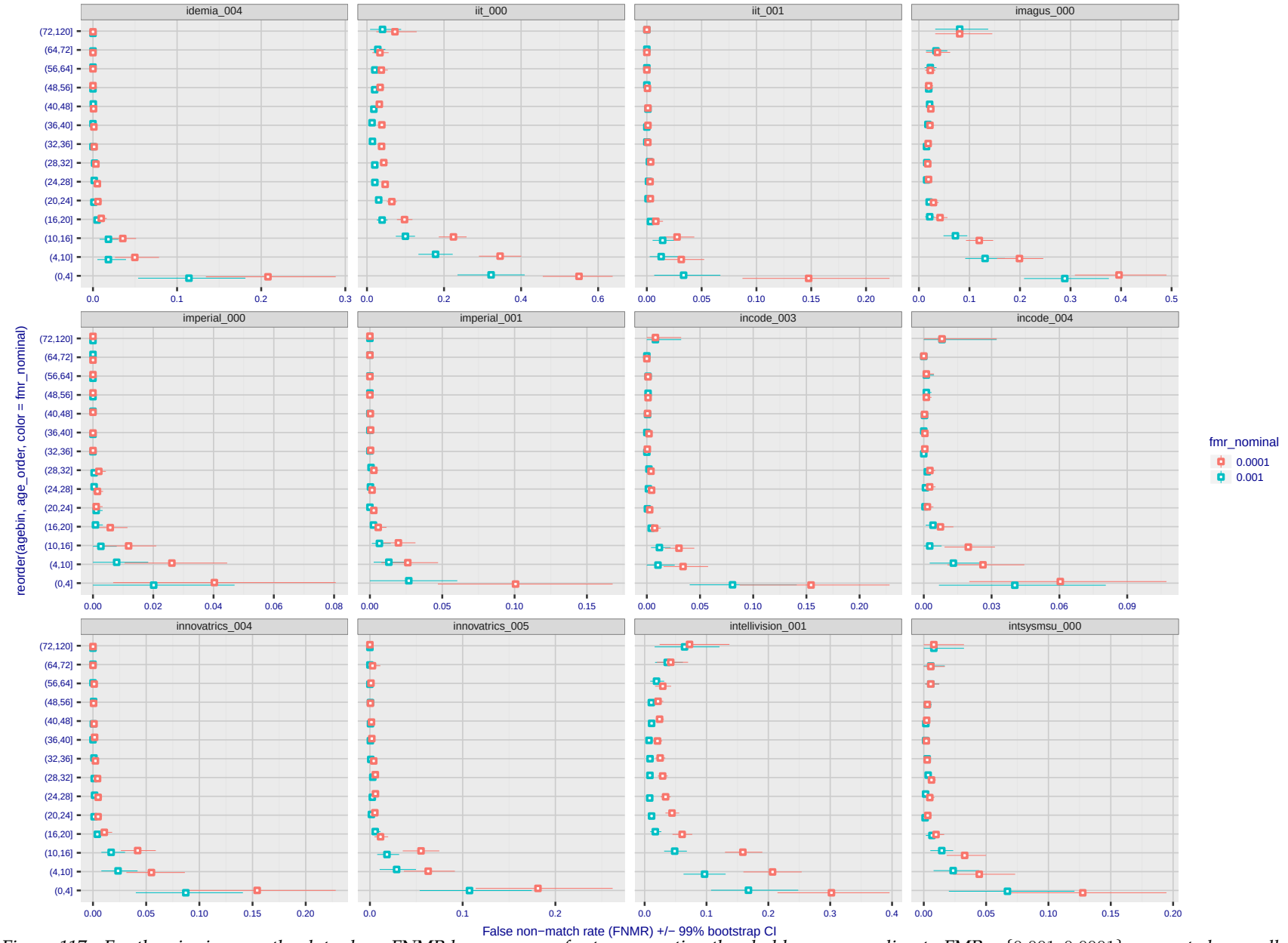


Figure 117: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

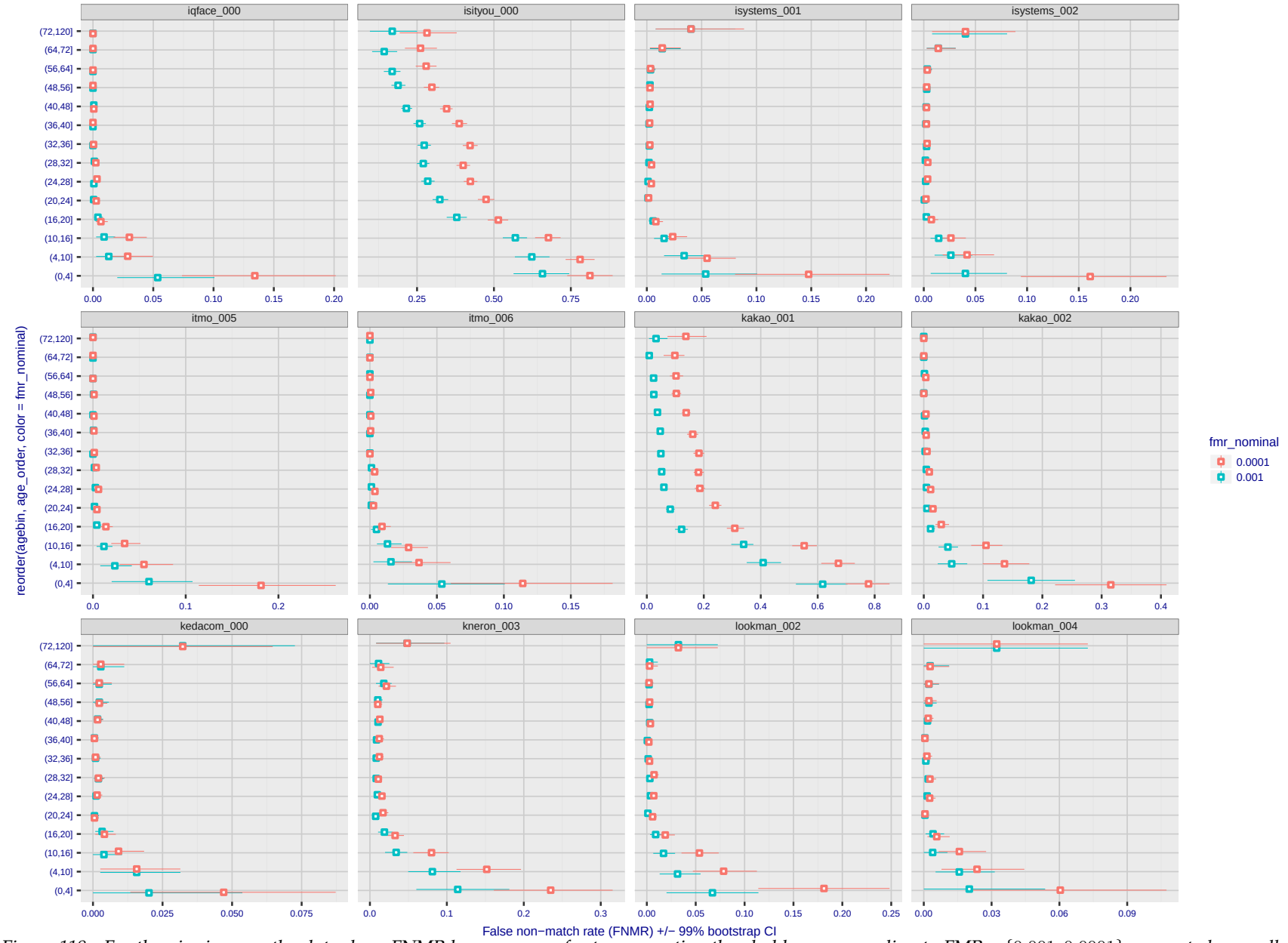


Figure 118: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

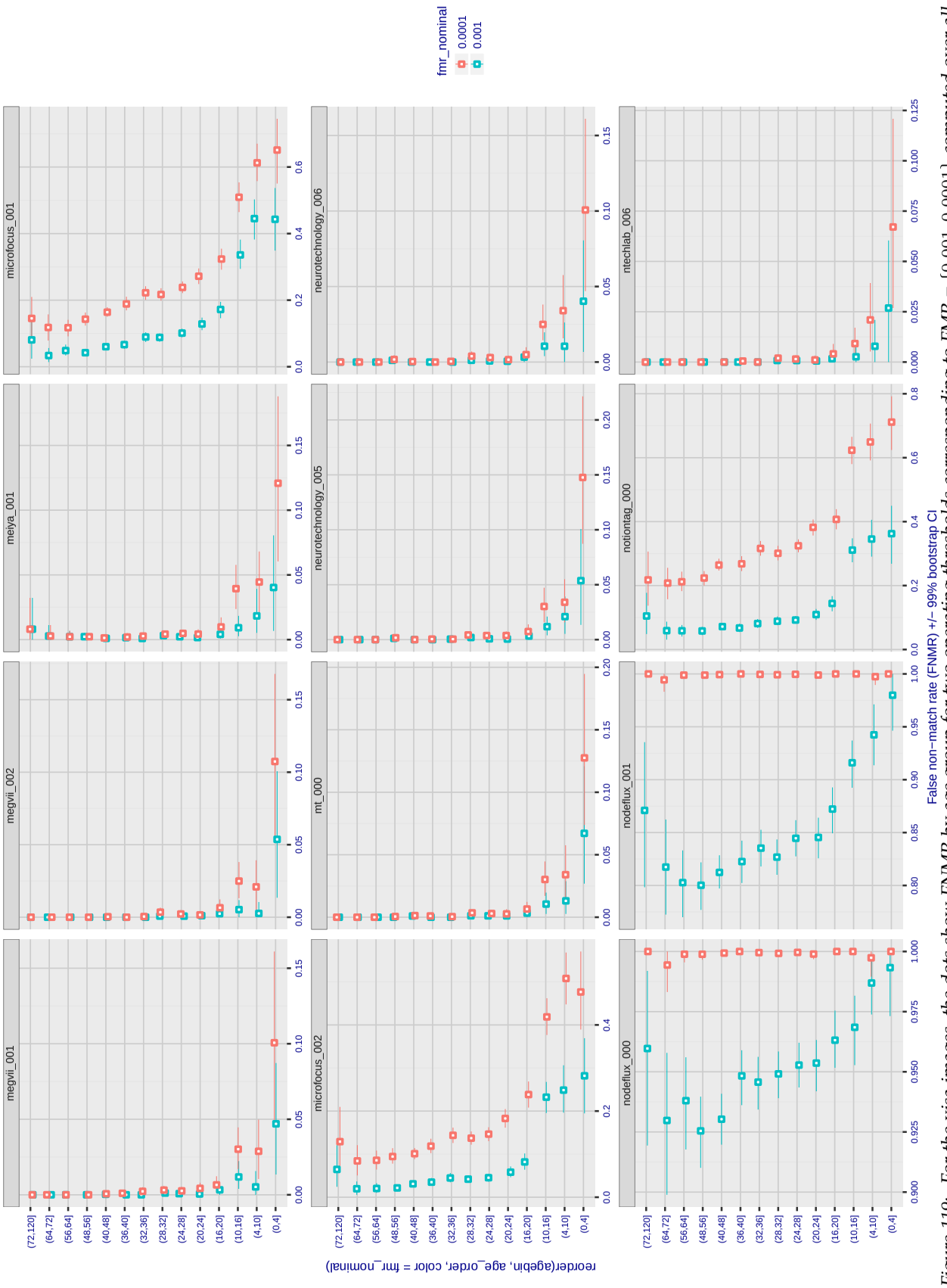


Figure 119: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = {0.001, 0.0001} computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

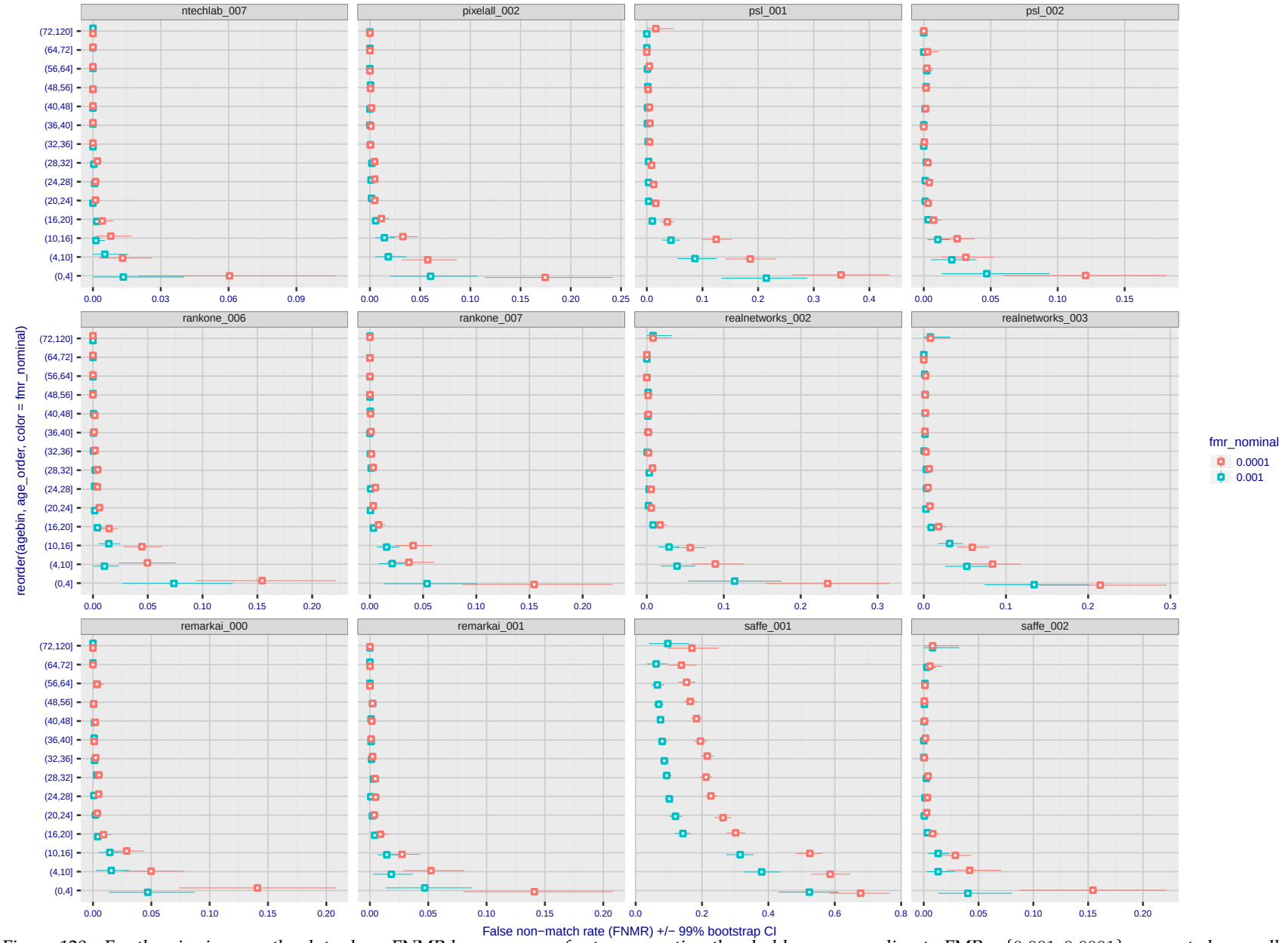


Figure 120: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

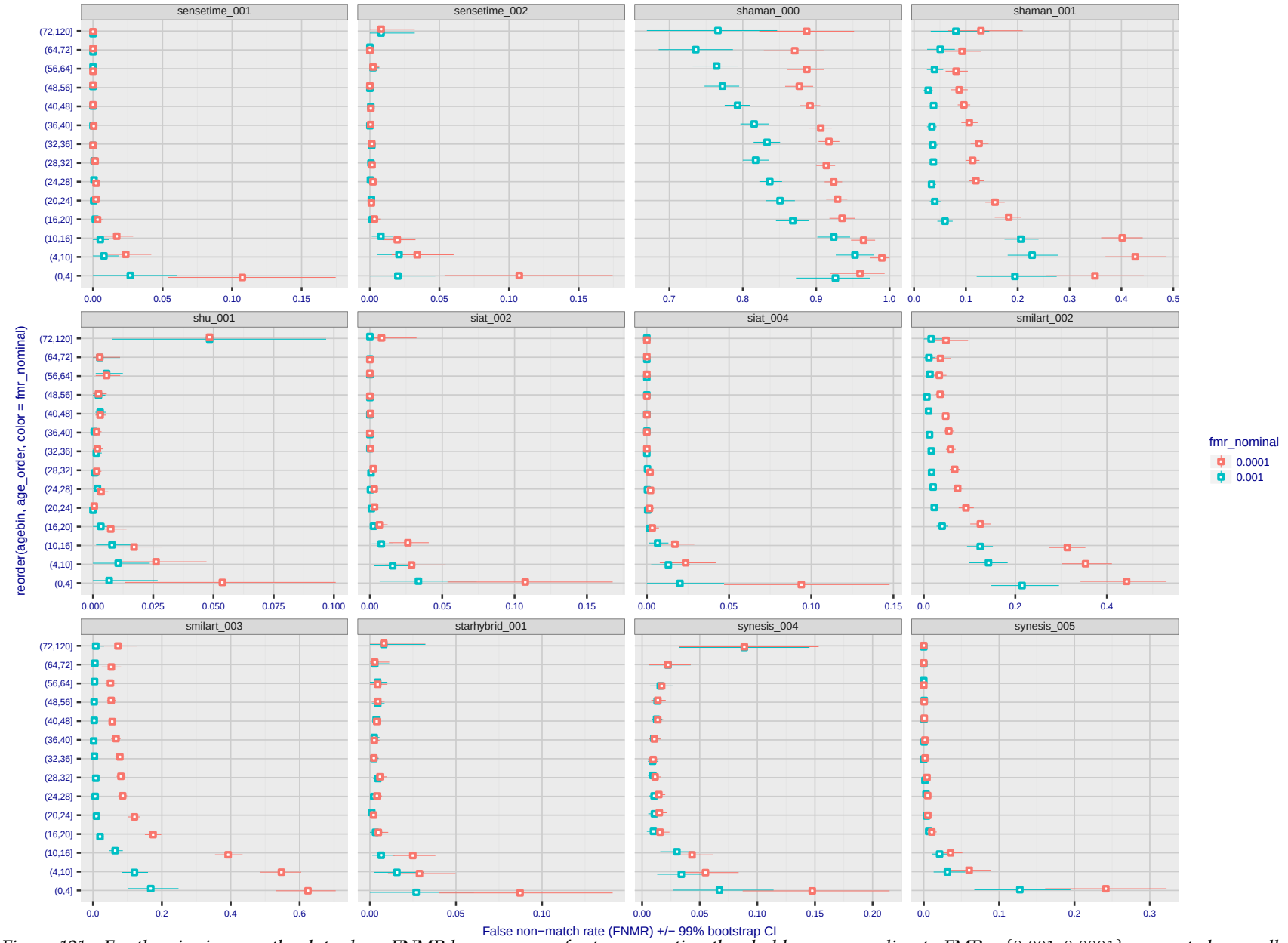


Figure 121: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

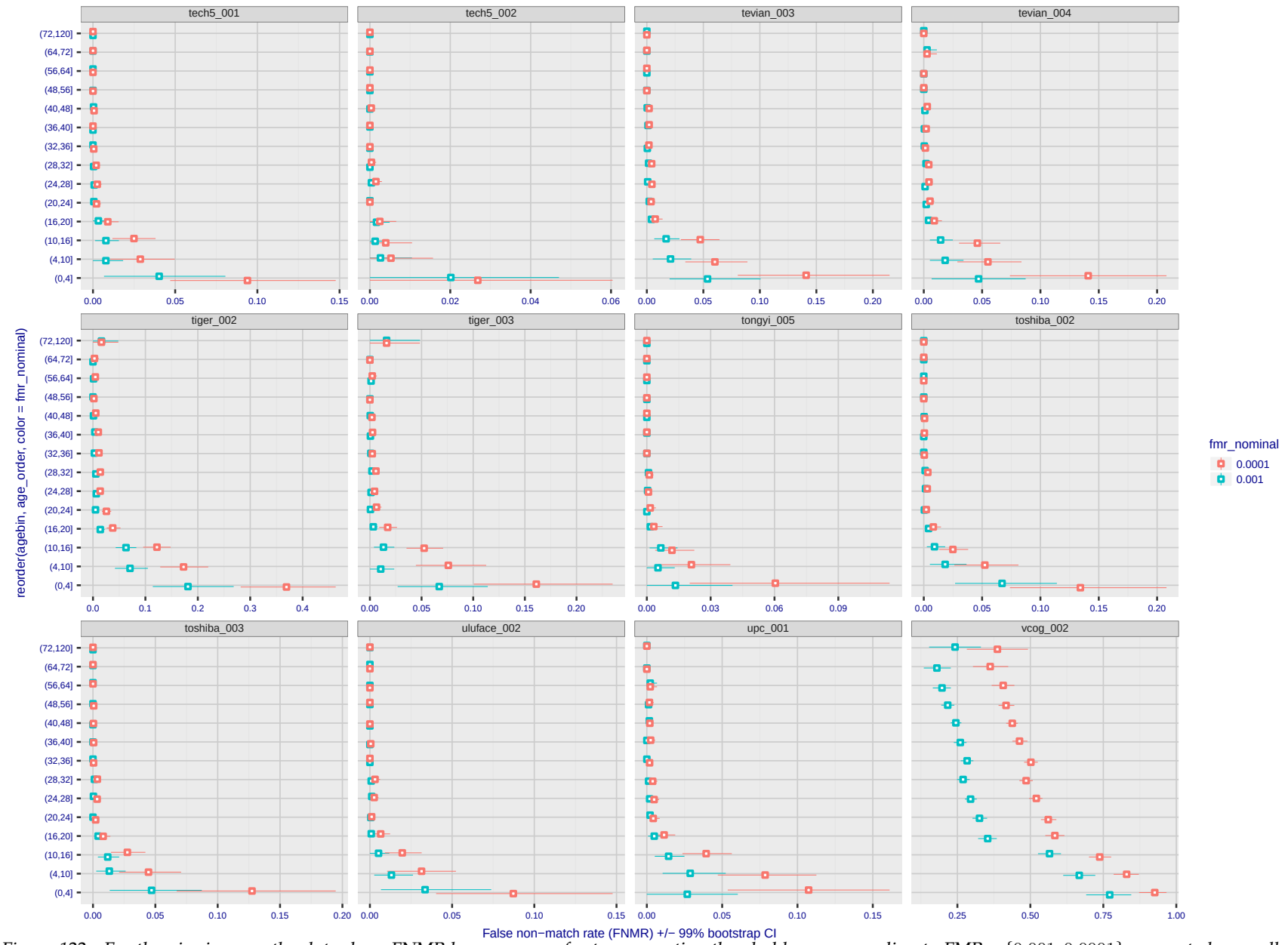


Figure 122: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

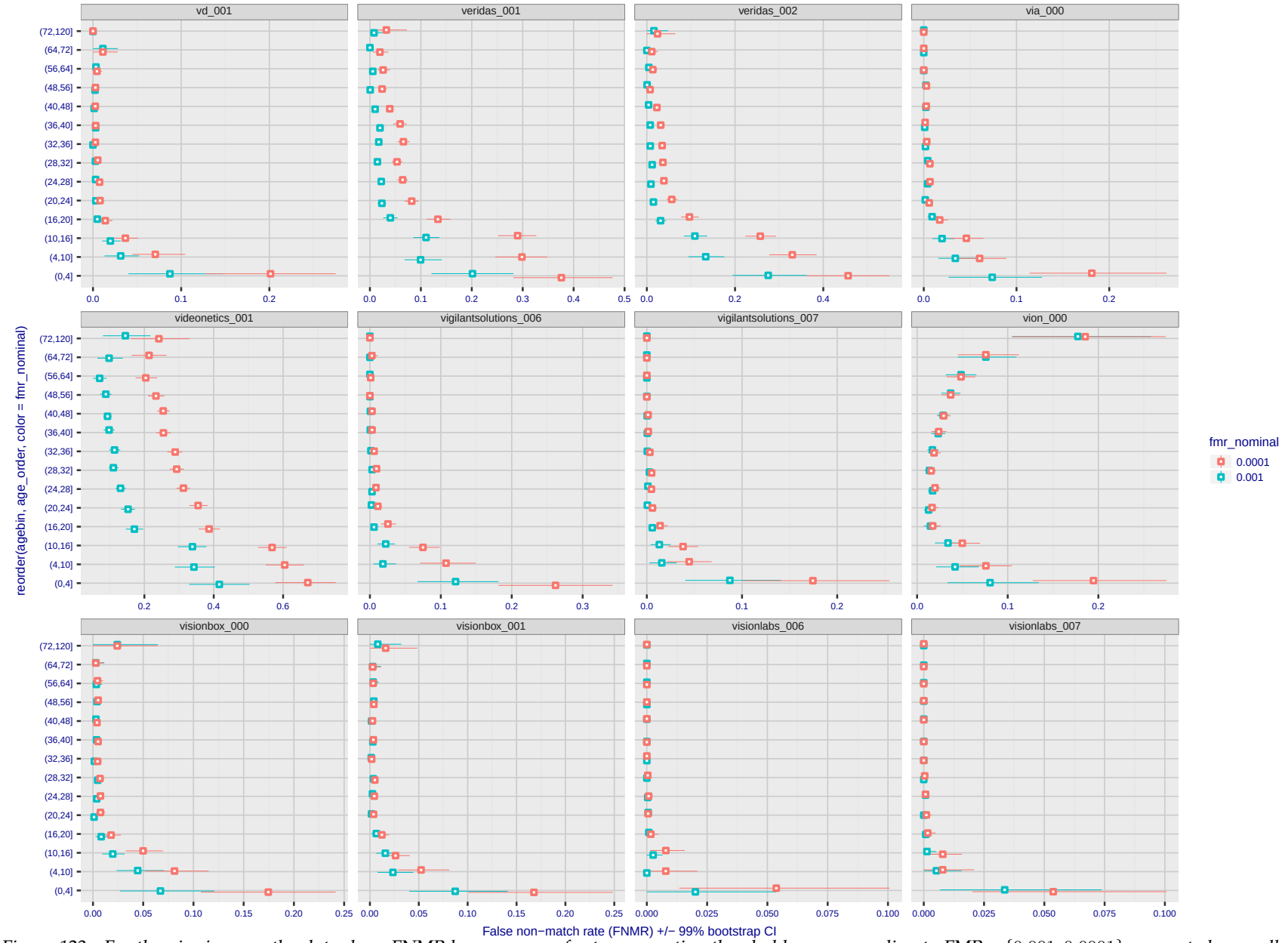


Figure 123: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

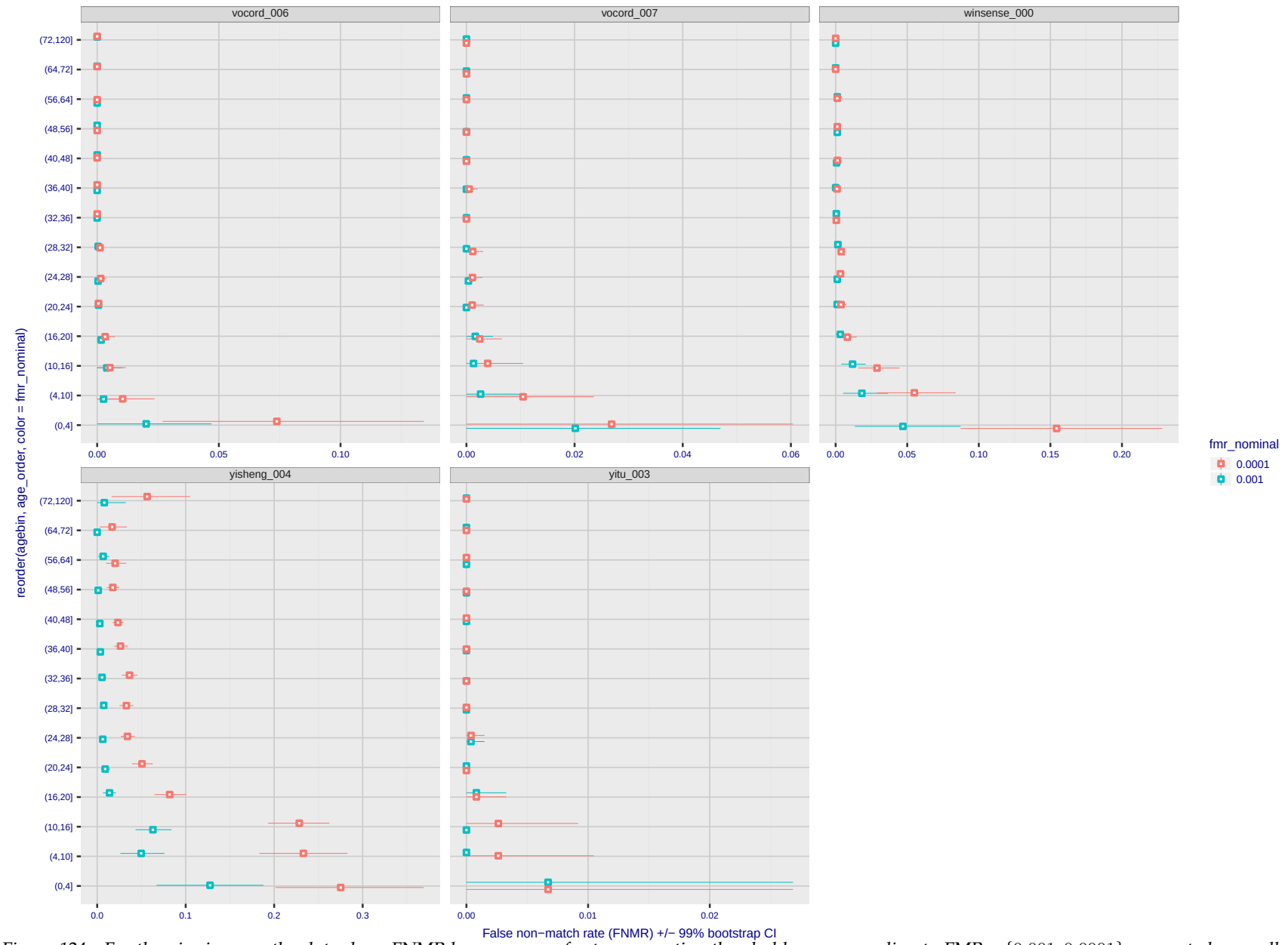


Figure 124: For the visa images, the dots show FNMR by age group for two operating thresholds corresponding to FMR = $\{0.001, 0.0001\}$ computed over all on the order of 10^{10} impostor scores. The FMR in each bin will vary also - see subsequent impostor heatmaps in sec. 3.6.2. Given a pair of face images taken at different times, we assign the comparison to the bin that is the arithmetic average of the subject's ages. This plot shows only the effect of age, not ageing. The number of comparisons in each bin is generally in the thousands, however the first and last bins are computed over 149 and 124 respectively. The error rates in some (adult) cases are zero, and in others the DET is flat so the error rates at the two thresholds are identical. The lines span 1% and 99% of boostrap replicated FNMR estimates.

Caveats: None.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

3.6 Impostor distribution stability

3.6.1 Effect of birth place on the impostor distribution

Background: Facial appearance varies geographically, both in terms of skin tone, cranio-facial structure and size. This section addresses whether false match rates vary intra- and inter-regionally.

Goals:

- ▷ To show the effect of birth region of the impostor and enrollee on false match rates.
- ▷ To determine whether some algorithms give better impostor distribution stability.

Methods:

- ▷ For the visa images, NIST defined 10 regions: Sub-Saharan Africa, South Asia, Polynesia, North Africa, Middle East, Europe, East Asia, Central and South America, Central Asia, and the Caribbean.
- ▷ For the visa images, NIST mapped each country of birth to a region. There is some arbitrariness to this. For example, Egypt could reasonably be assigned to the Middle East instead of North Africa. An alternative methodology could, for example, assign the Philippines to *both* Polynesia and East Asia.
- ▷ FMR is computed for cases where all face images of impostors born in region r_2 are compared with enrolled face images of persons born in region r_1.

$$\text{FMR}(r_1, r_2, T) = \frac{\sum_{i=1}^{N_{r_1,r_2}} H(s_i - T)}{N_{r_1,r_2}} \tag{5}$$

  where the same threshold, T, is used in all cells, and H is the unit step function. The threshold is set to give FMR(T) = 0.001 over the entire set of visa image impostor comparisons.
- ▷ This analysis is then repeated by country-pair, but only for those country pairs where both have at least 1000 images available. The countries[1] appear in the axes of graphs that follow.
- ▷ The mean number of impostor scores in any cross-region bin is 33 million. The smallest number of impostor scores in any bin is 135000, for Central Asia - North Africa. While these counts are large enough to support reasonable significance, the number of individual faces is much smaller, on the order of $N^{0.5}$.
- ▷ The numbers of impostor scores in any cross-country bin is shown in Figure 401.

Results: Subsequent figures show heatmaps that use color to represent the base-10 logarithm of the false match rate. Red colors indicate high (bad) false match rates. Dark colors indicate benign false match rates. There are two series of graphs corresponding to aggregated geographical regions, and to countries. The notable observations are:

- ▷ The on-diagonal elements correspond to within-region impostors. FMR is generally above the nominal value of FMR = 0.001. Particularly there is usually higher FMR in, Sub-Saharan Africa, South Asia, and the Caribbean. Europe and Central Asia, on the other hand, usually give FMR closer to the nominal value.
- ▷ The off-diagonal elements correspond to across-region impostors. The highest FMR is produced between the Caribbean and Sub-Saharan Africa.
- ▷ Algorithms vary.

[1] These are Argentina, Australia, Brazil, Chile, China, Costa Rica, Cuba, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Germany, Ghana, Great Britain, Greece, Guatamala, Haiti, Hong Kong, Honduras, Indonesia, India, Israel, Jamaica, Japan, Kenya, Korea, Lebanon, Mexico, Malaysia, Nepal, Nigeria, Peru, Philippines, Pakistan, Poland, Romania, Russia, South Africa, Saudi Arabia, Thailand, Trinidad, Turkey, Taiwan, Ukraine, Venezuela, and Vietnam.

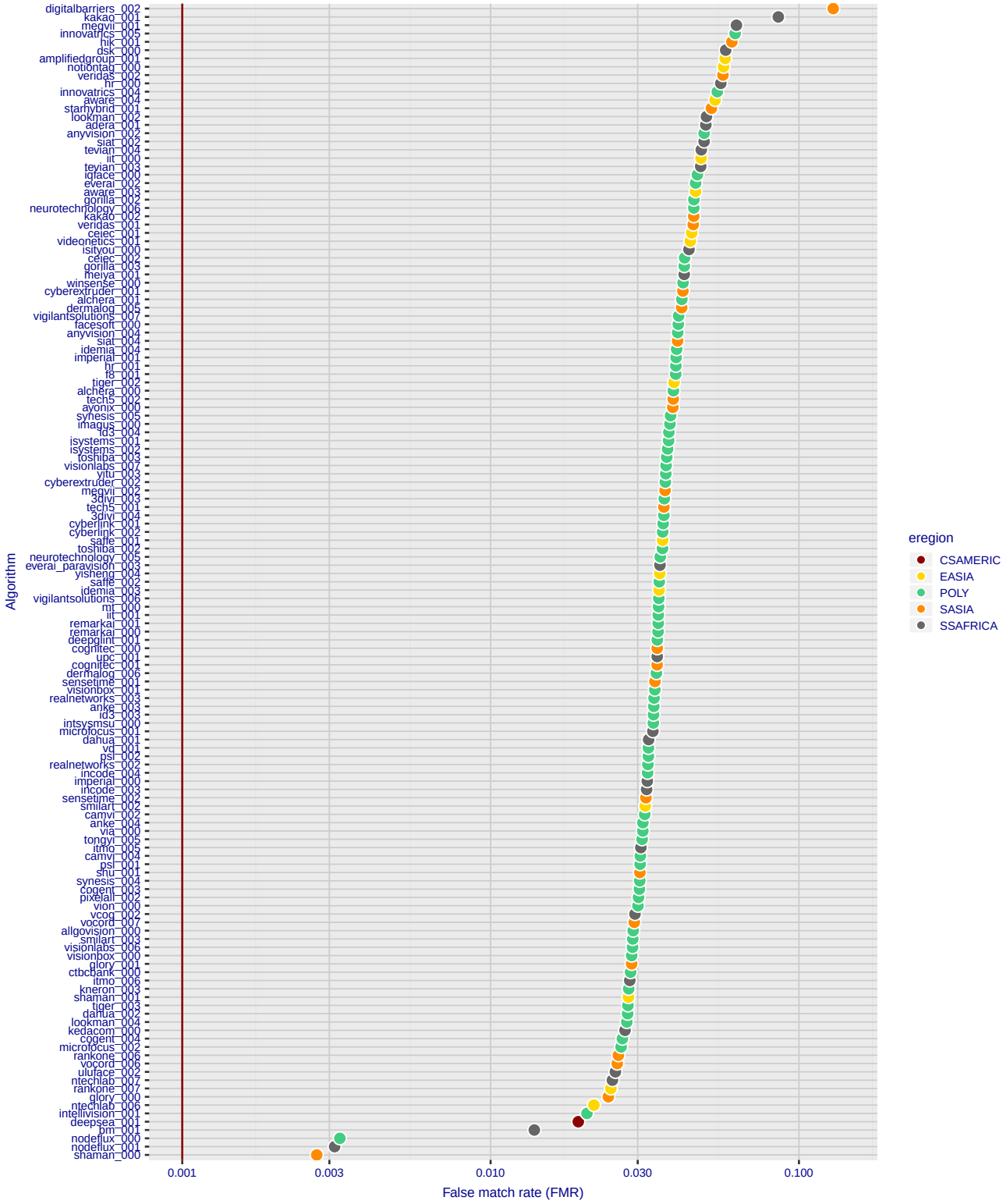


Figure 125: For the visa images, the dots show FMR for impostor comparisons of individuals of the same sex and same age group for the region of the world that gives the worst (highest) FMR when the threshold is set to give FMR = 0.001 (red vertical line) over all on the order of 10^{10} impostor scores i.e. zero-effort. The shift of the dots to right shows massive increases in FMR when impostors have the same sex, age, and region of birth. The color code indicates which region gives the worst case FMR. If the observed variation is due to the prevalence of one kind of images in the training imagery, then algorithms developed on one kind of data might be expected to give higher FMR on other kinds.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

▷ We computed the same quantities for a global FMR = 0.0001. The effects are similar.

Caveats:

▷ The effects of variable impostor rates on one-to-many identification systems may well differ from what's implied by these one-to-one verification results. Two reasons for this are a) the enrollment galleries are usually imbalanced across countries of birth, age and sex; b) one-to-many identification algorithms often implement techniques aimed at stabilizing the impostor distribution. Further research is necessary.

▷ In principle, the effects seen in this subsection could be due to differences in the image capture process. We consider this unlikely since the effects are maintained across geography - e.g. Caribbean vs. Africa, or Japan vs. China.

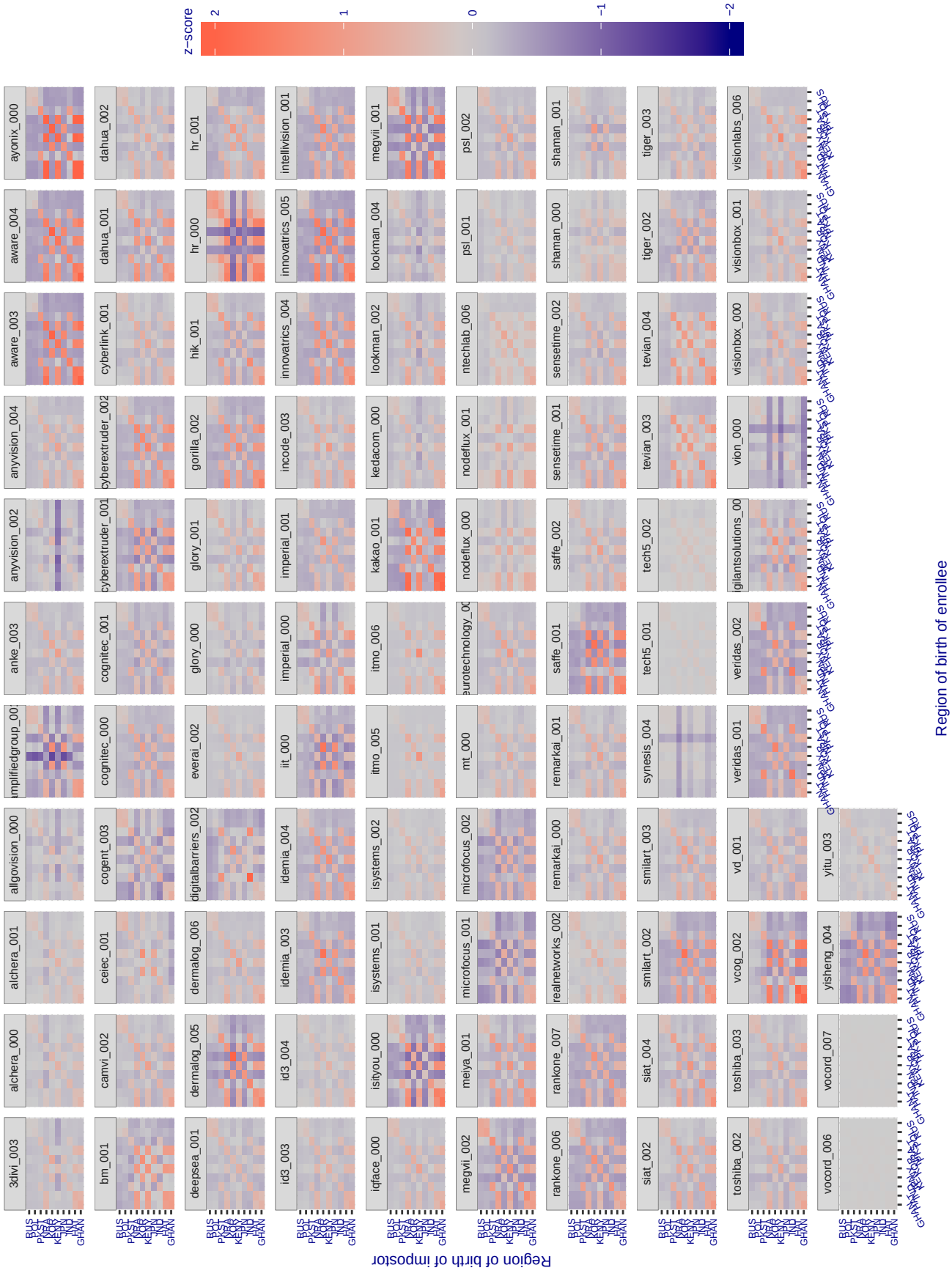


Figure 126: For visa images, the heatmap shows how the mean of the impostor distribution for the country pair (a,b) is shifted relative to the mean of the global impostor distribution, expressed as a number of standard deviations of the global impostor distribution. This statistic is designed to show shifts in the entire impostor distribution, not just tail effects that manifest as the anomalously high (or low) false match rates that appear in the subsequent figures. The countries are chosen to show that skin tone alone does not explain impostor distribution shifts. The reduced shift in Asian populations with the Yitu and TongYiTrans algorithms, is accompanied by positive shifts in the European populations. This reversal relative to most other algorithms, may derive from use of nationally weighted training sets. The Visionlabs algorithm appears most insensitive to country effects. The figure is computed from same-sex and same-age impostor pairs.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

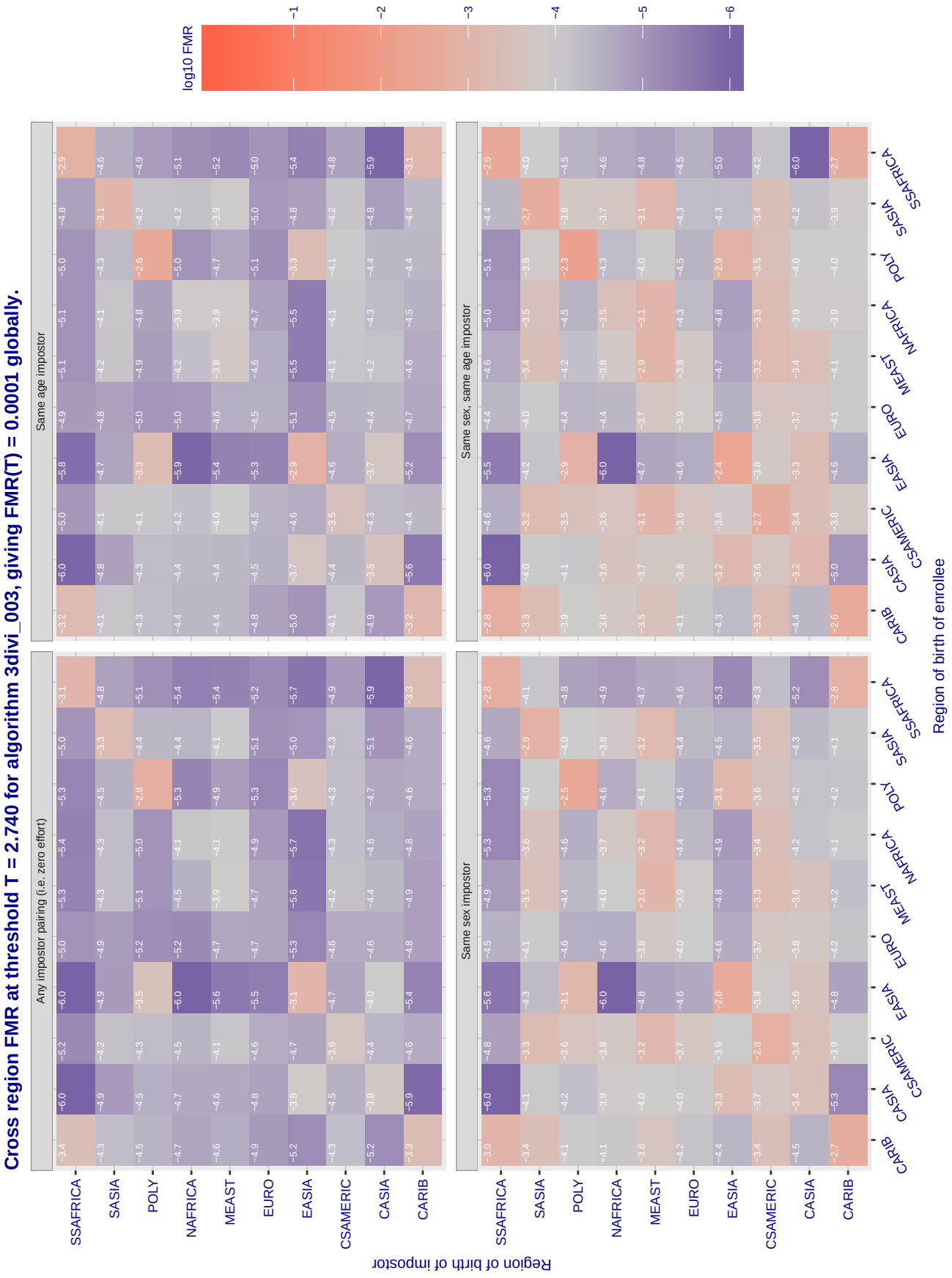


Figure 127: For algorithm 3divi-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

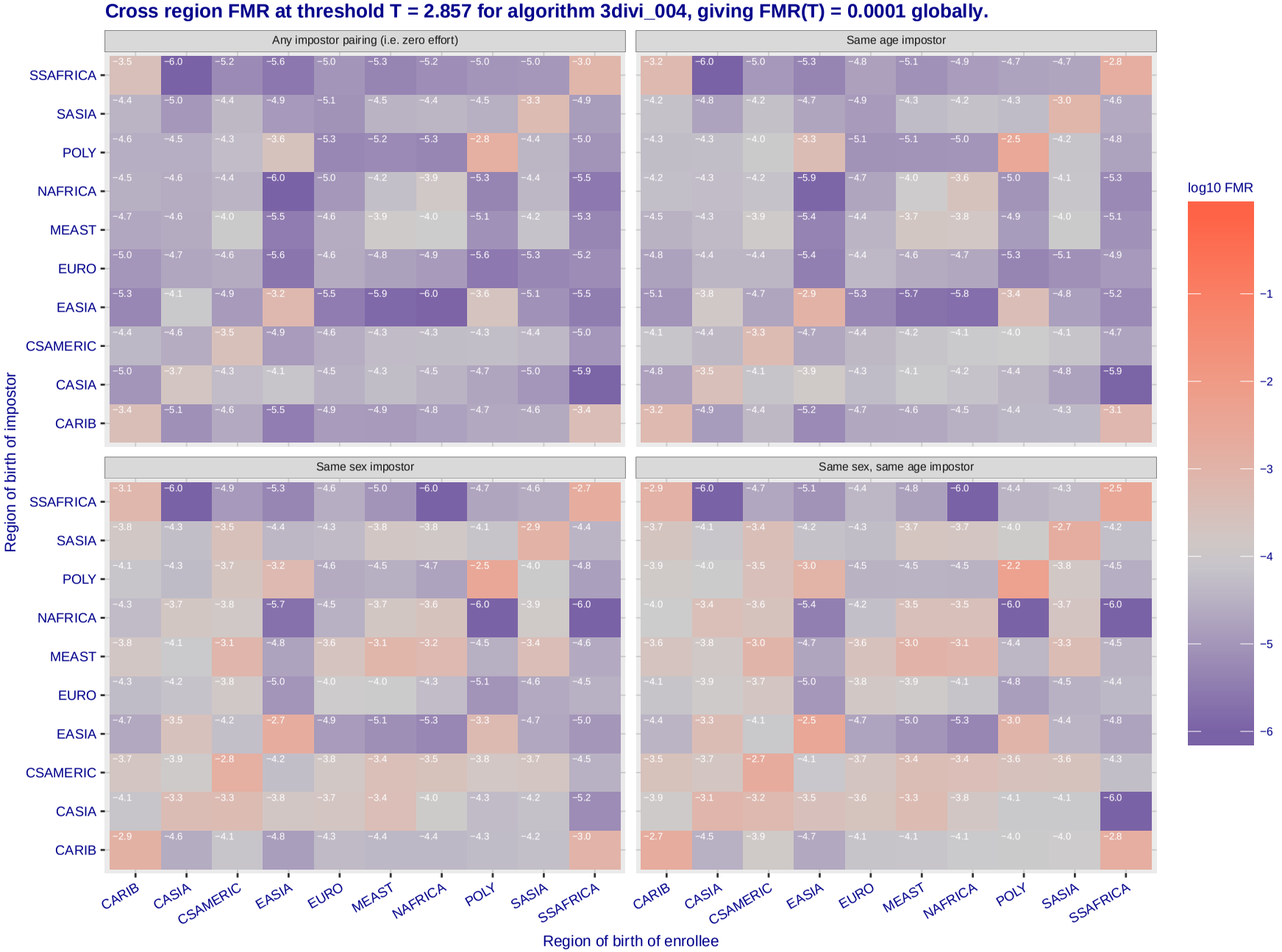


Figure 128: For algorithm 3divi-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

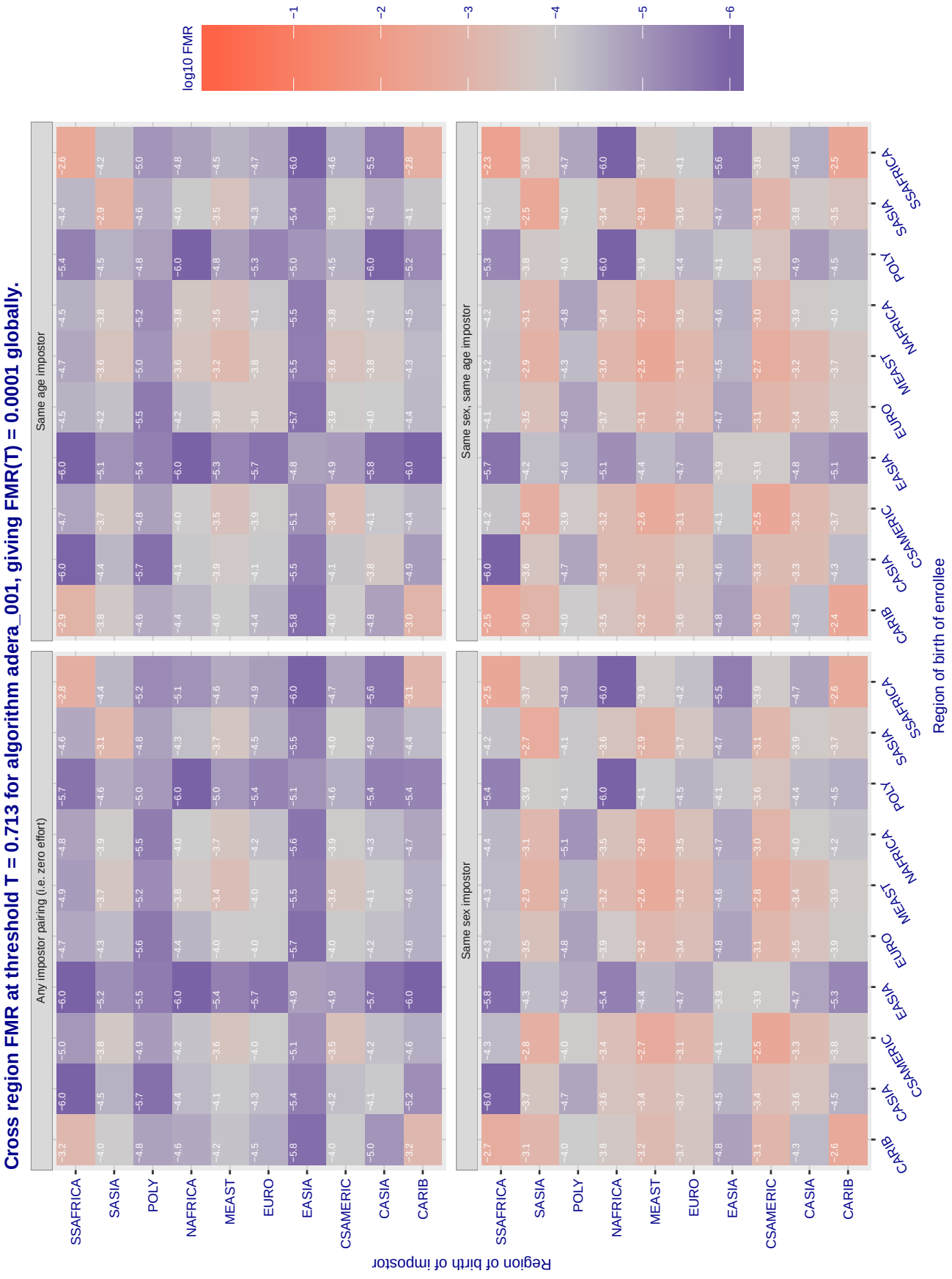


Figure 129: For algorithm adera-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

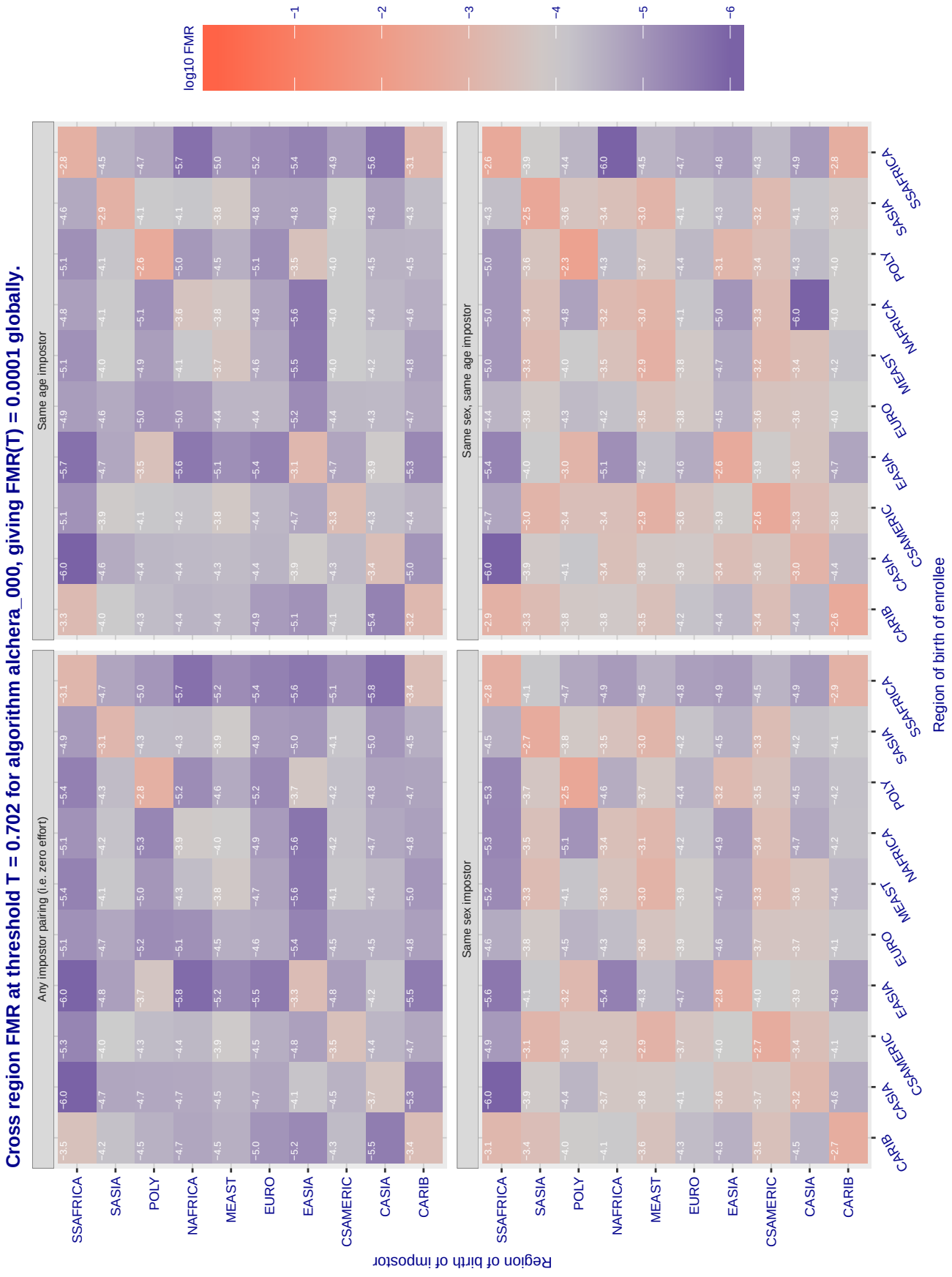


Figure 130: For algorithm alchera-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

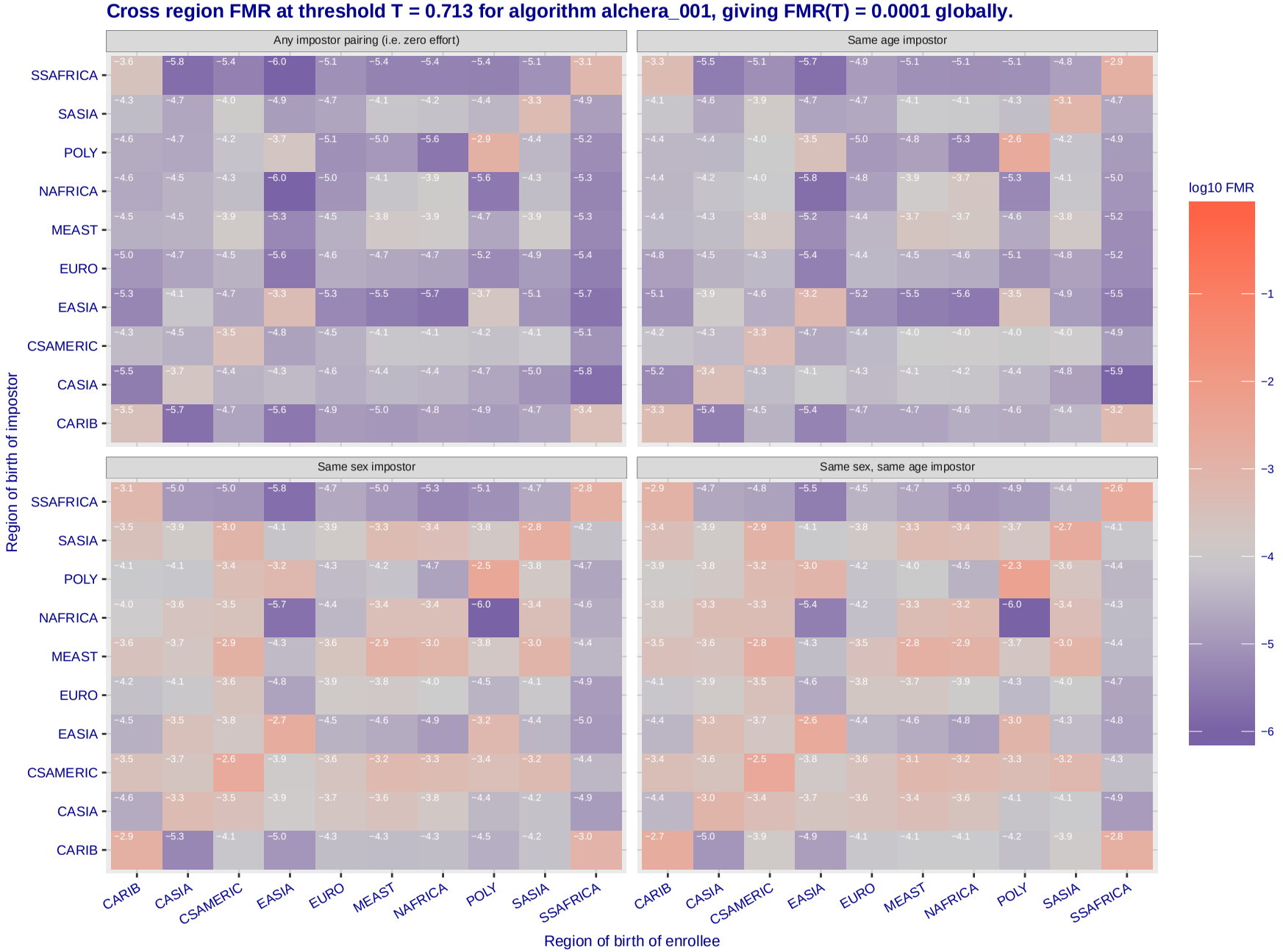


Figure 131: For algorithm alchera-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

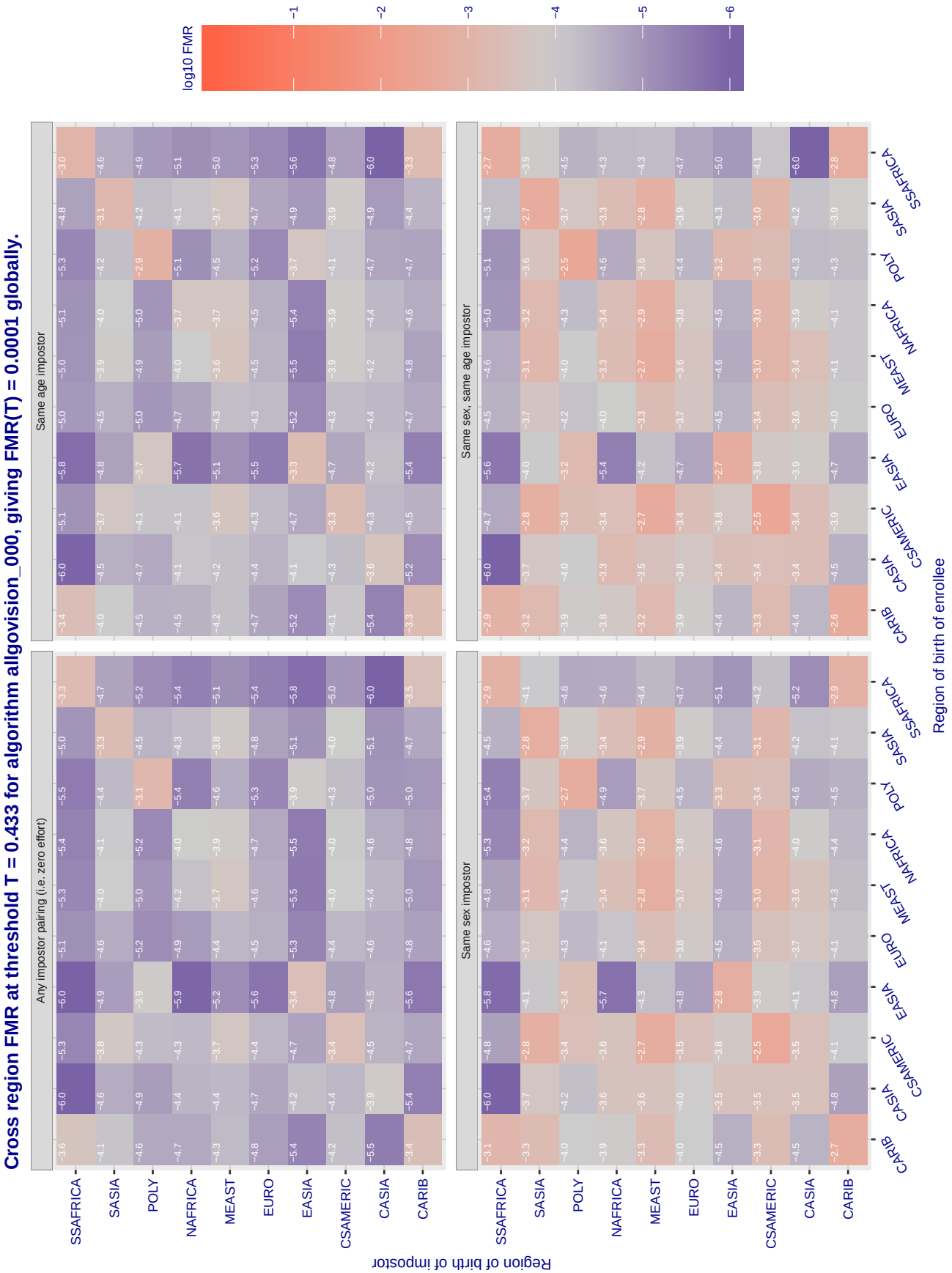


Figure 132: For algorithm allgovision-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

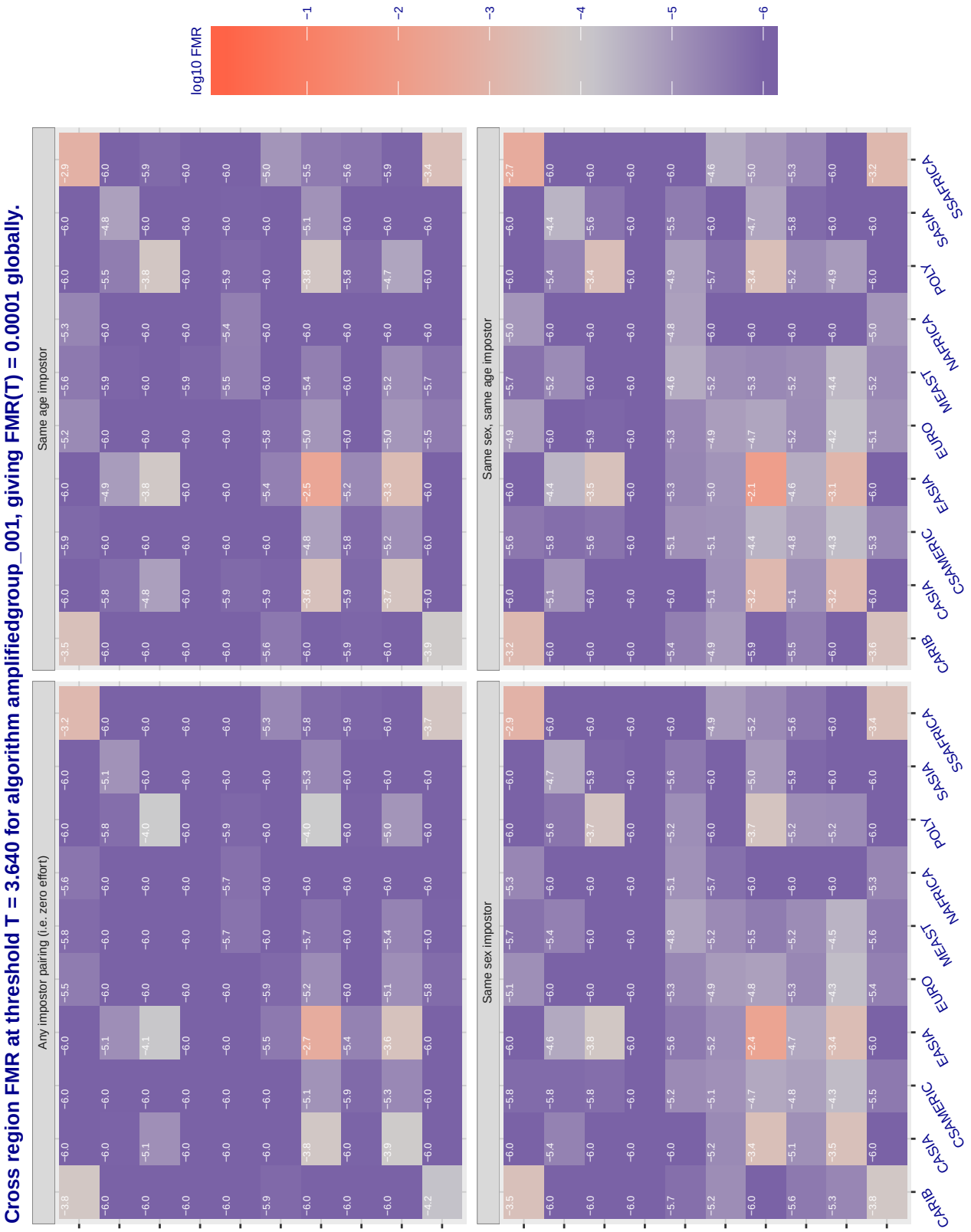


Figure 133: For algorithm amplifiedgroup-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

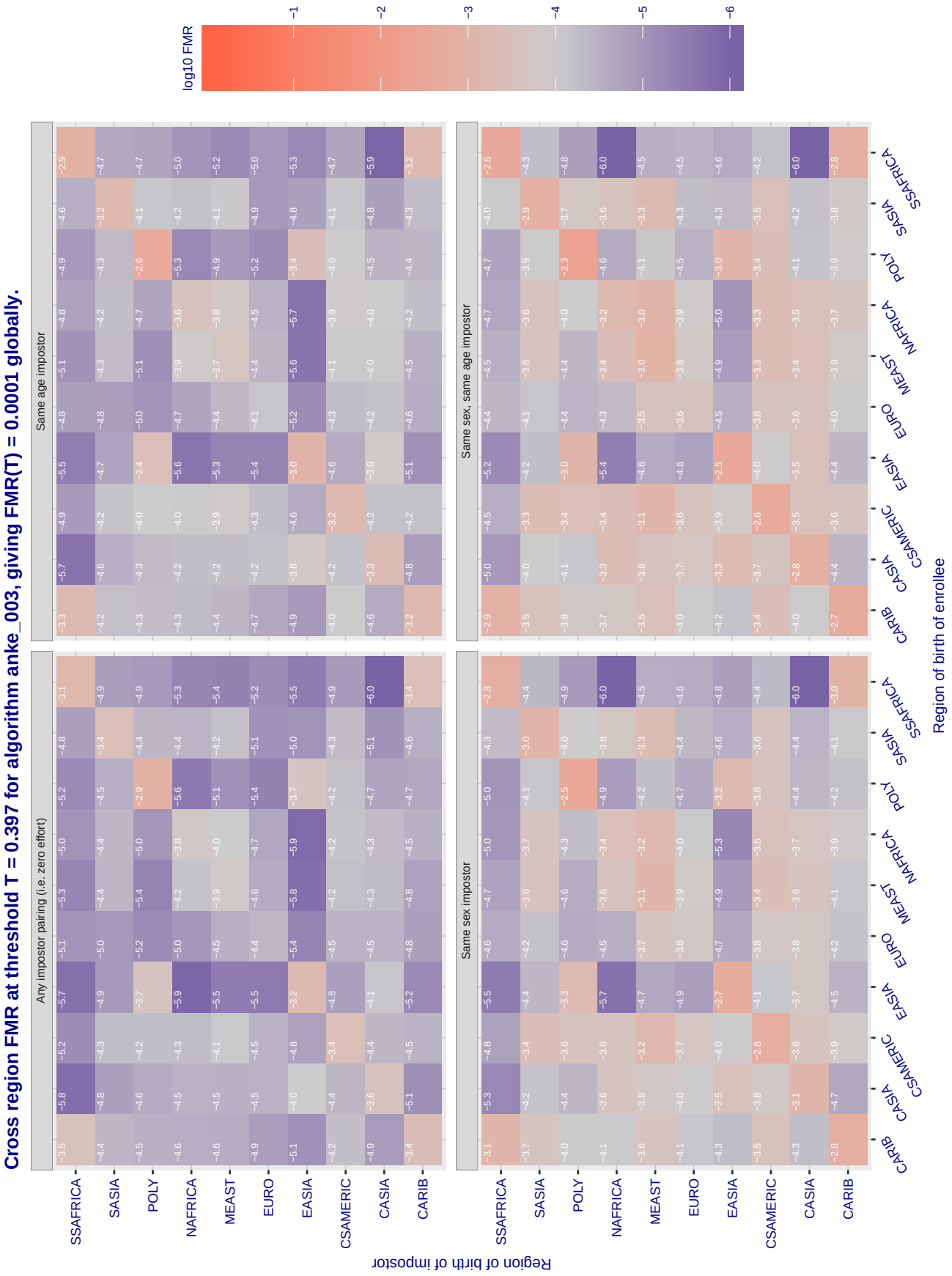


Figure 134: For algorithm anke-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

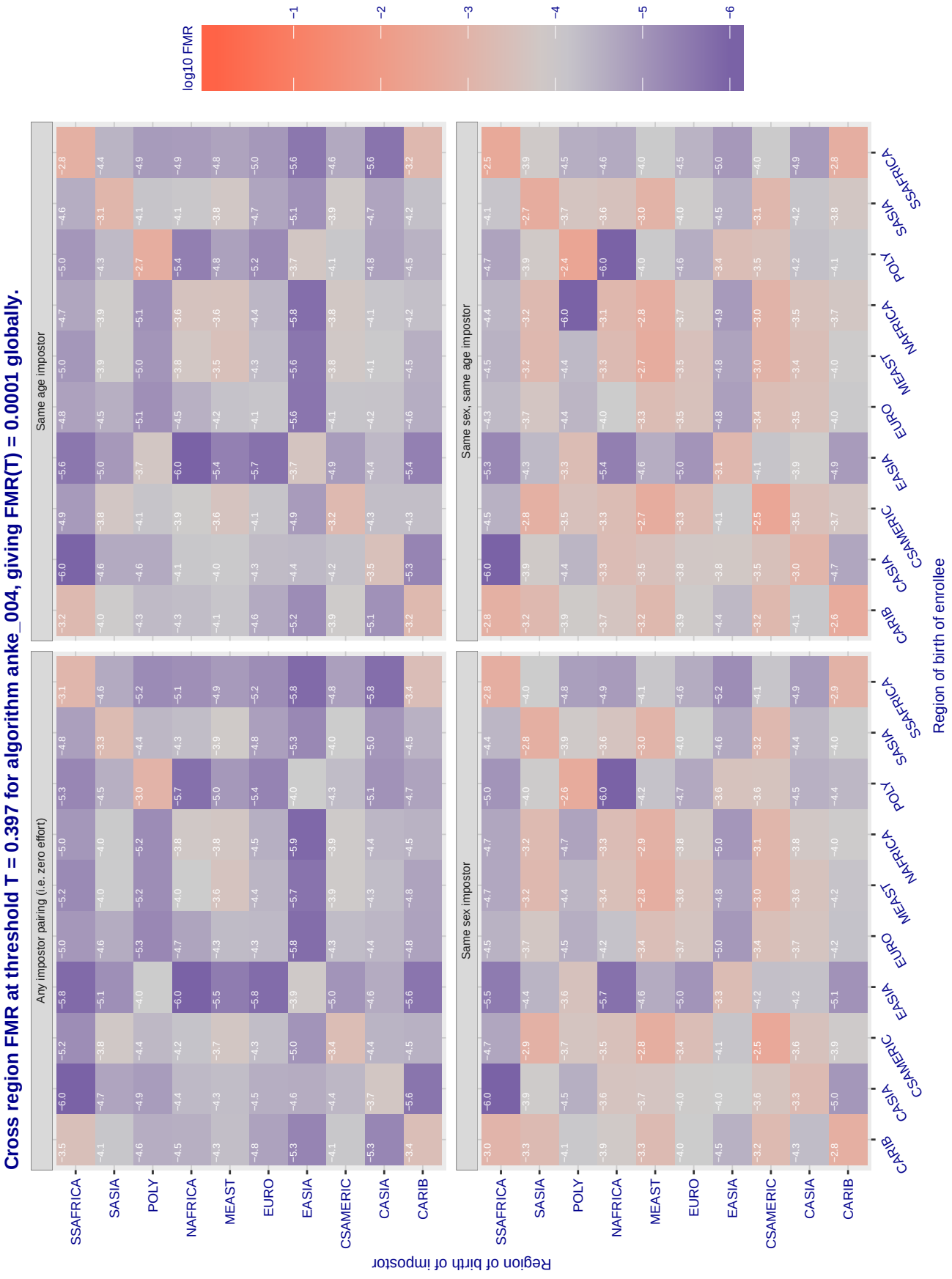


Figure 135: For algorithm anke-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

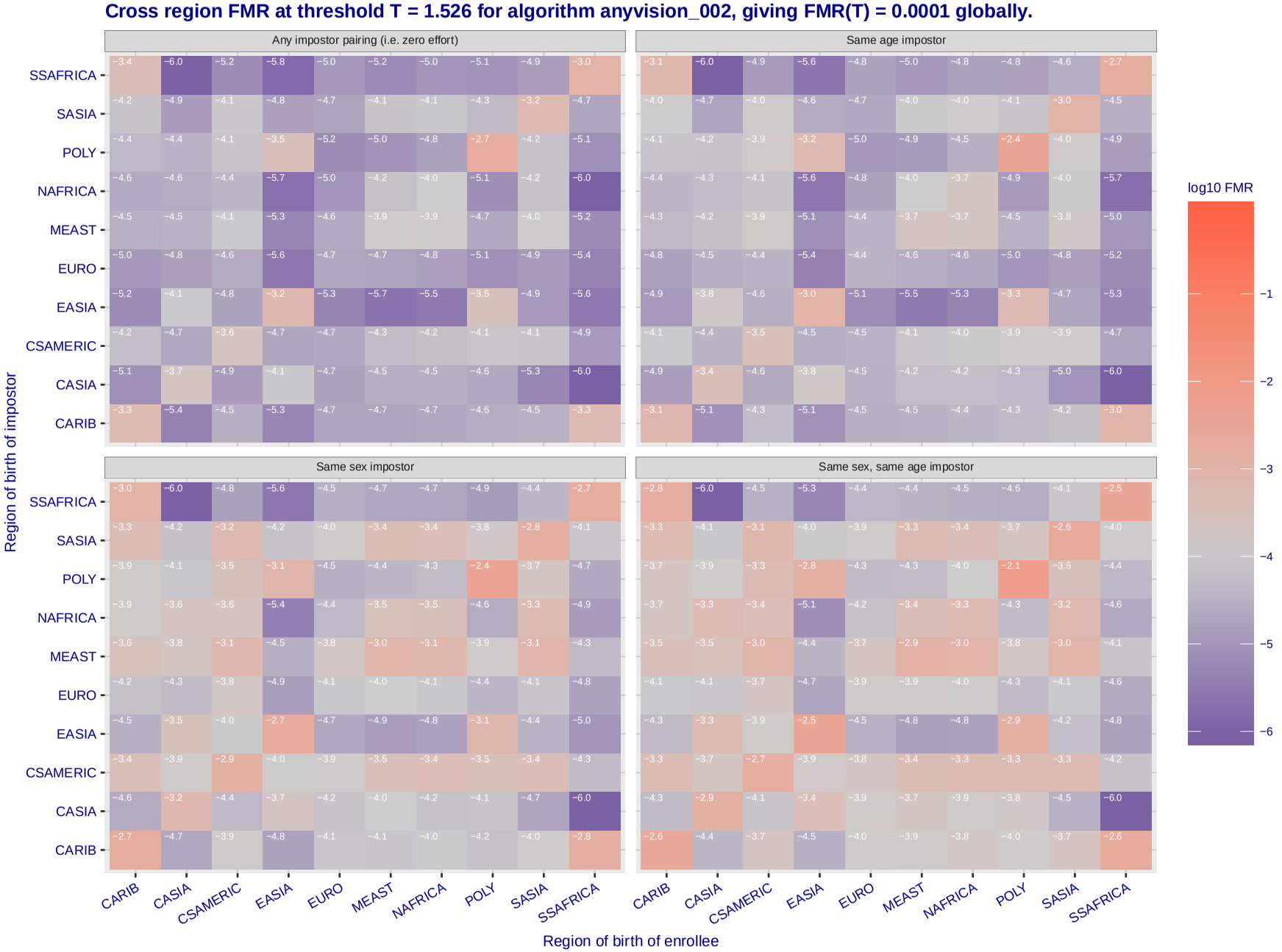


Figure 136: For algorithm anyvision-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

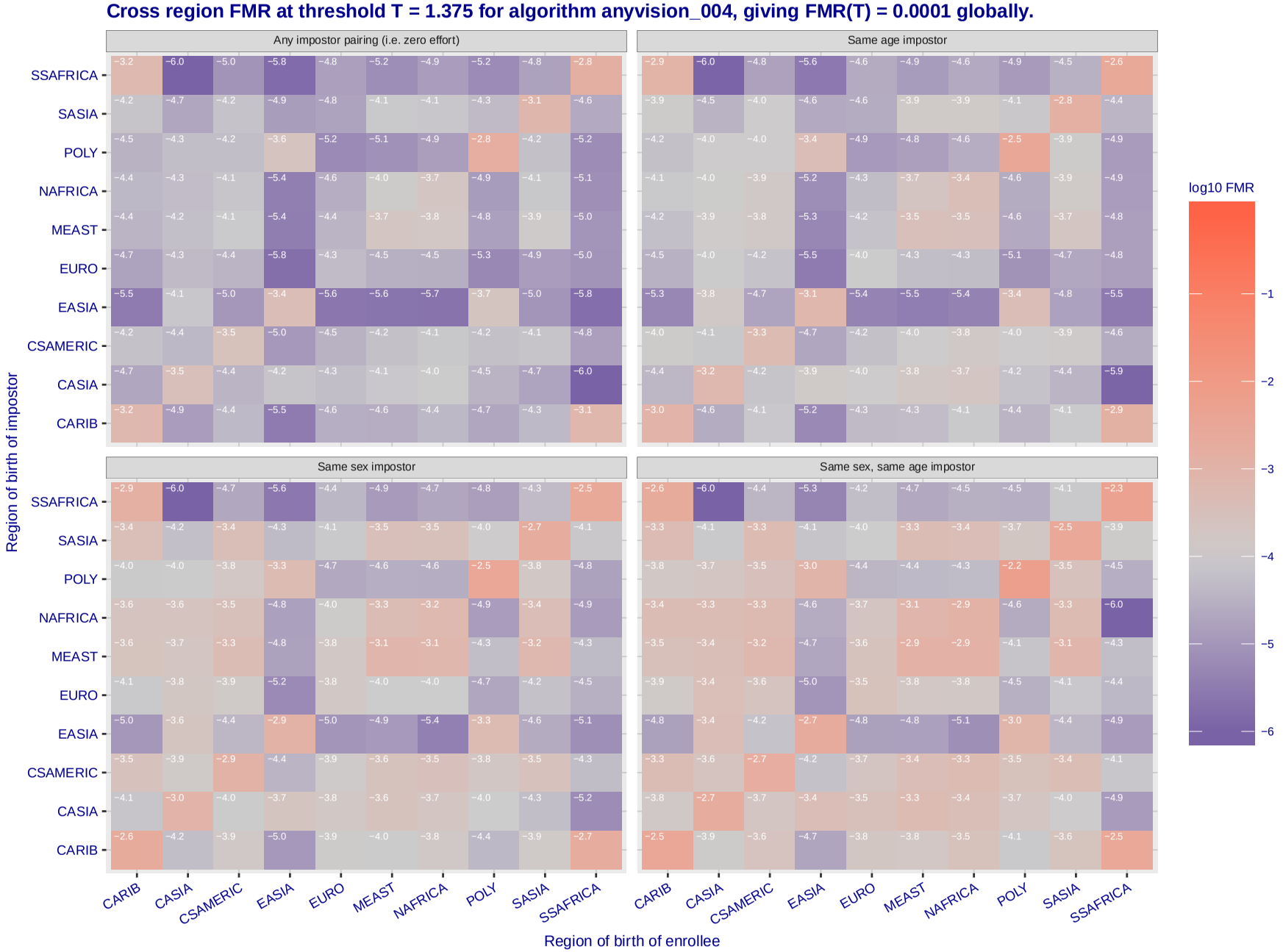


Figure 137: For algorithm anyvision-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

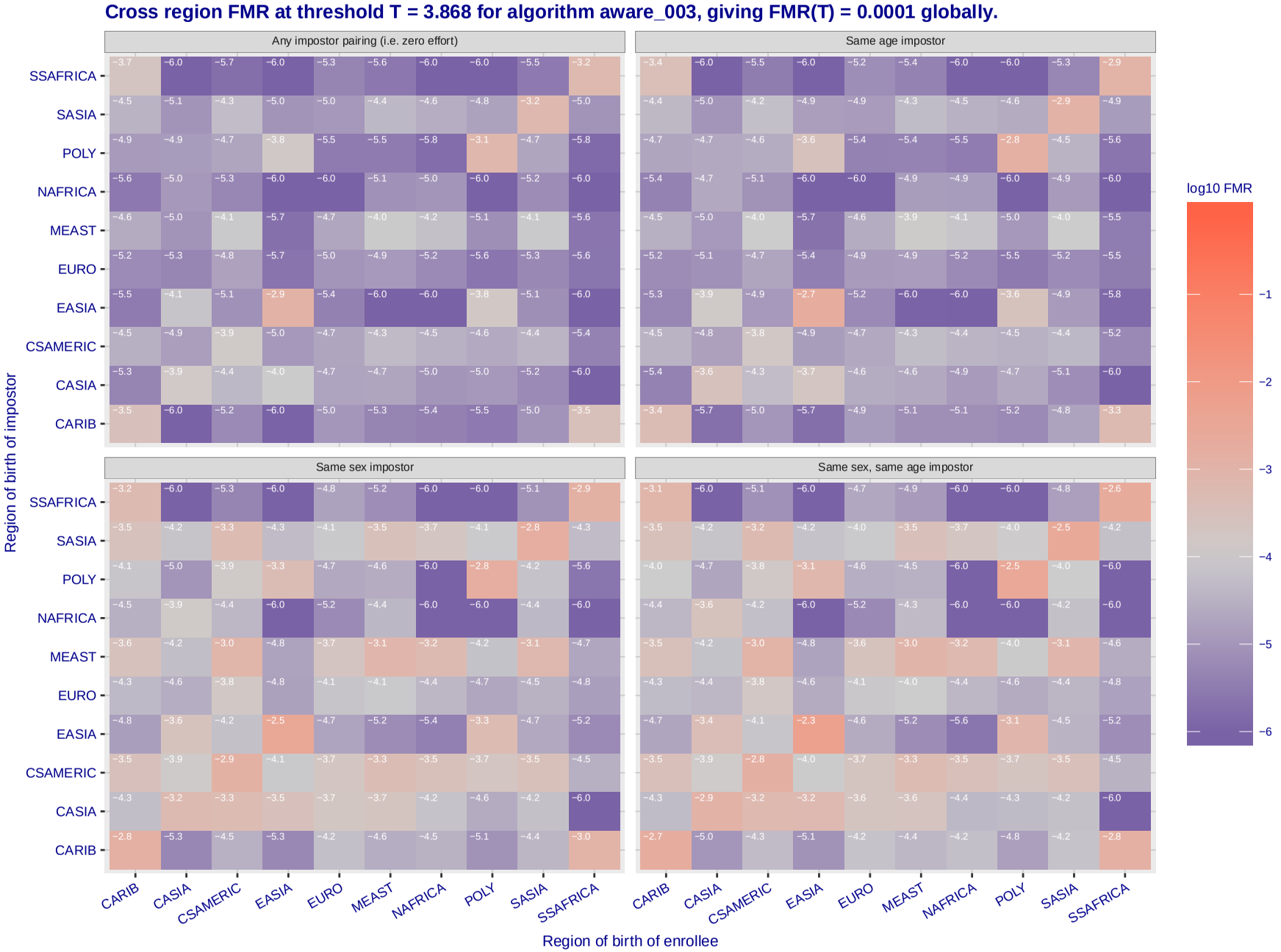


Figure 138: For algorithm aware-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

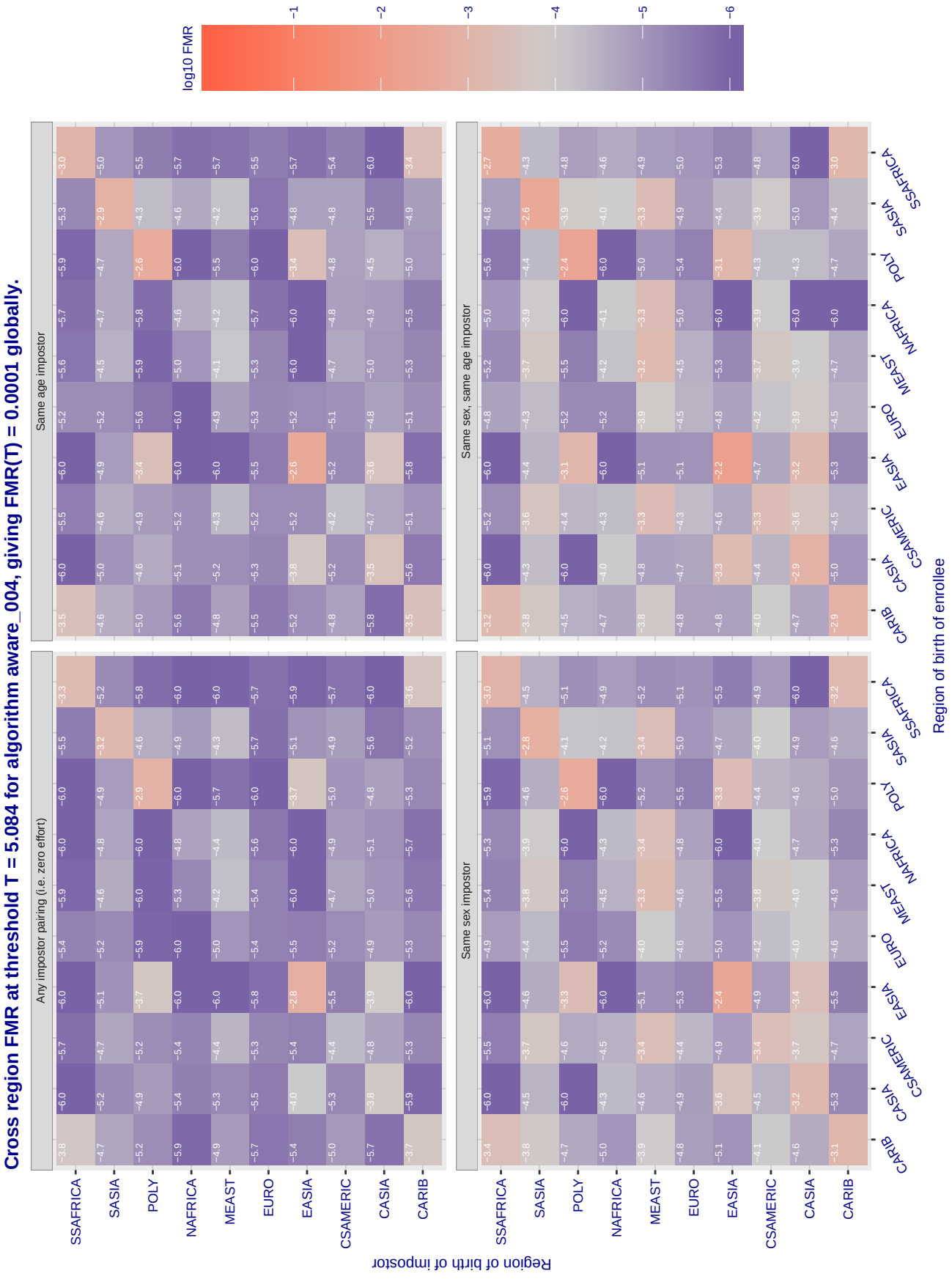


Figure 139: For algorithm aware-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

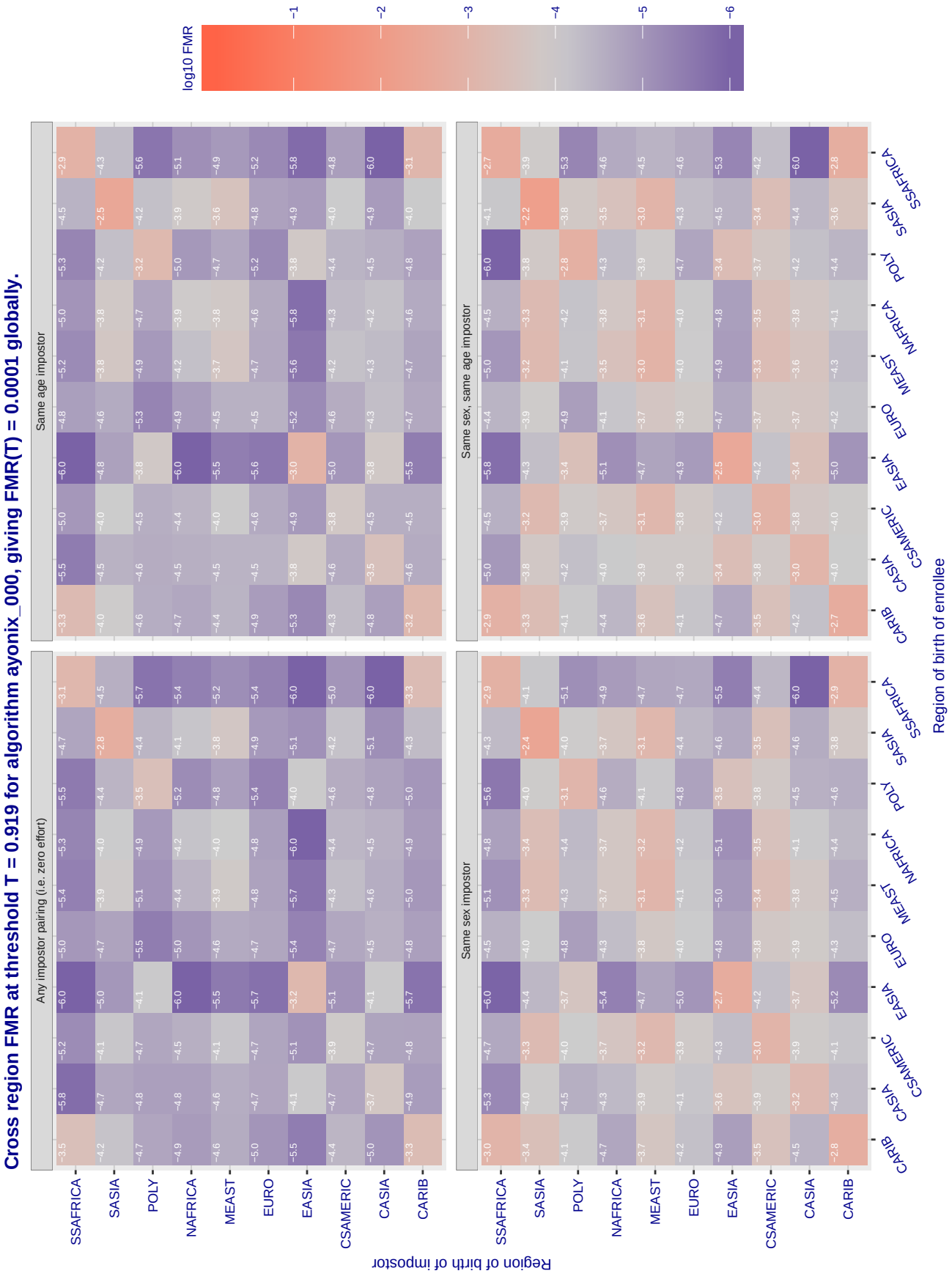


Figure 140: For algorithm ayonix-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

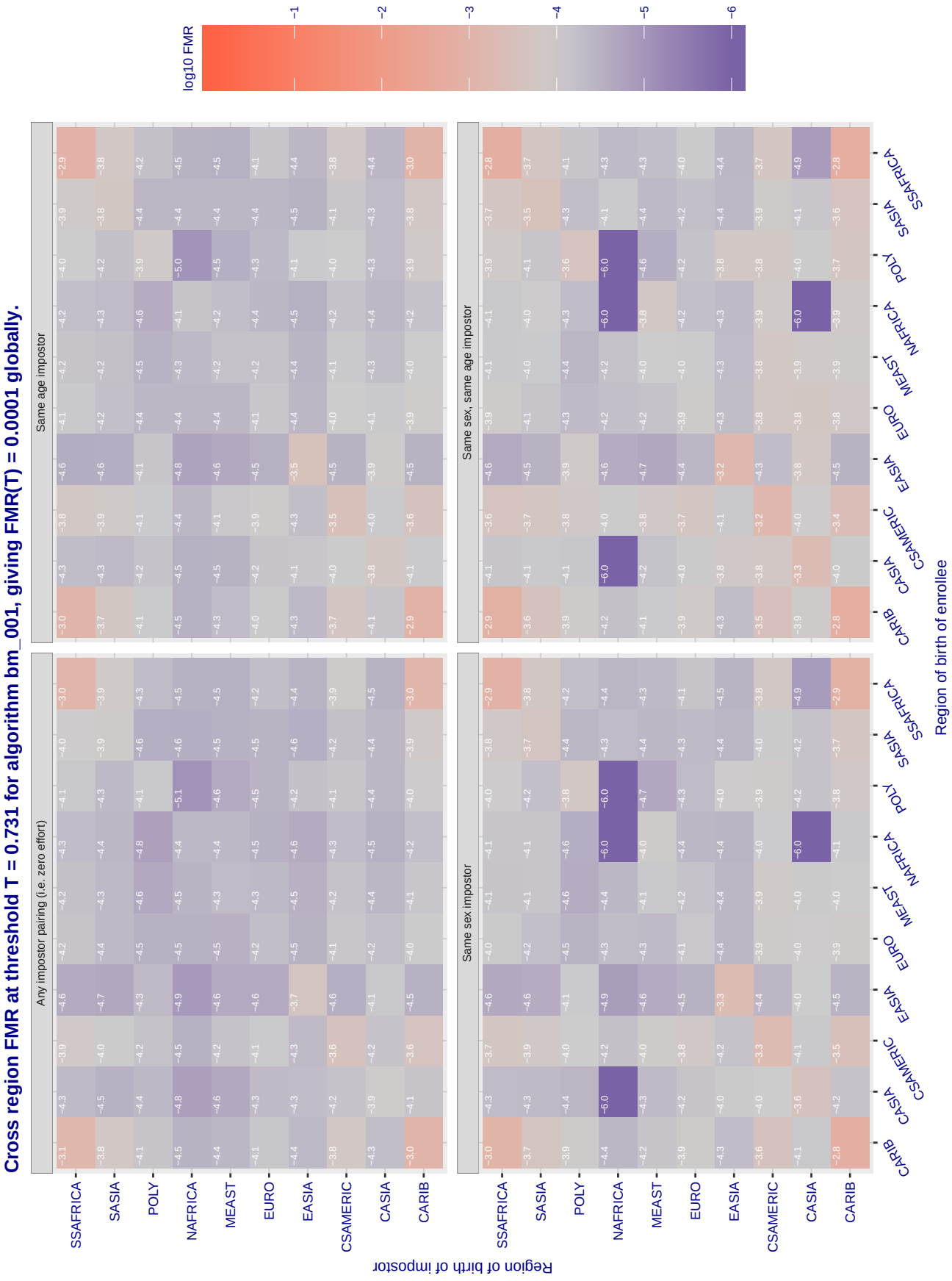


Figure 141: For algorithm bm-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

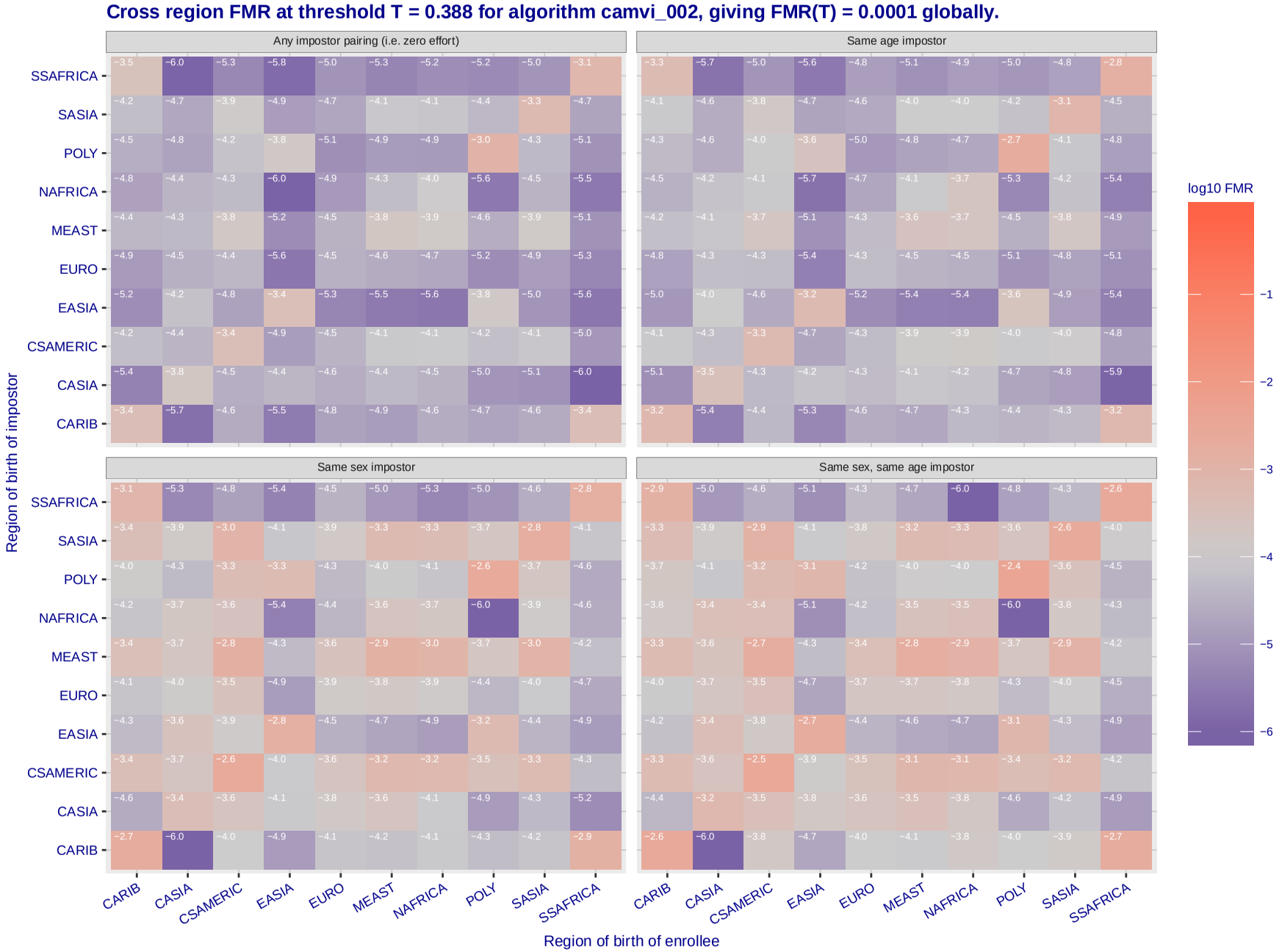


Figure 142: For algorithm camvi-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

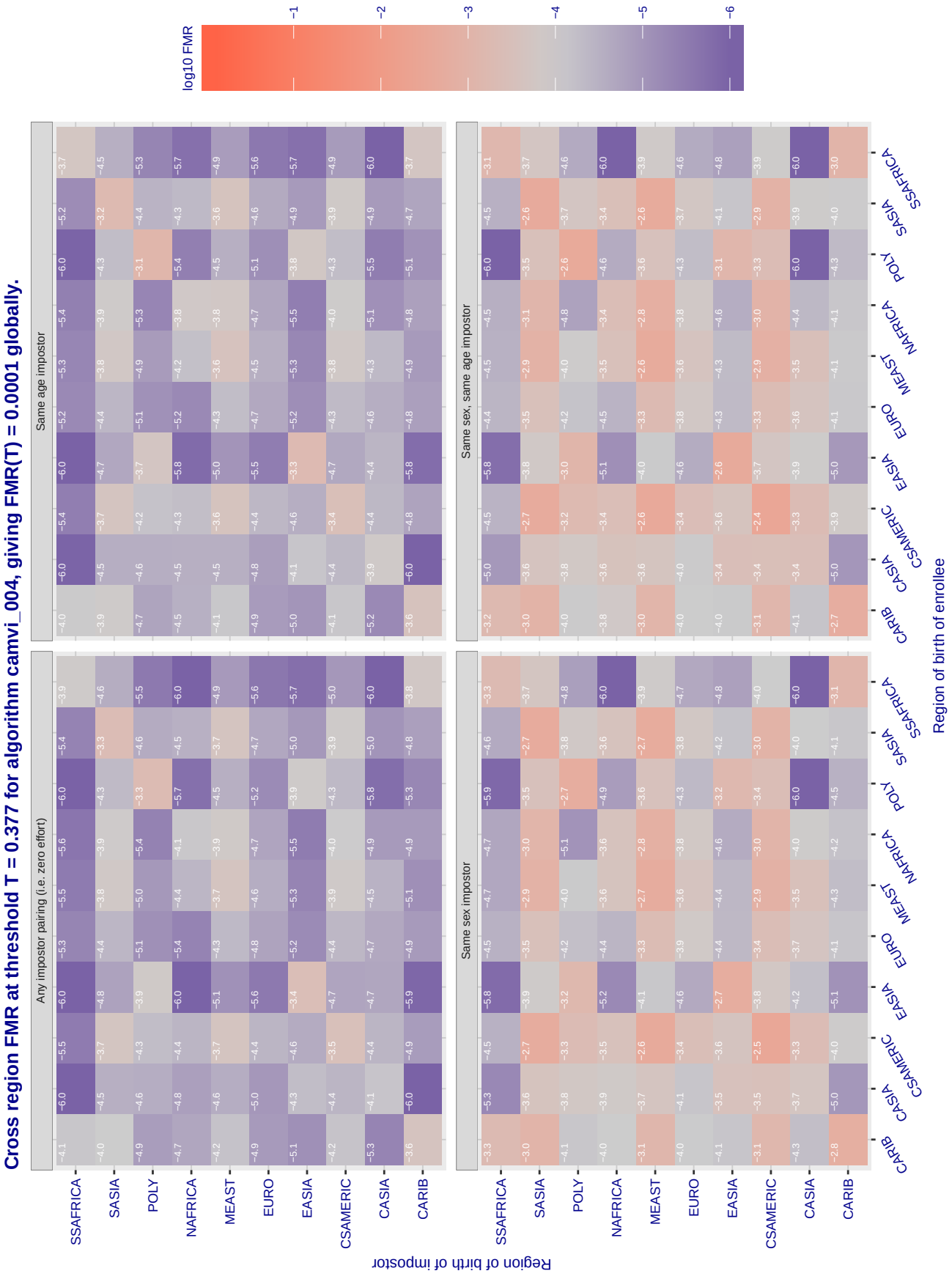


Figure 143: For algorithm camvi-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

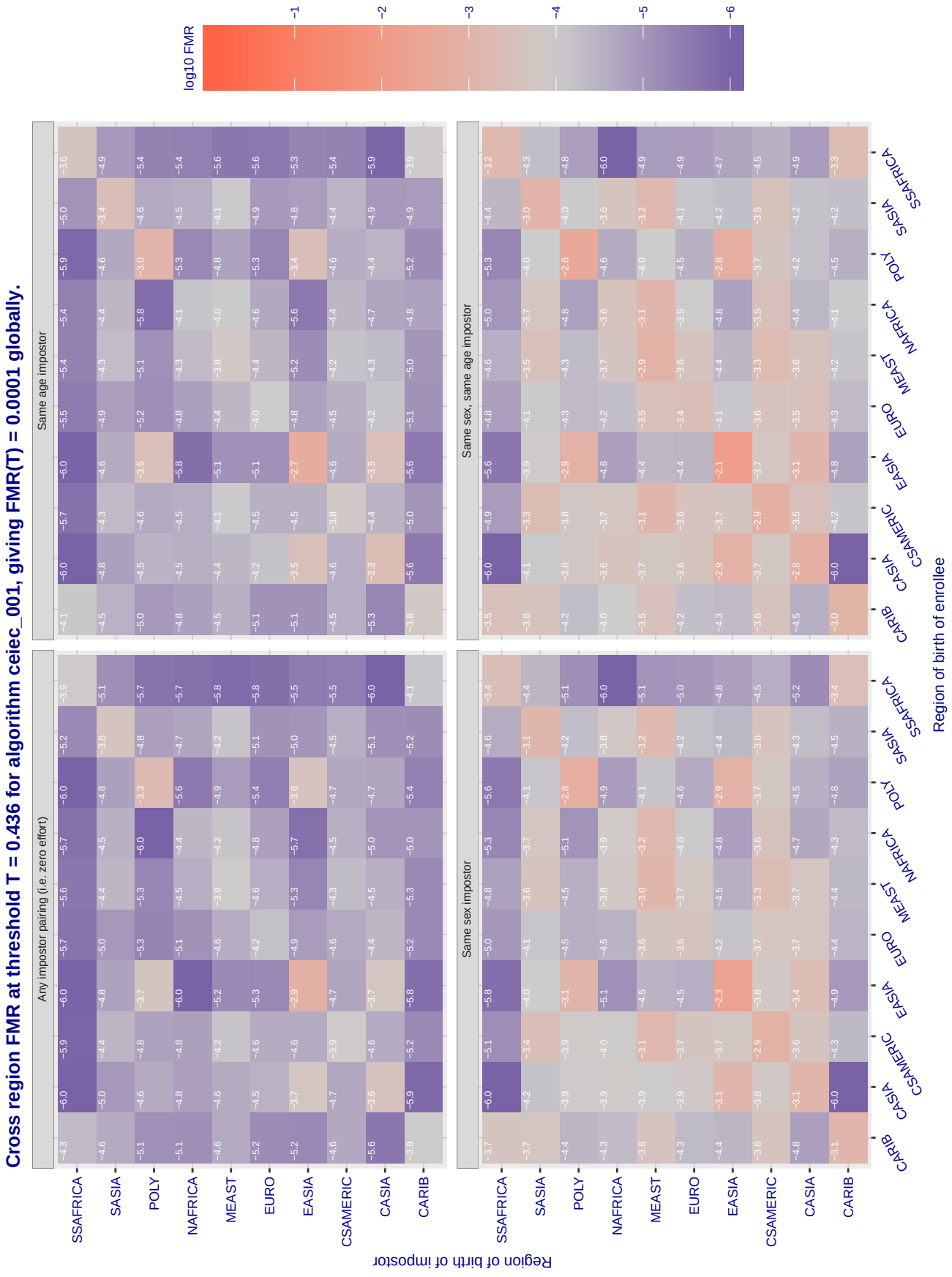


Figure 144: For algorithm ceiec-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

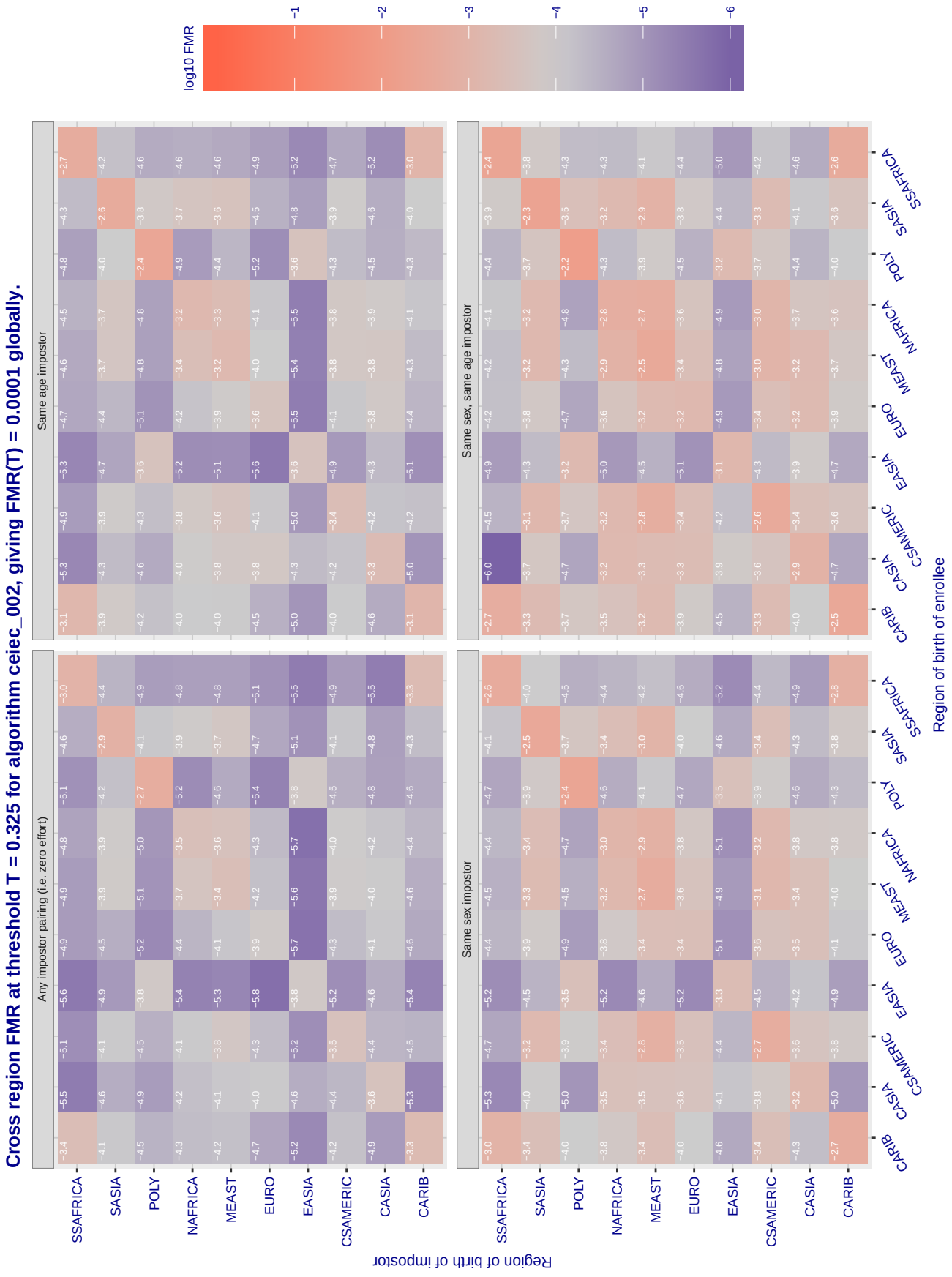


Figure 145: For algorithm ceiec-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

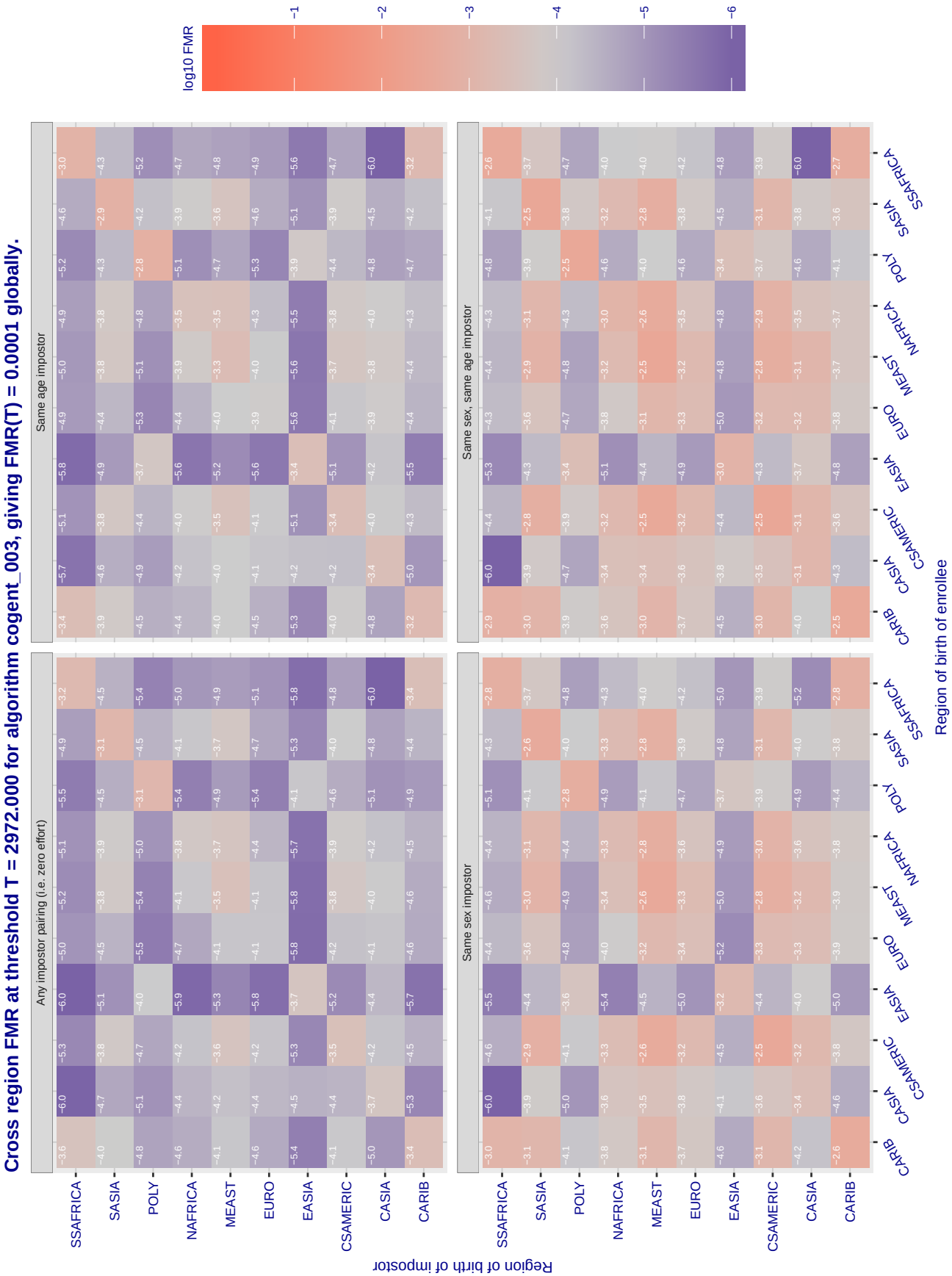


Figure 146: For algorithm cogent-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

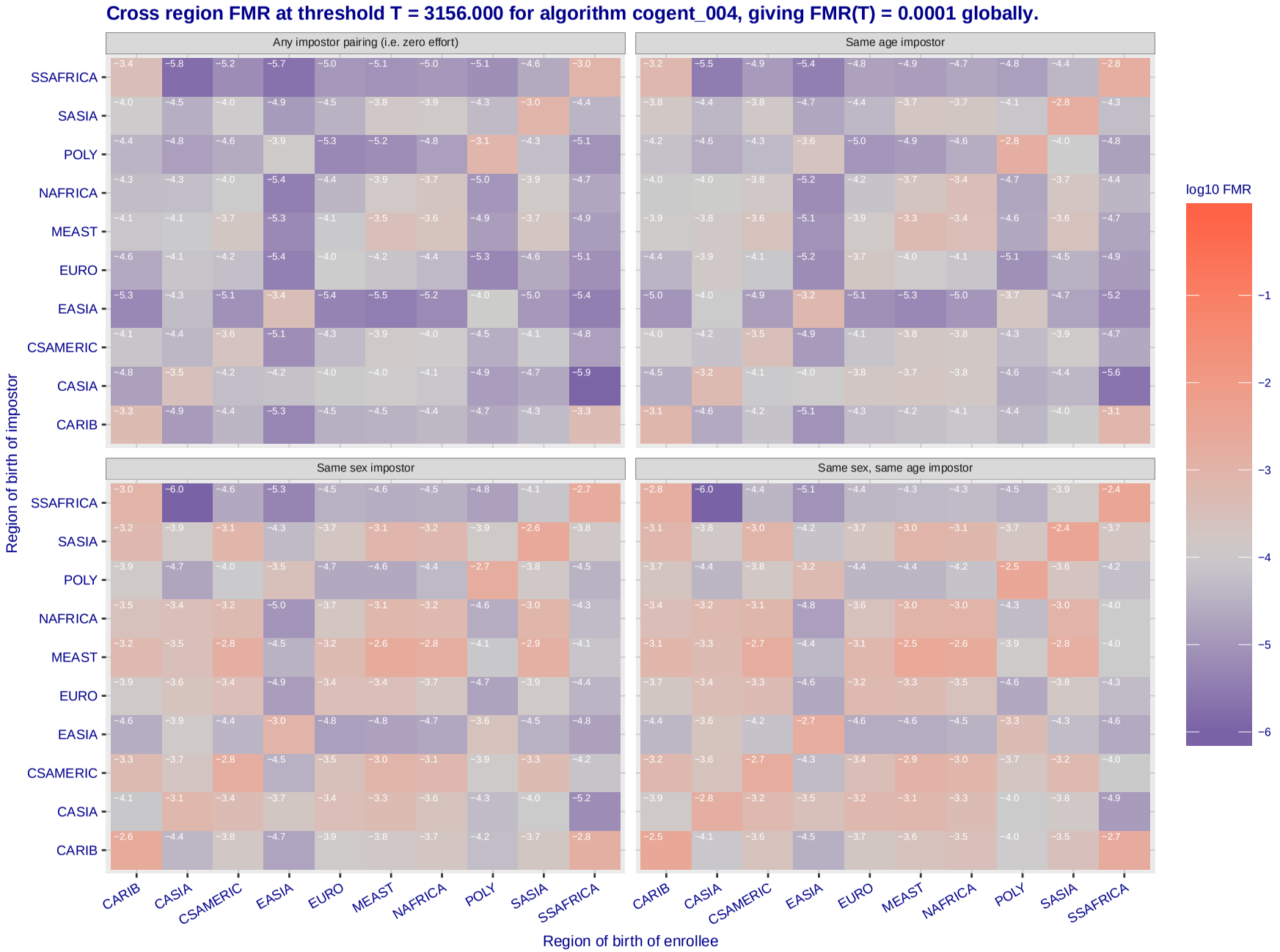


Figure 147: For algorithm cogent-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

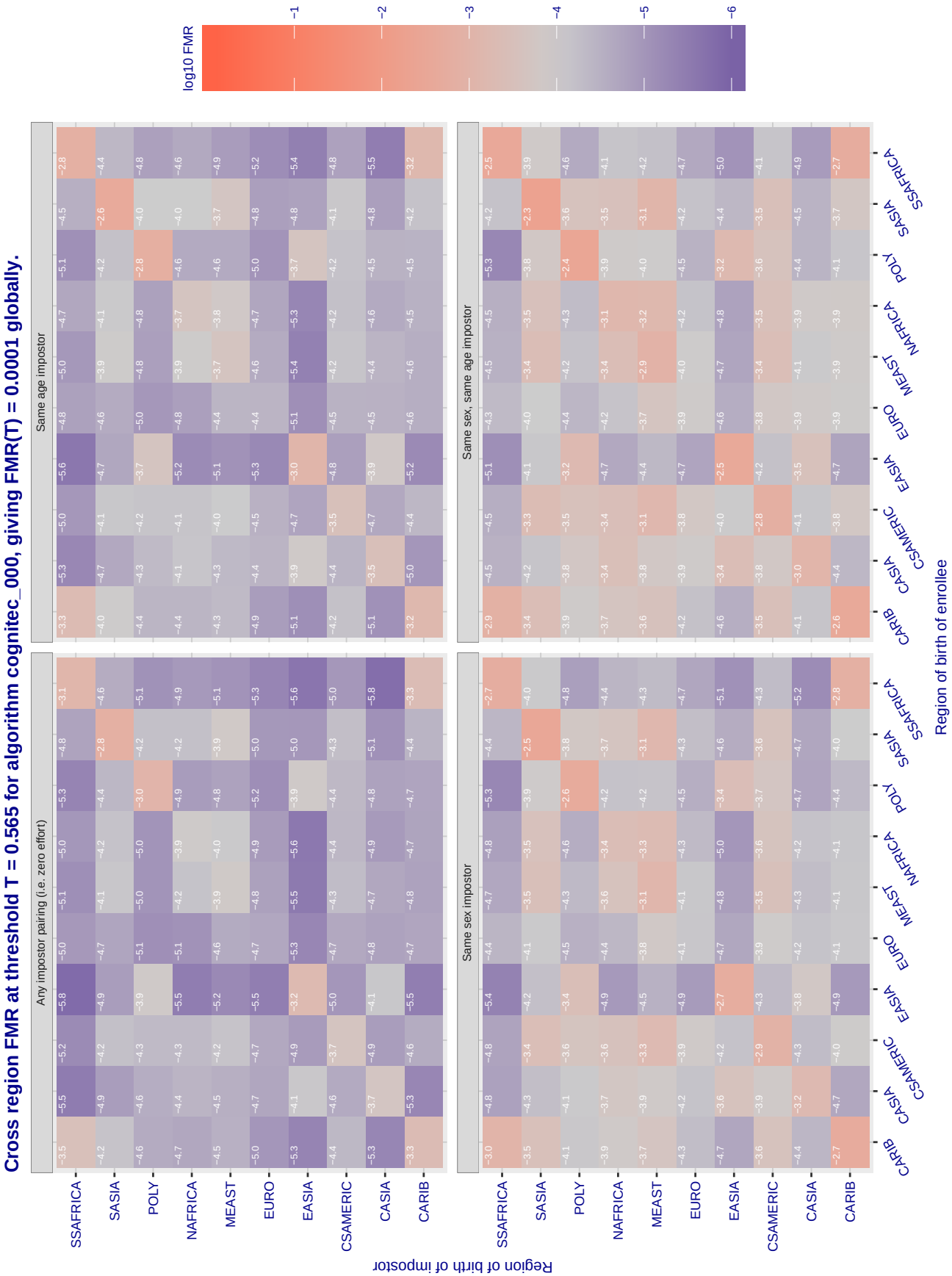


Figure 148: For algorithm cognitec-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

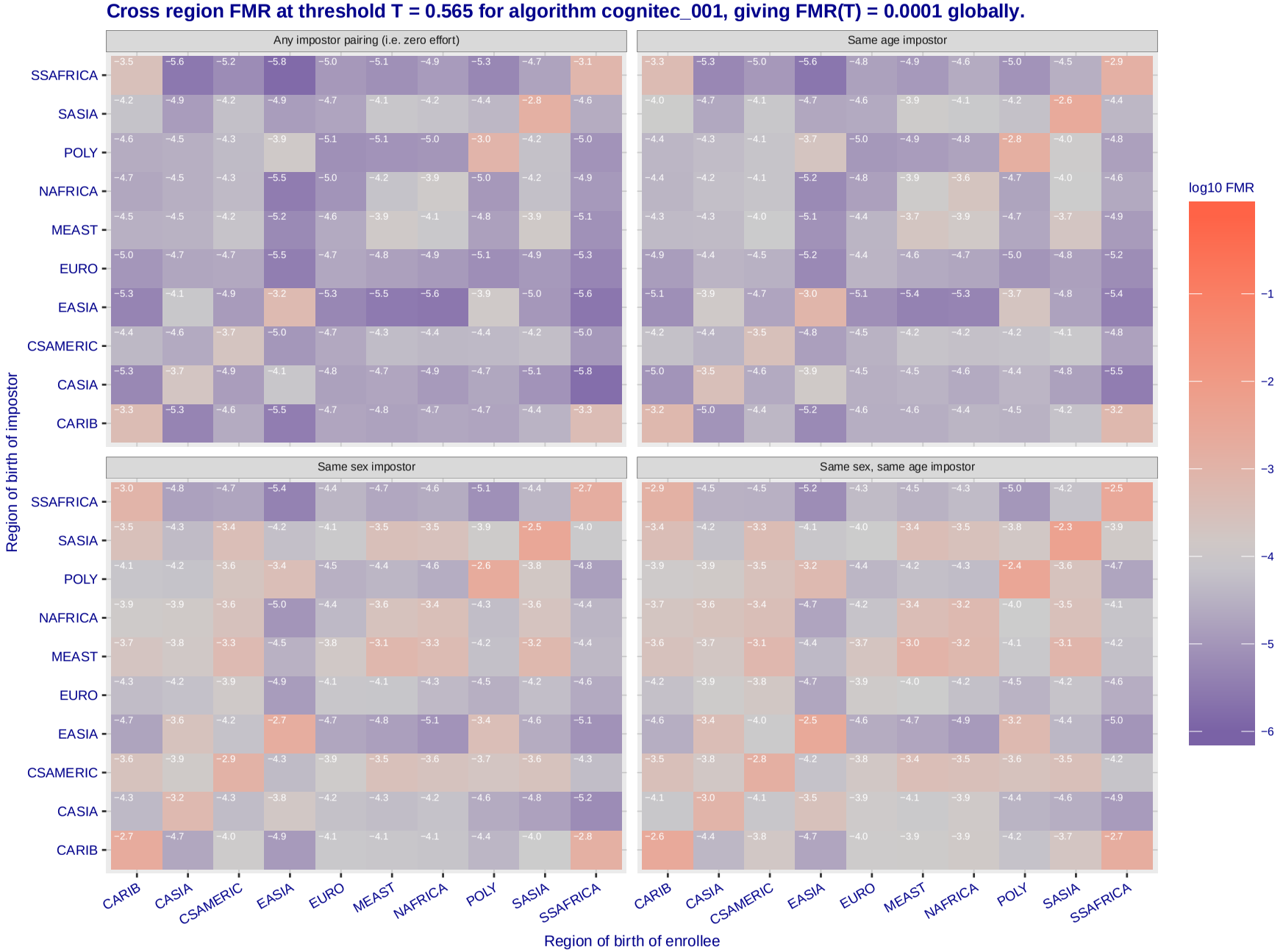


Figure 149: For algorithm cognitec-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

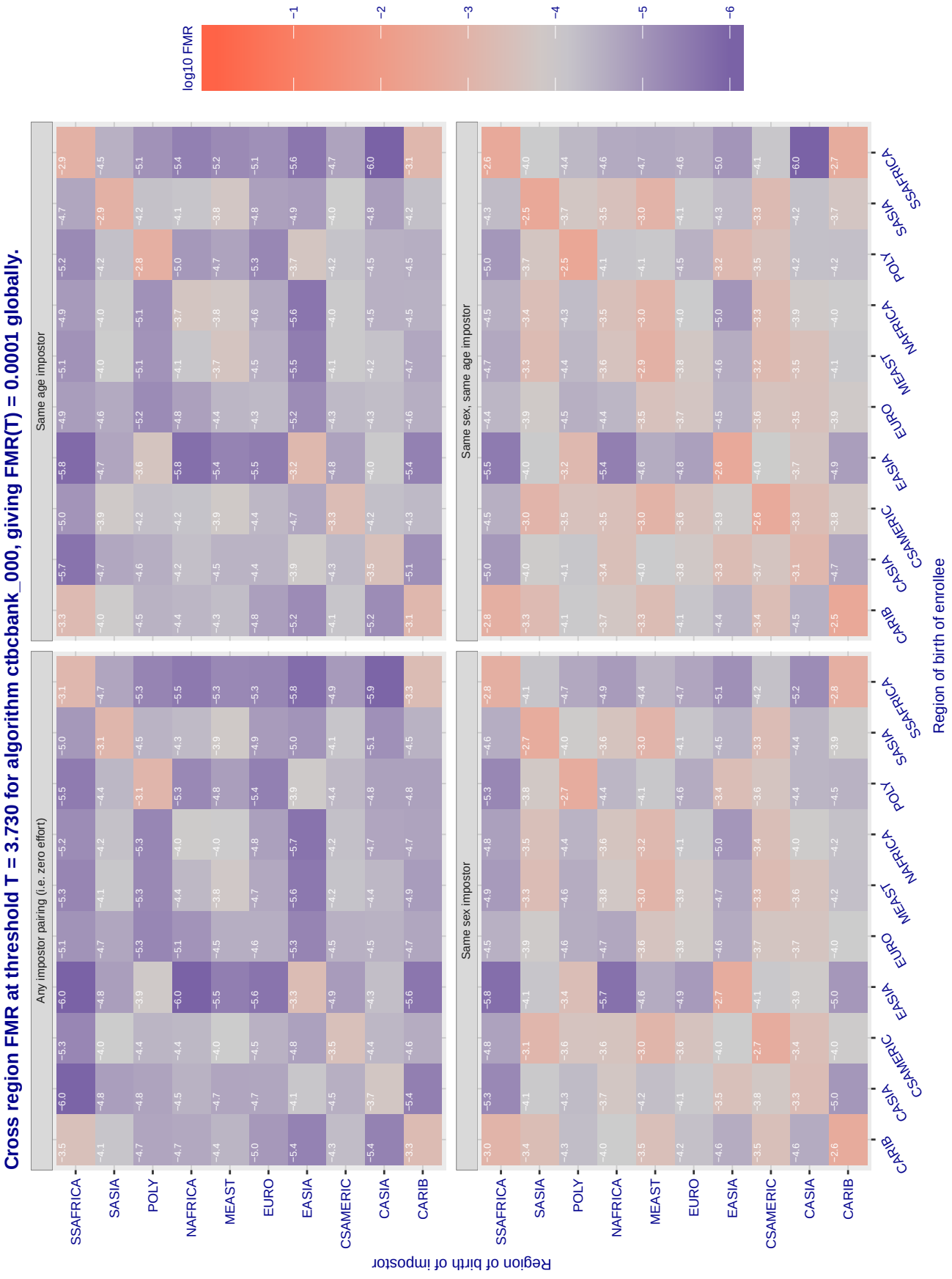


Figure 150: For algorithm ctbcbank-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

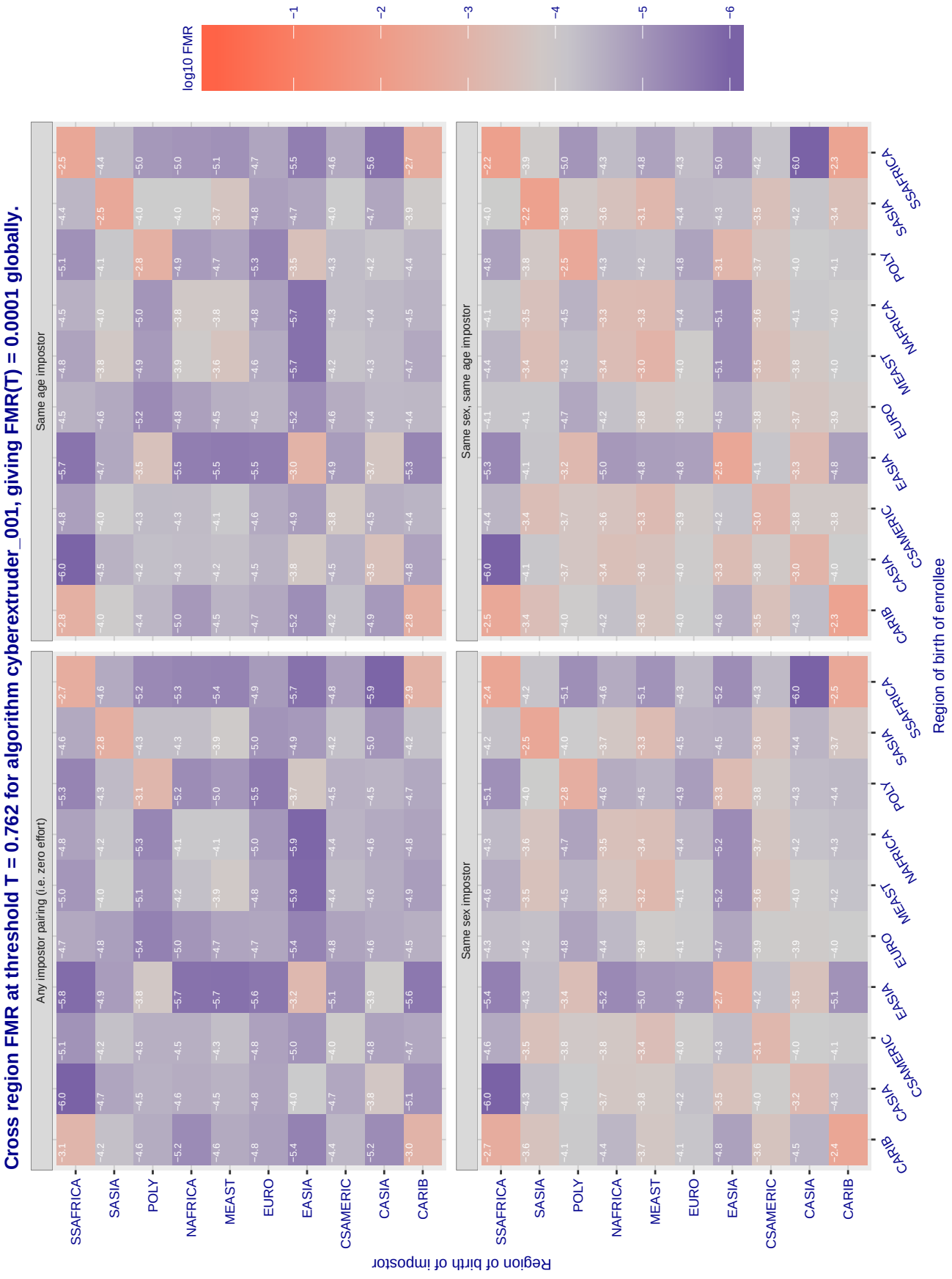


Figure 151: For algorithm cyberextruder-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

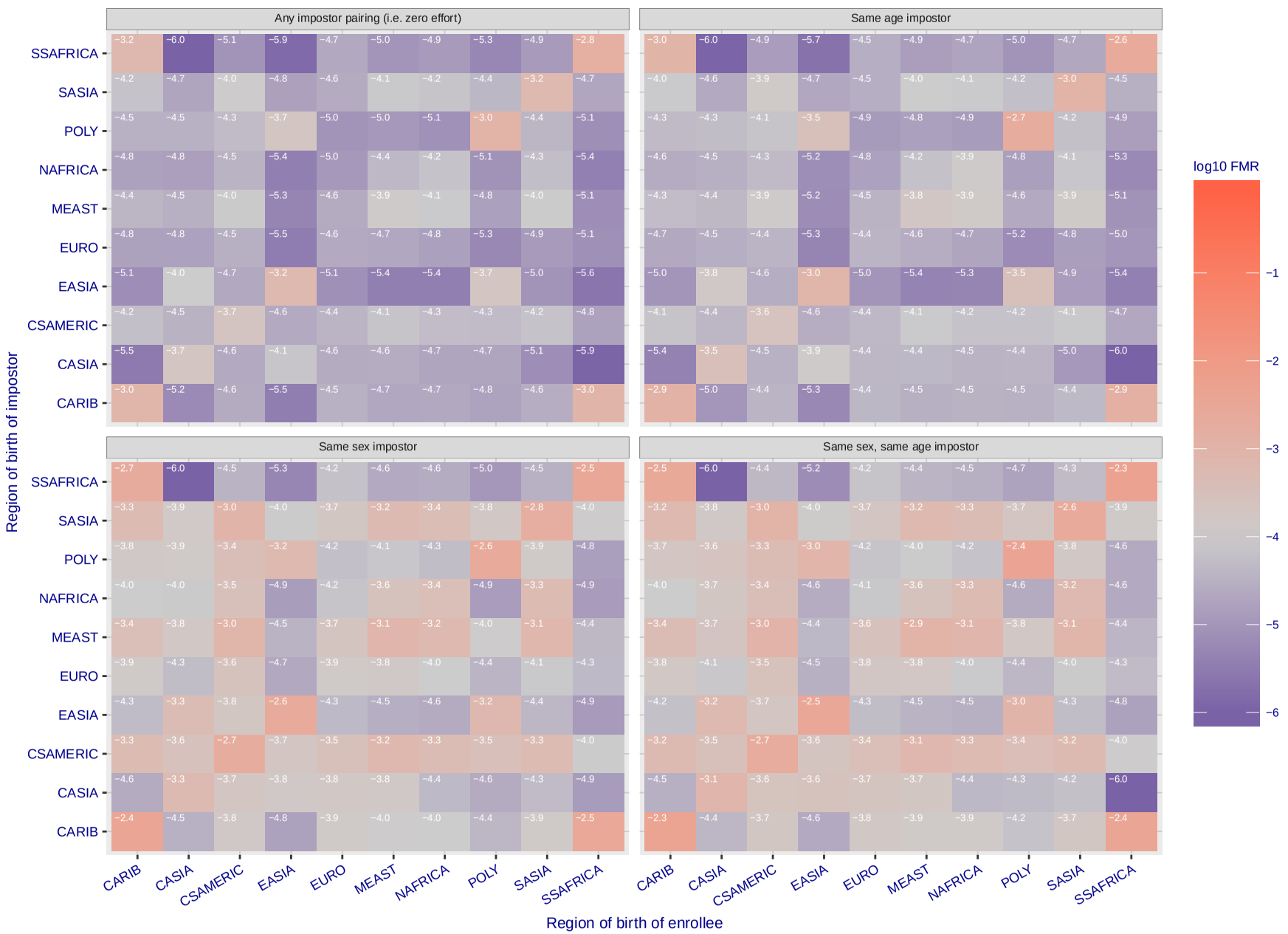


Figure 152: For algorithm cyberextruder-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

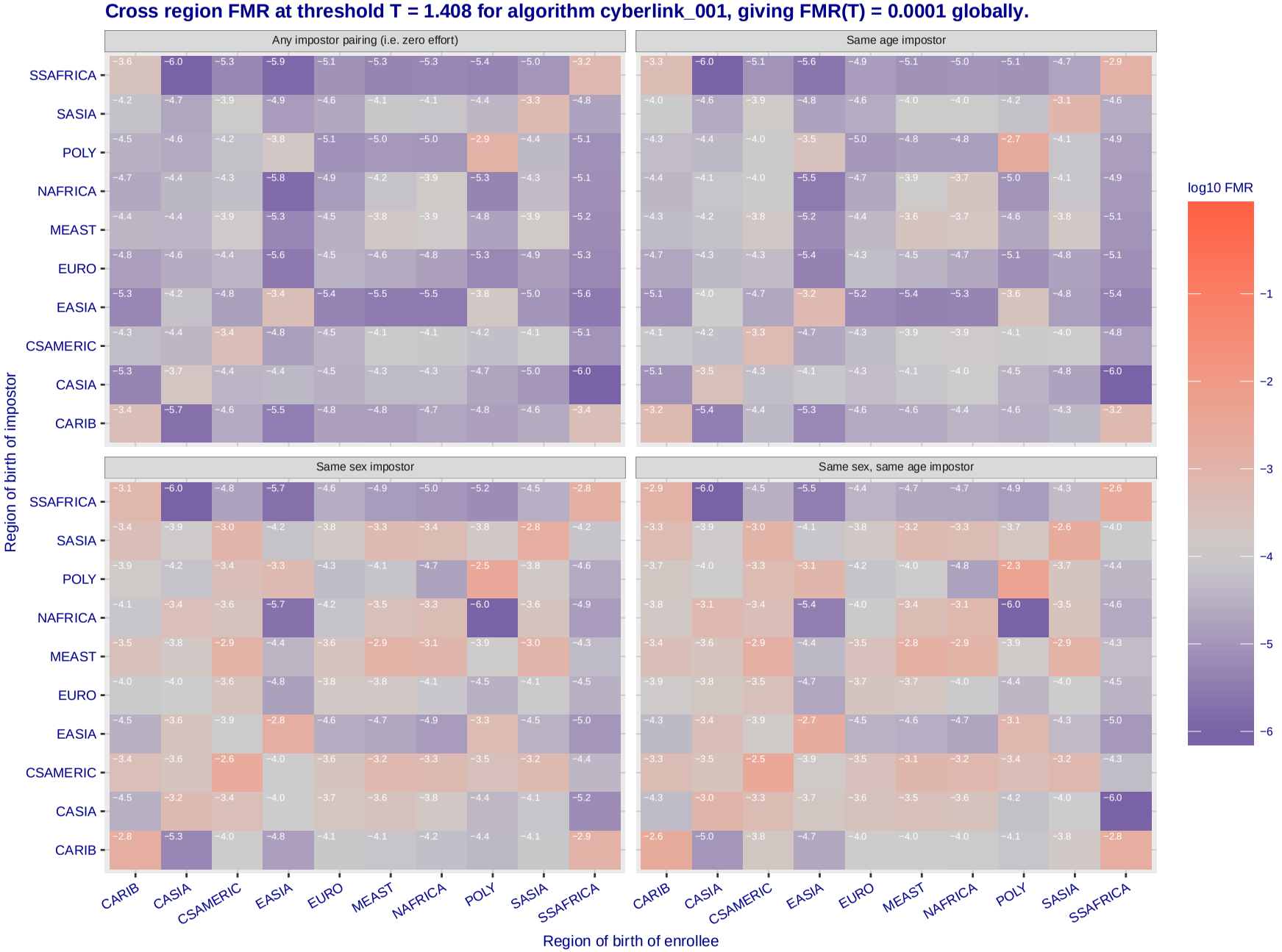


Figure 153: For algorithm cyberlink-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

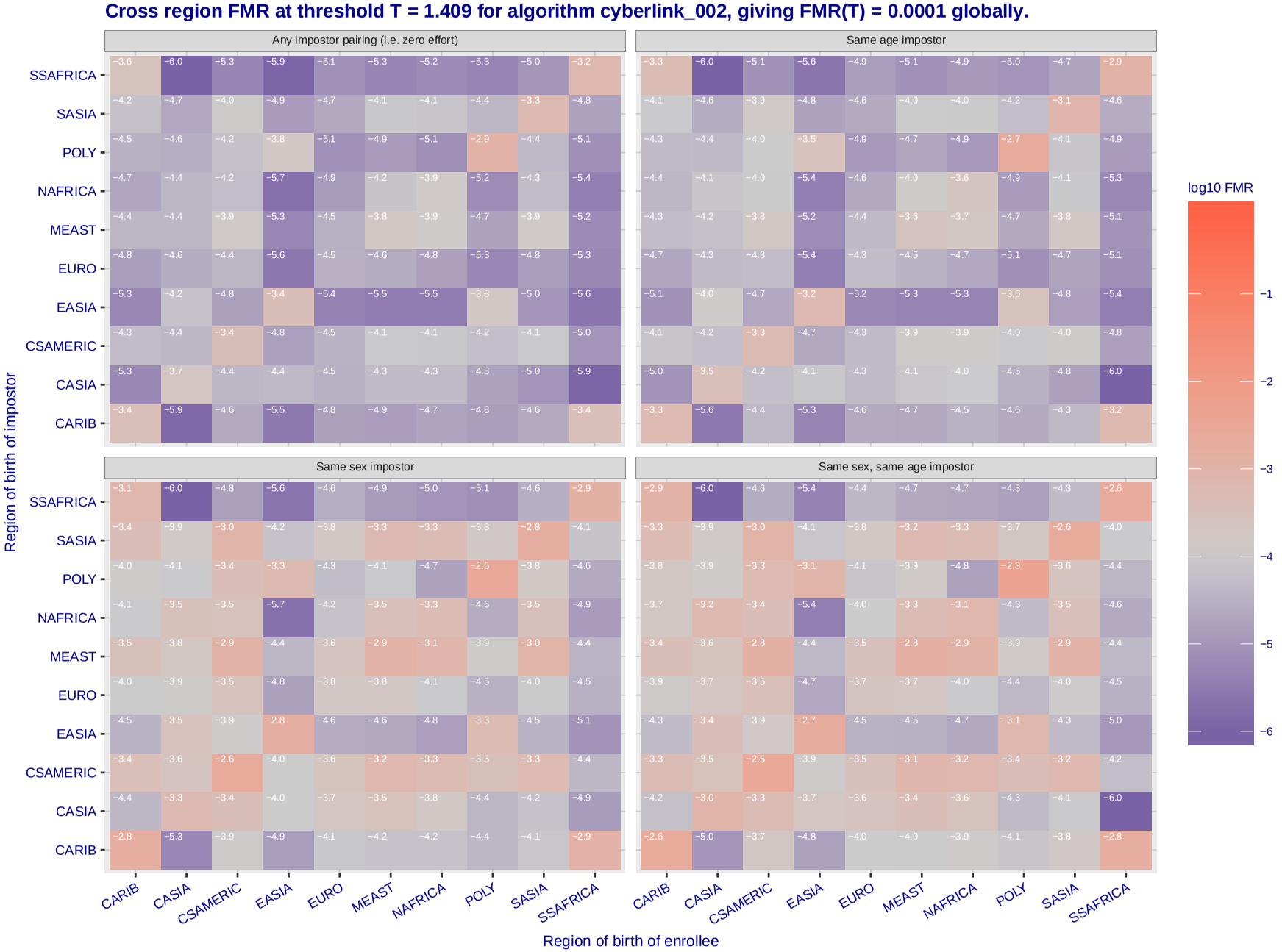


Figure 154: For algorithm cyberlink-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

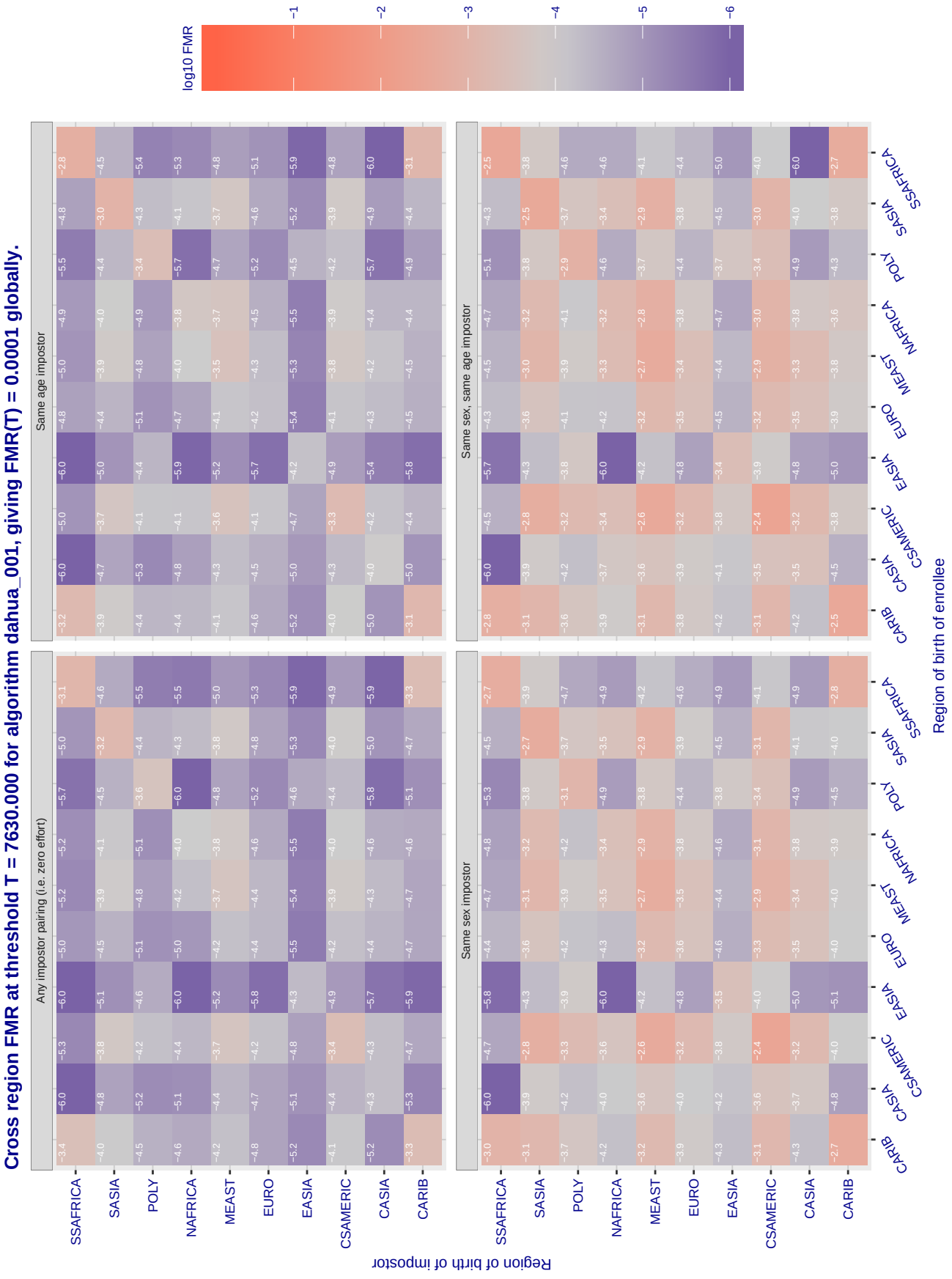


Figure 155: For algorithm dahua-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

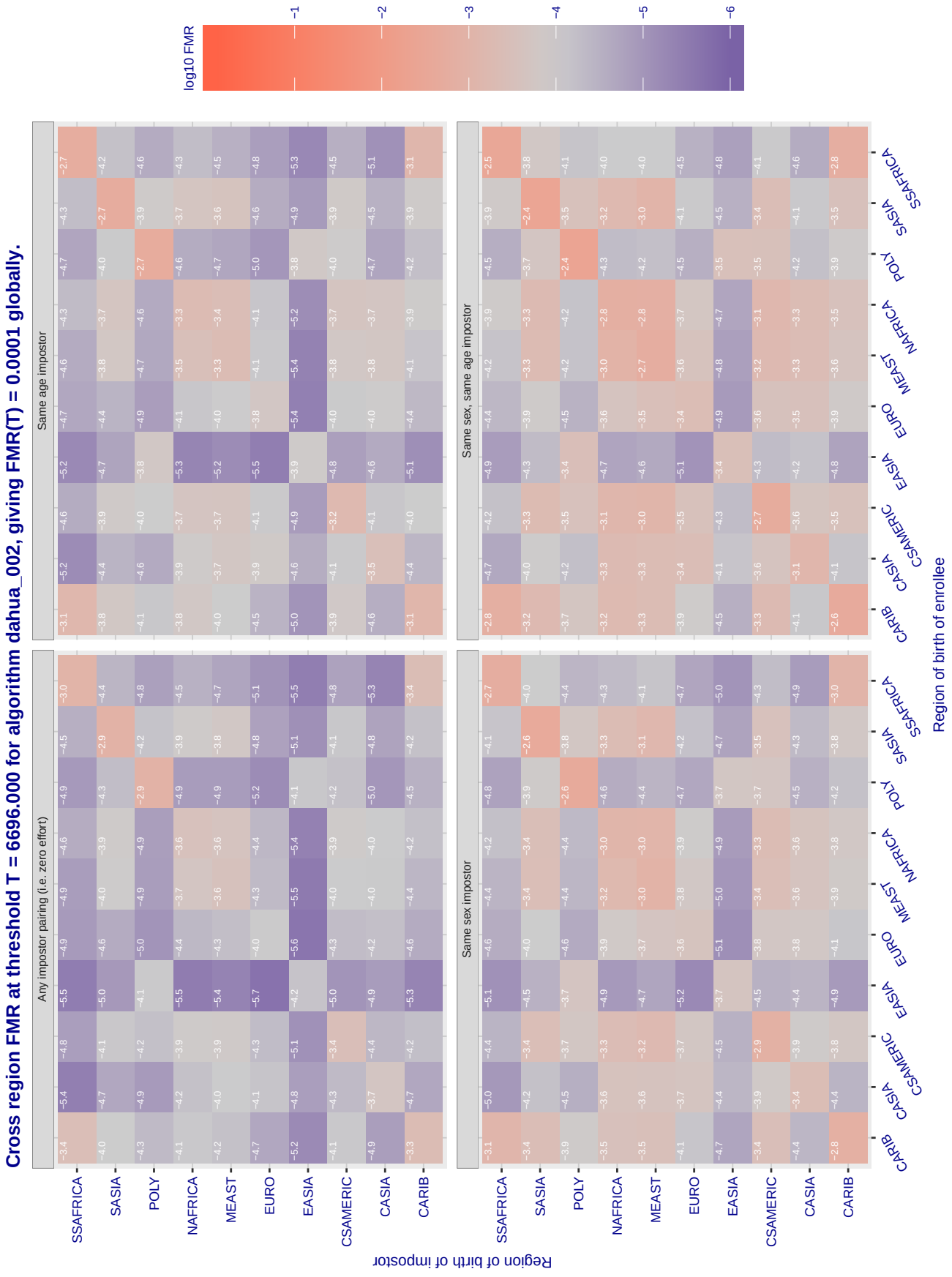


Figure 156: For algorithm dahua-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

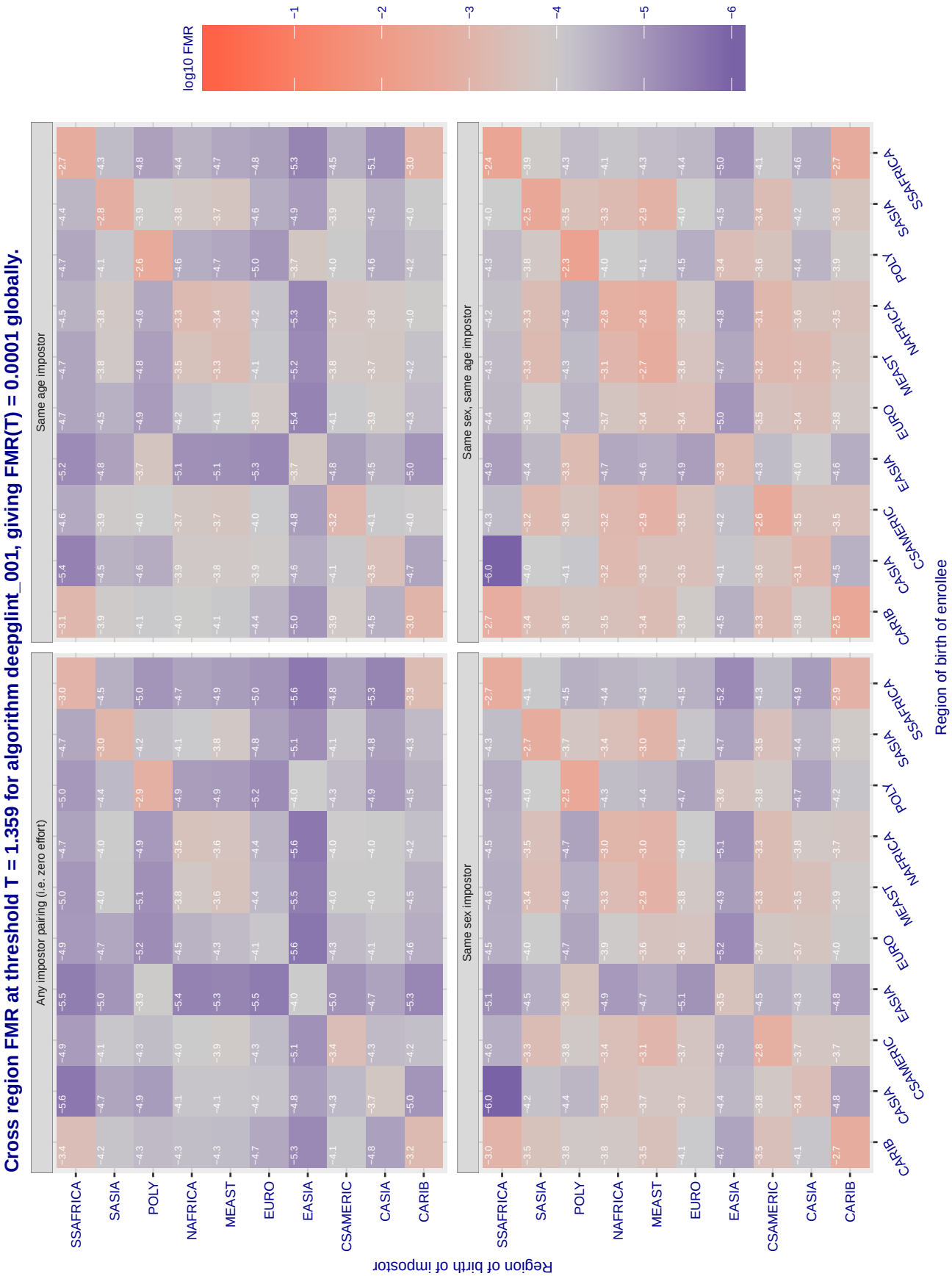


Figure 157: For algorithm deepglint-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

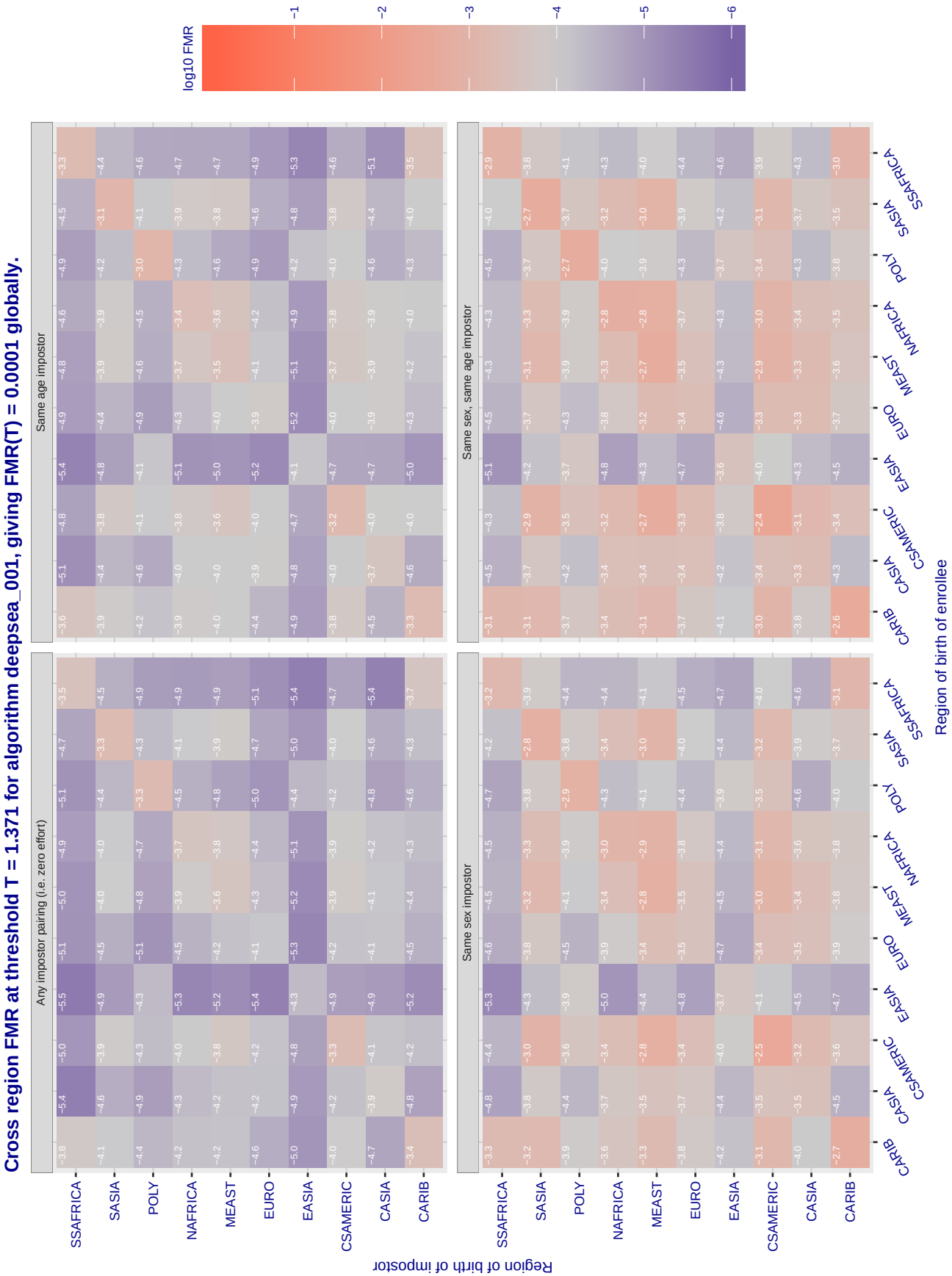


Figure 158: For algorithm deepsea-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

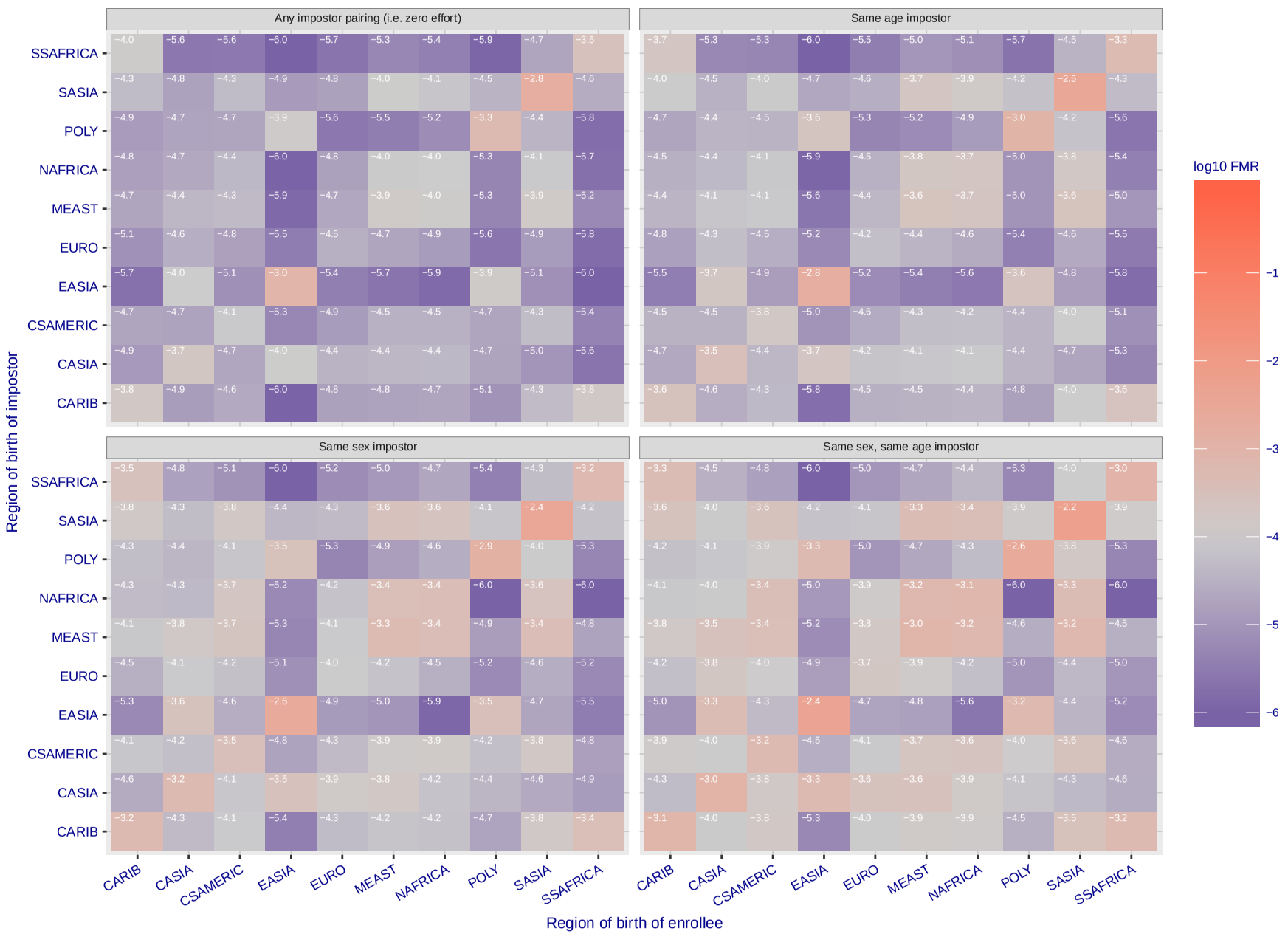


Figure 159: For algorithm dermalog-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

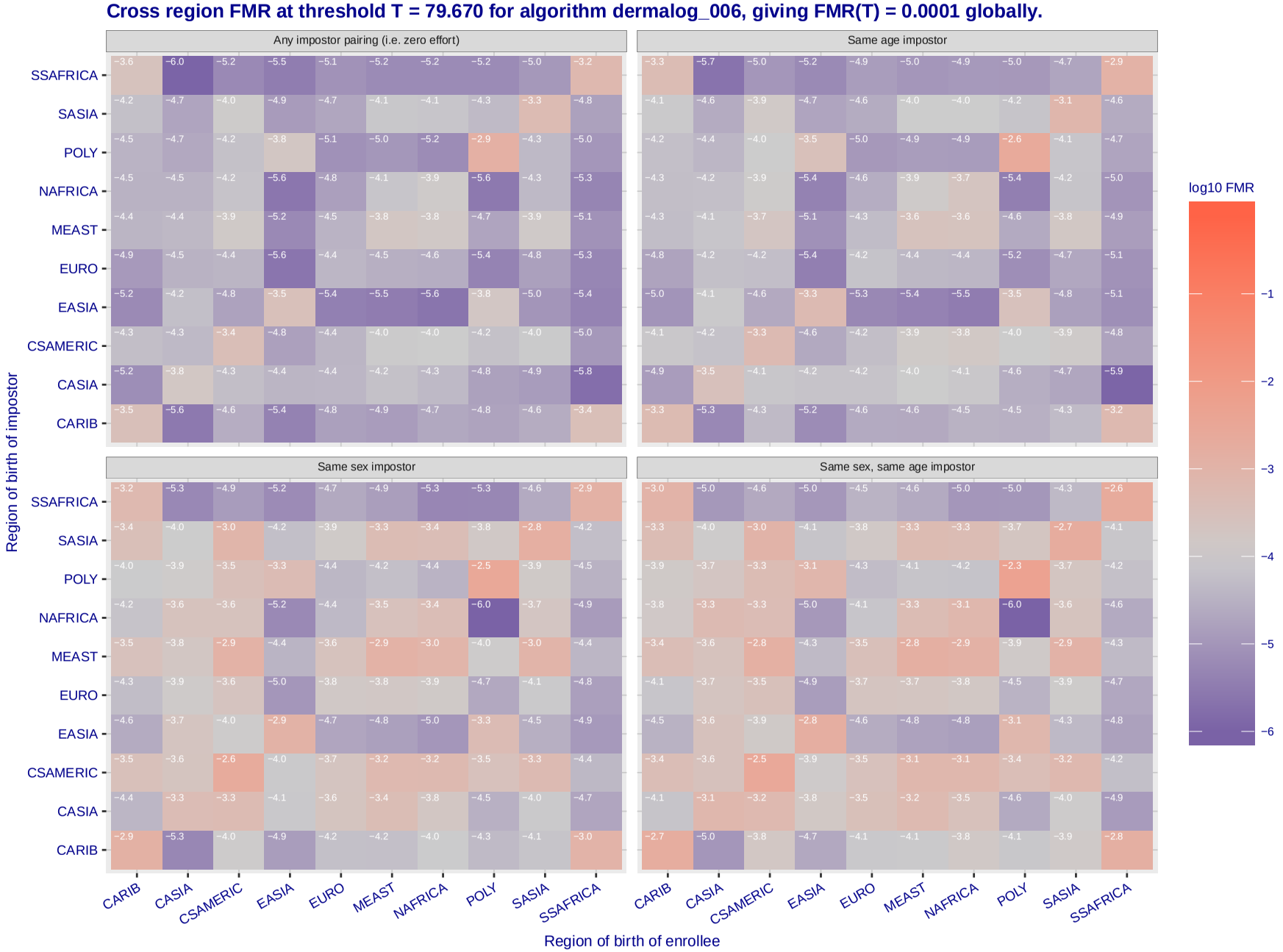


Figure 160: For algorithm dermalog-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

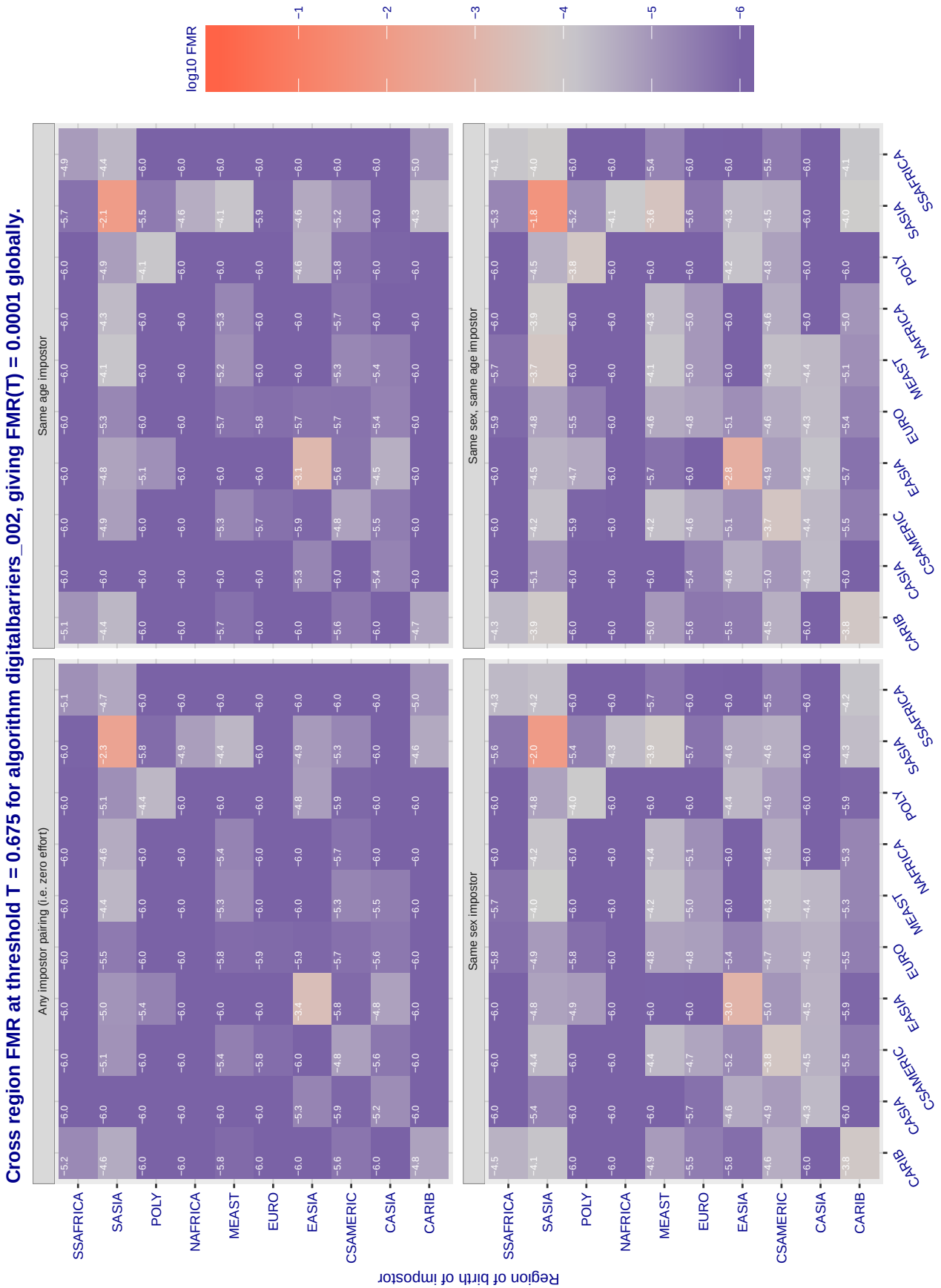


Figure 161: For algorithm digitalbarriers-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

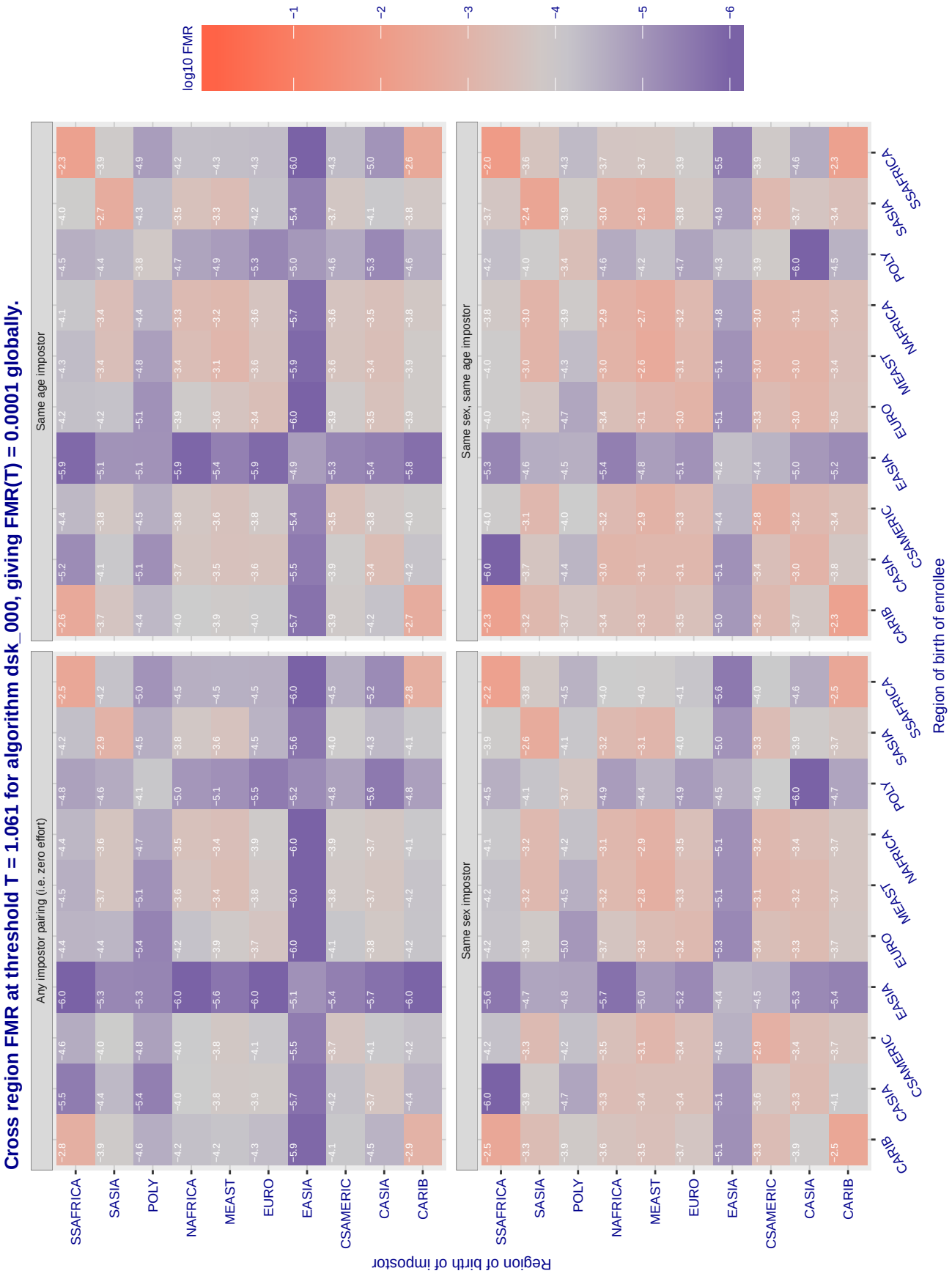


Figure 162: For algorithm dsk-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

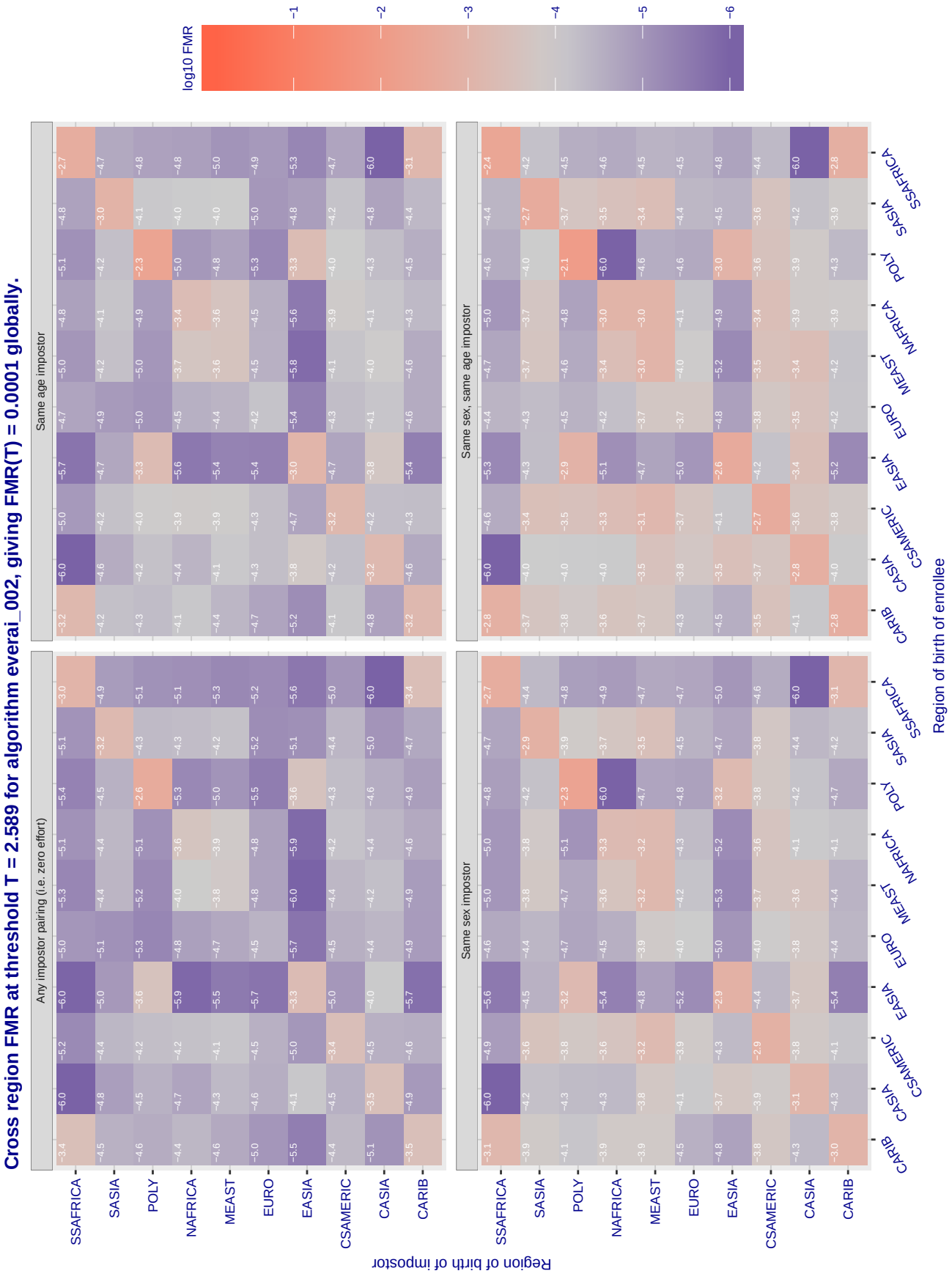


Figure 163: For algorithm everai-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

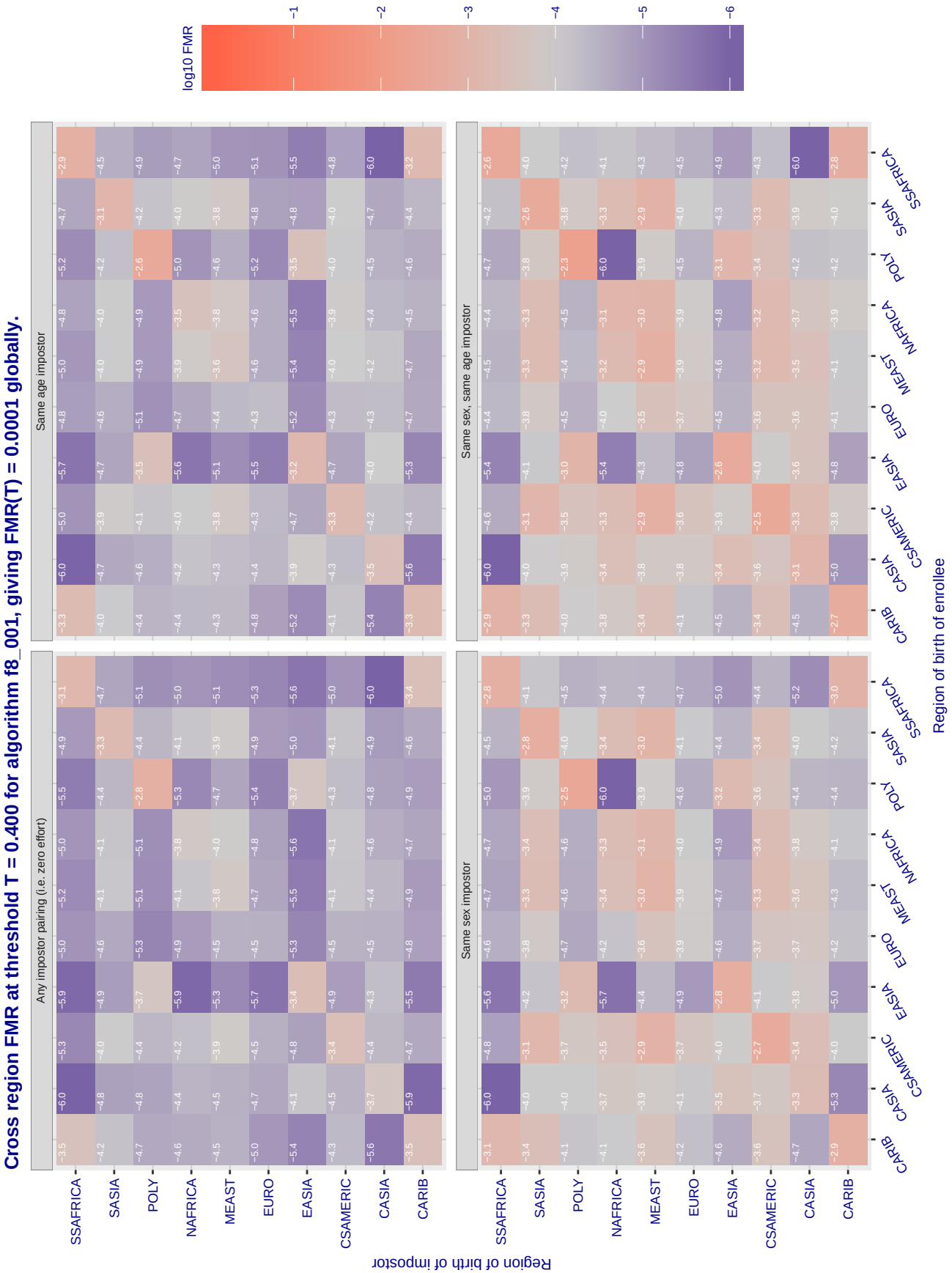


Figure 164: For algorithm f8-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

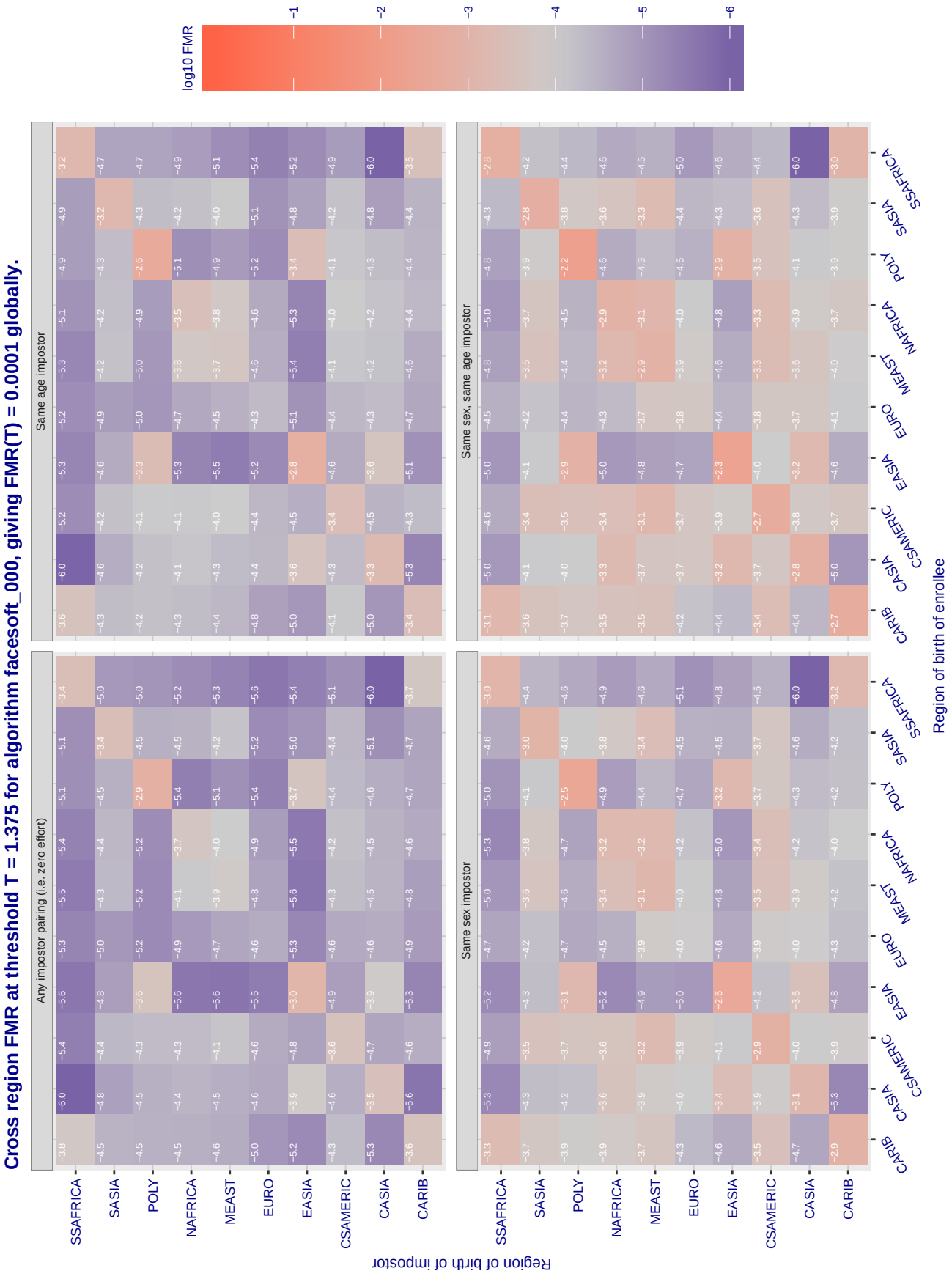


Figure 165: For algorithm facesoft-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

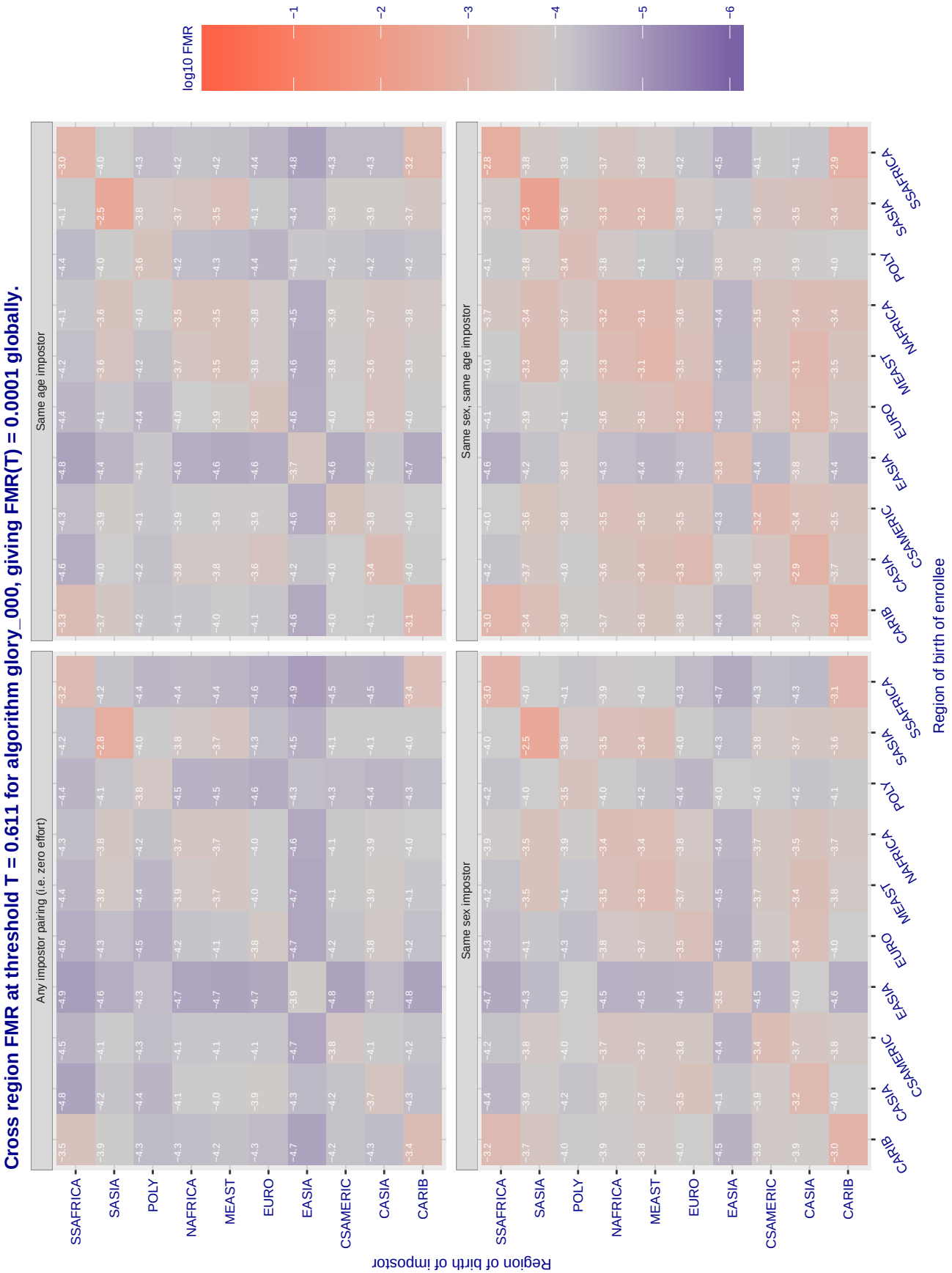


Figure 166: For algorithm glory-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

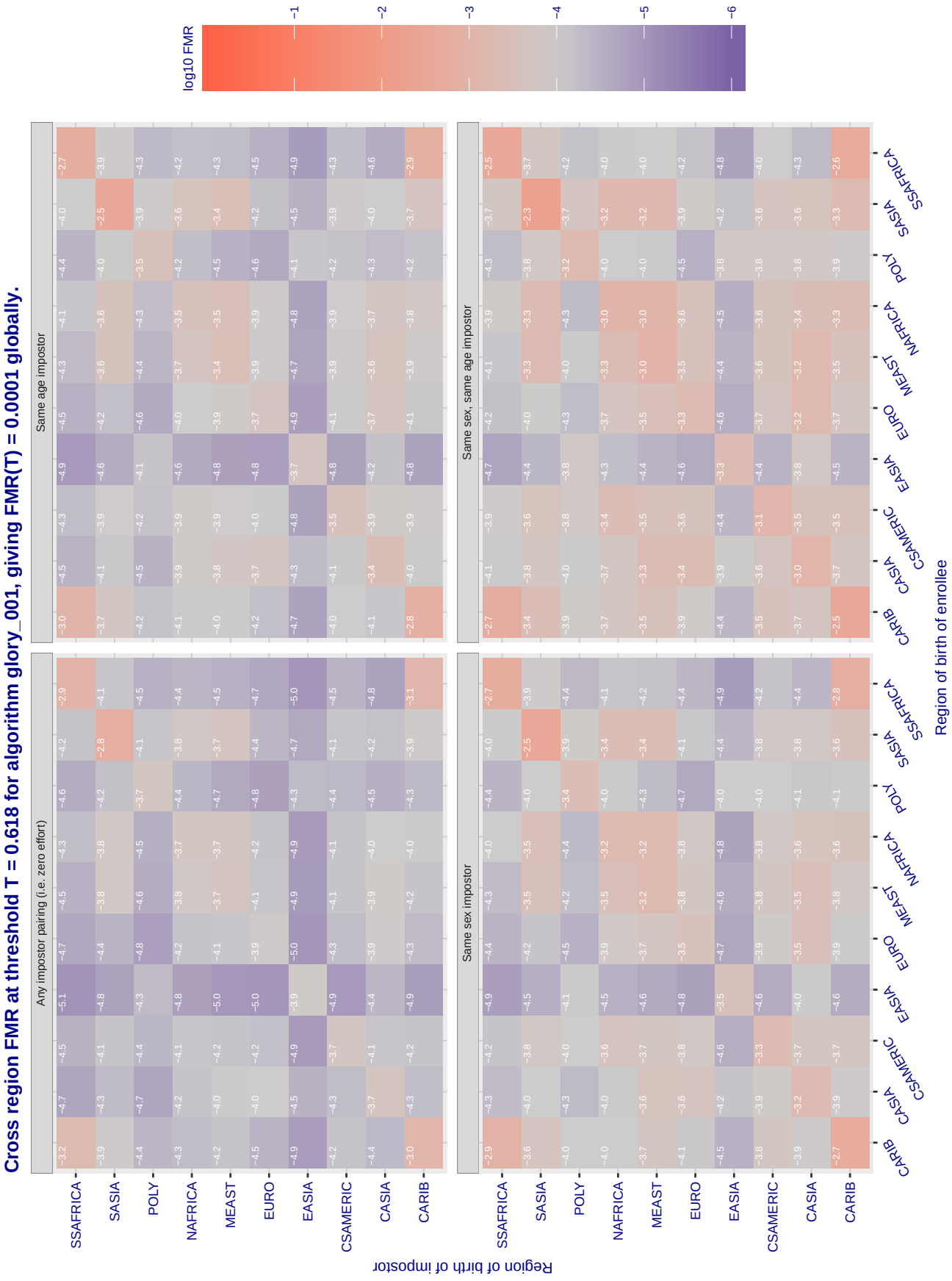


Figure 167: For algorithm glory-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

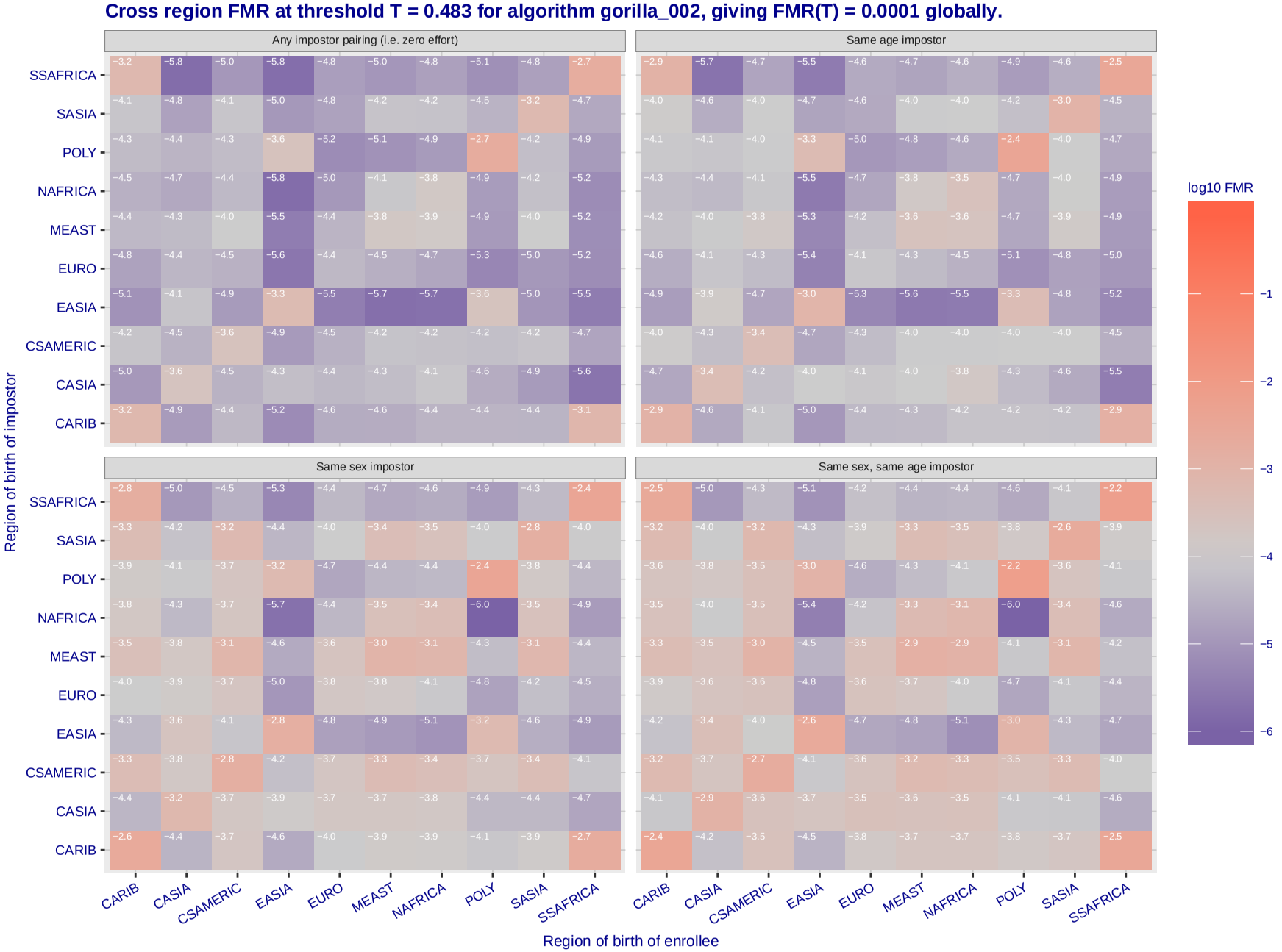


Figure 168: For algorithm gorilla-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

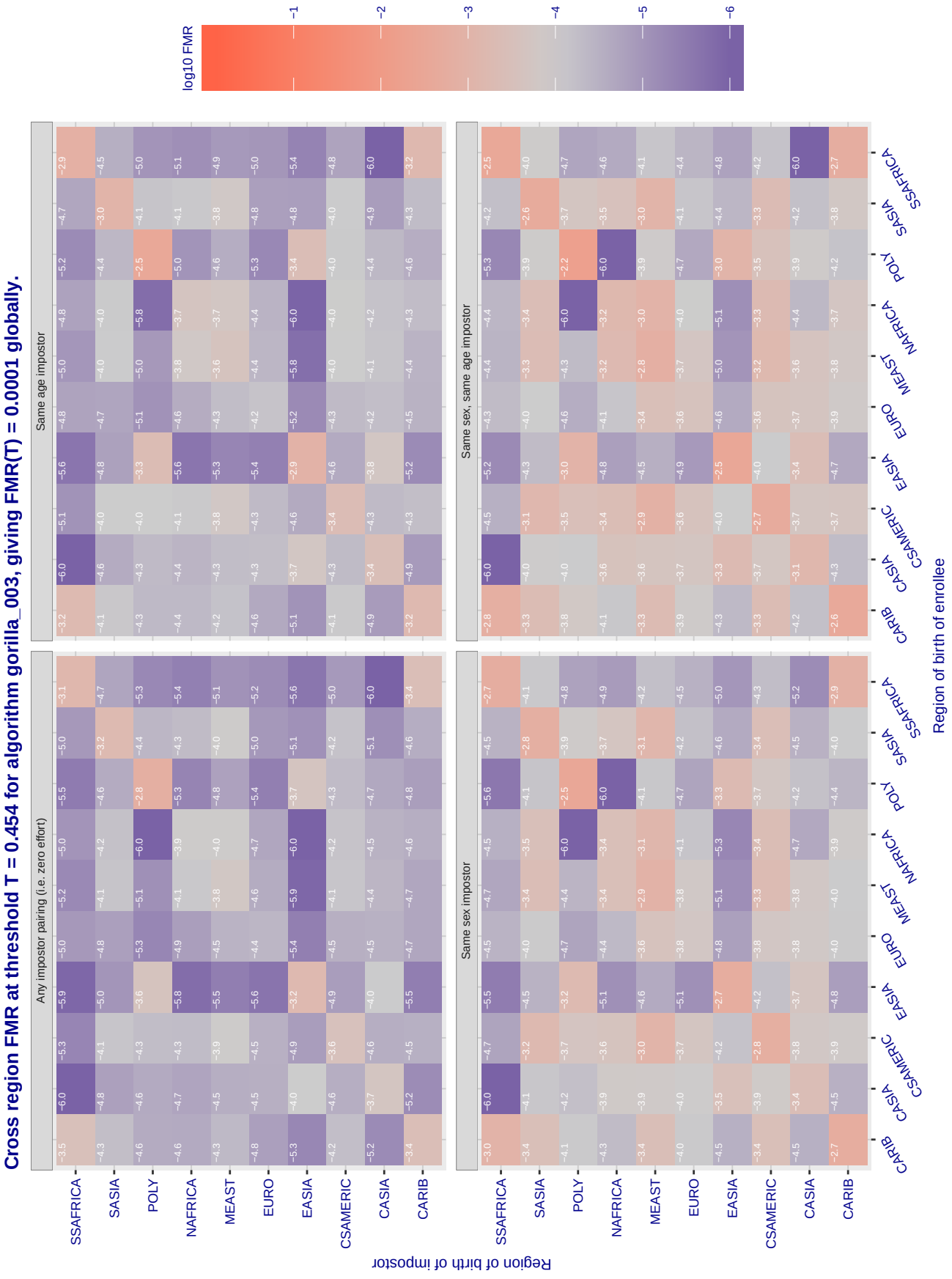


Figure 169: For algorithm gorilla-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

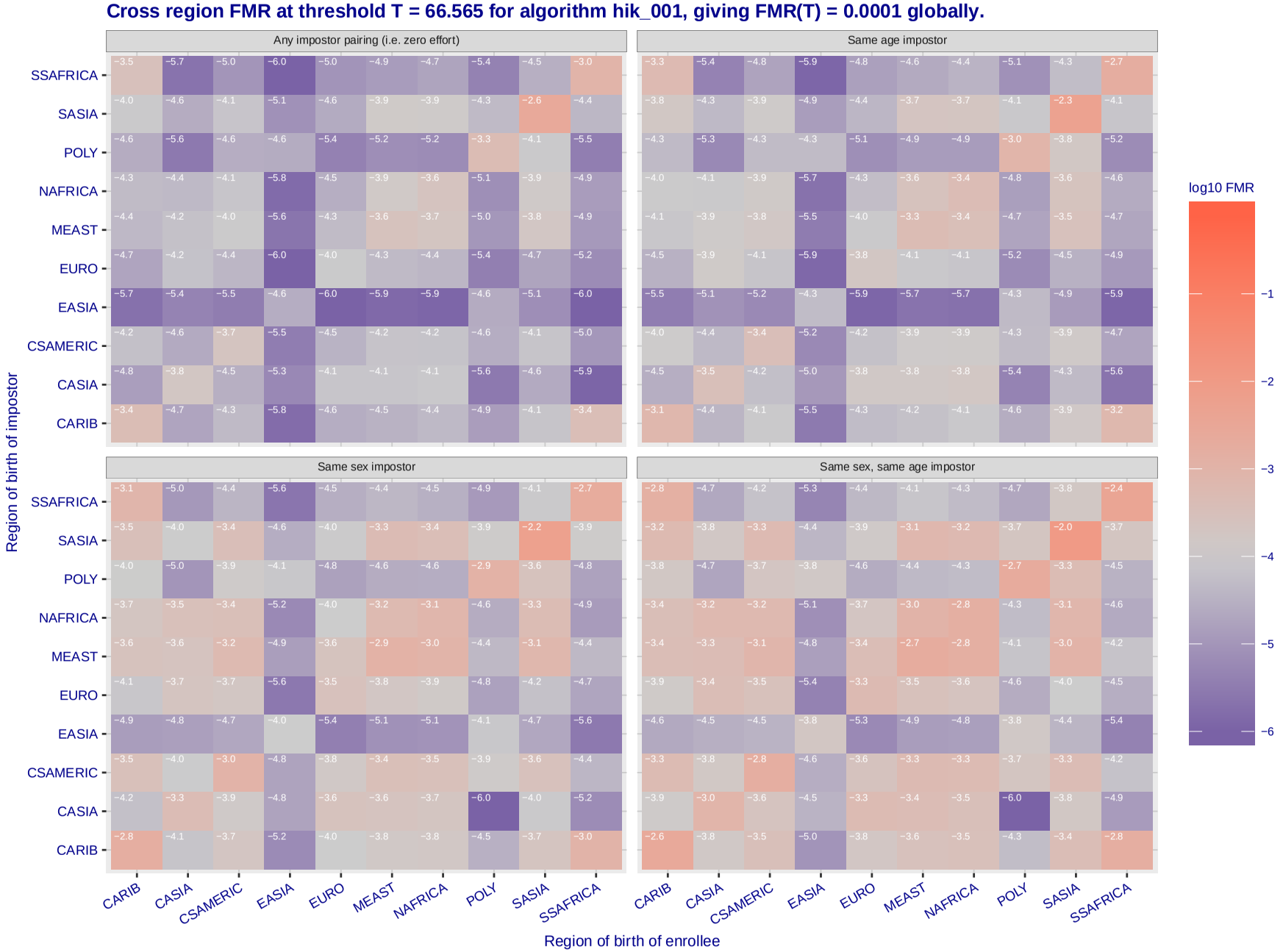


Figure 170: For algorithm hik-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

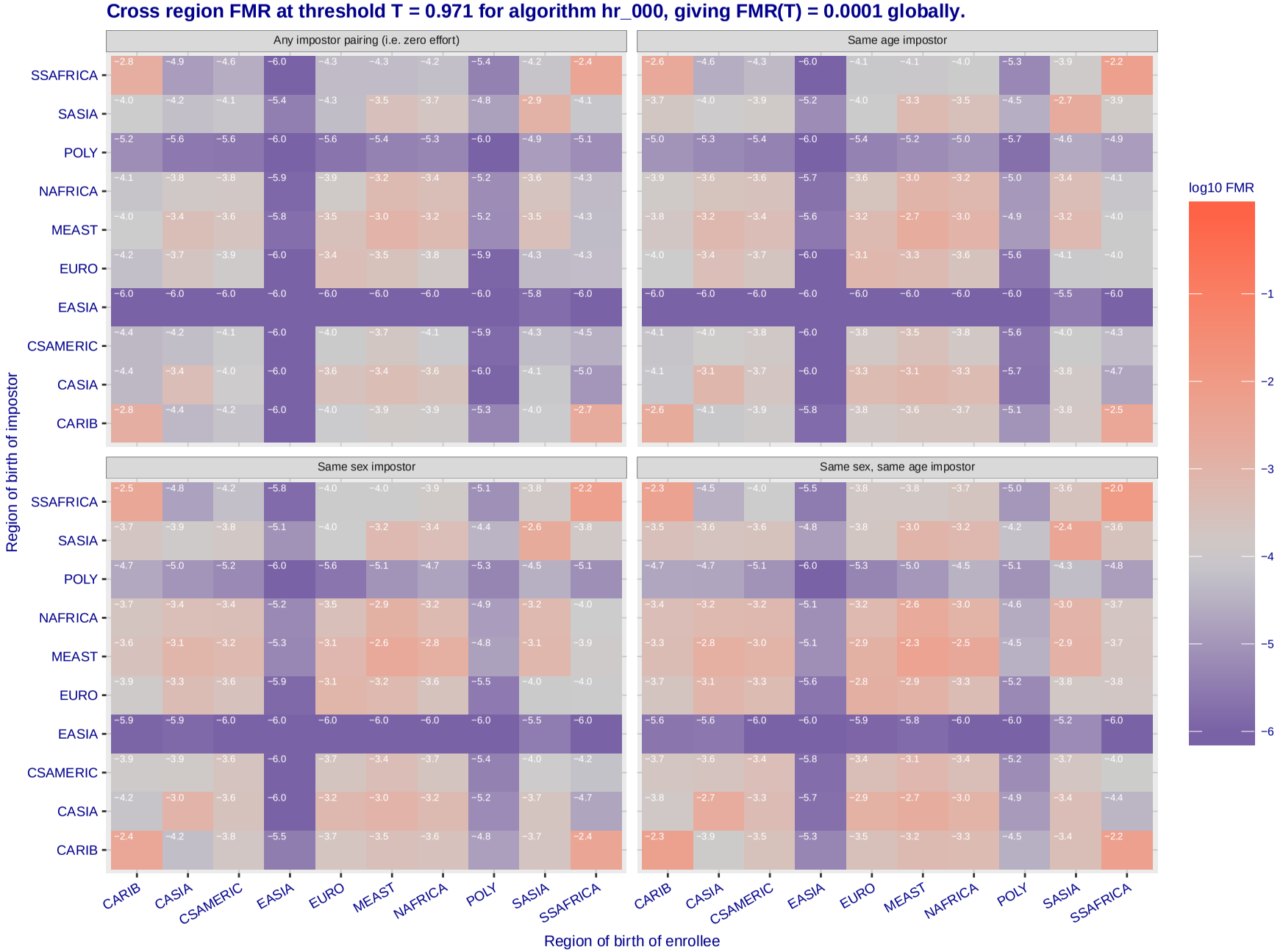


Figure 171: For algorithm hr-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

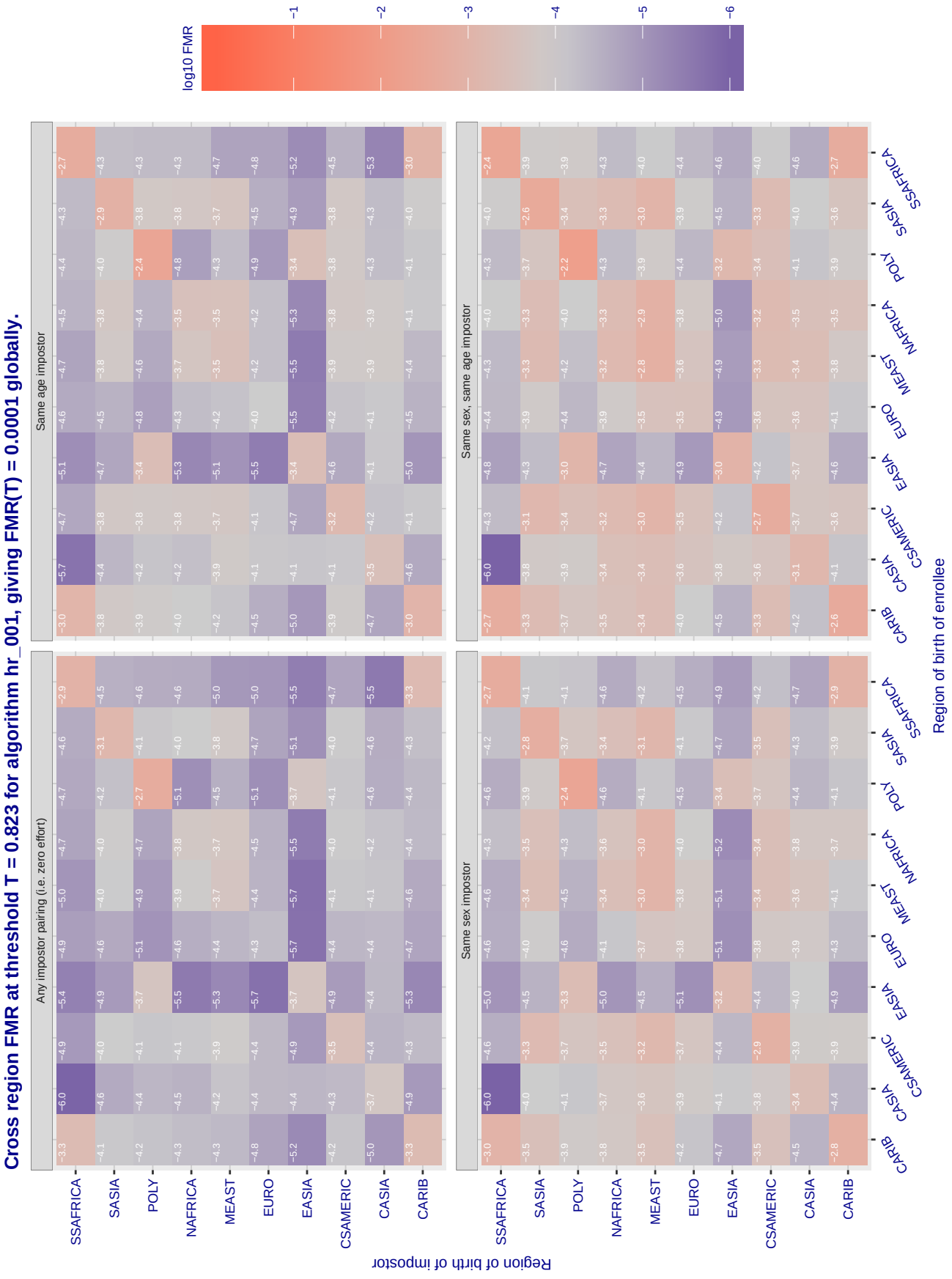


Figure 172: For algorithm hr-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

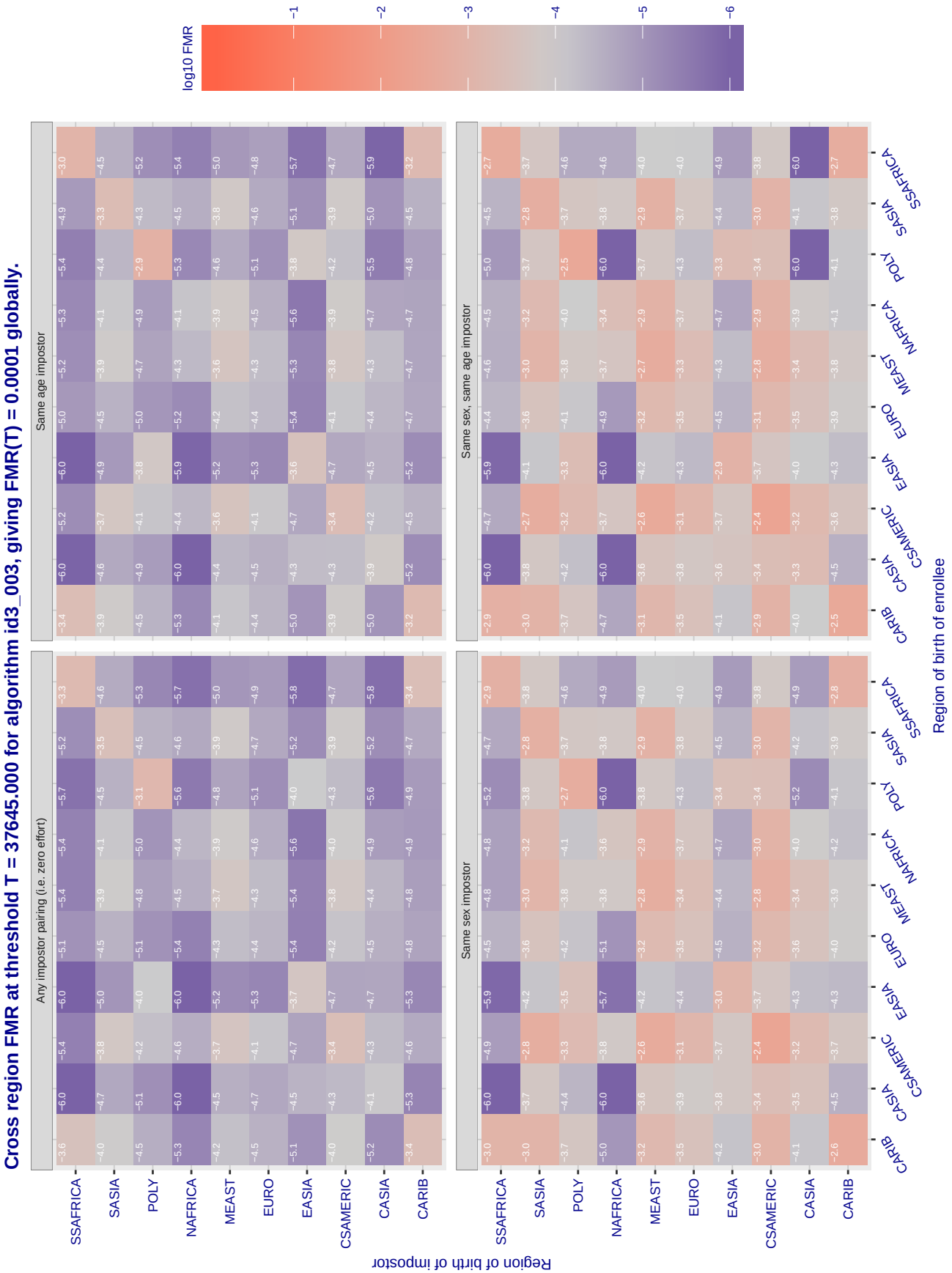


Figure 173: For algorithm id3-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

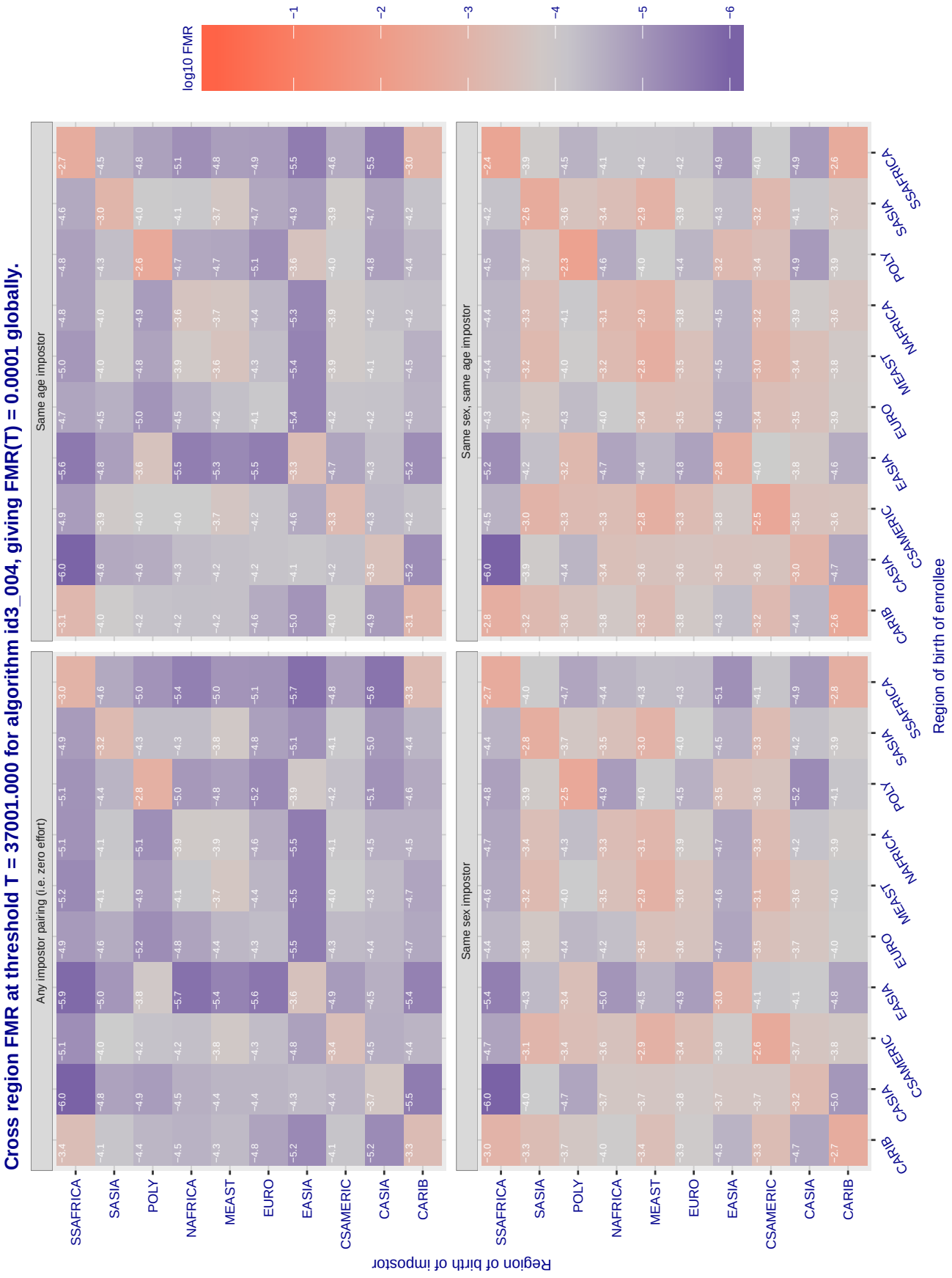


Figure 174: For algorithm id3-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

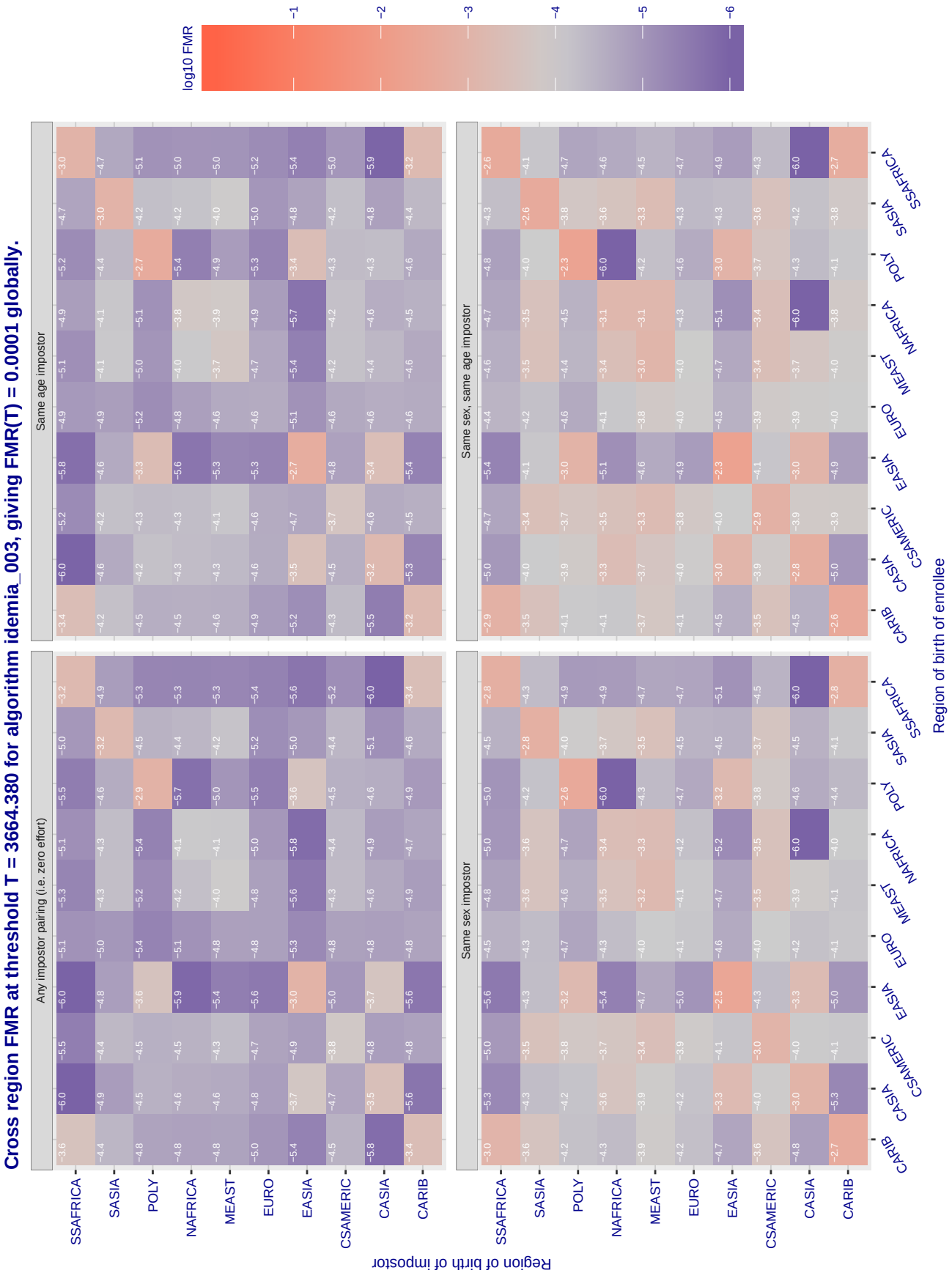


Figure 175: For algorithm idemia-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

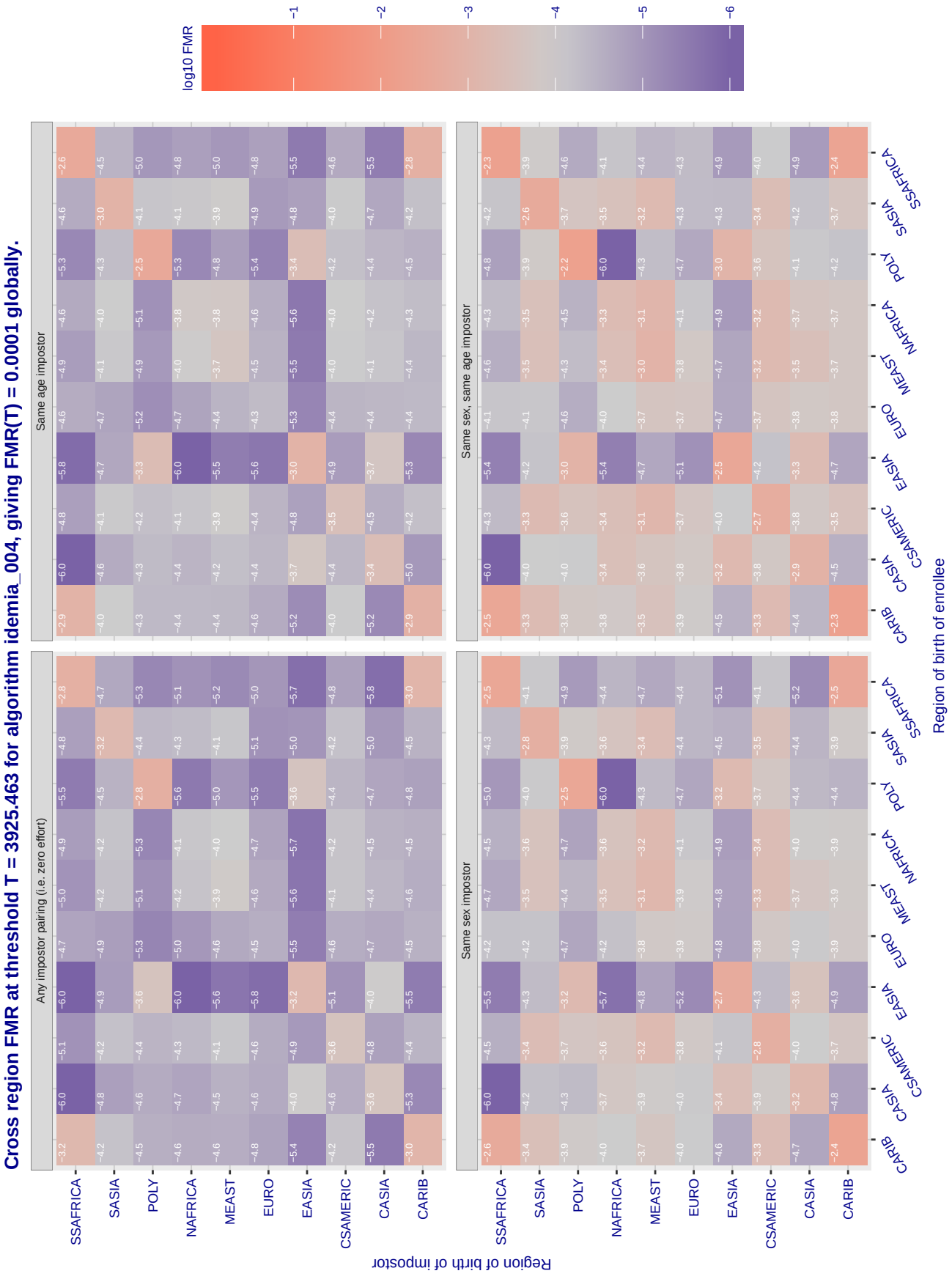


Figure 176: For algorithm idemia-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

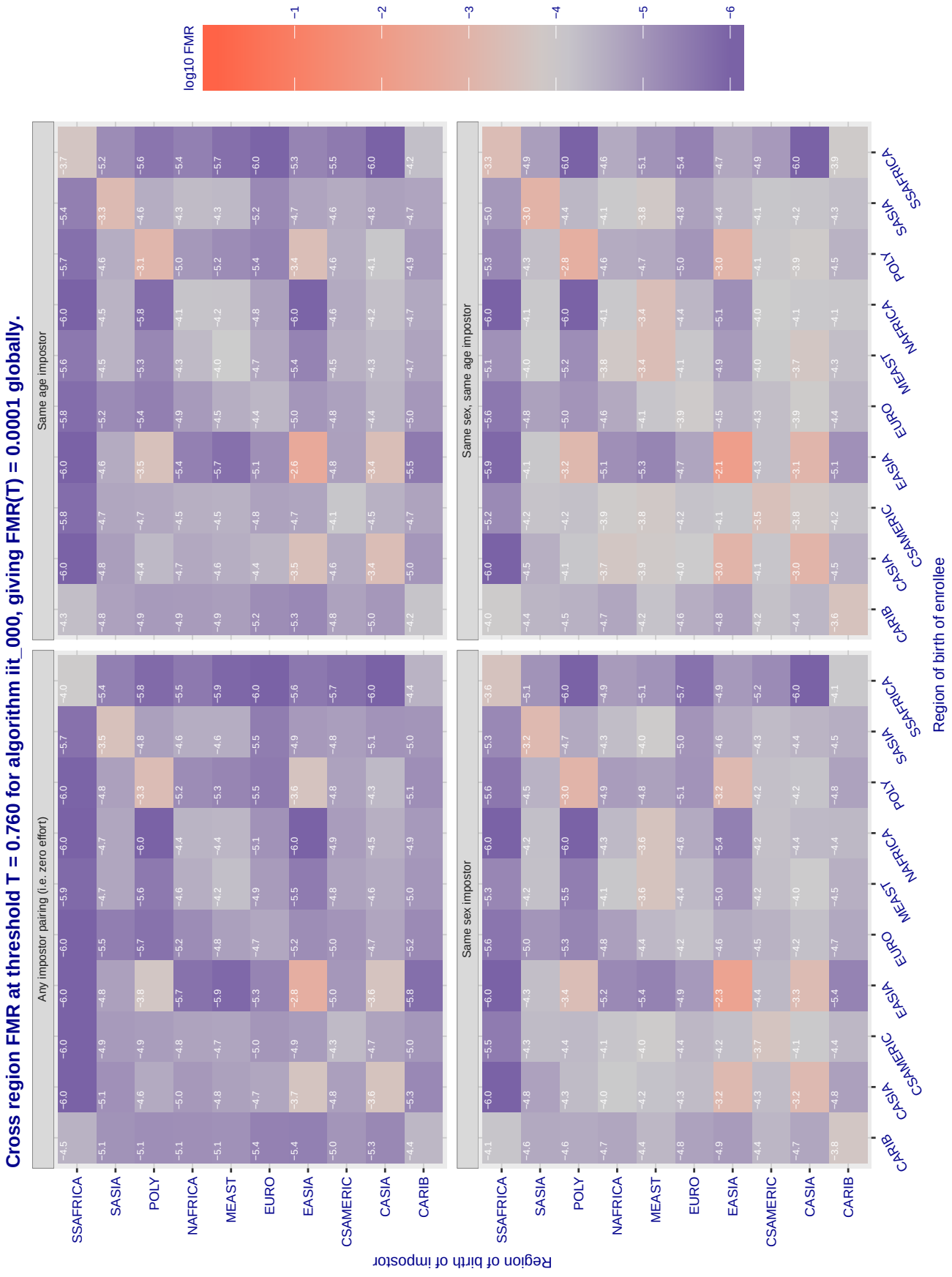


Figure 177: For algorithm iit-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

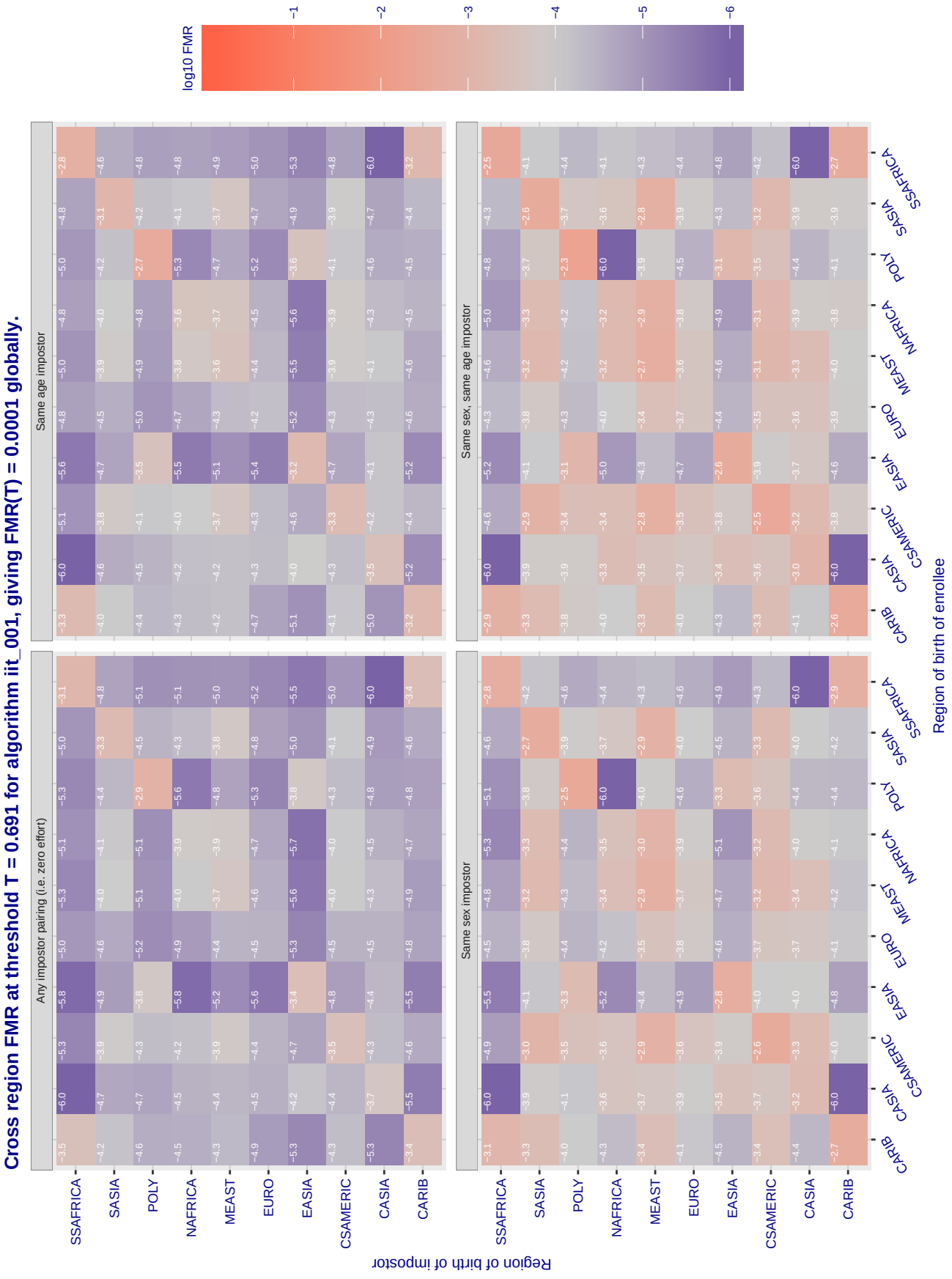


Figure 178: For algorithm iit-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

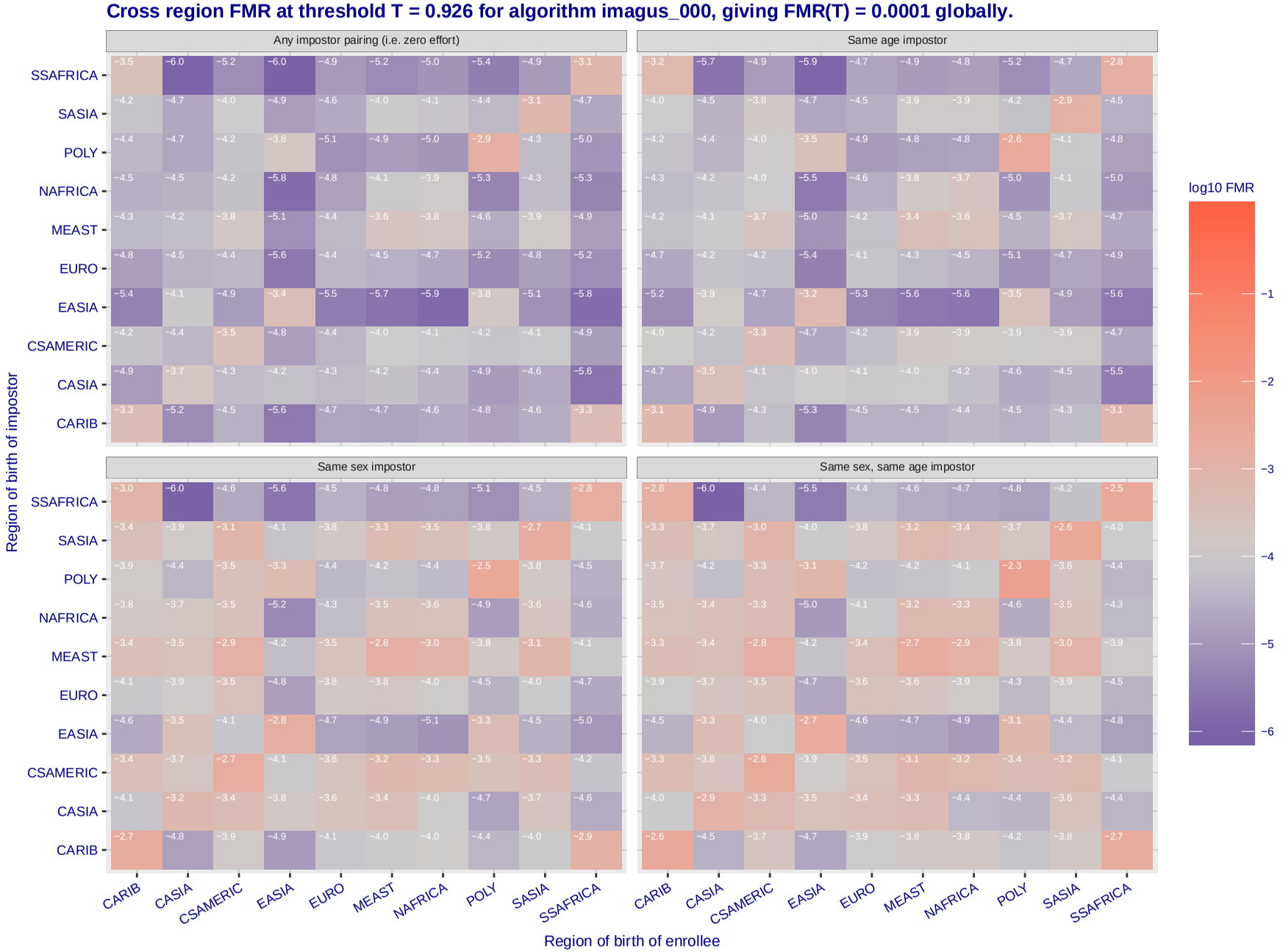


Figure 179: For algorithm imagus-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

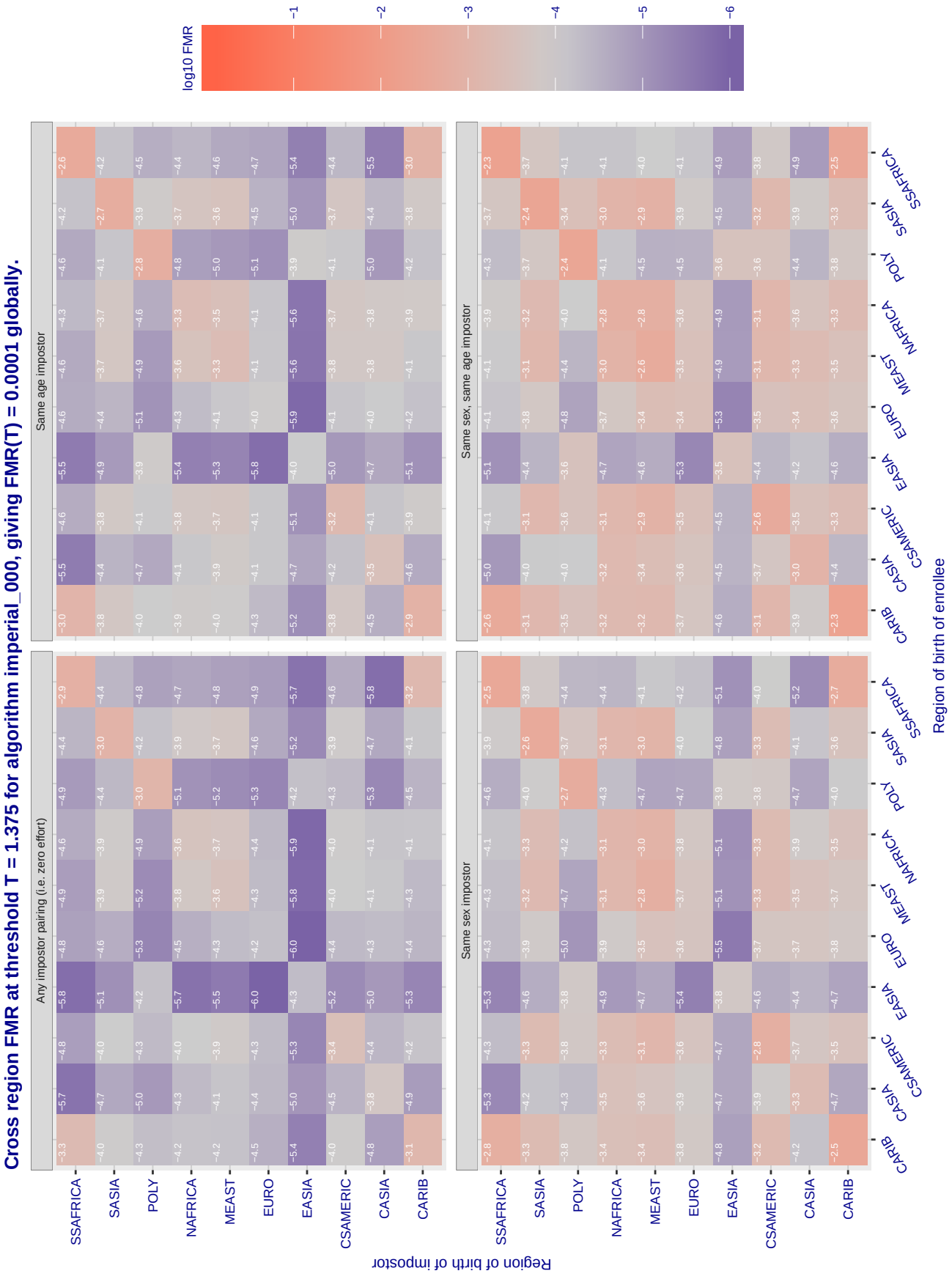


Figure 180: For algorithm imperial-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

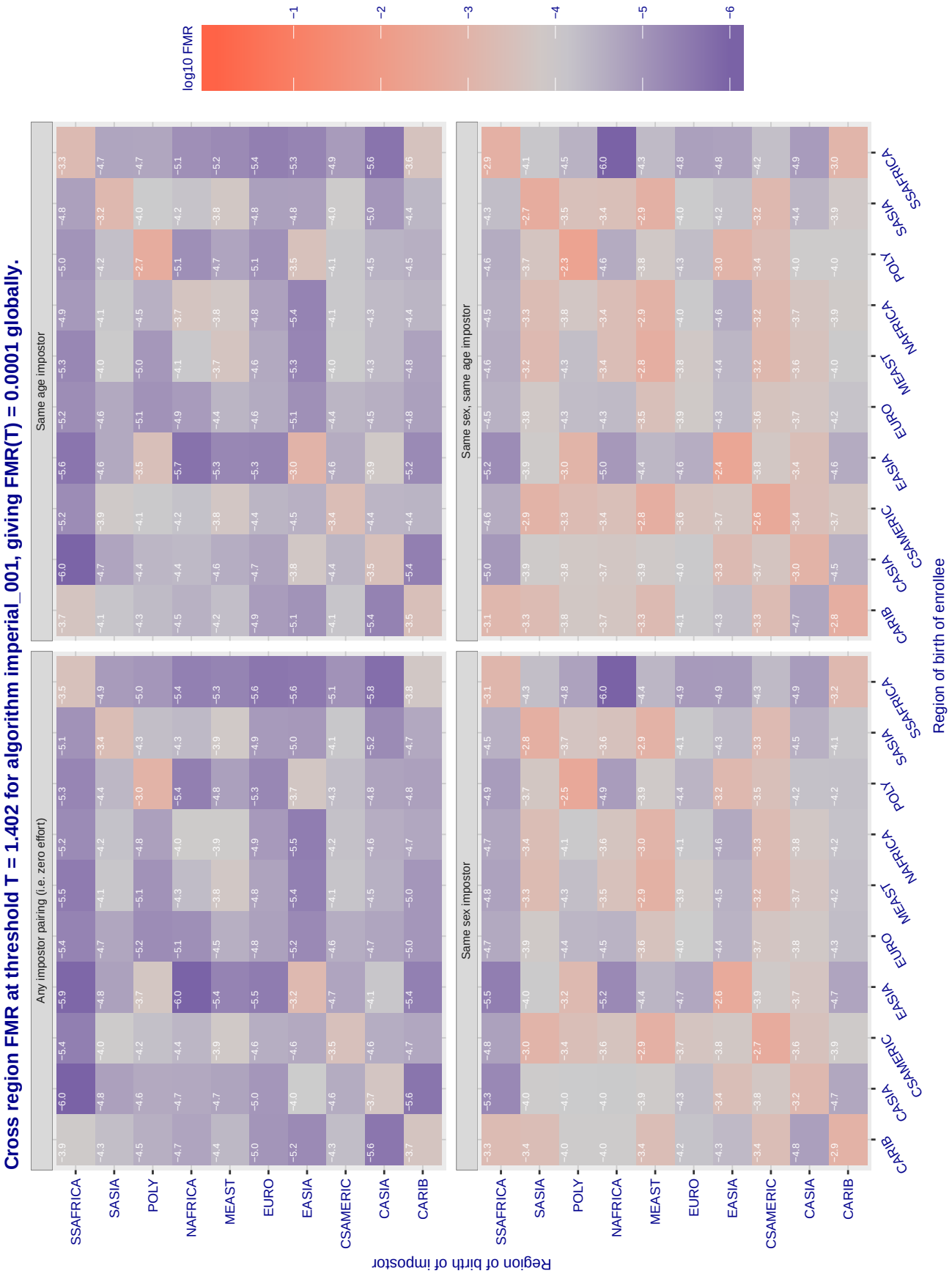


Figure 181: For algorithm imperial-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

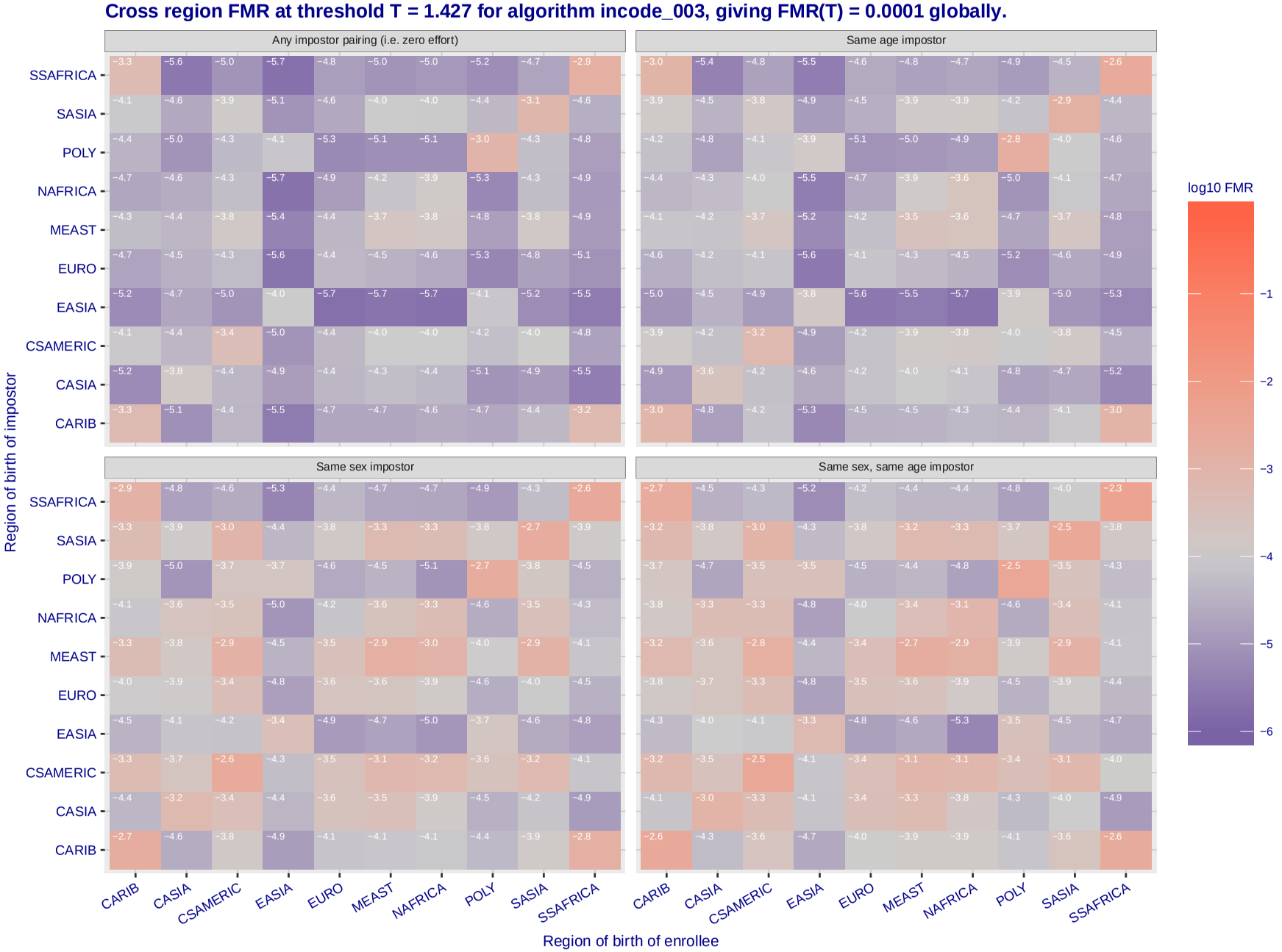


Figure 182: For algorithm incode-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

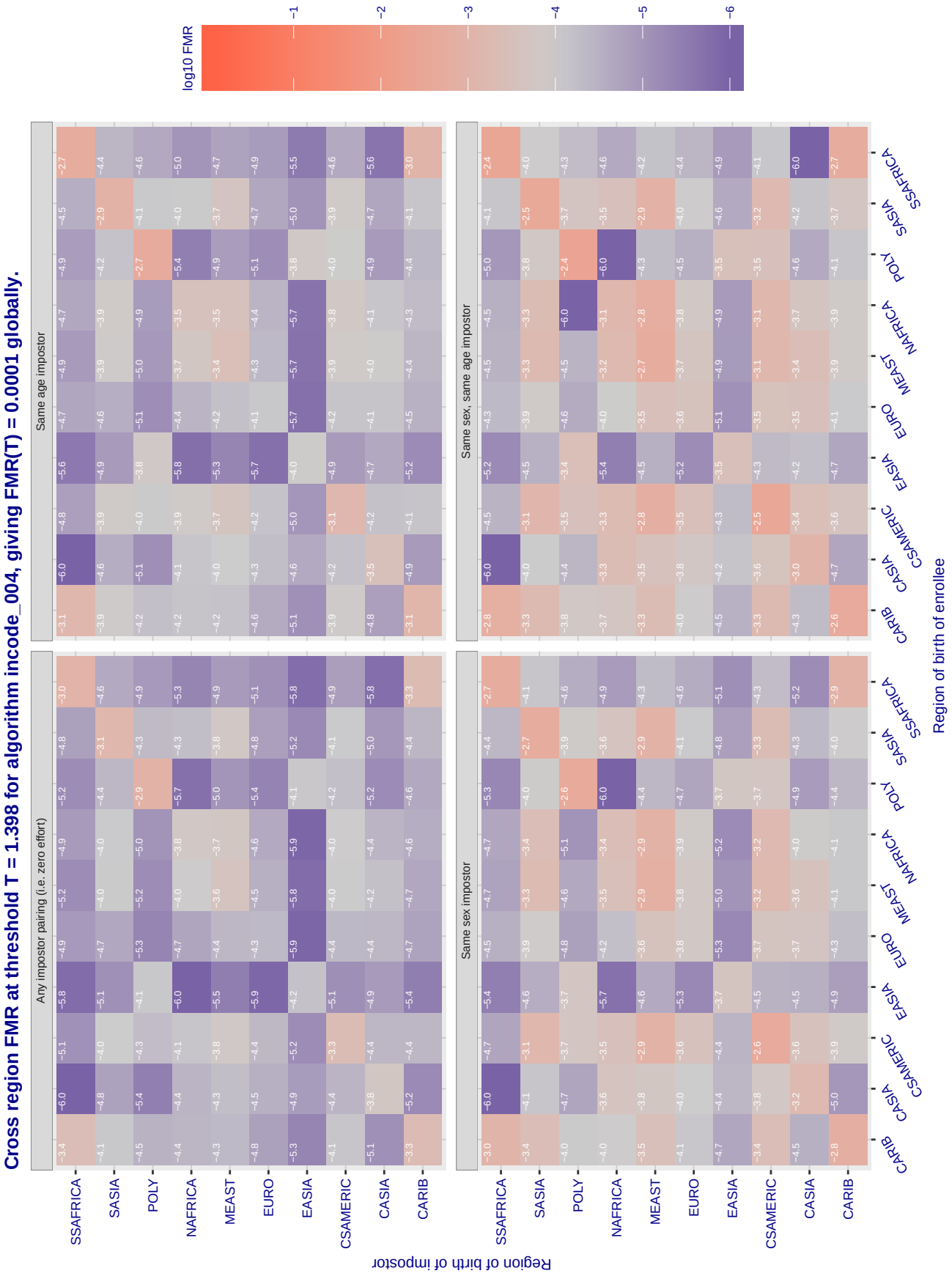


Figure 183: For algorithm incode-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

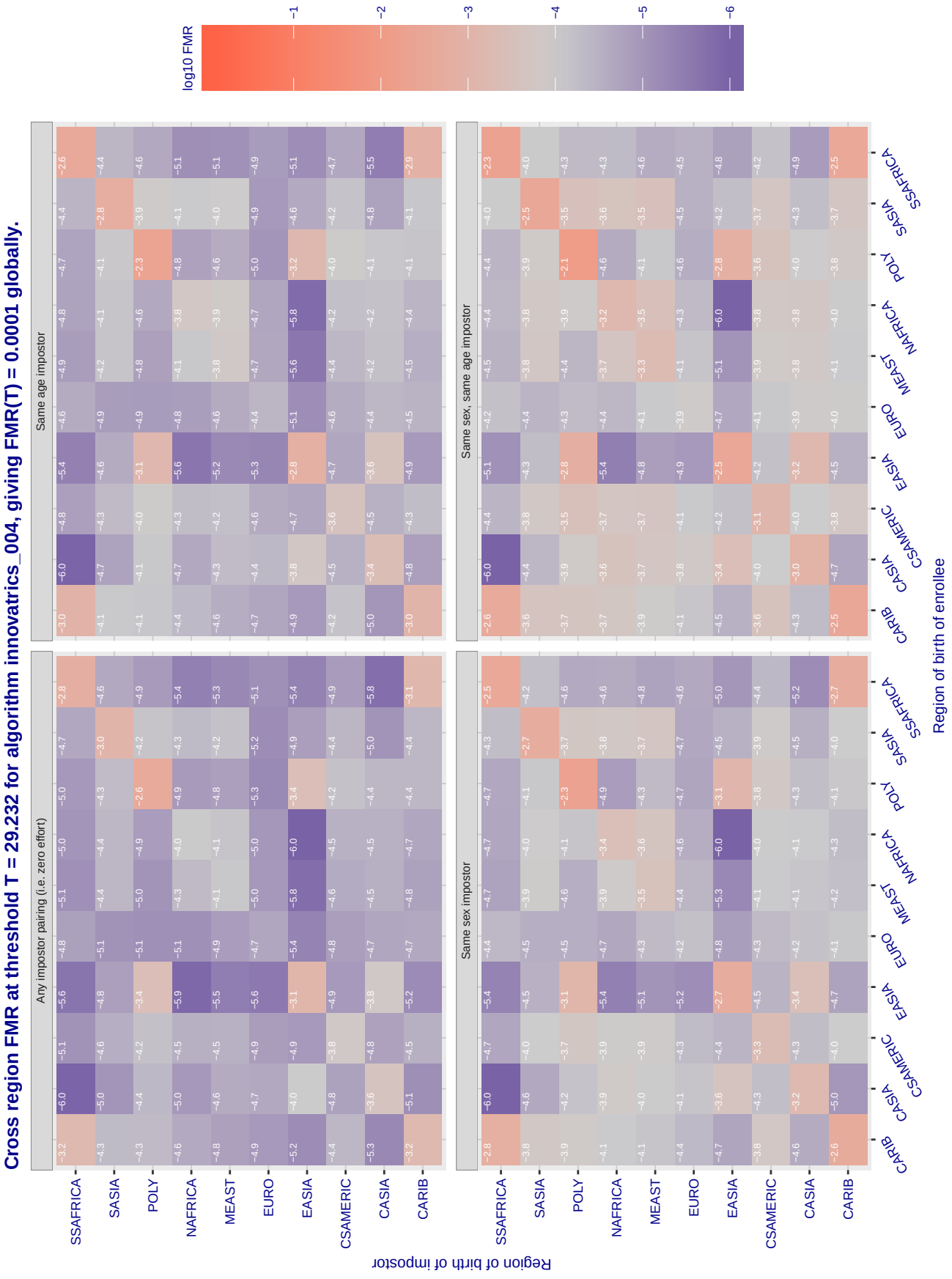


Figure 184: For algorithm innovatrics-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

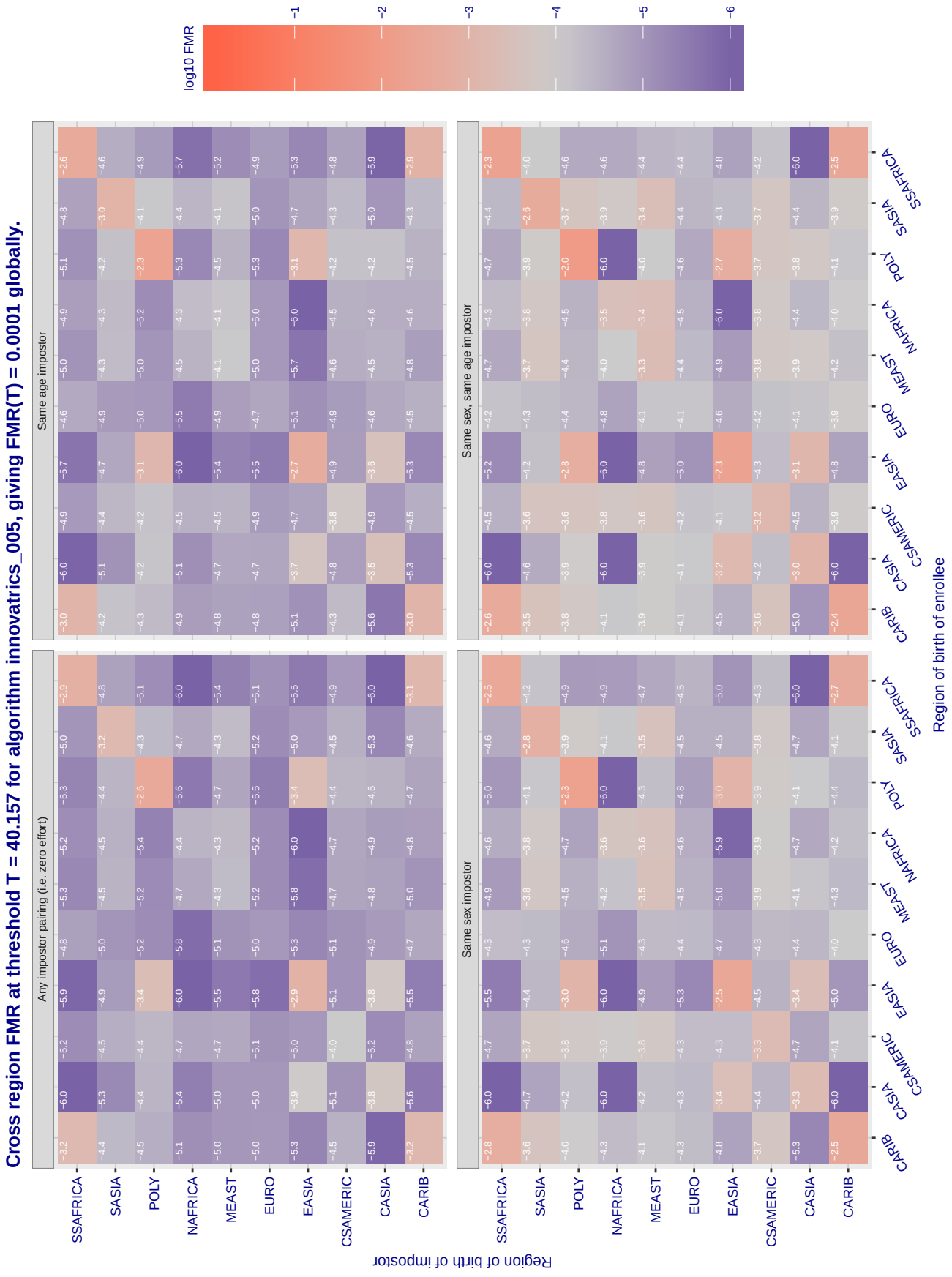


Figure 185: For algorithm innovatrics-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

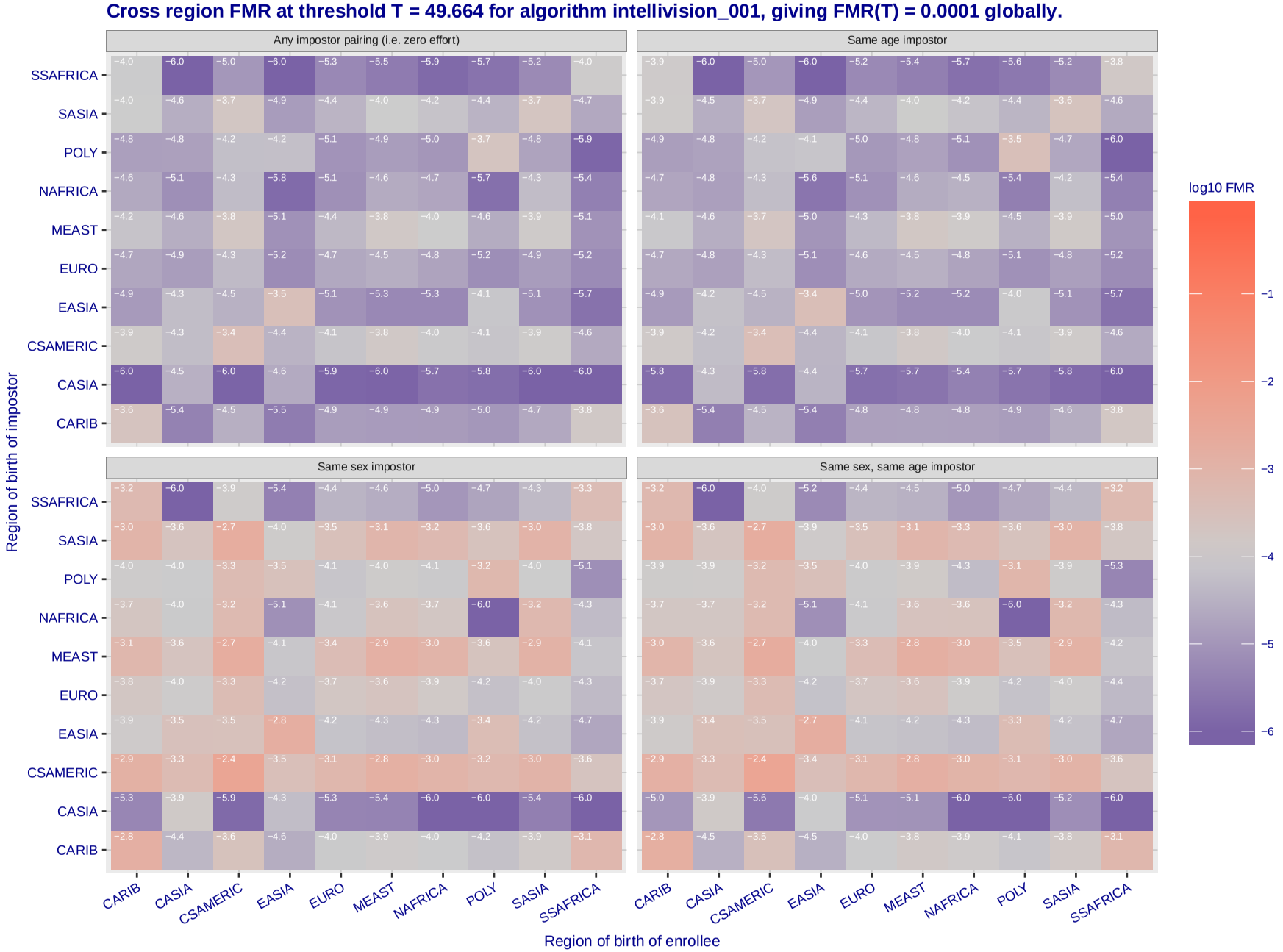


Figure 186: For algorithm intellivision-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

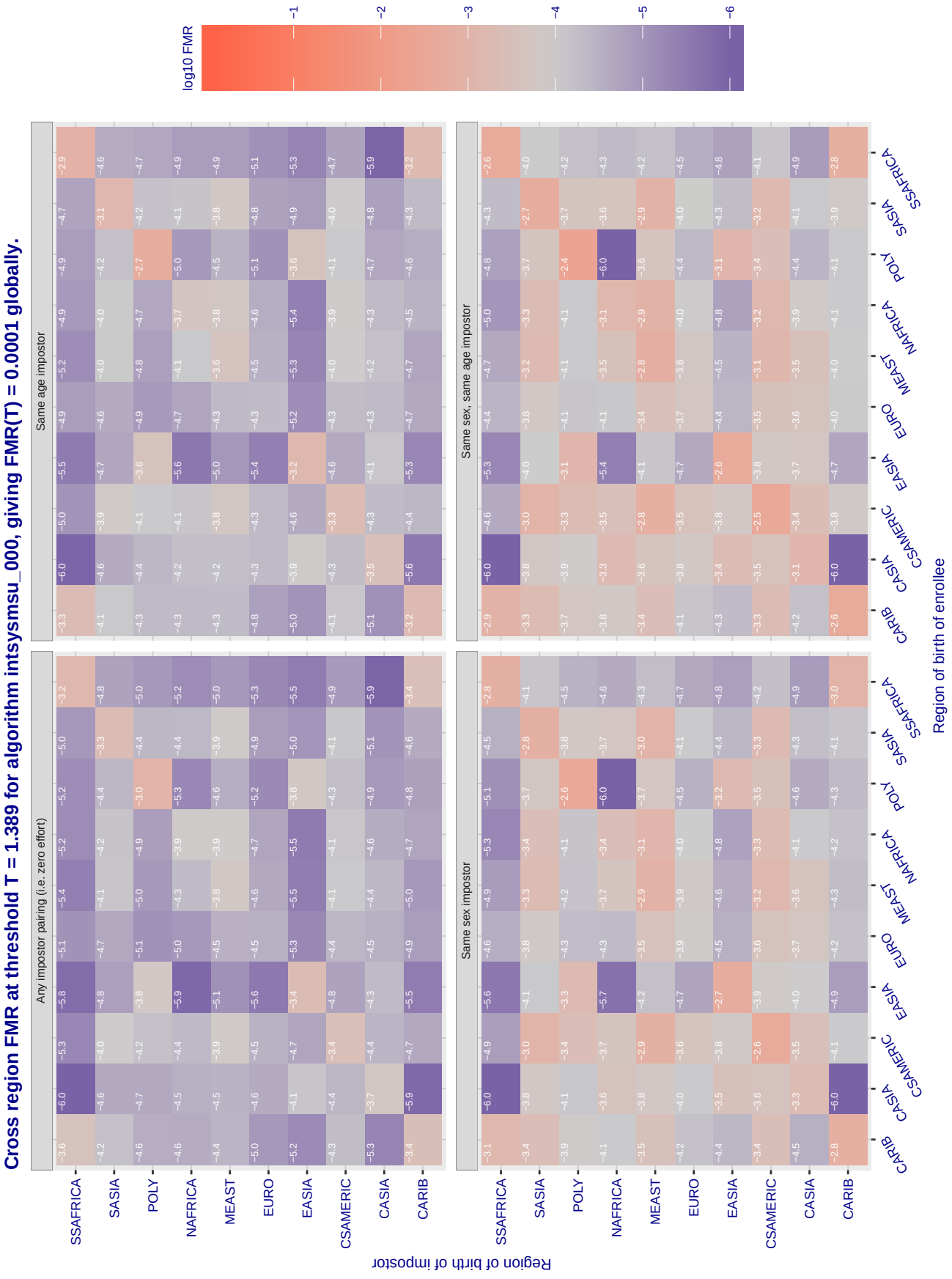


Figure 187: For algorithm intsysmsu-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

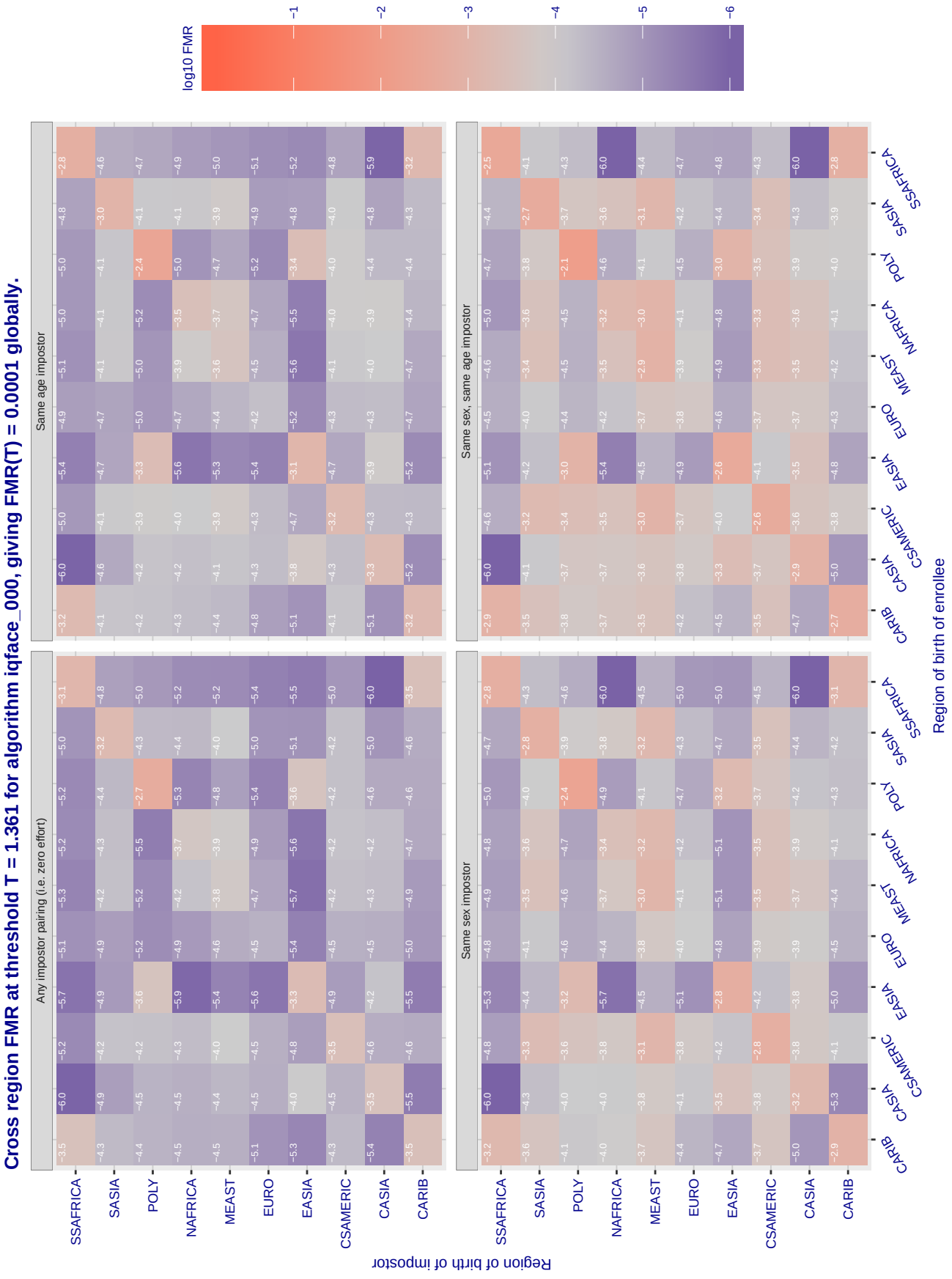


Figure 188: For algorithm iqface-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

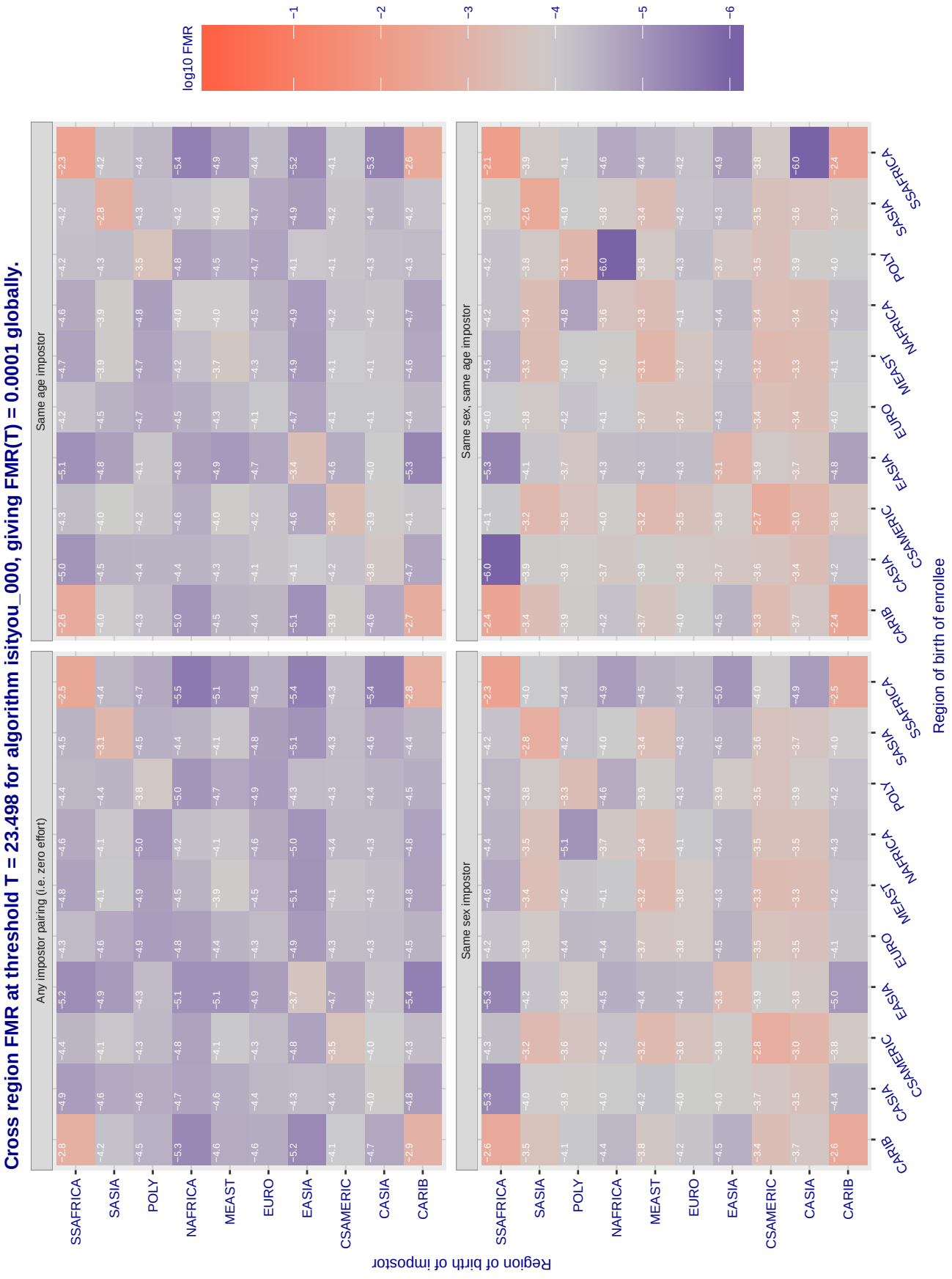


Figure 189: For algorithm isityou-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

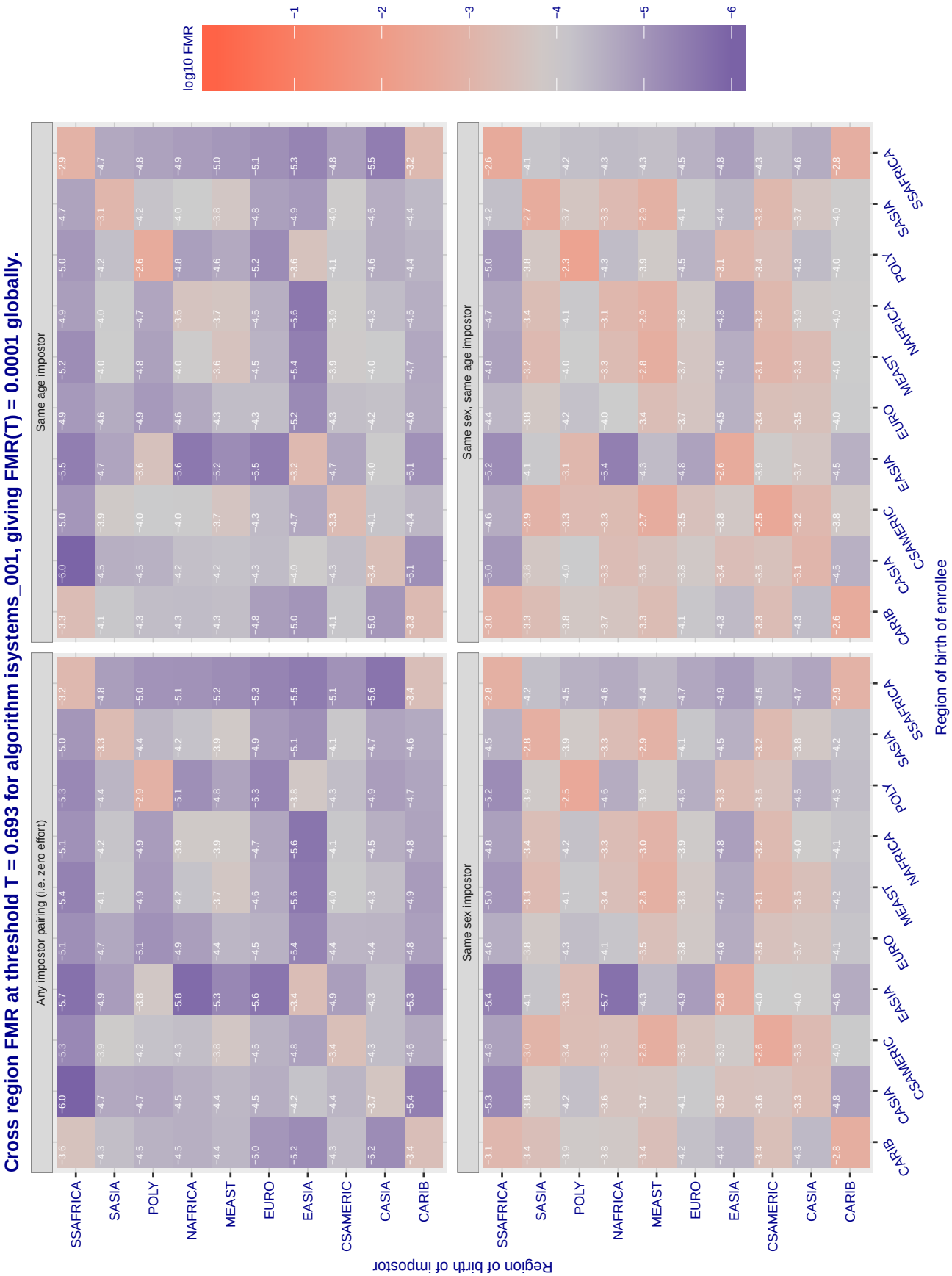


Figure 190: For algorithm isystems-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

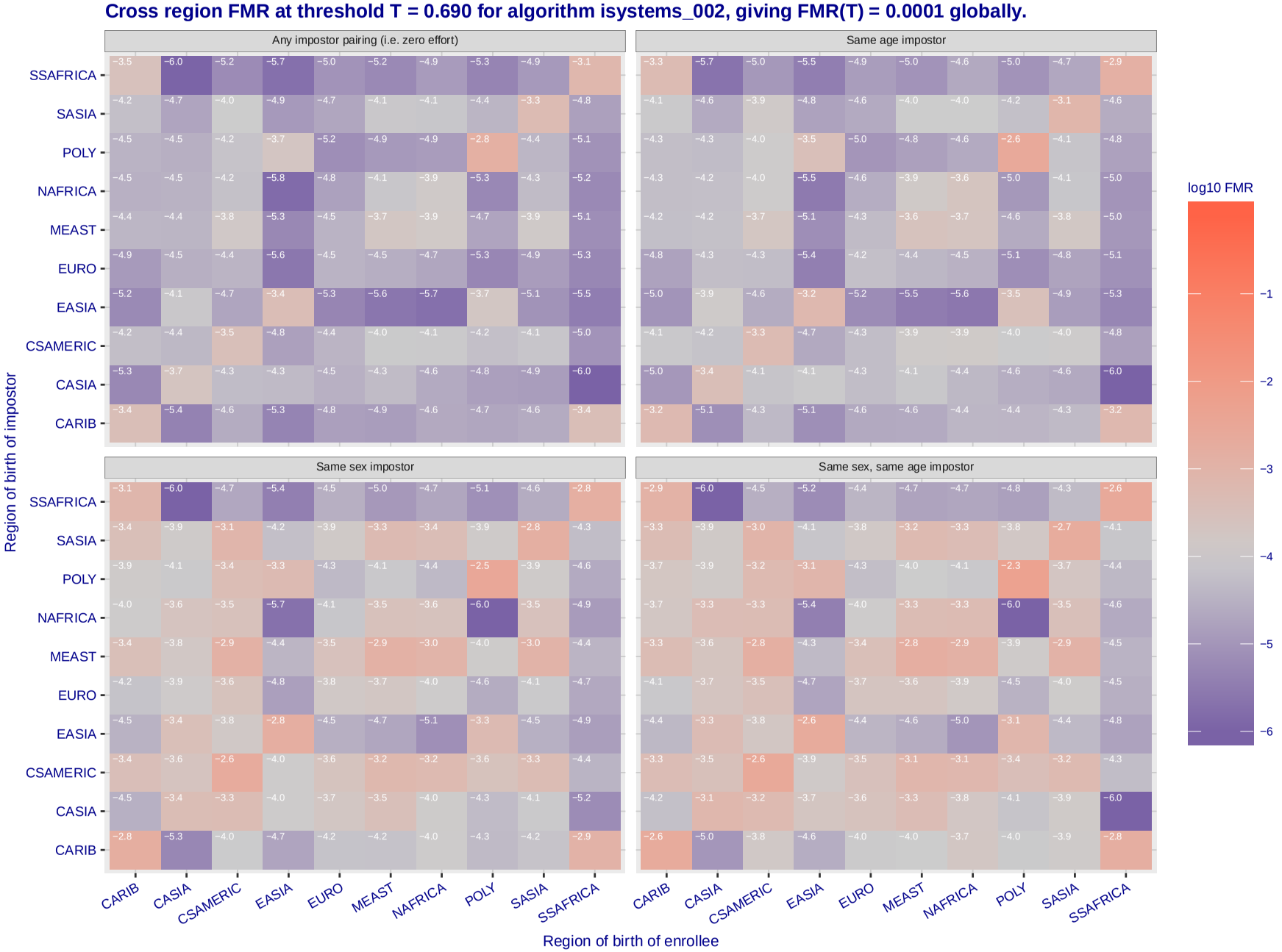


Figure 191: For algorithm isystems-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

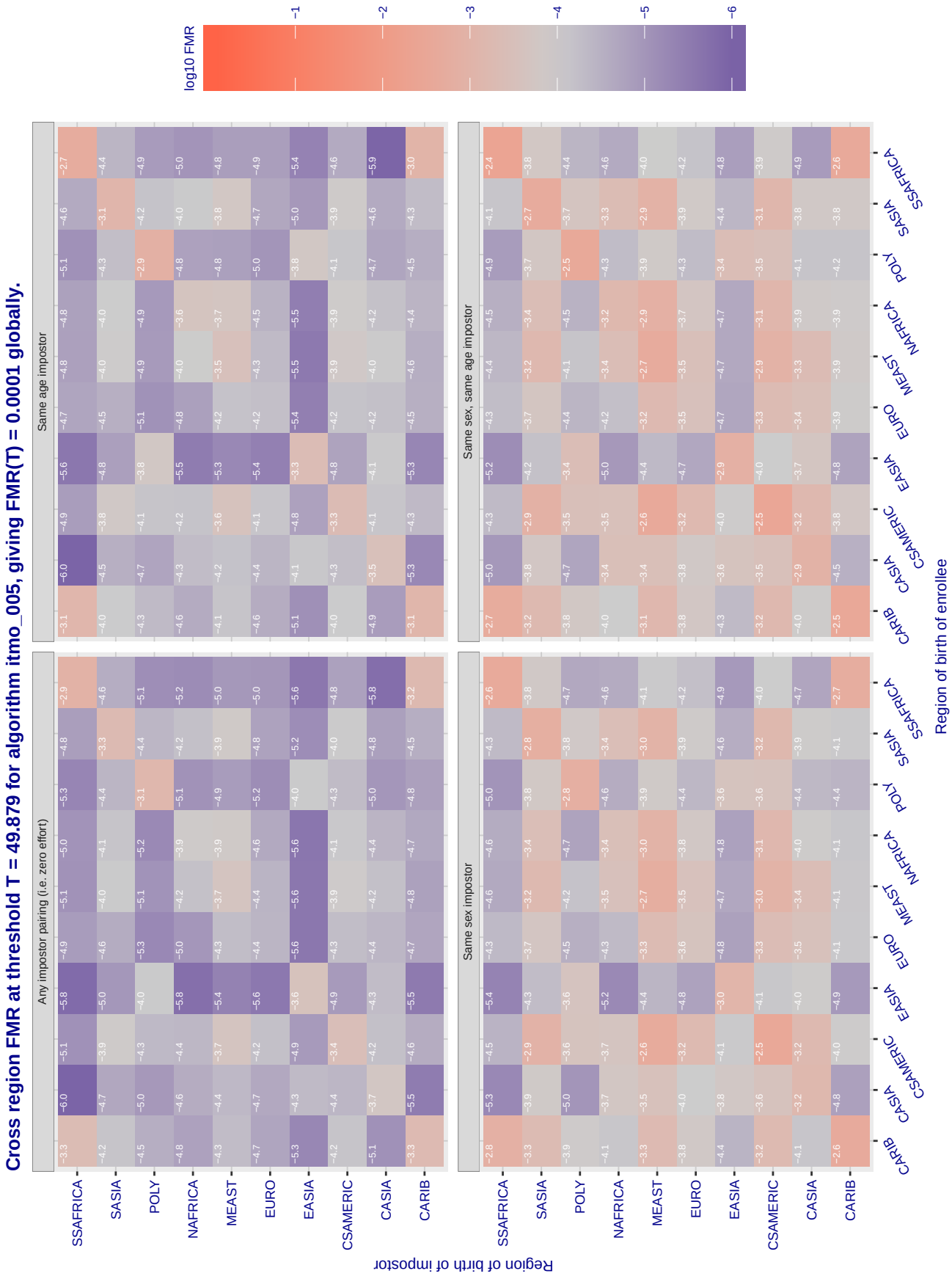


Figure 192: For algorithm itmo-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

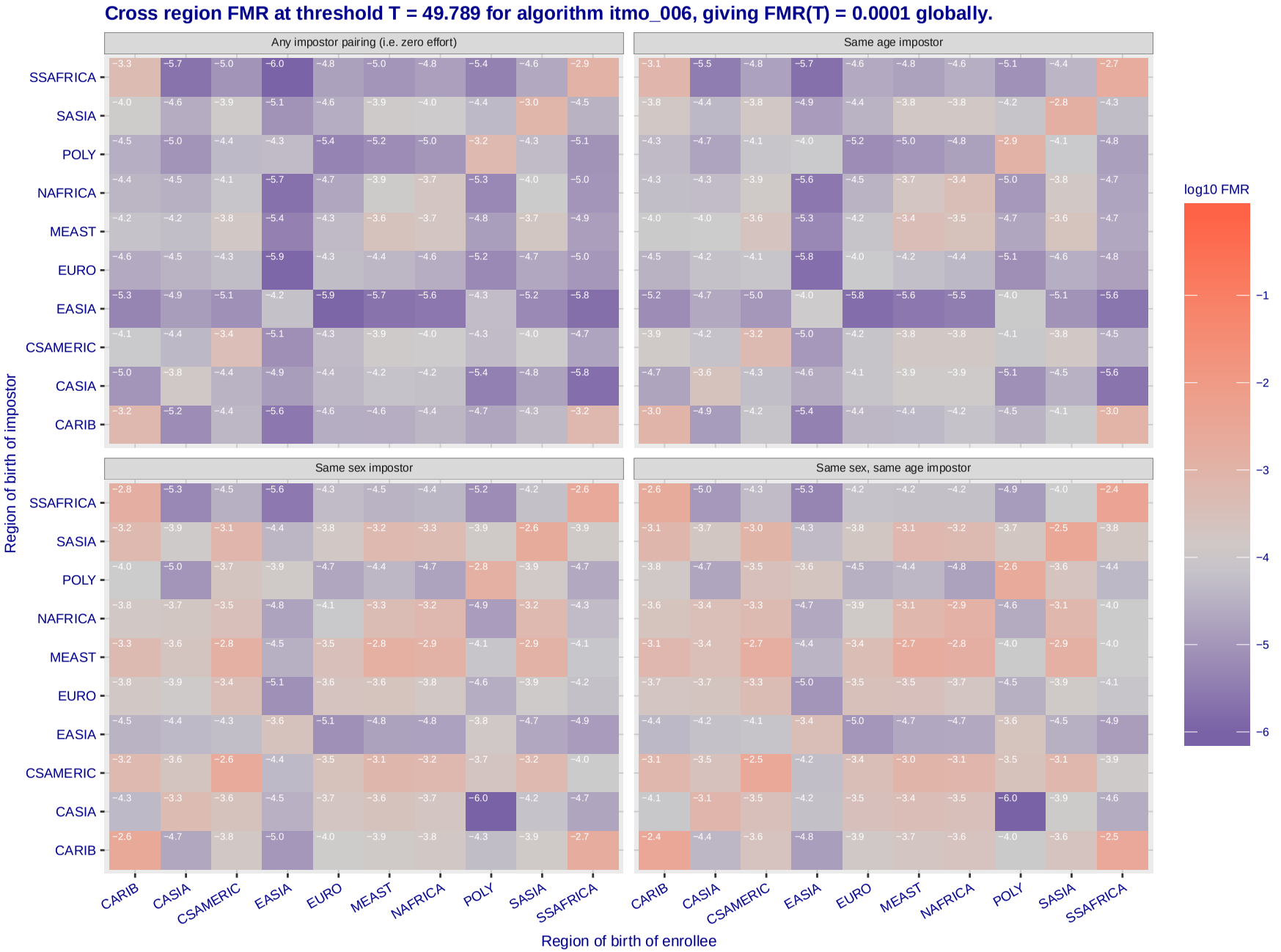


Figure 193: For algorithm itmo-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

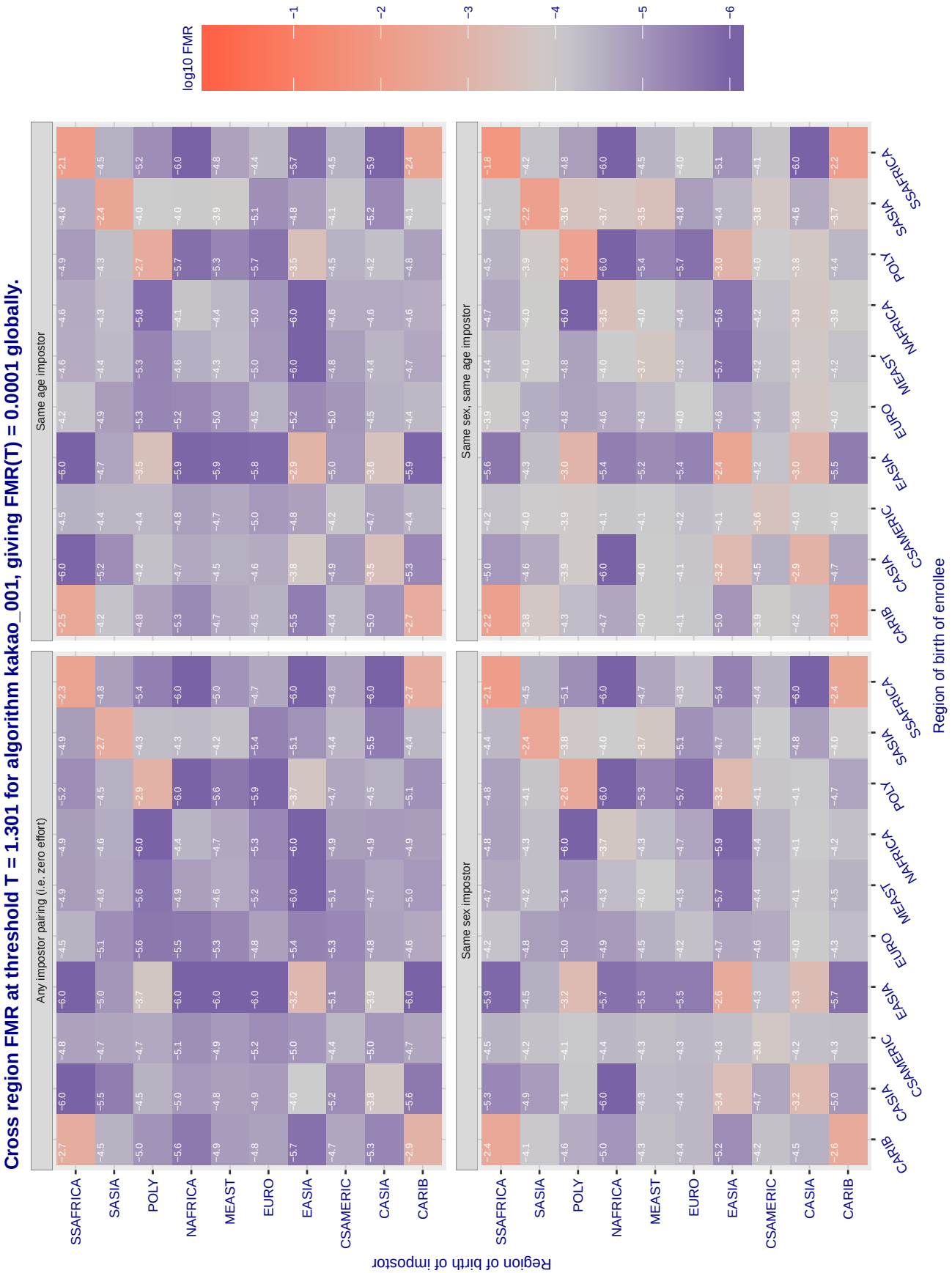


Figure 194: For algorithm kakao-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

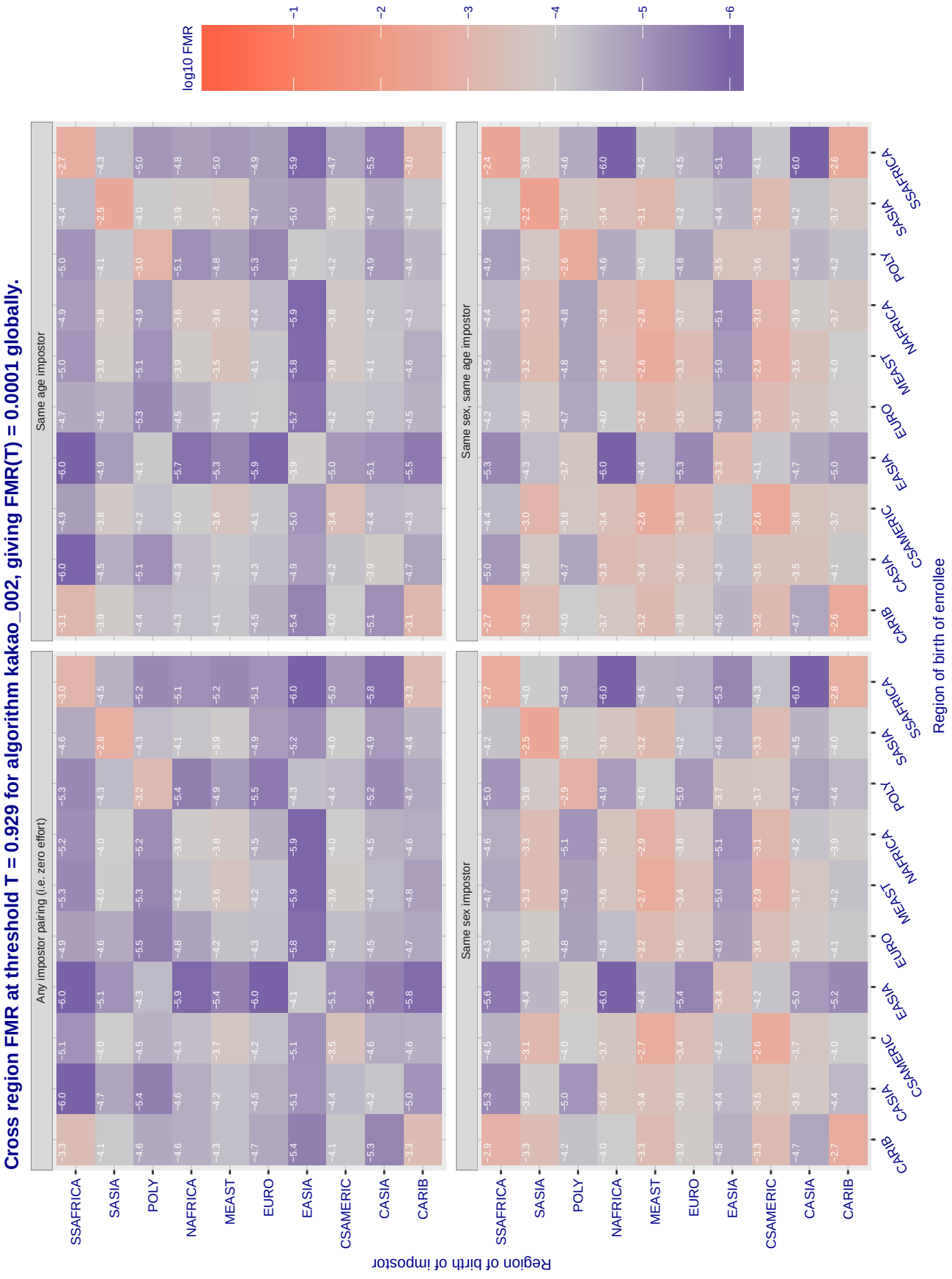


Figure 195: For algorithm kakao-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

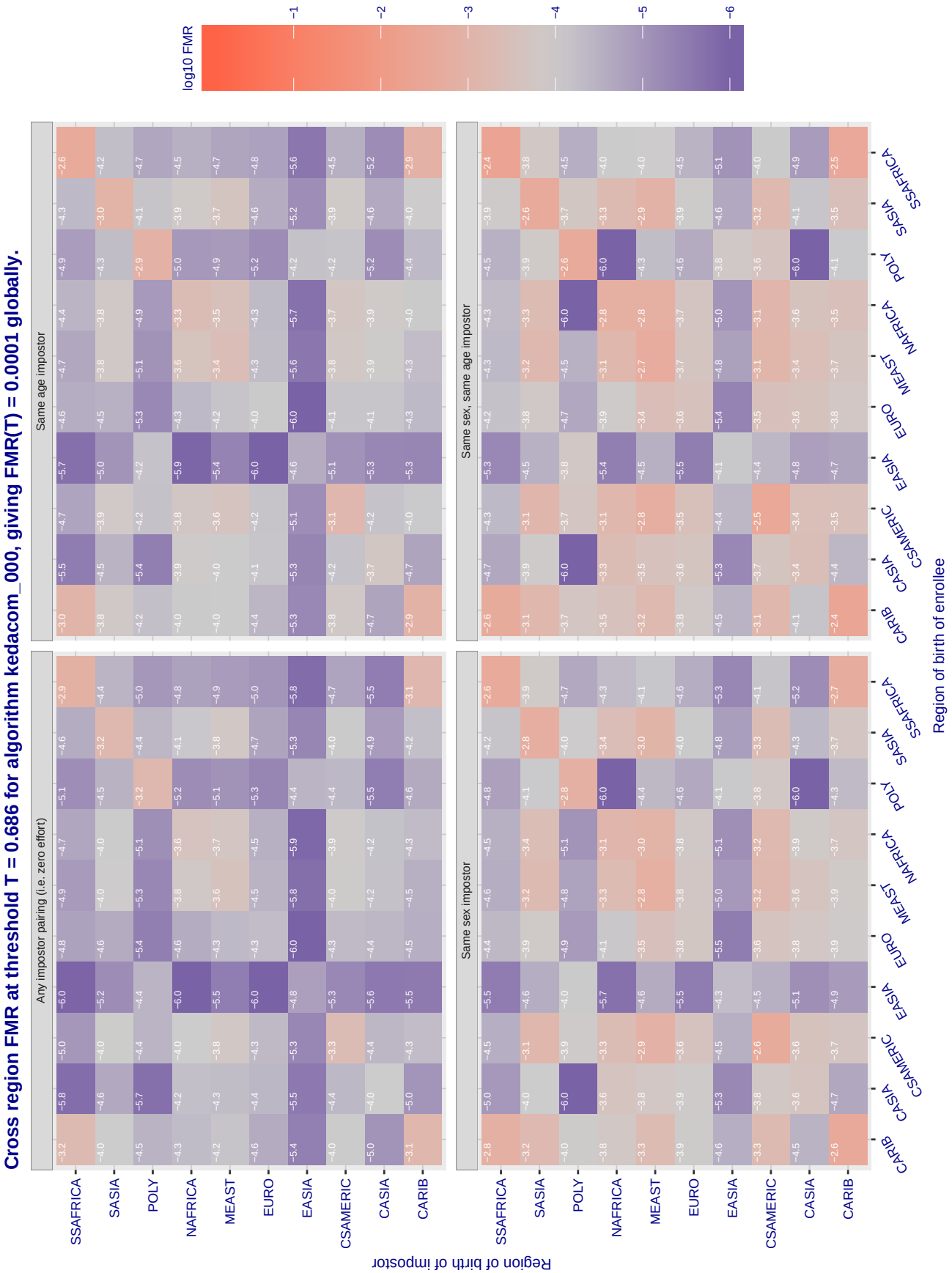


Figure 196: For algorithm kedacom-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

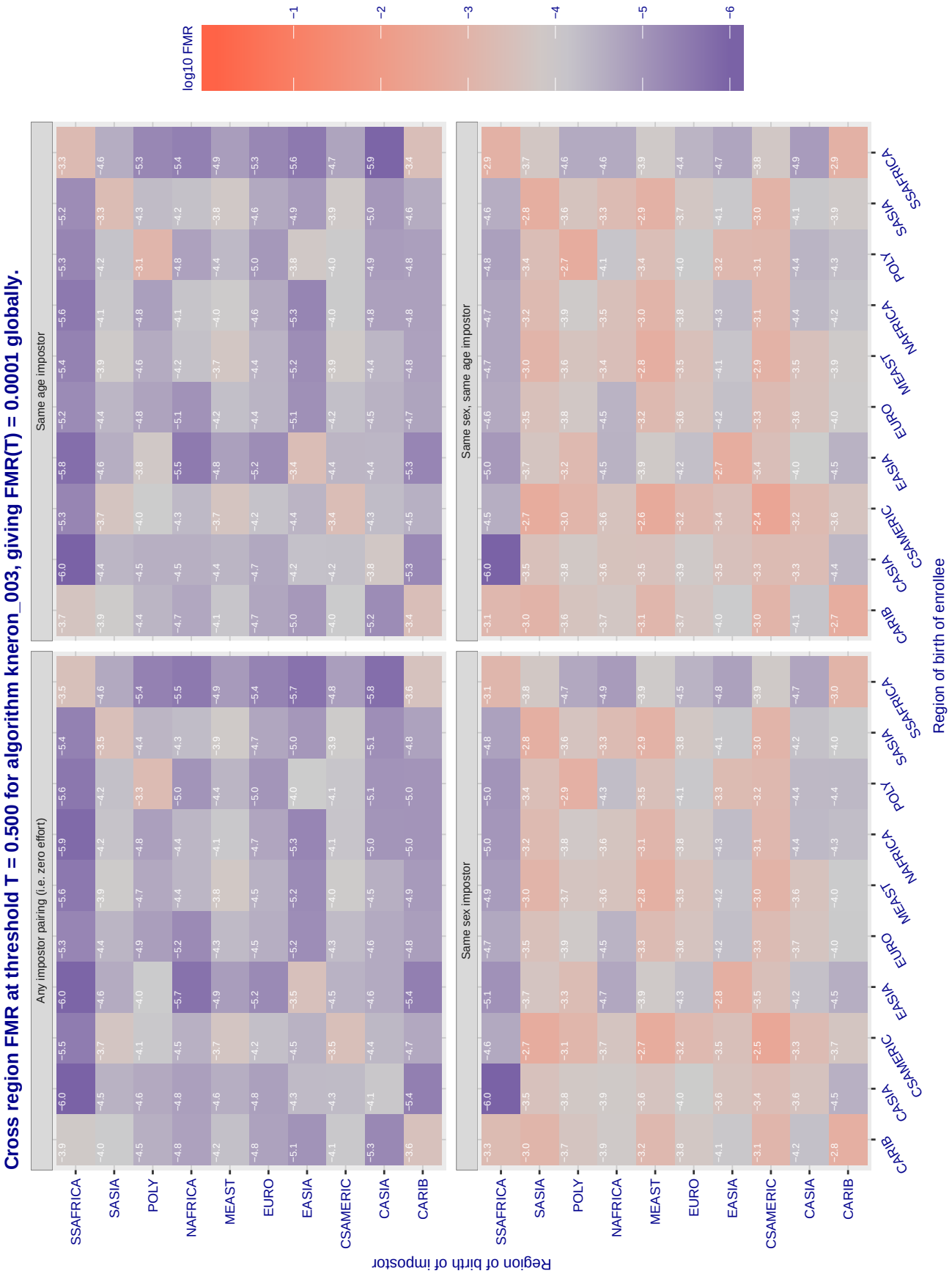


Figure 197: For algorithm kneron-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

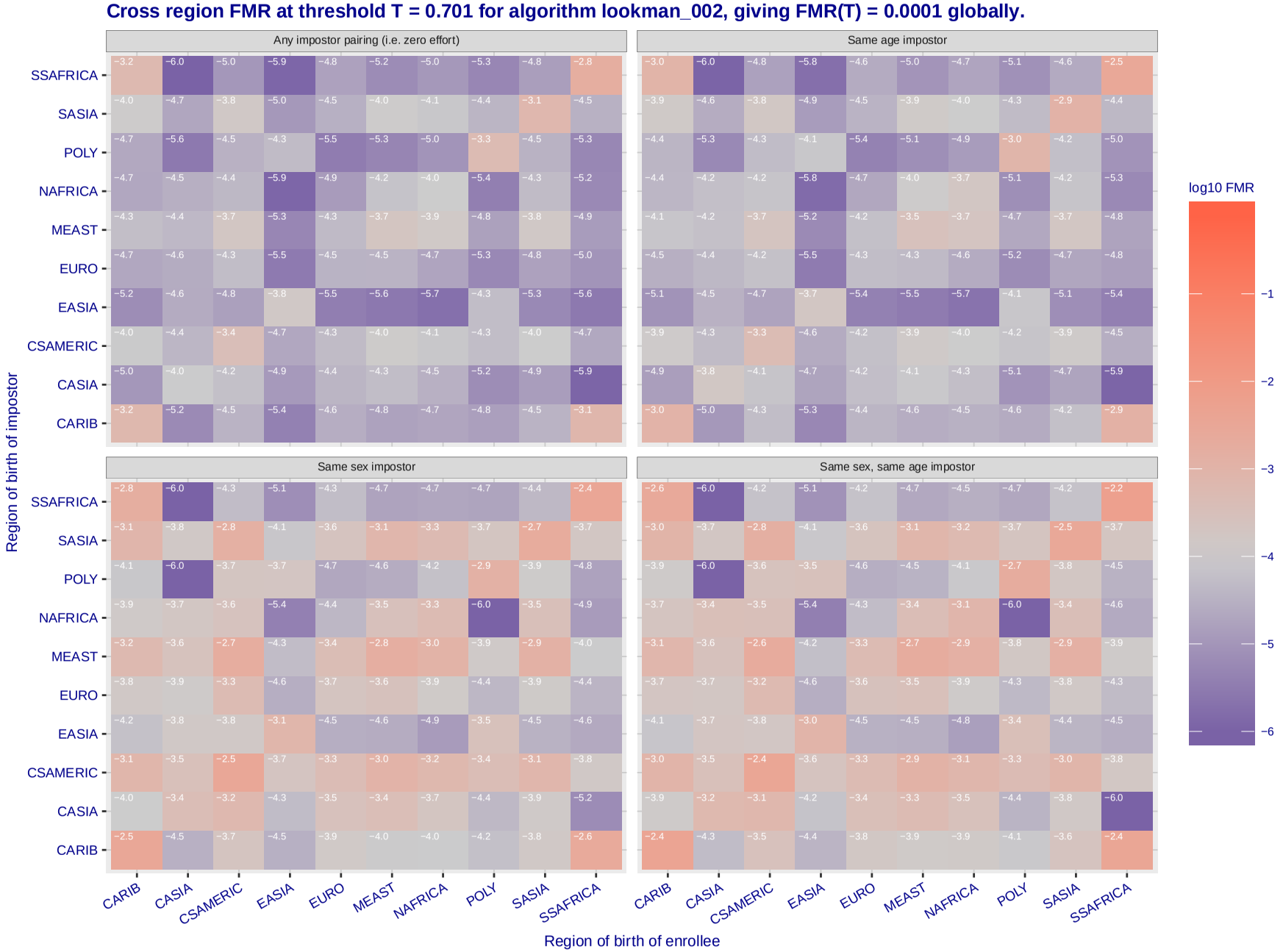


Figure 198: For algorithm lookman-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

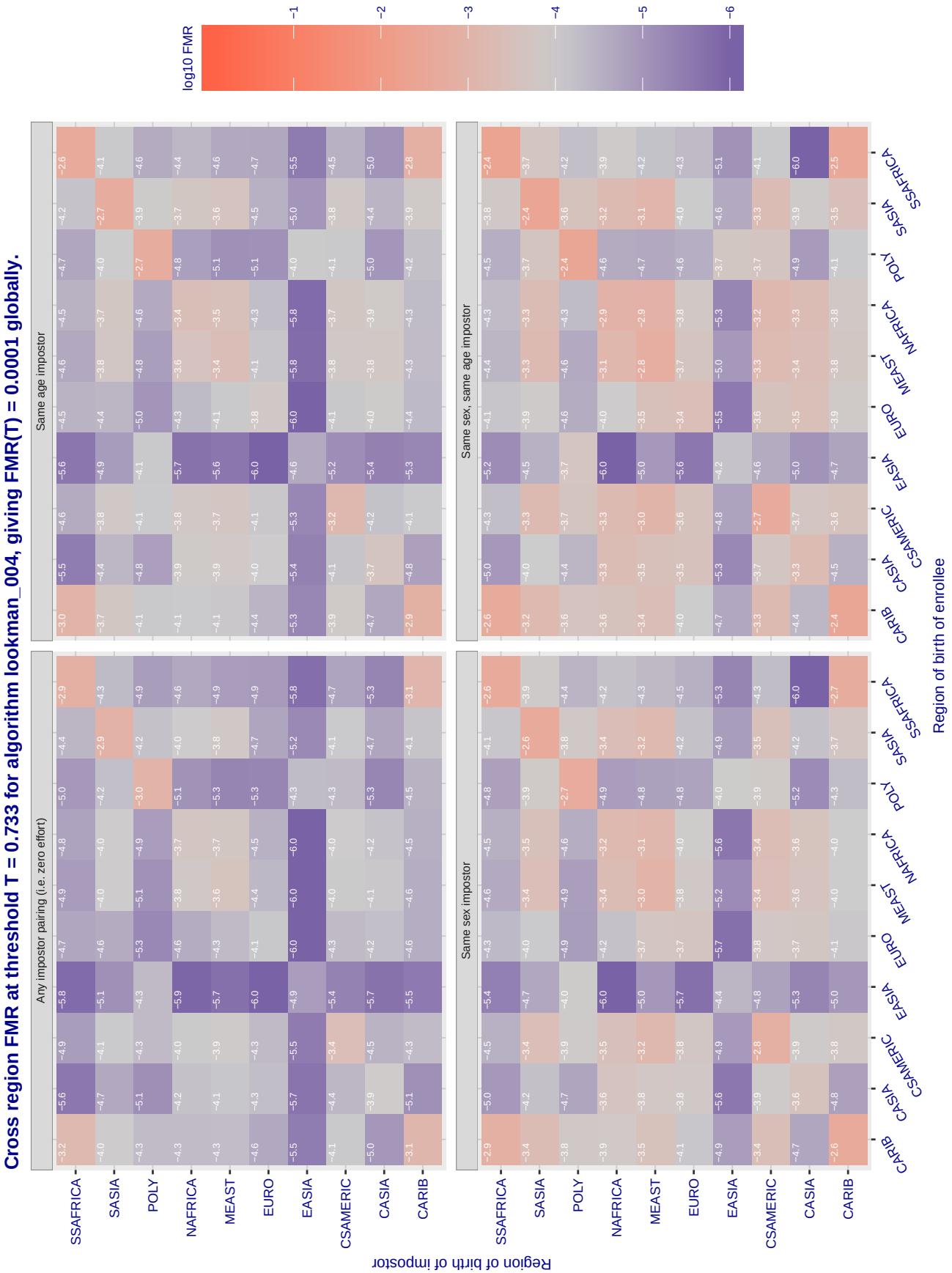


Figure 199: For algorithm lookman-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

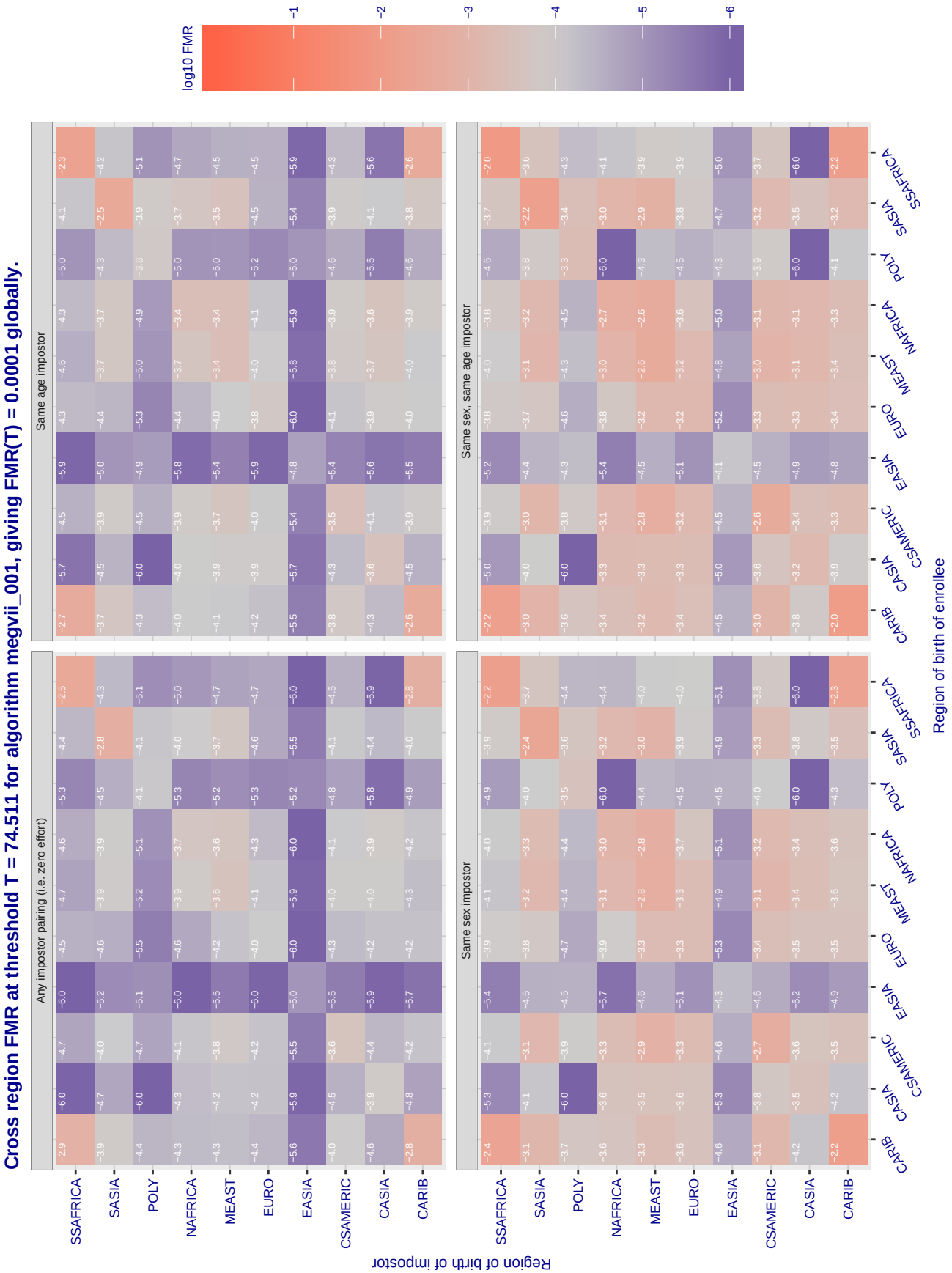


Figure 200: For algorithm megvii-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

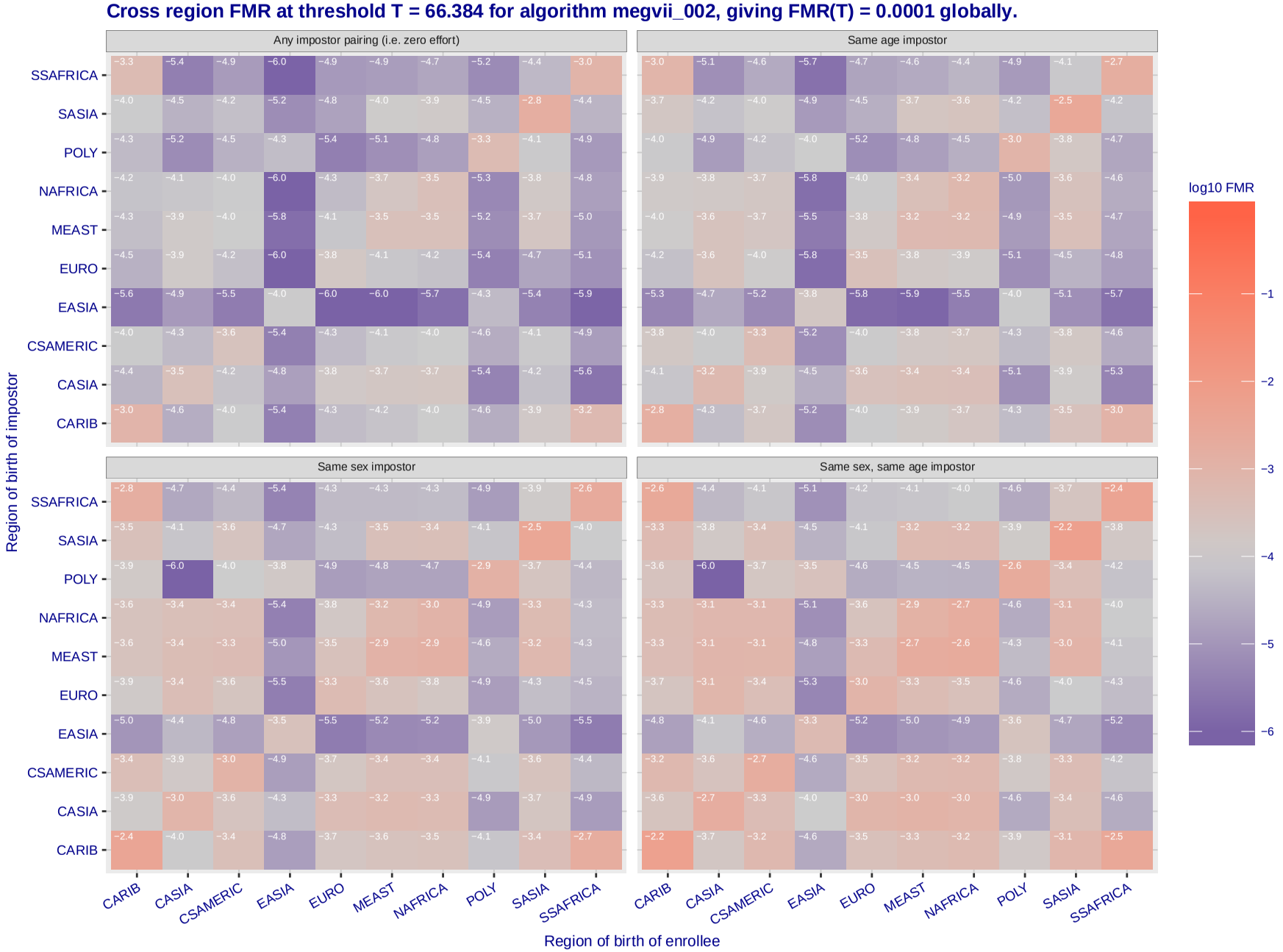


Figure 201: For algorithm megvii-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

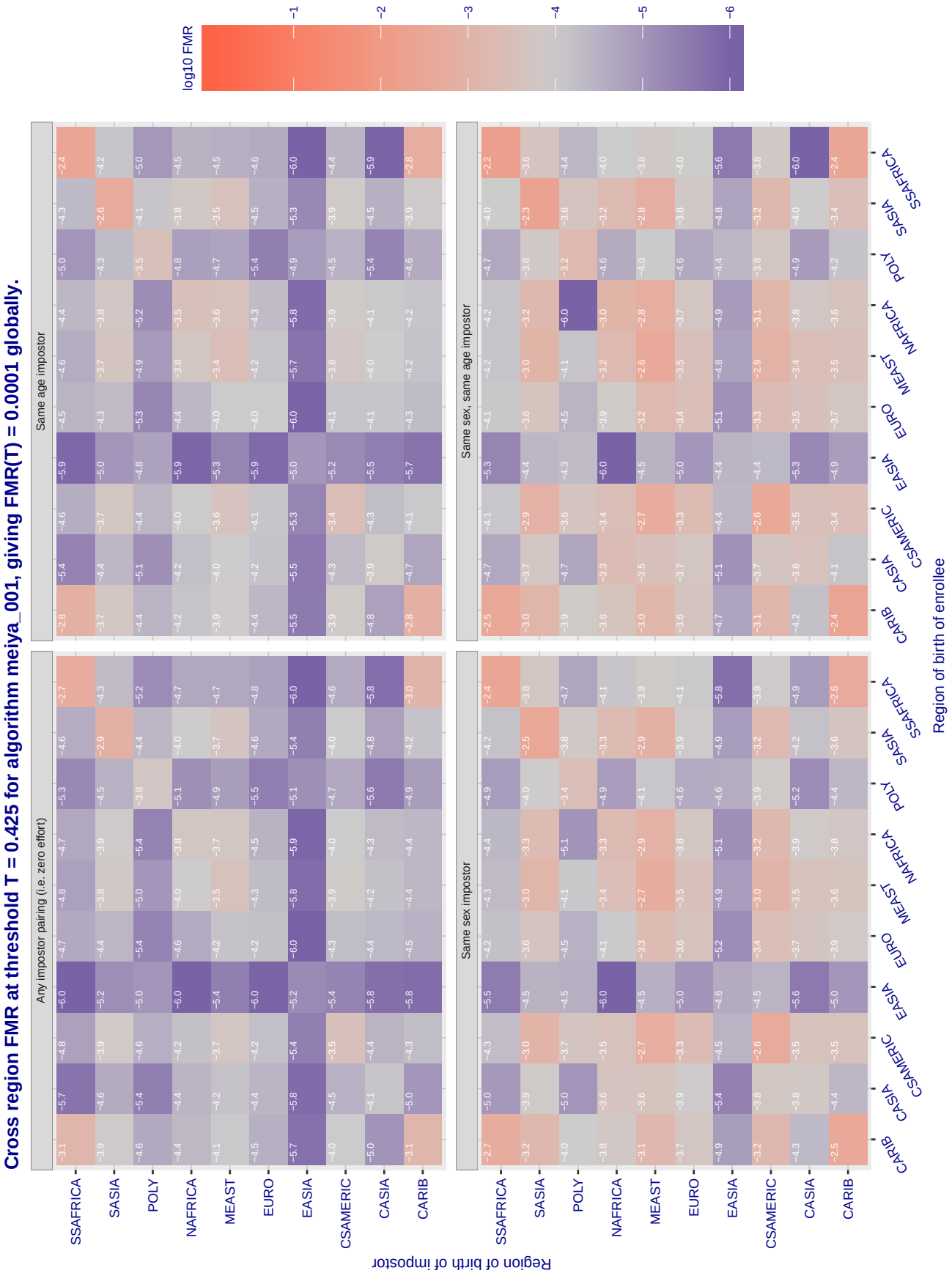


Figure 202: For algorithm meiya-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

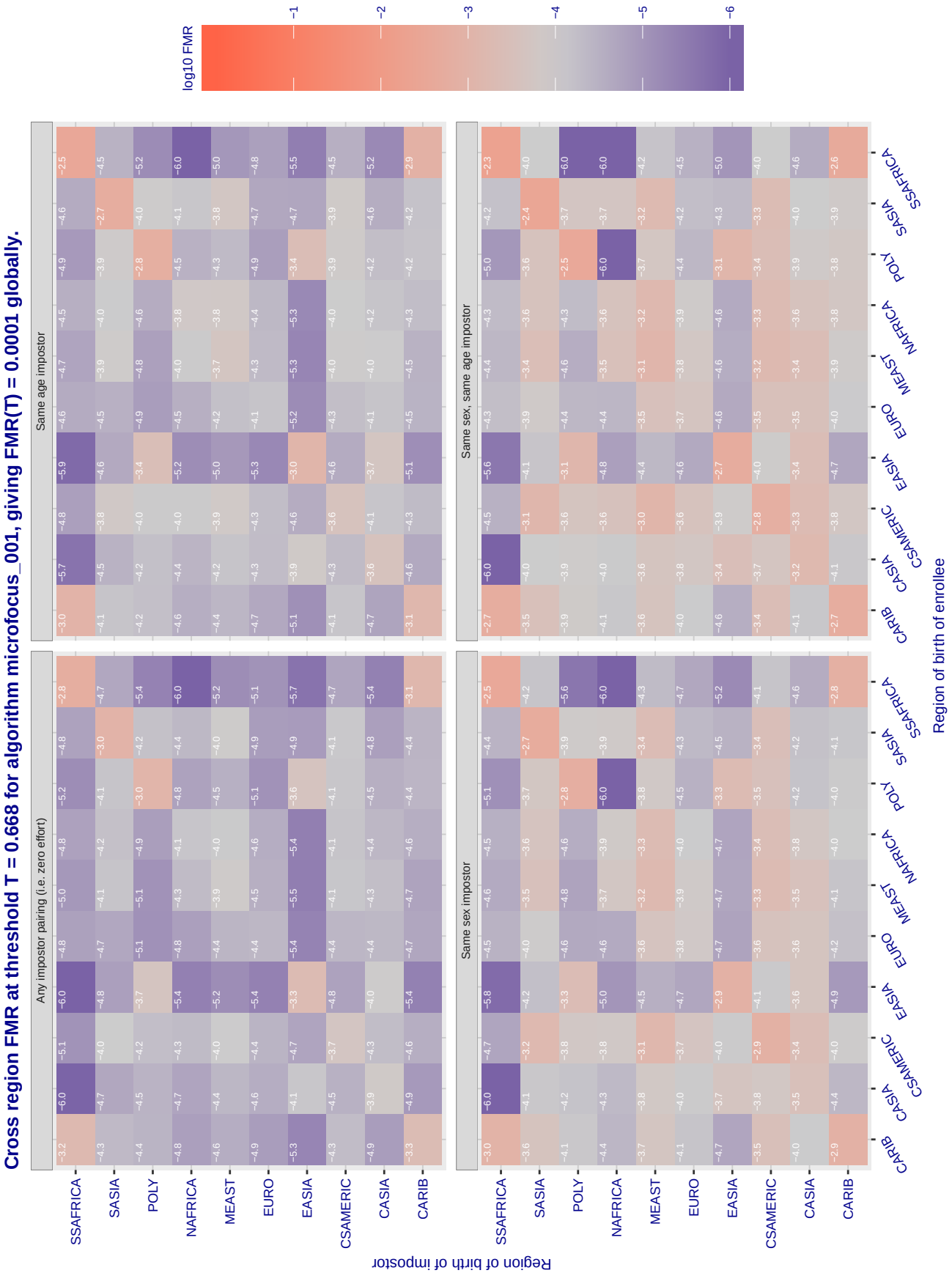


Figure 203: For algorithm microfocus-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

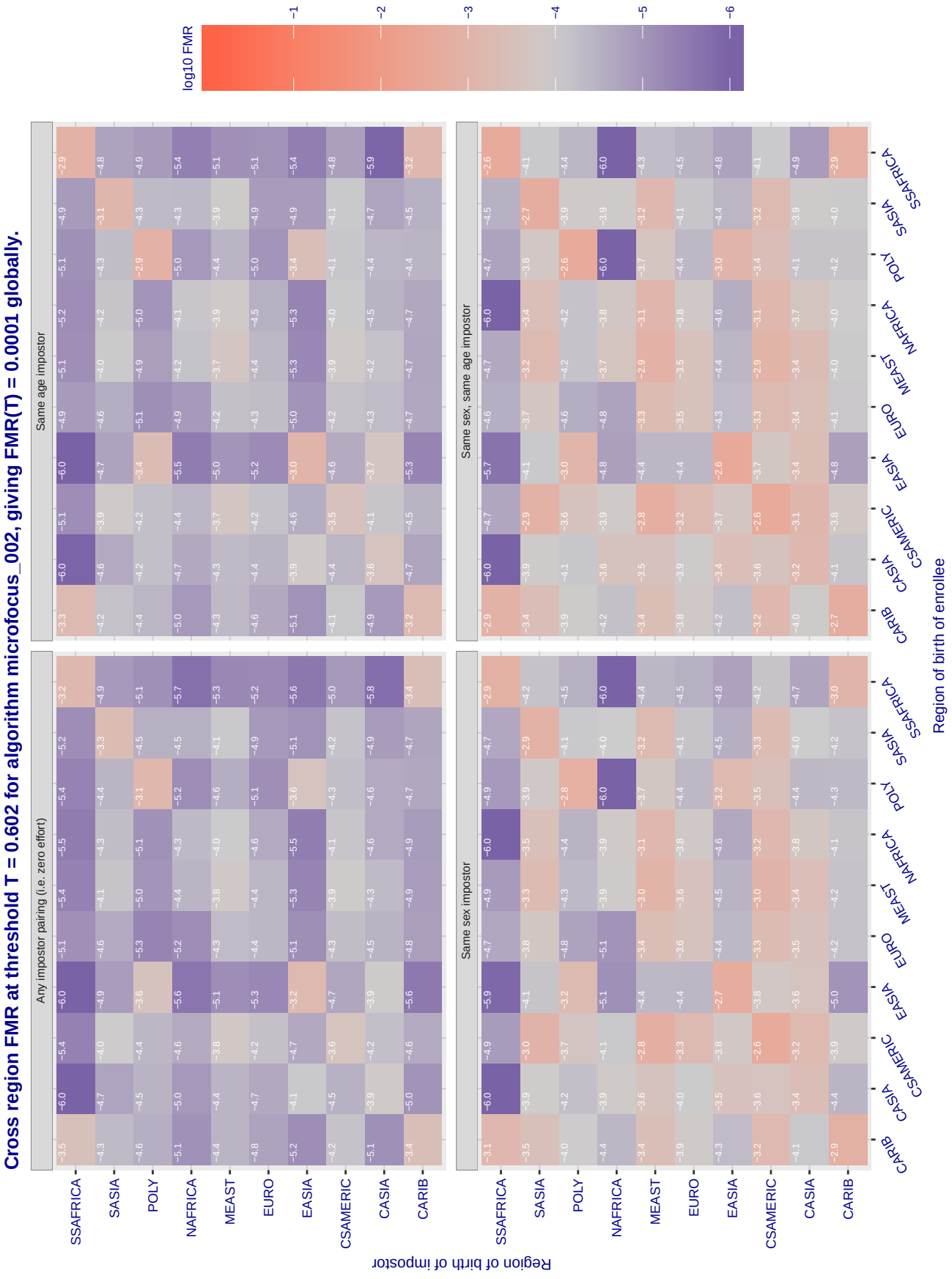


Figure 204: For algorithm microfocus-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

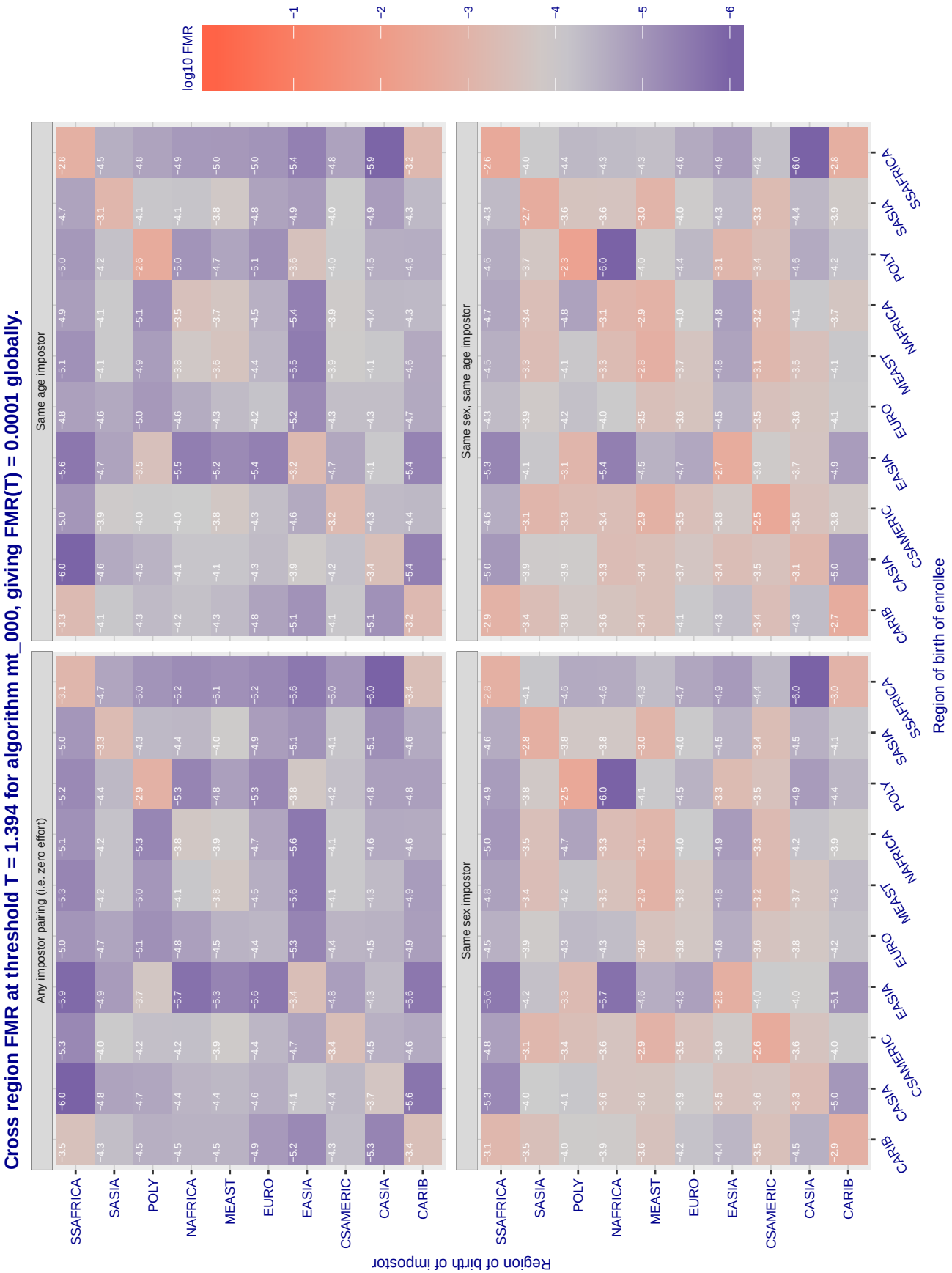


Figure 205: For algorithm mt-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

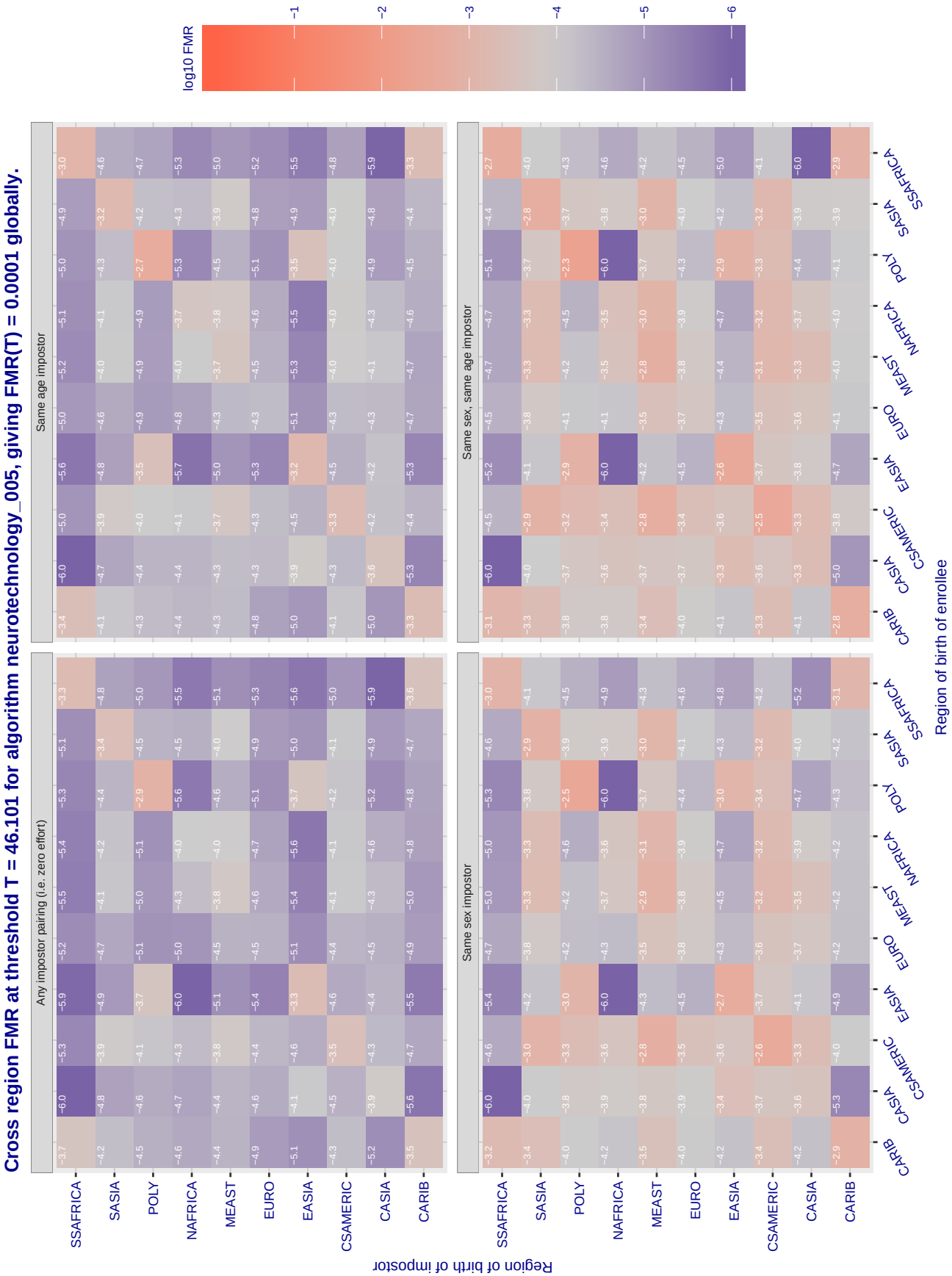


Figure 206: For algorithm neurotechnology-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

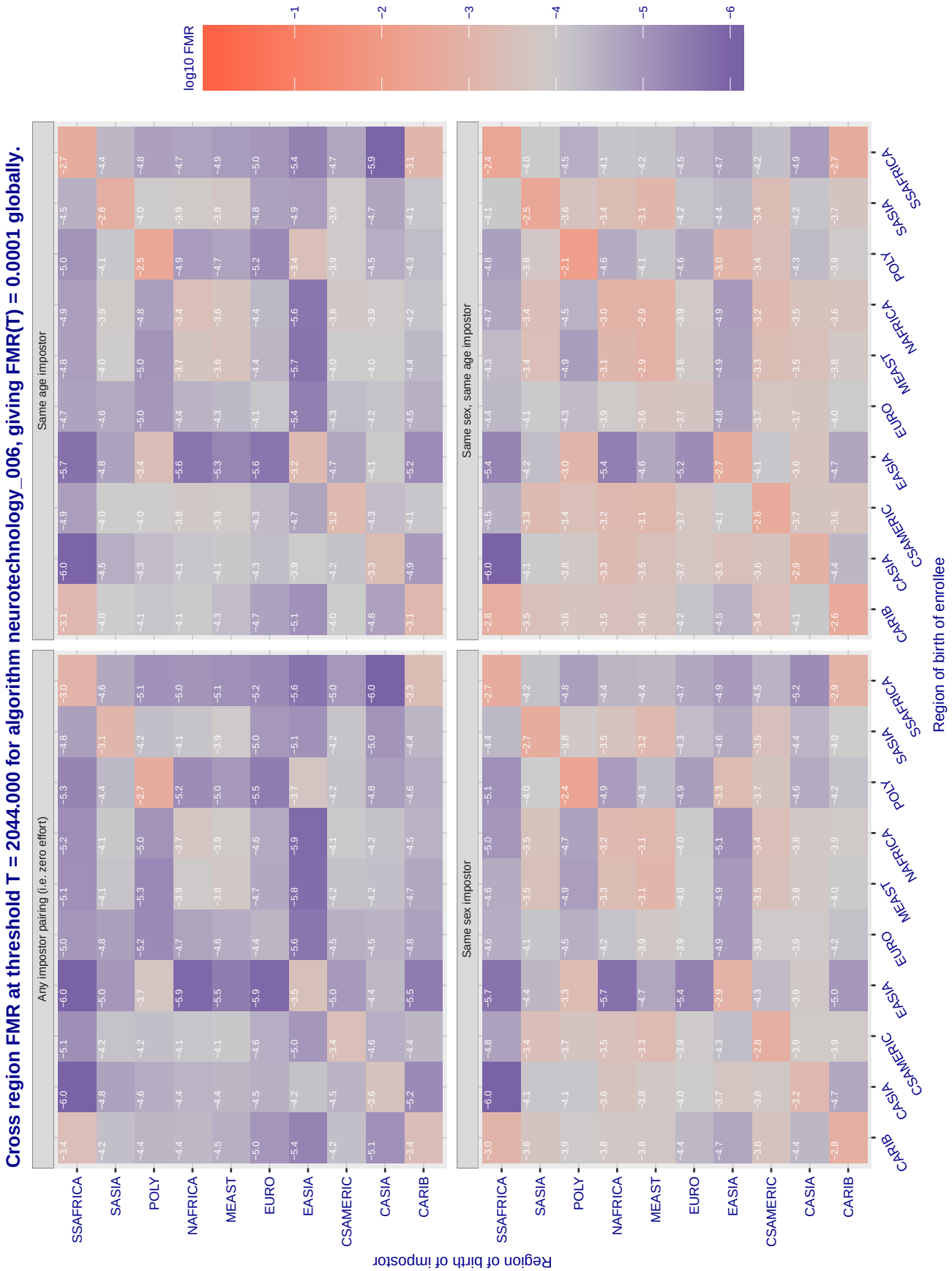


Figure 207: For algorithm neurotechnology-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

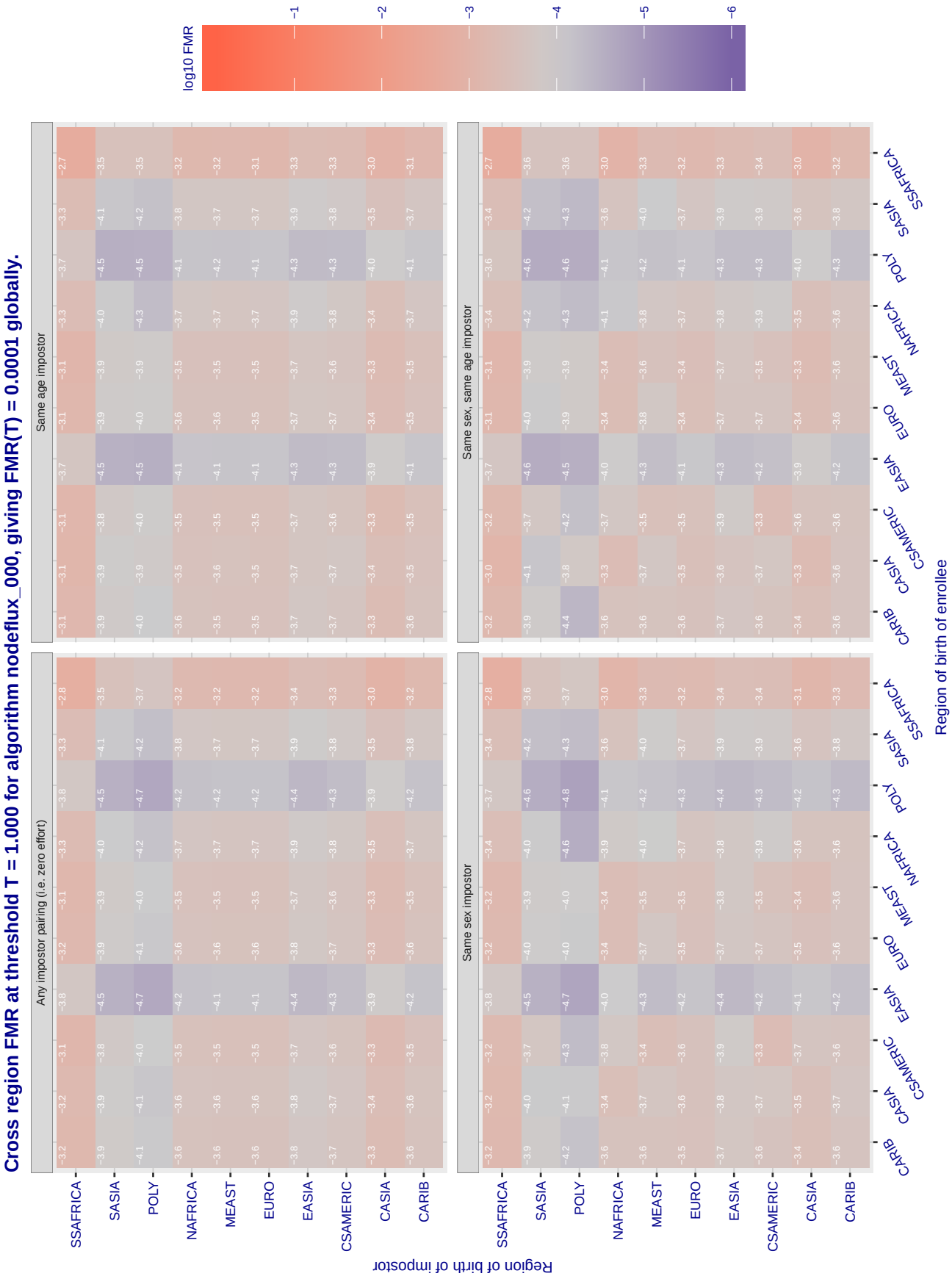


Figure 208: For algorithm nodeflux-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

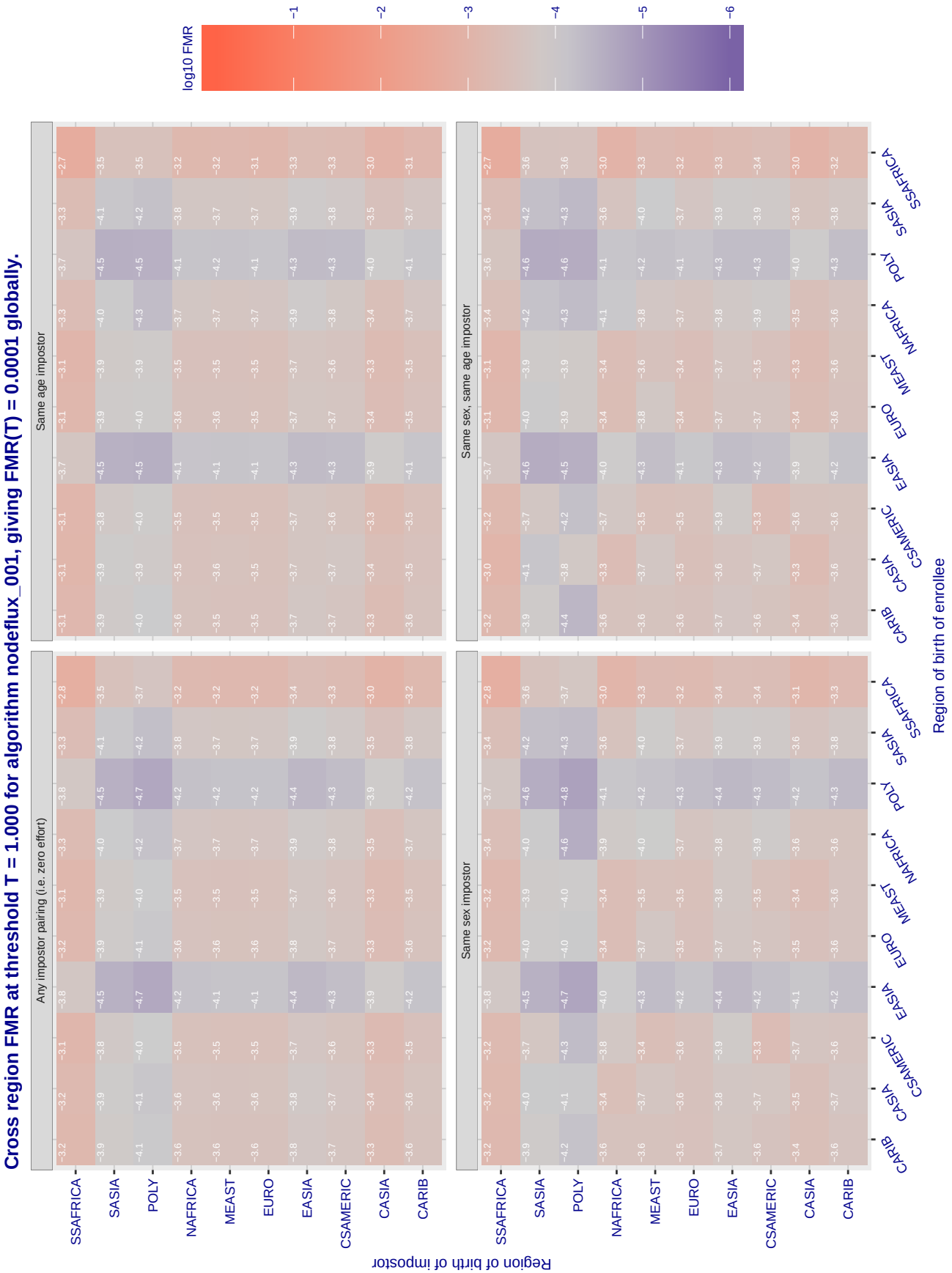


Figure 209: For algorithm nodeflux-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

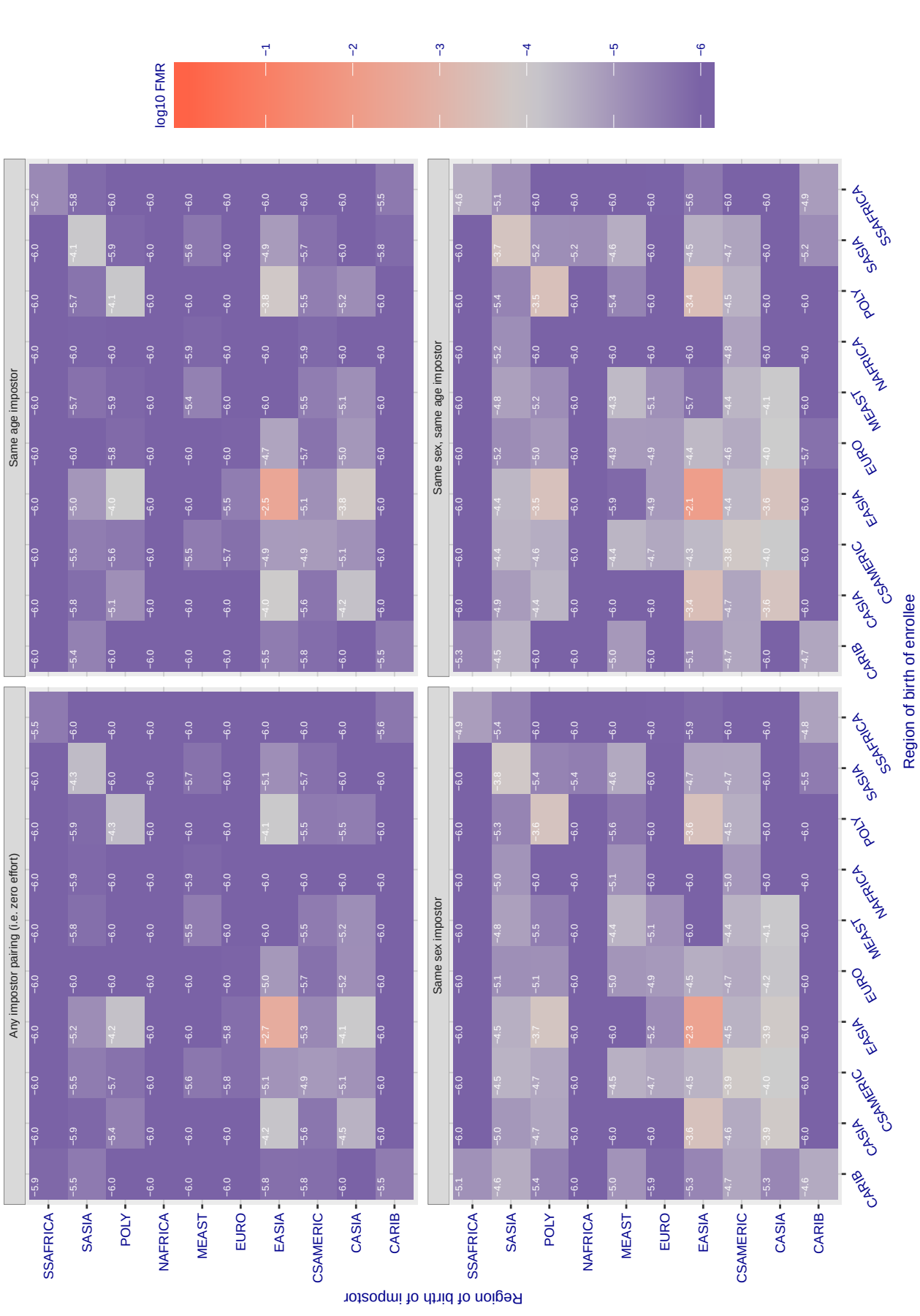


Figure 210: For algorithm notiontag-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

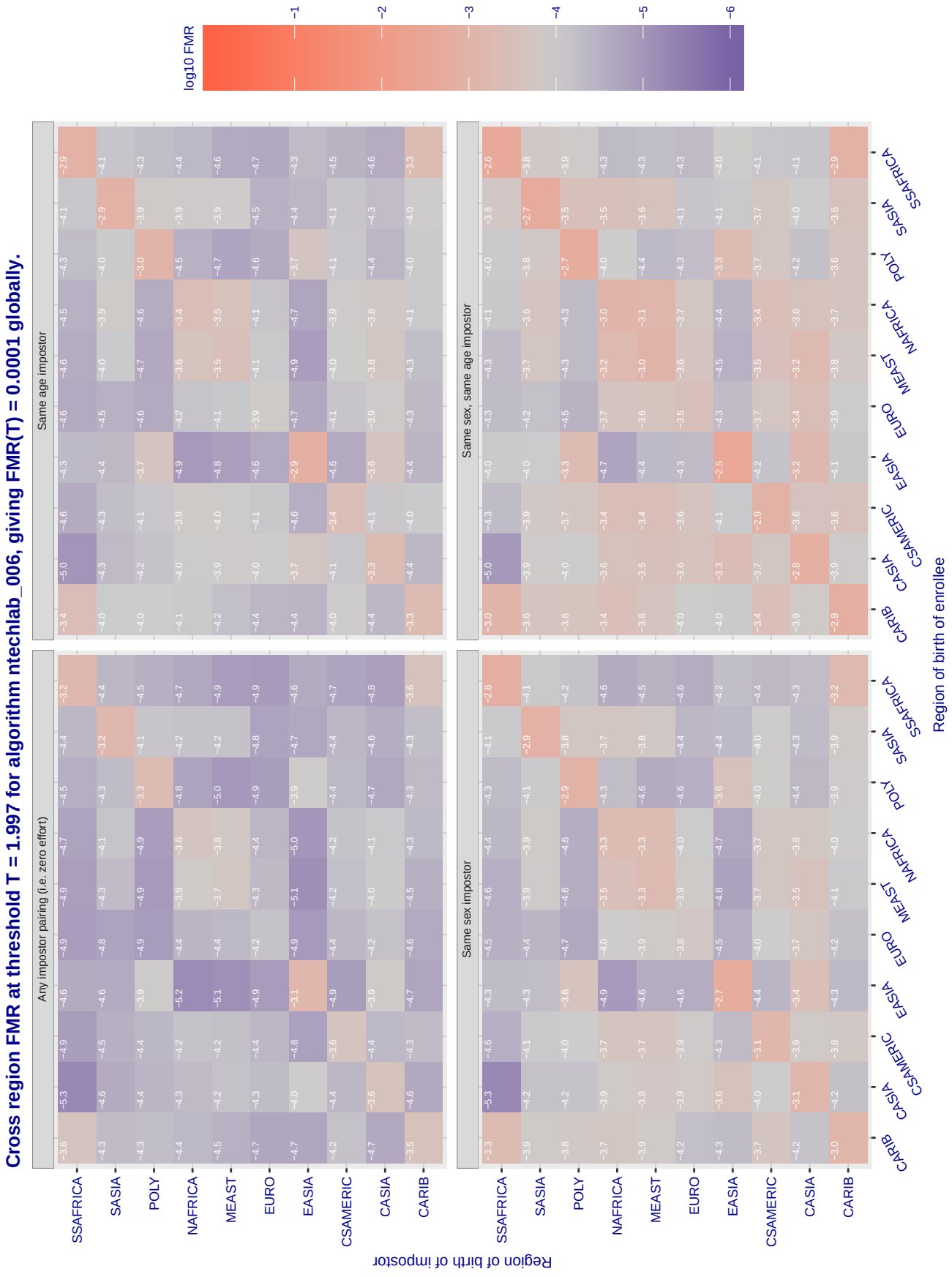


Figure 211: For algorithm ntechlab-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

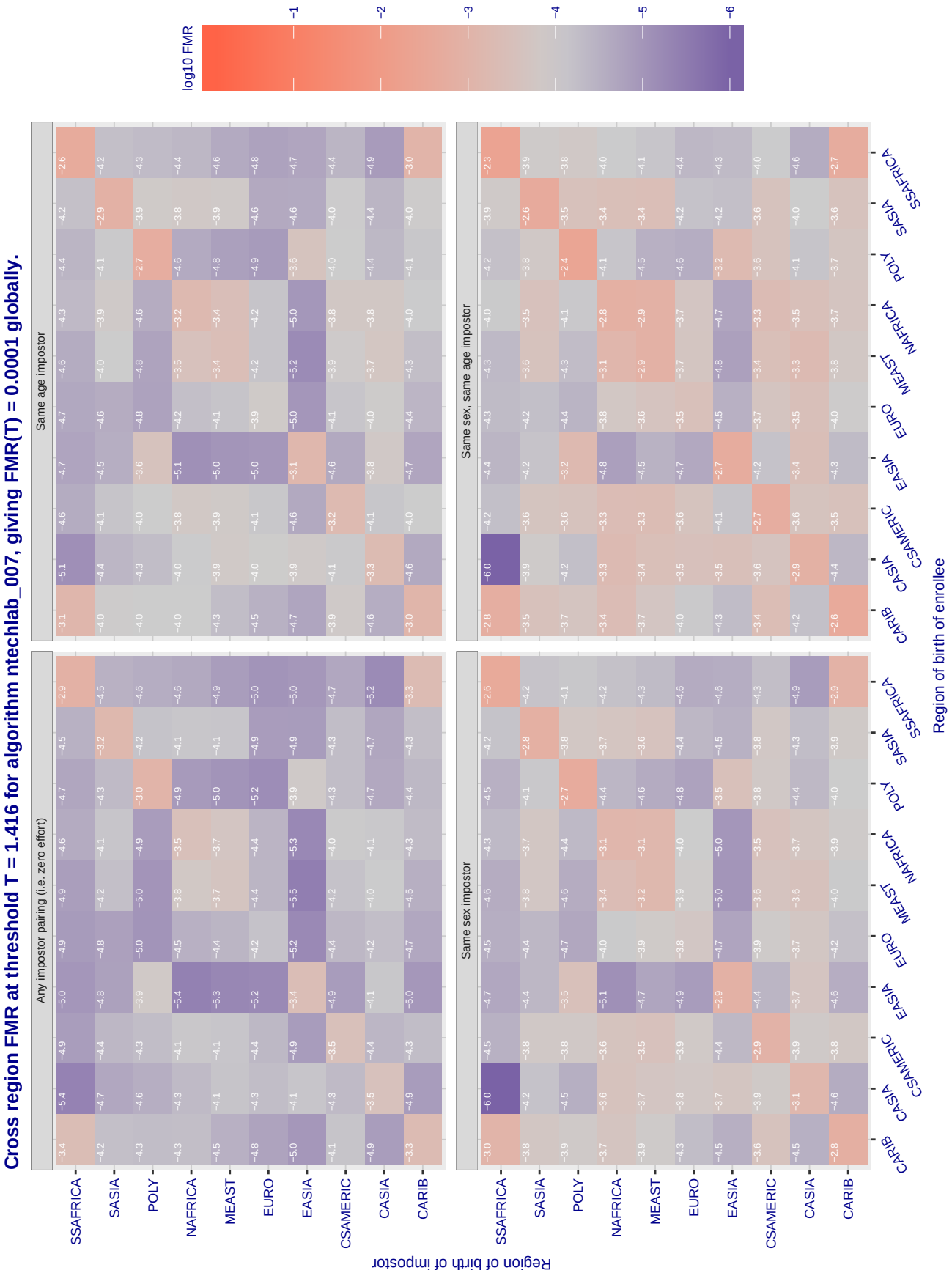


Figure 212: For algorithm ntechlab-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

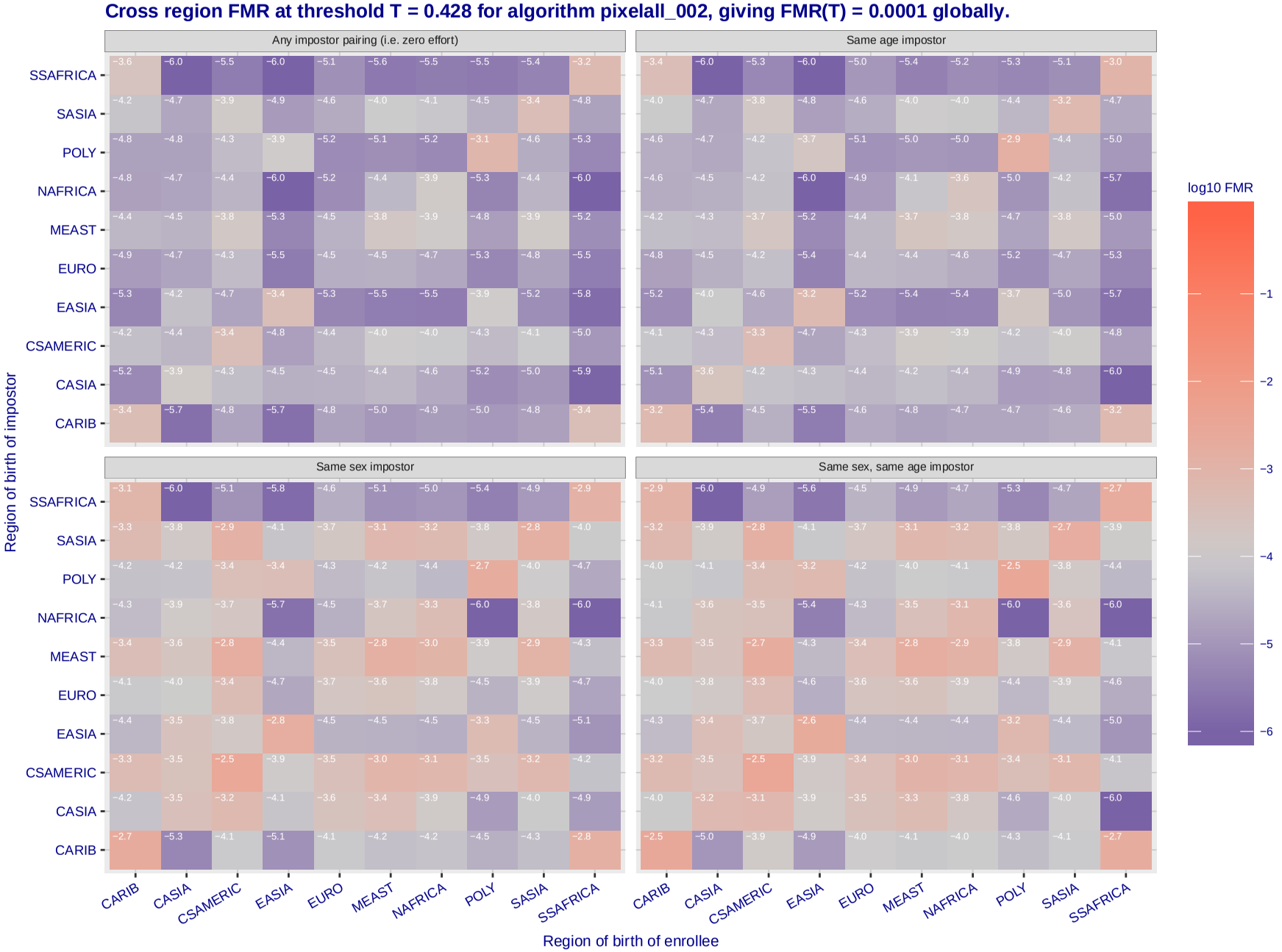


Figure 213: For algorithm pixelall-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

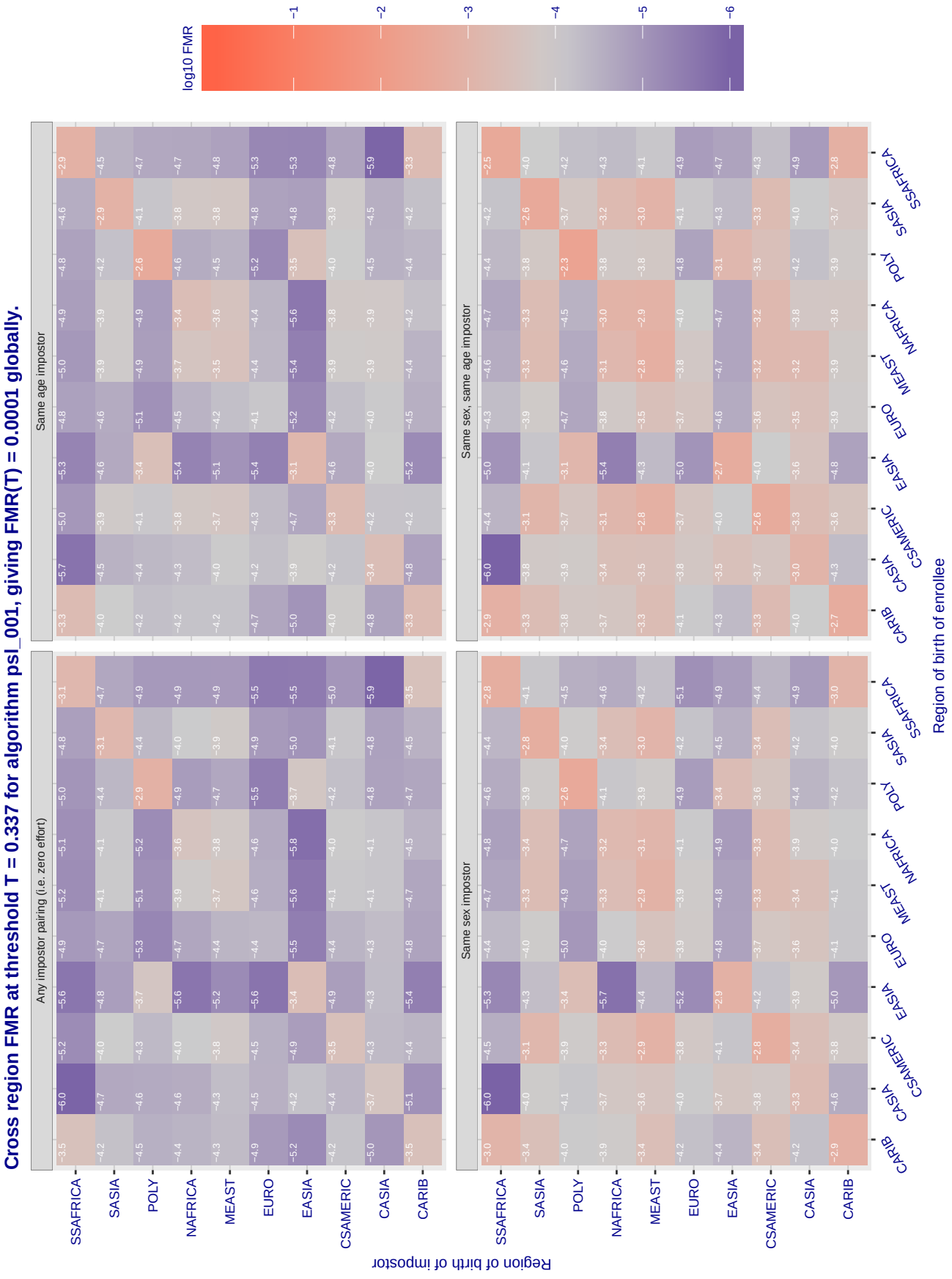


Figure 214: For algorithm psl-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

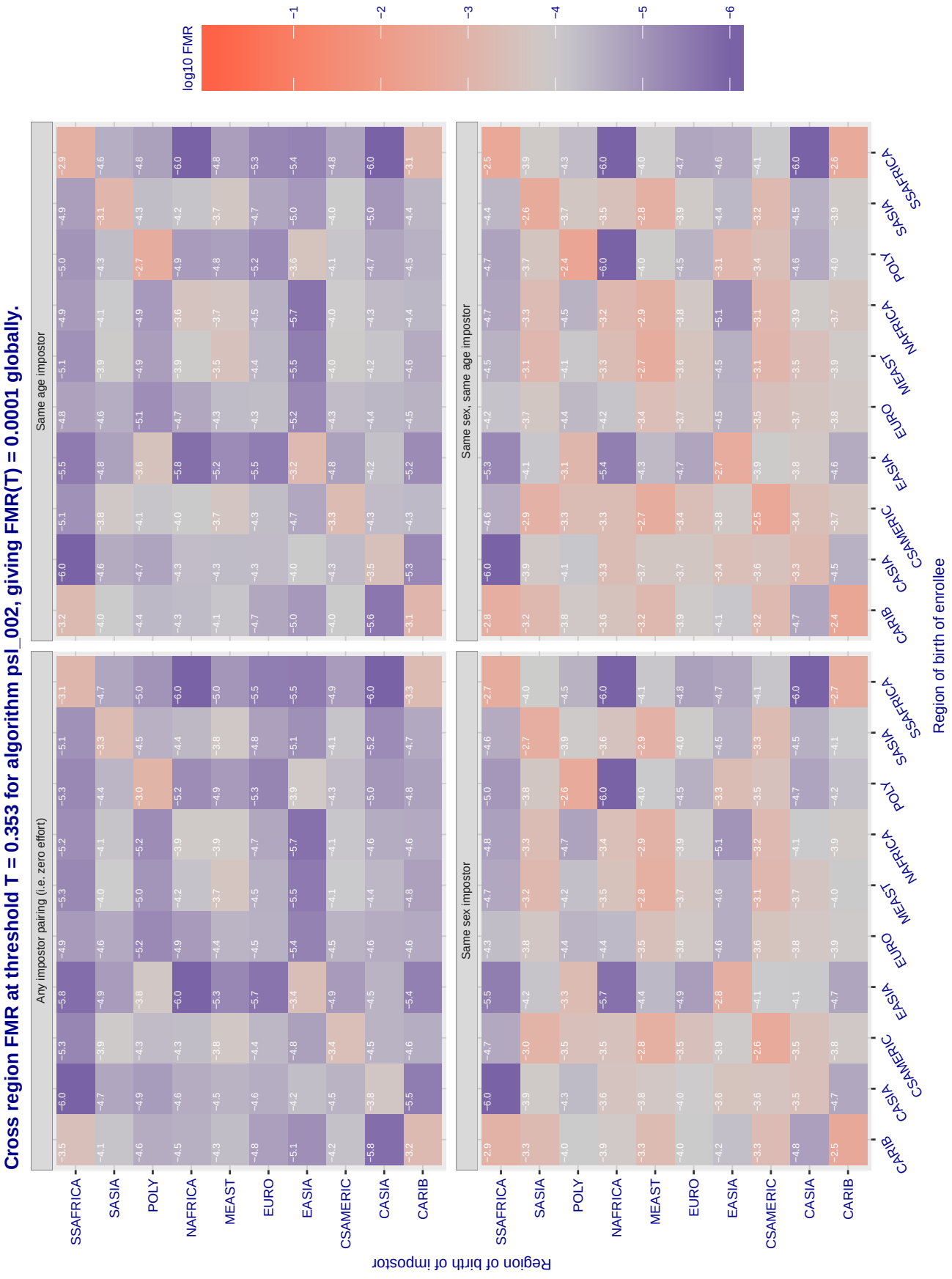


Figure 215: For algorithm psl-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

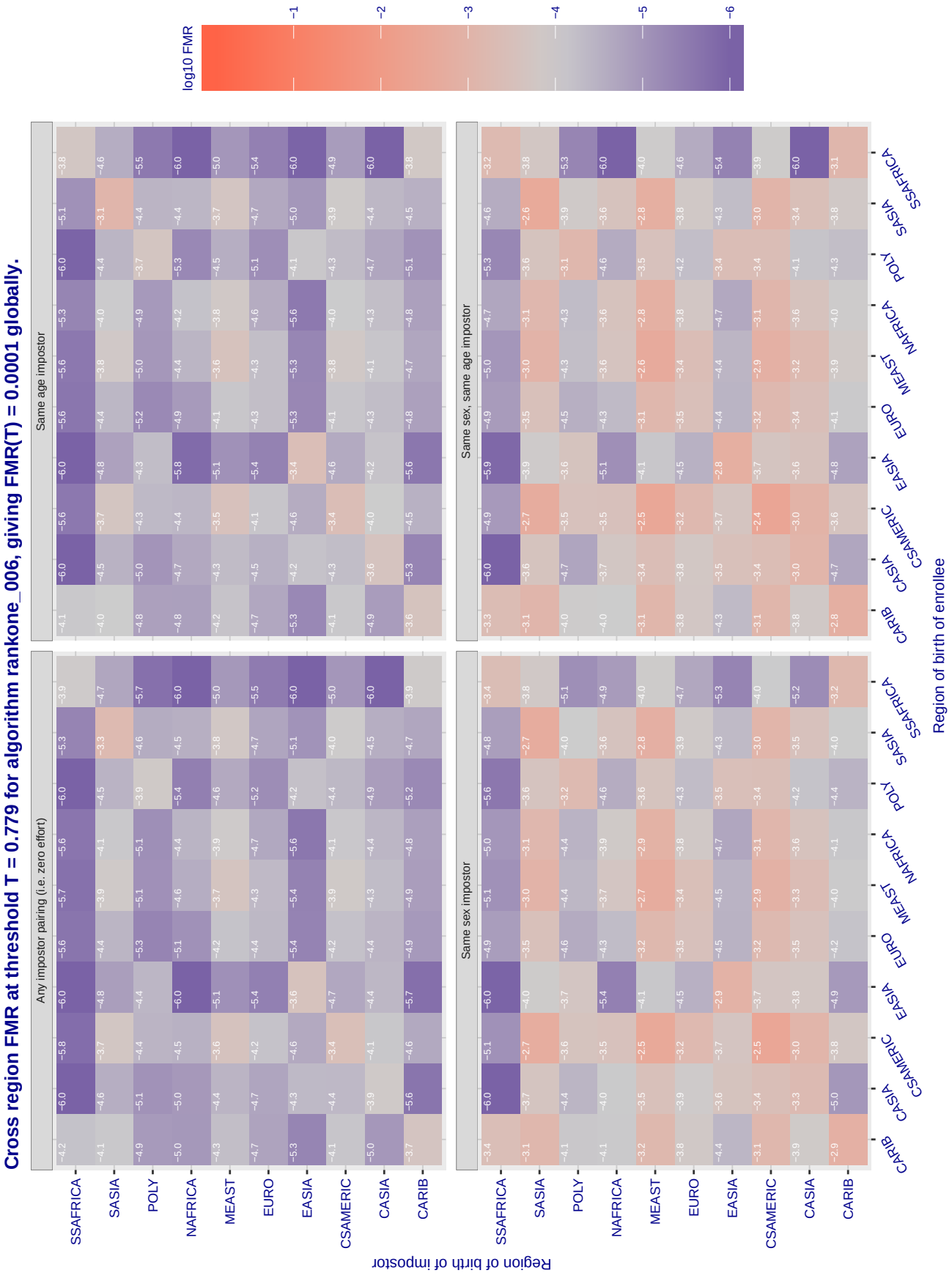


Figure 216: For algorithm rankone-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

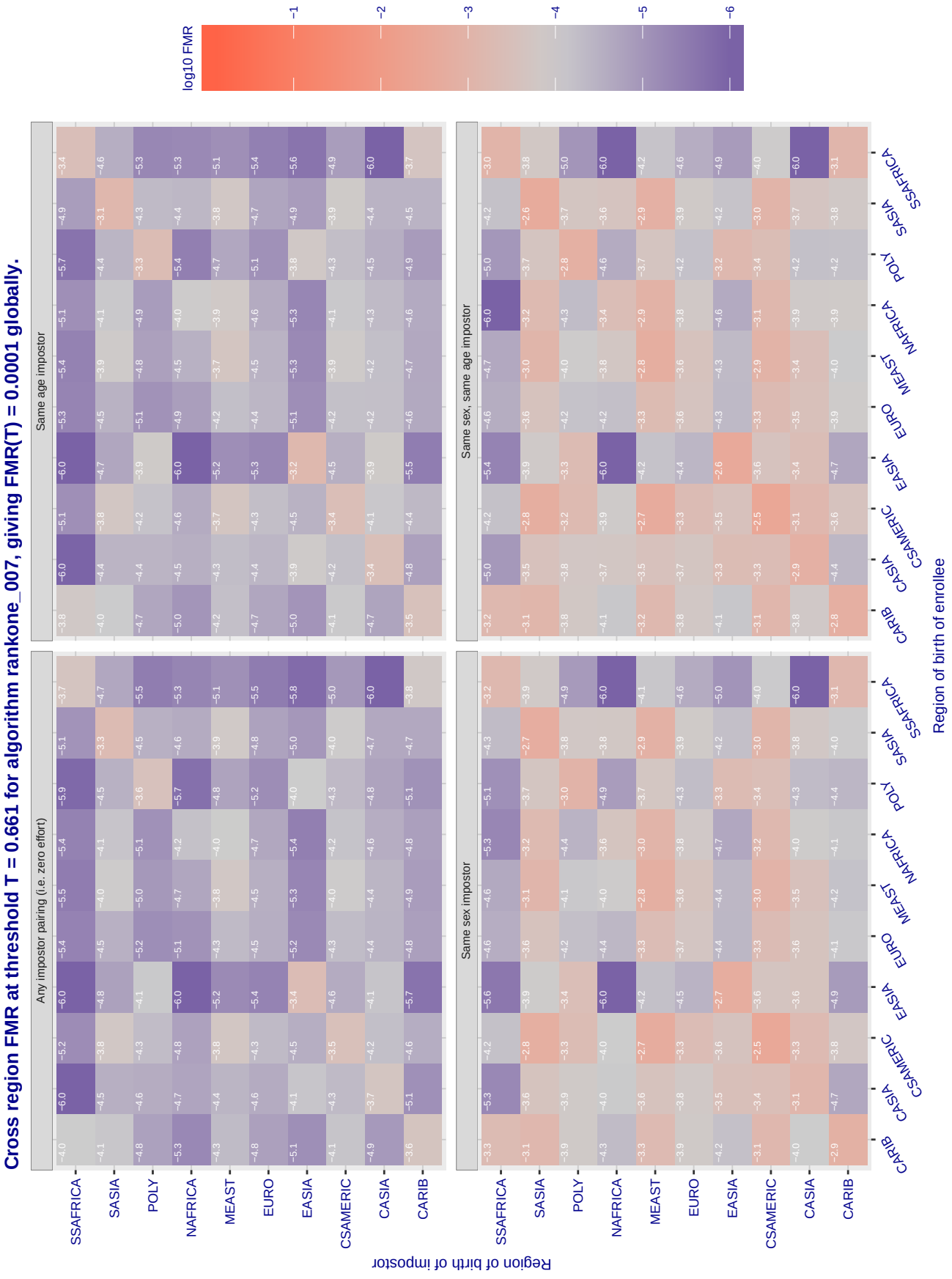


Figure 217: For algorithm rankone-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

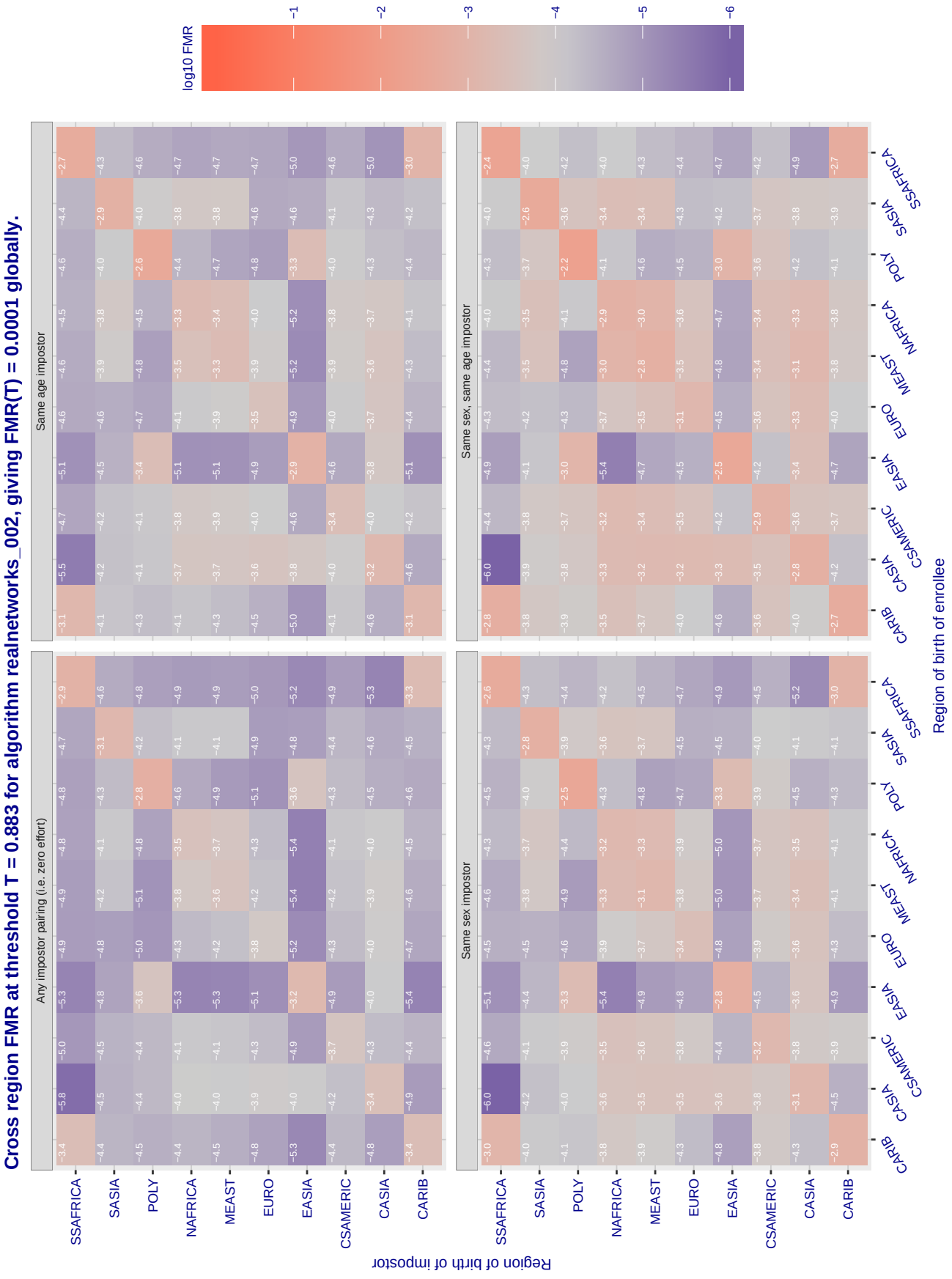


Figure 218: For algorithm realnetworks-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

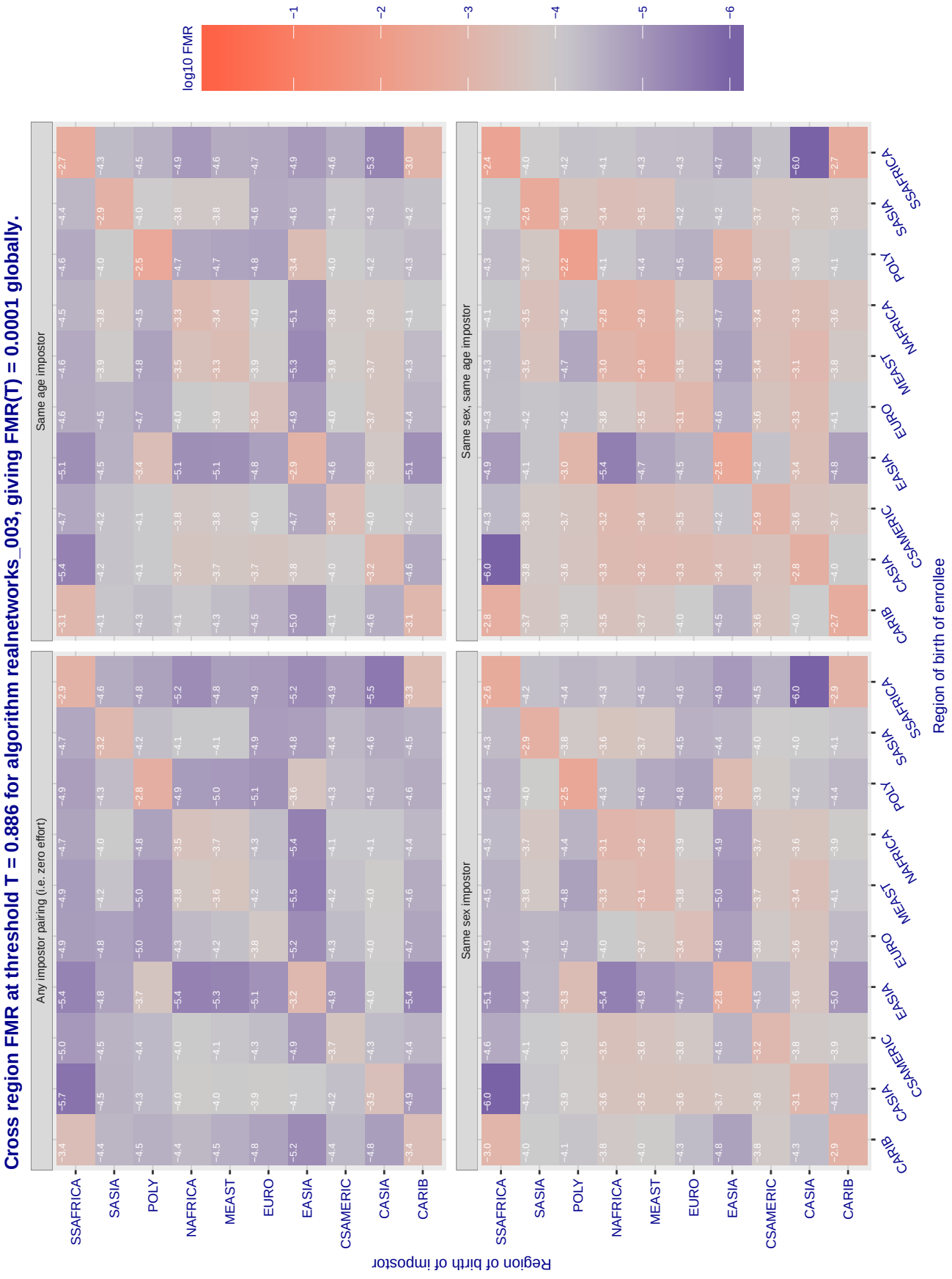


Figure 219: For algorithm realnetworks-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

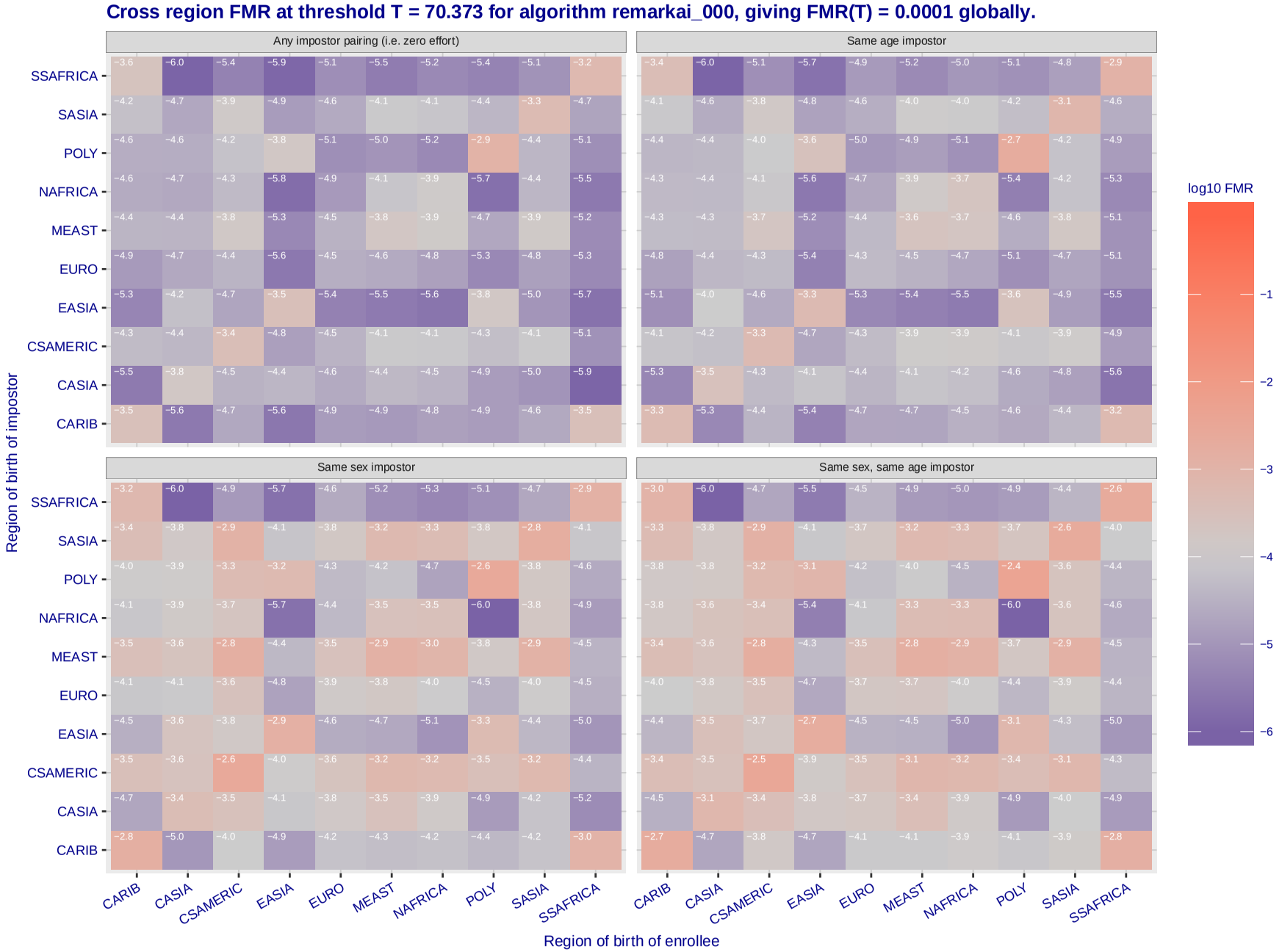


Figure 220: For algorithm remarkai-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

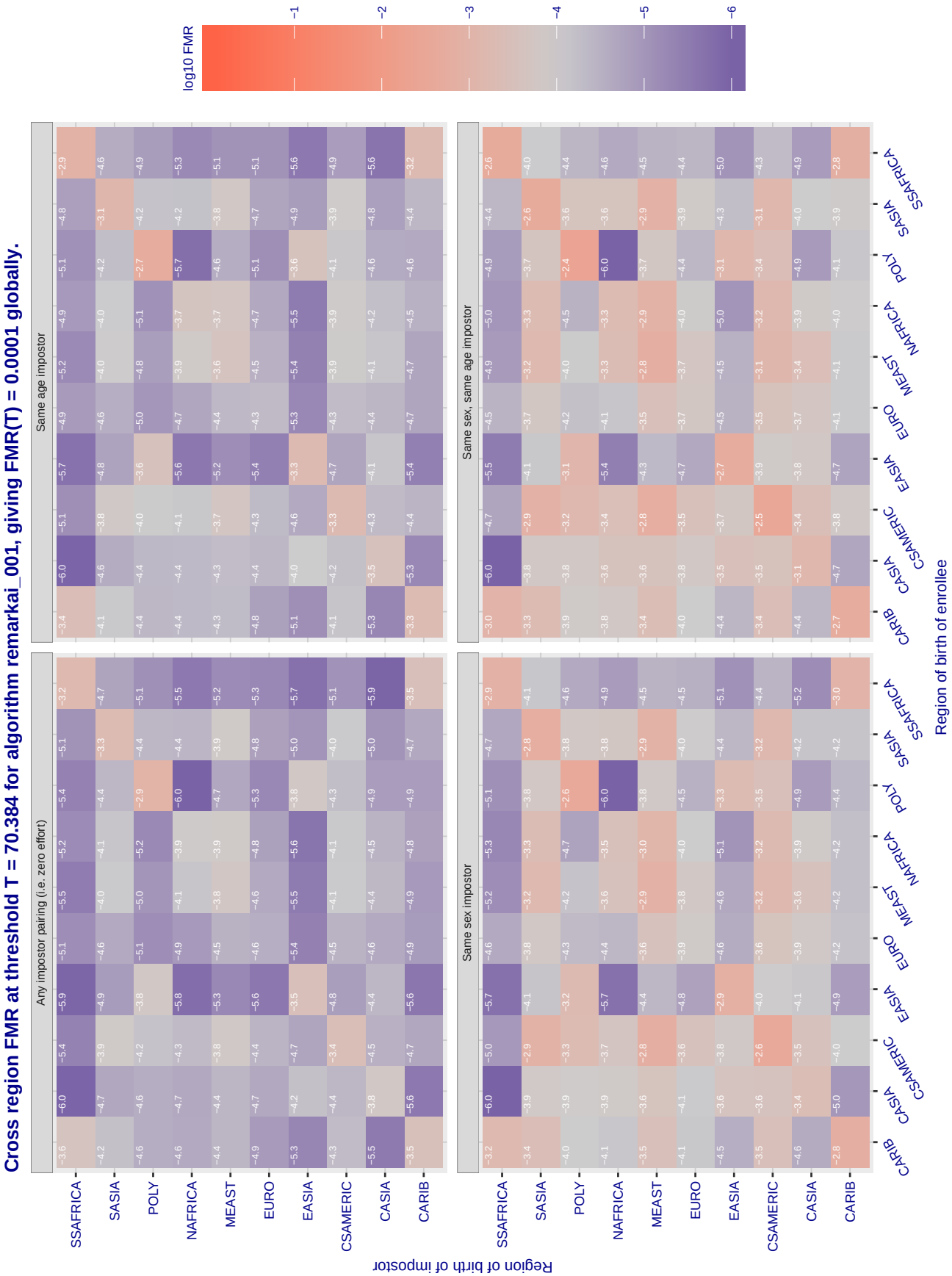


Figure 221: For algorithm remarkai-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

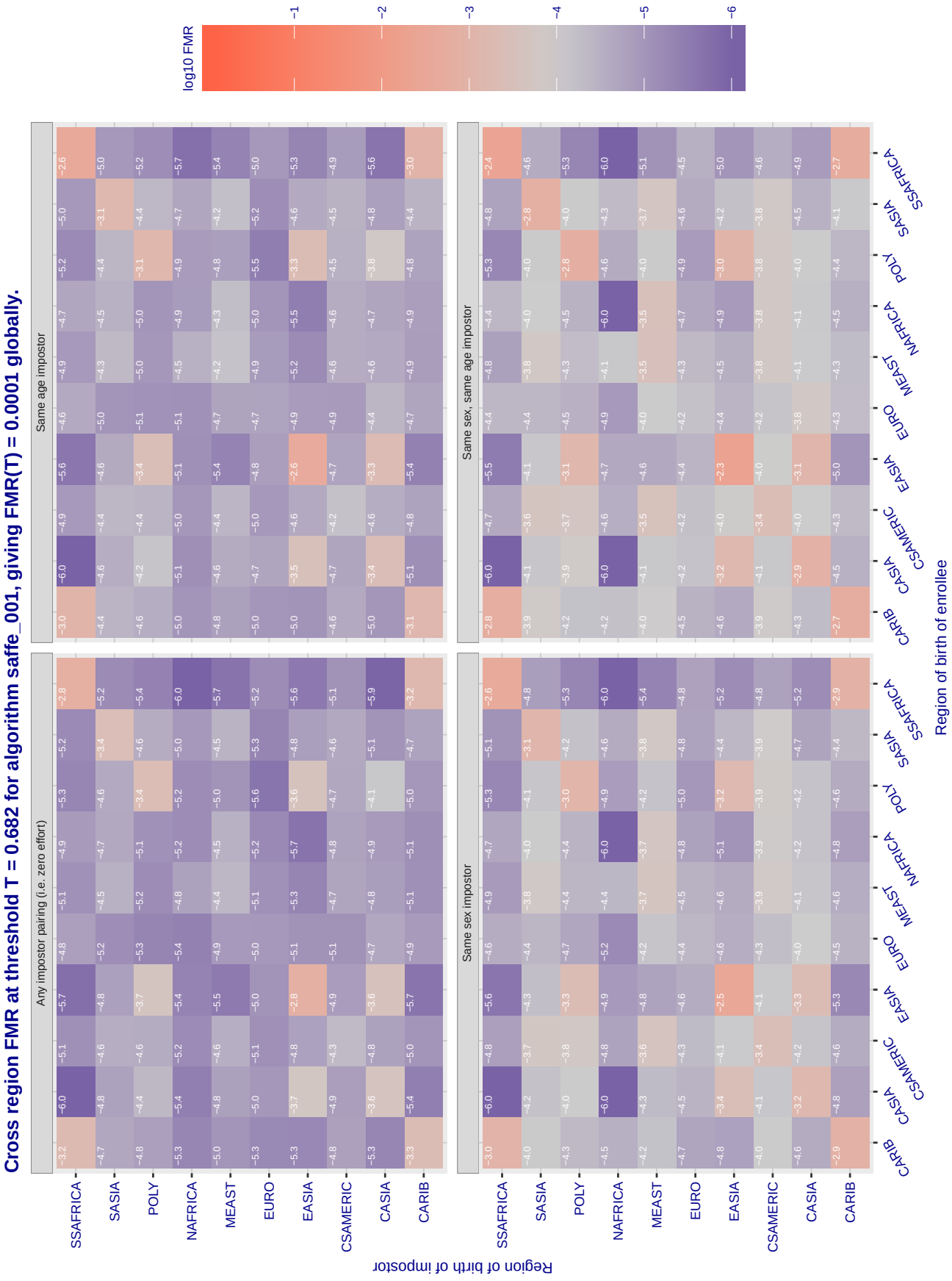


Figure 222: For algorithm saffe-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

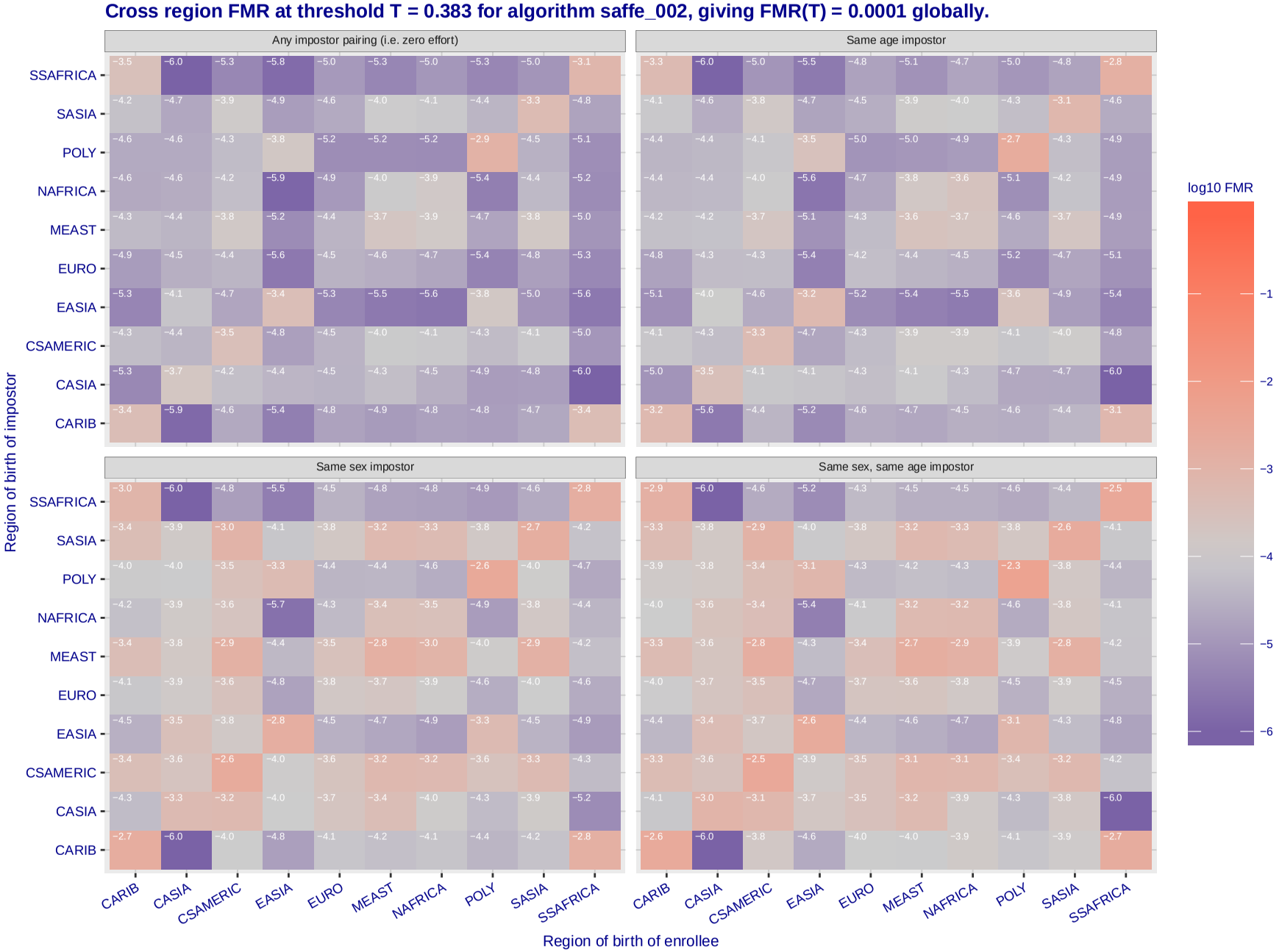


Figure 223: For algorithm saffe-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

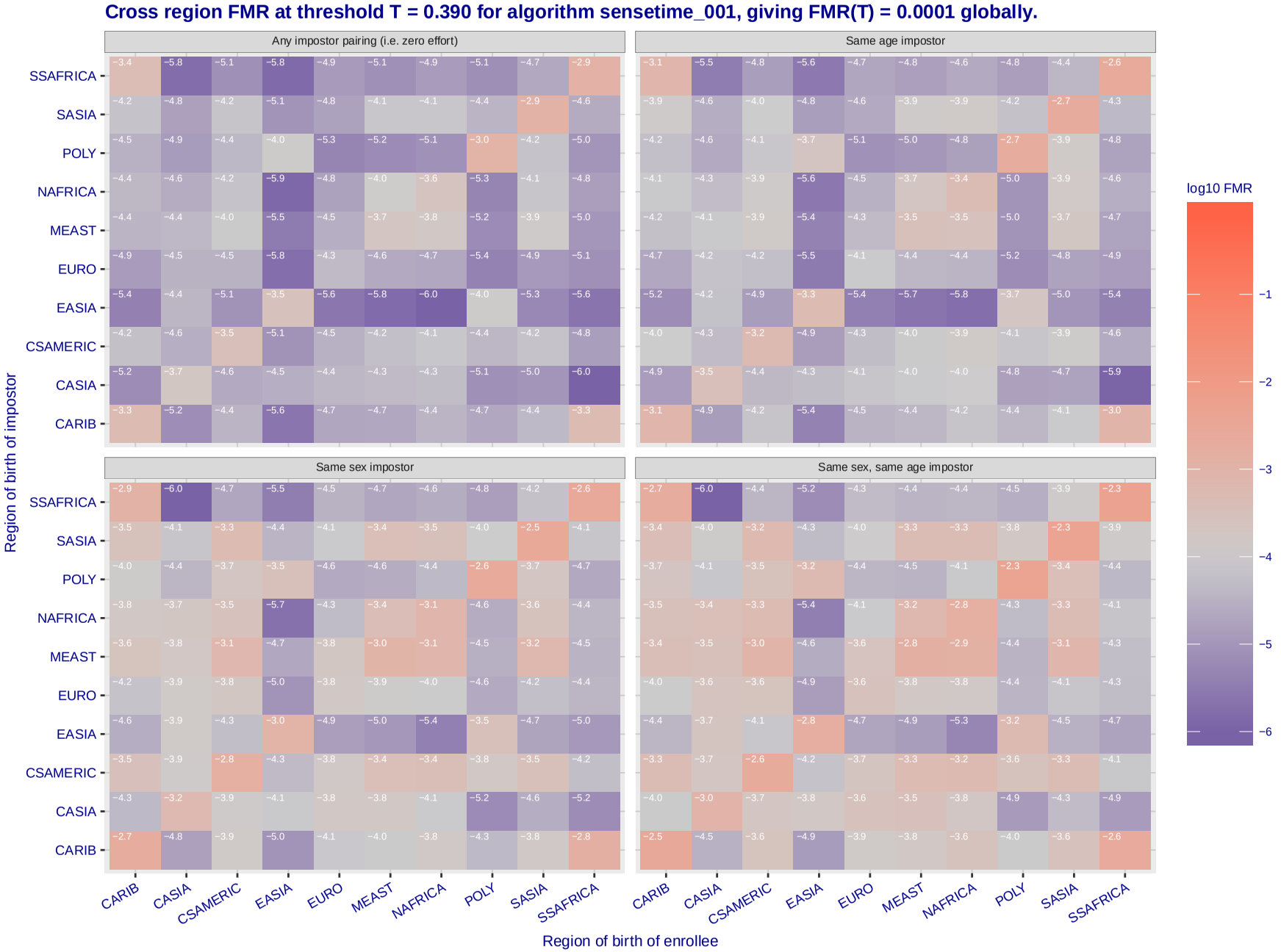


Figure 224: For algorithm sensetime-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

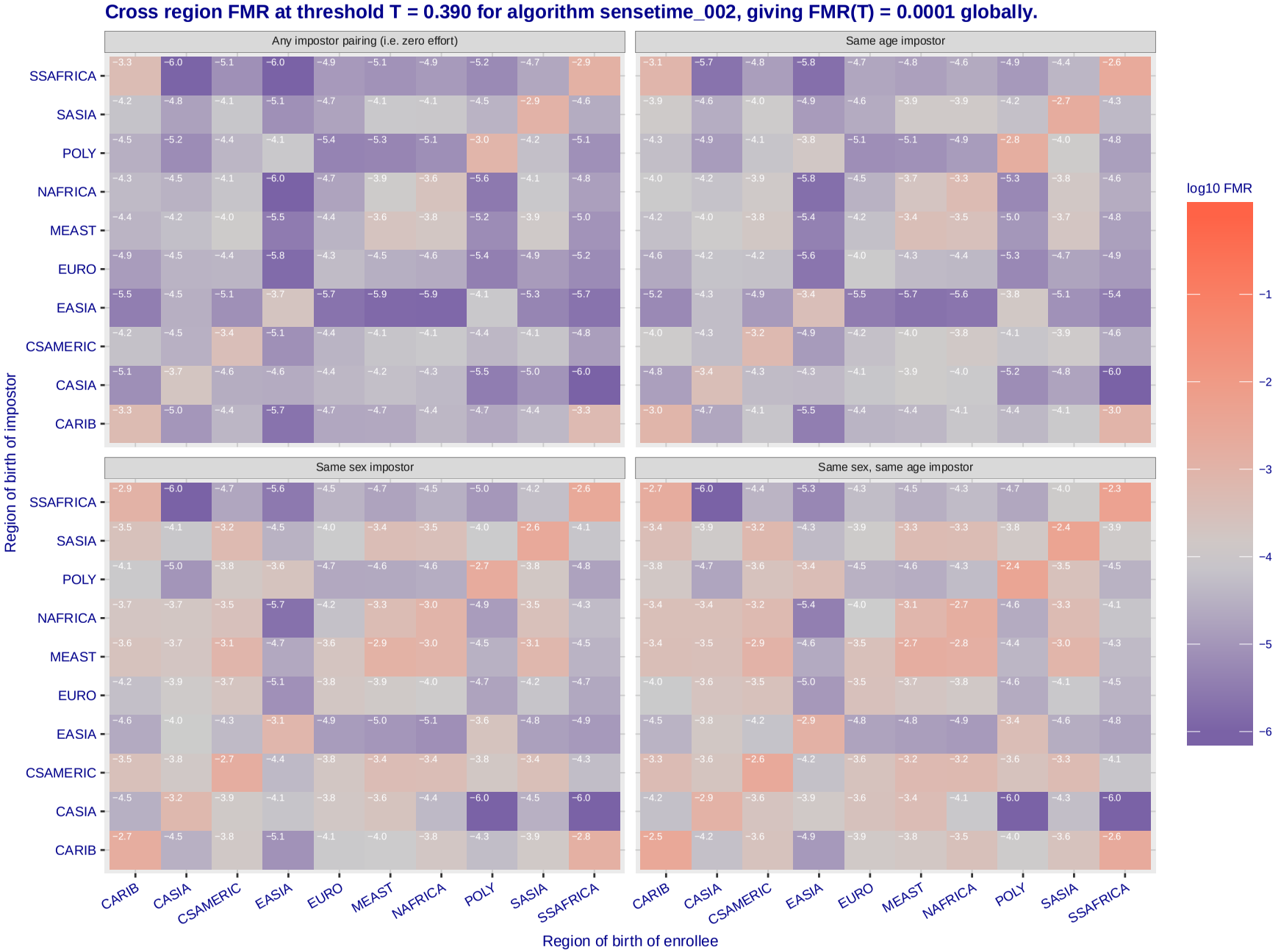


Figure 225: For algorithm sensetime-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

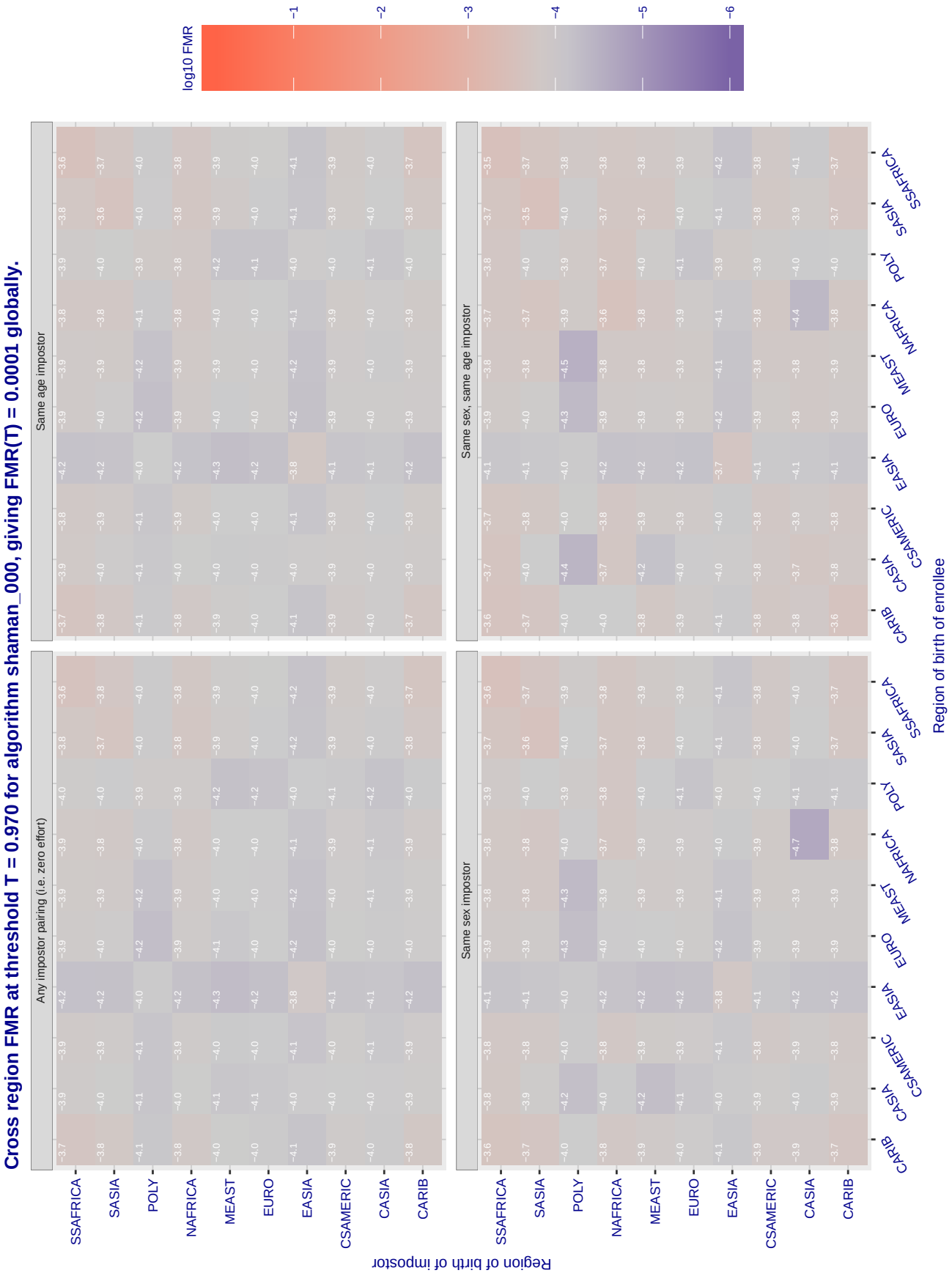


Figure 226: For algorithm shaman-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

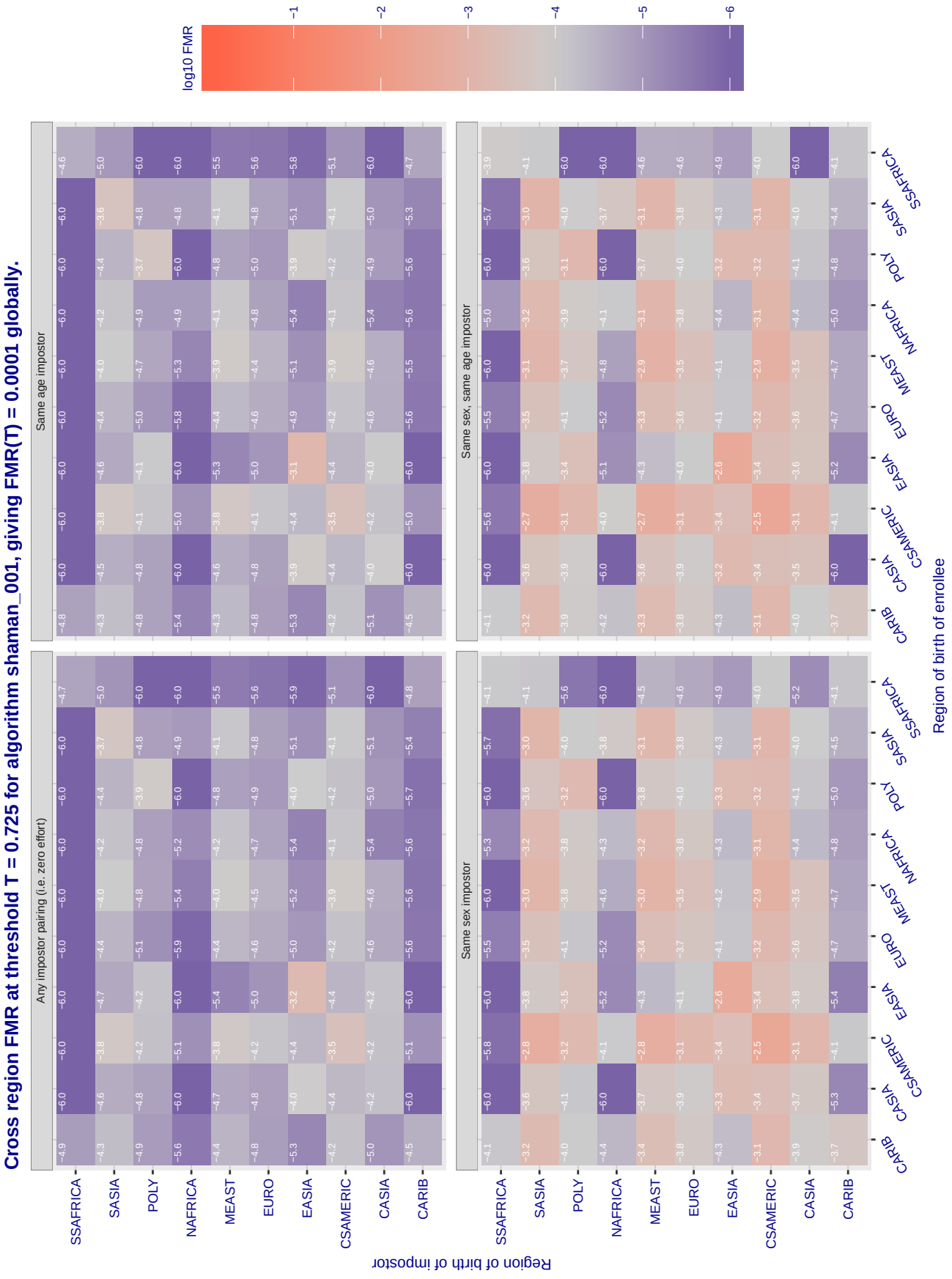


Figure 227: For algorithm shaman-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

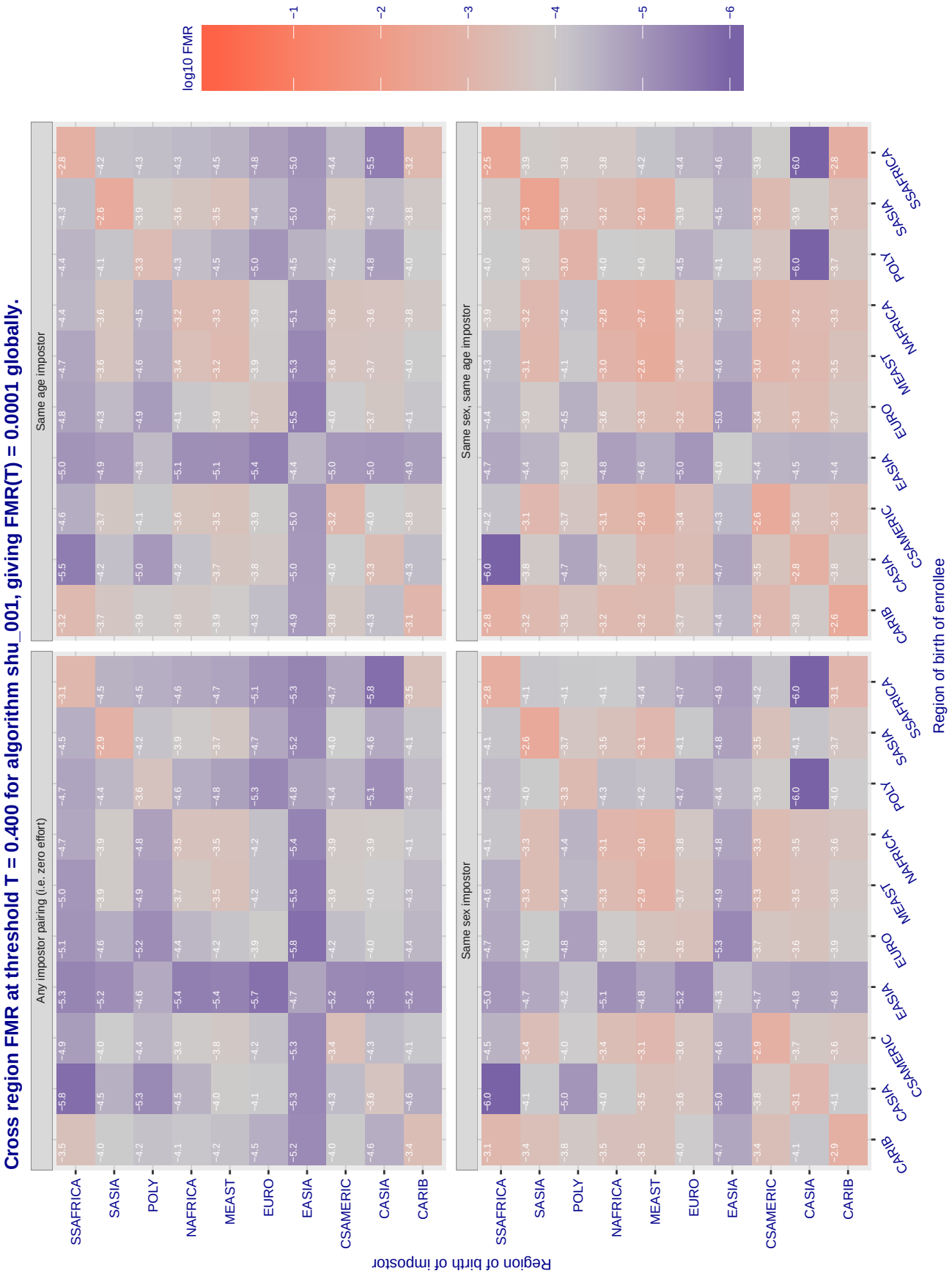


Figure 228: For algorithm shu-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

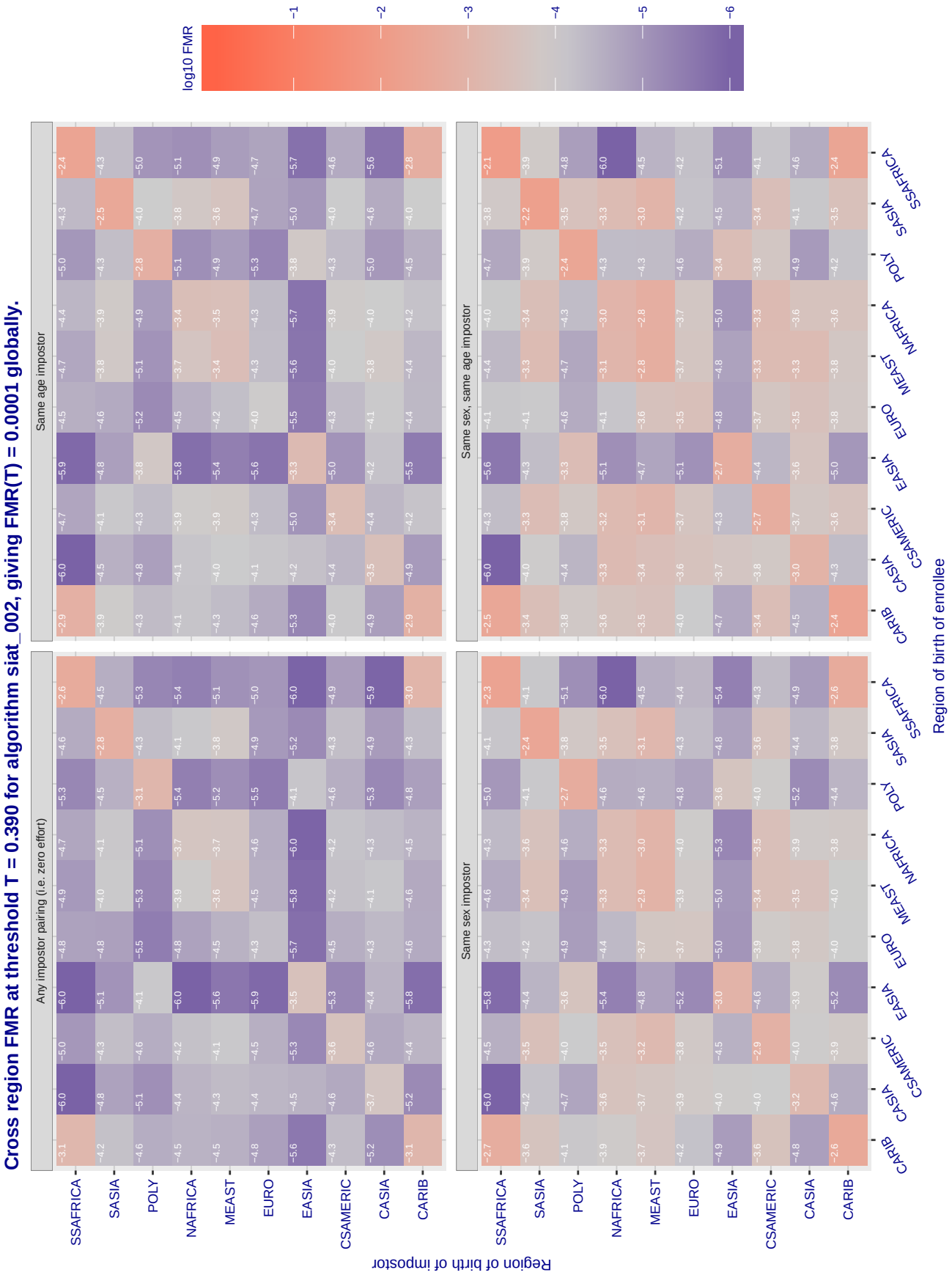


Figure 229: For algorithm siat-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

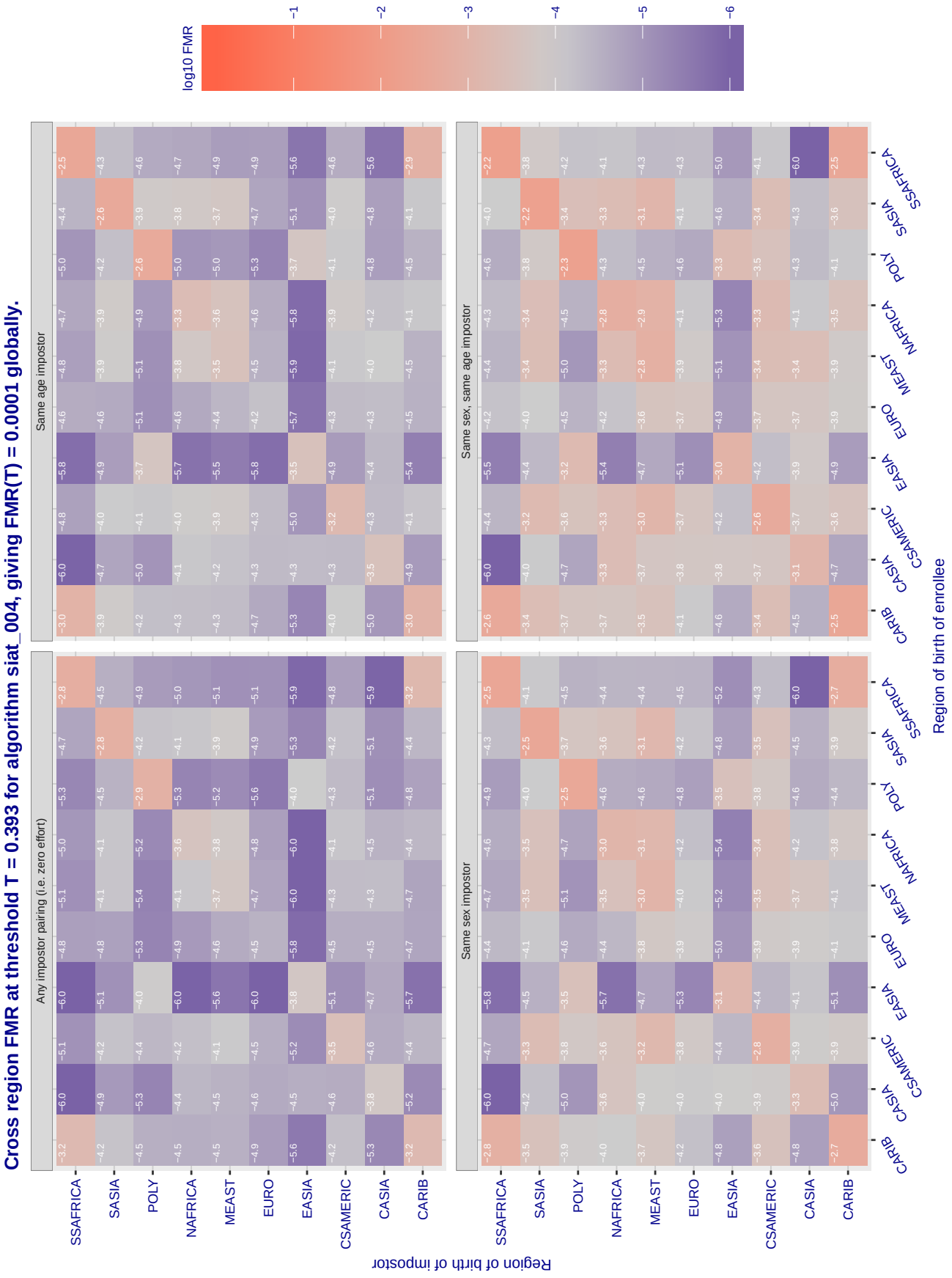


Figure 230: For algorithm siat-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

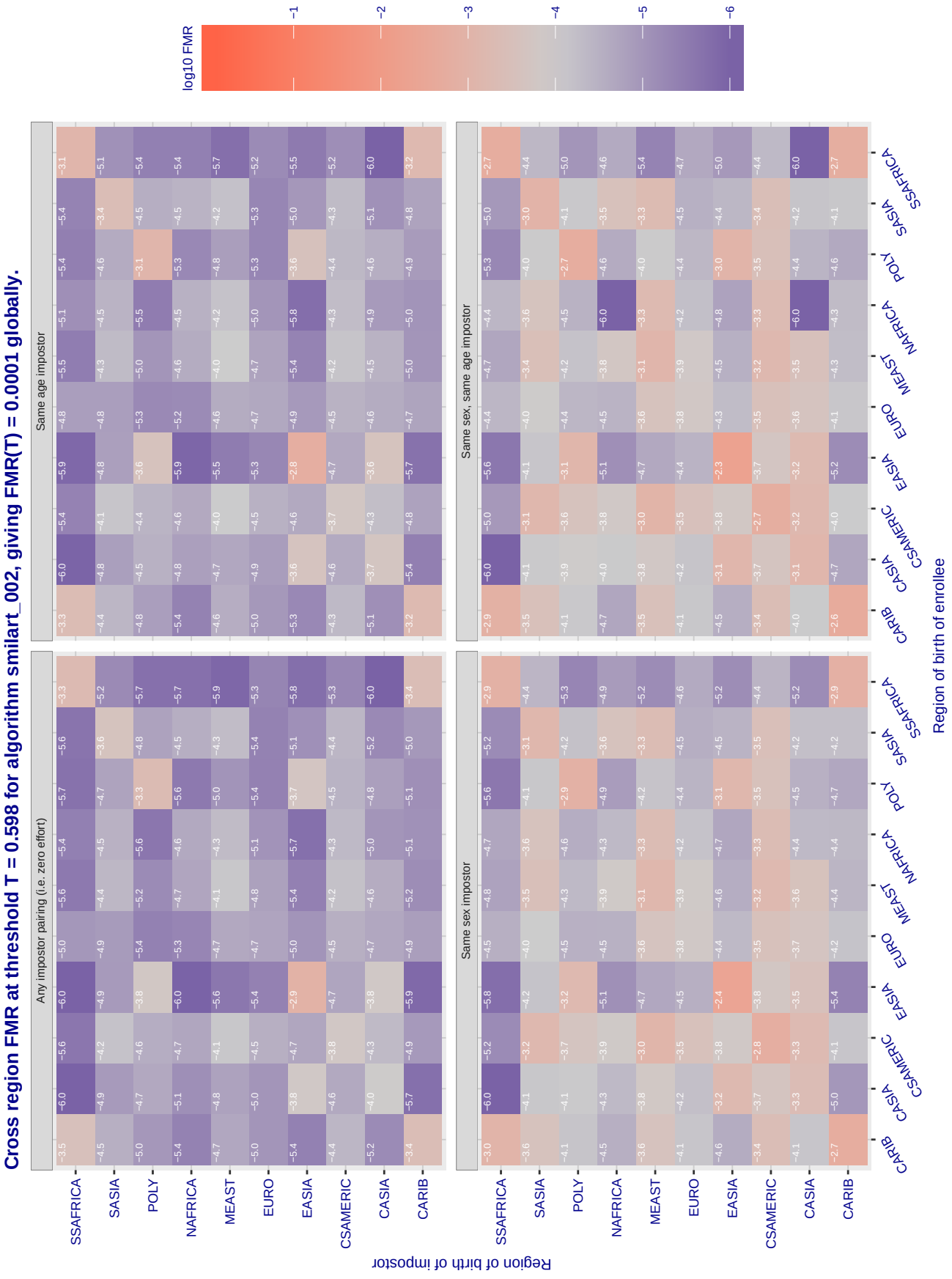


Figure 231: For algorithm smilart-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

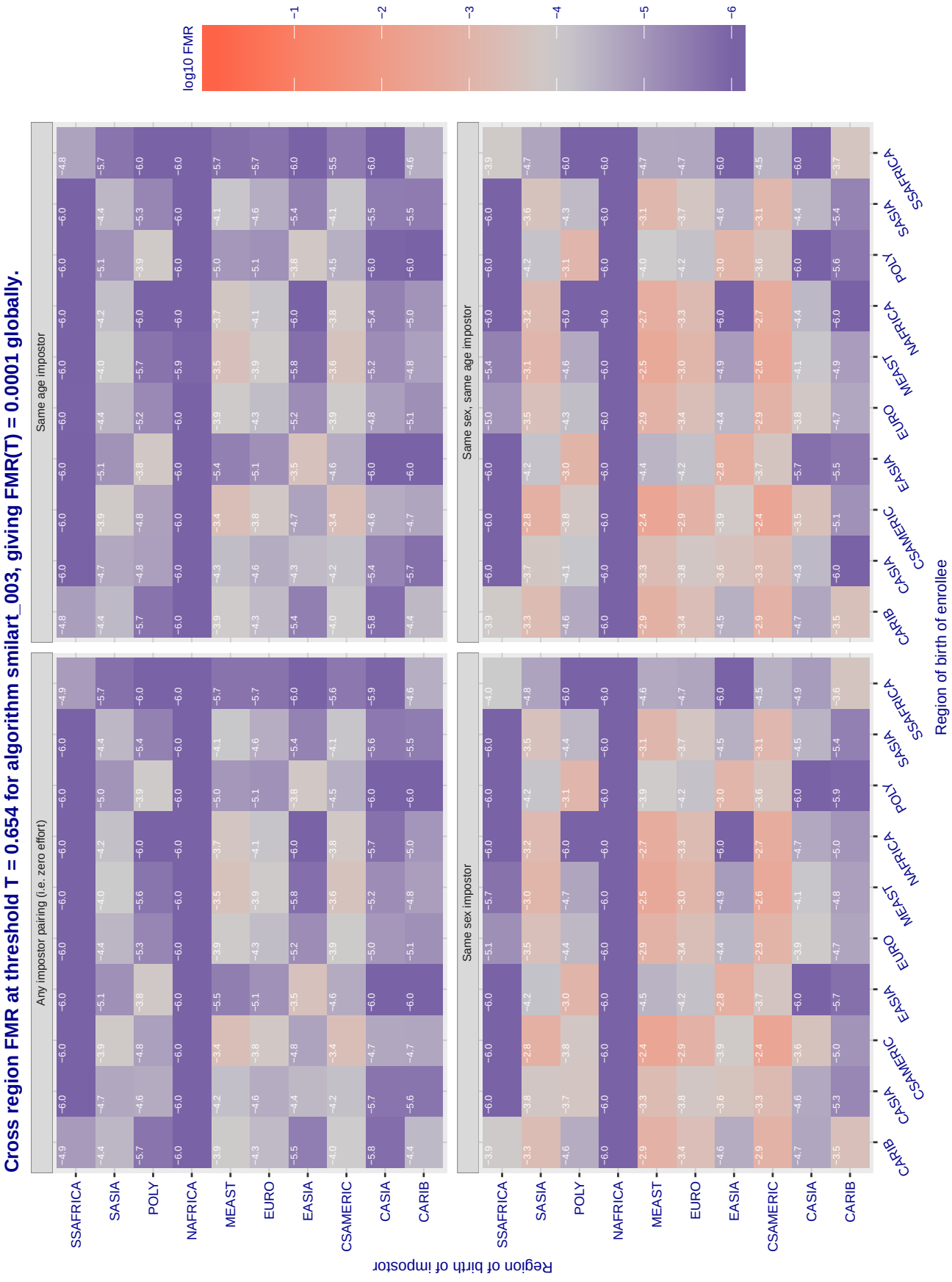


Figure 232: For algorithm smilart-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

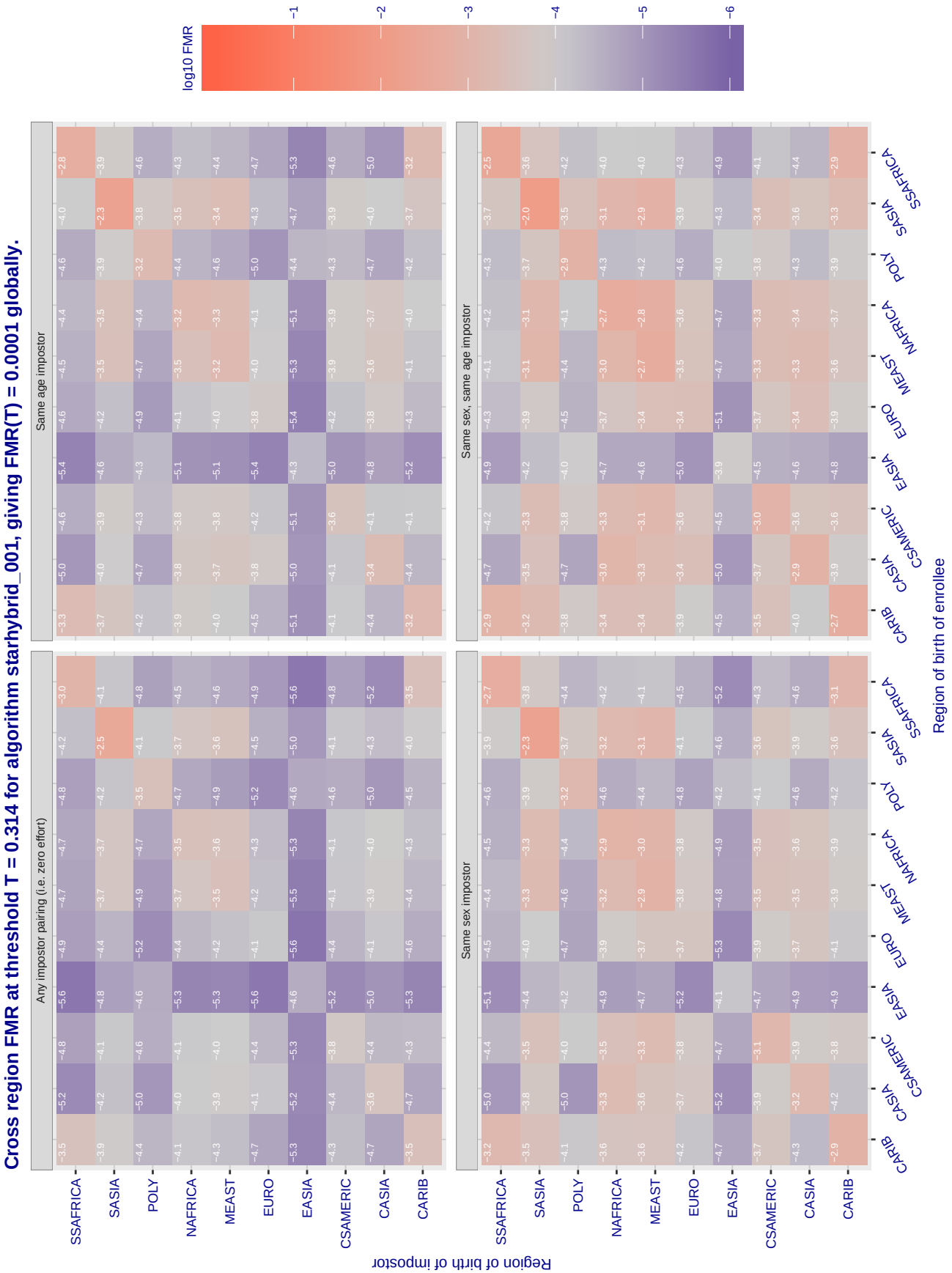


Figure 233: For algorithm starhybrid-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

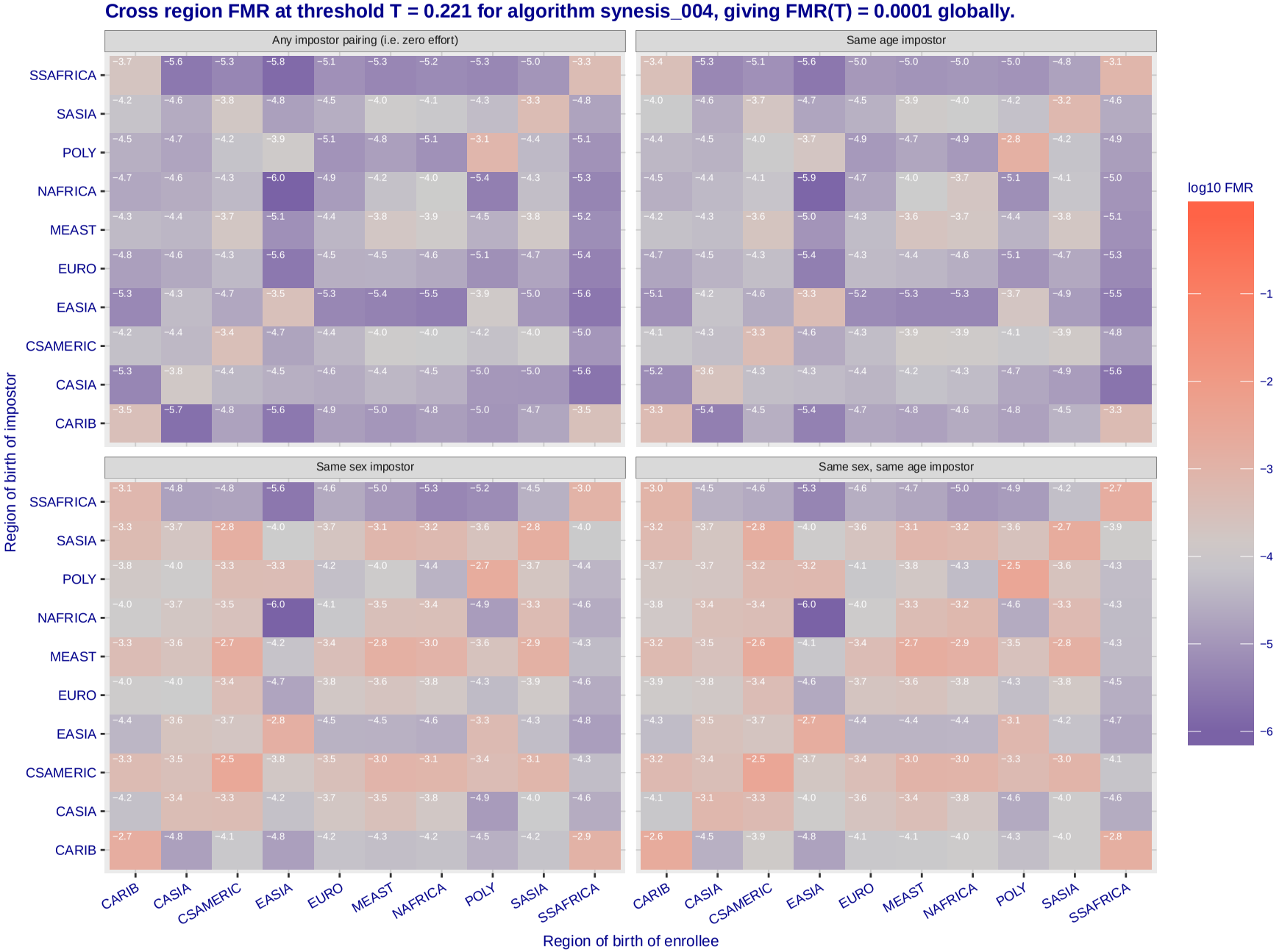


Figure 234: For algorithm synesis-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

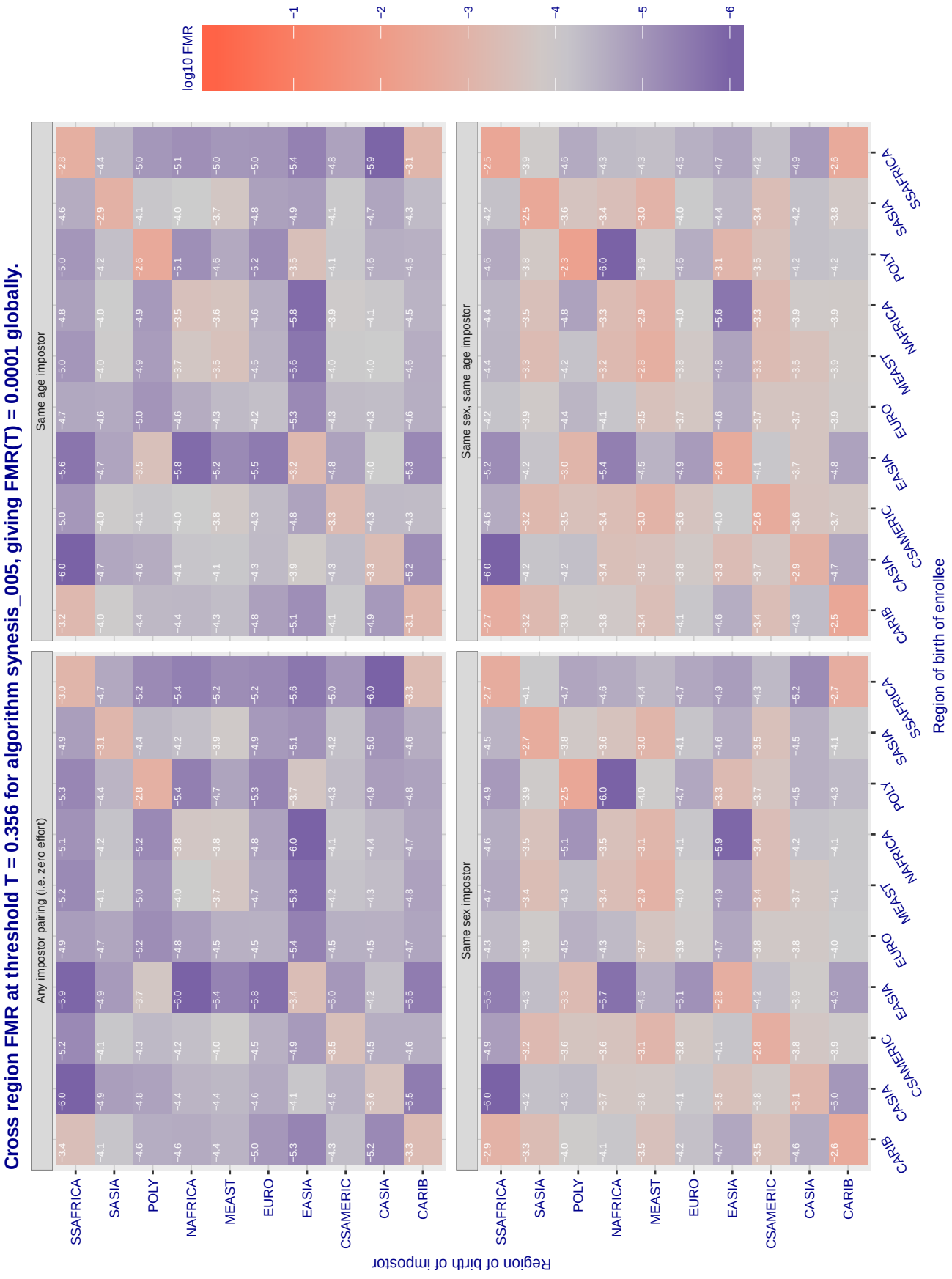


Figure 235: For algorithm synesis-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

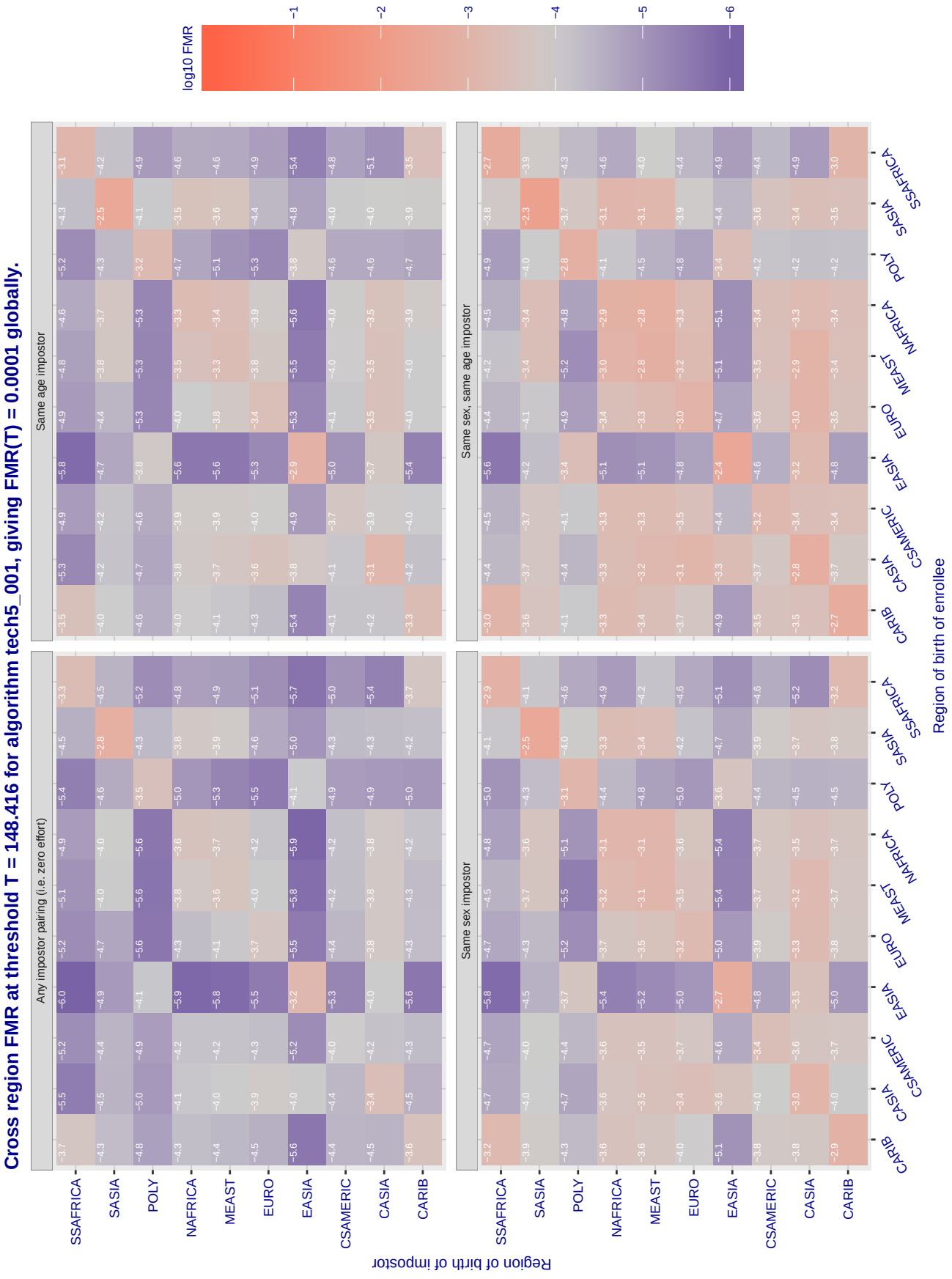


Figure 236: For algorithm tech5-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

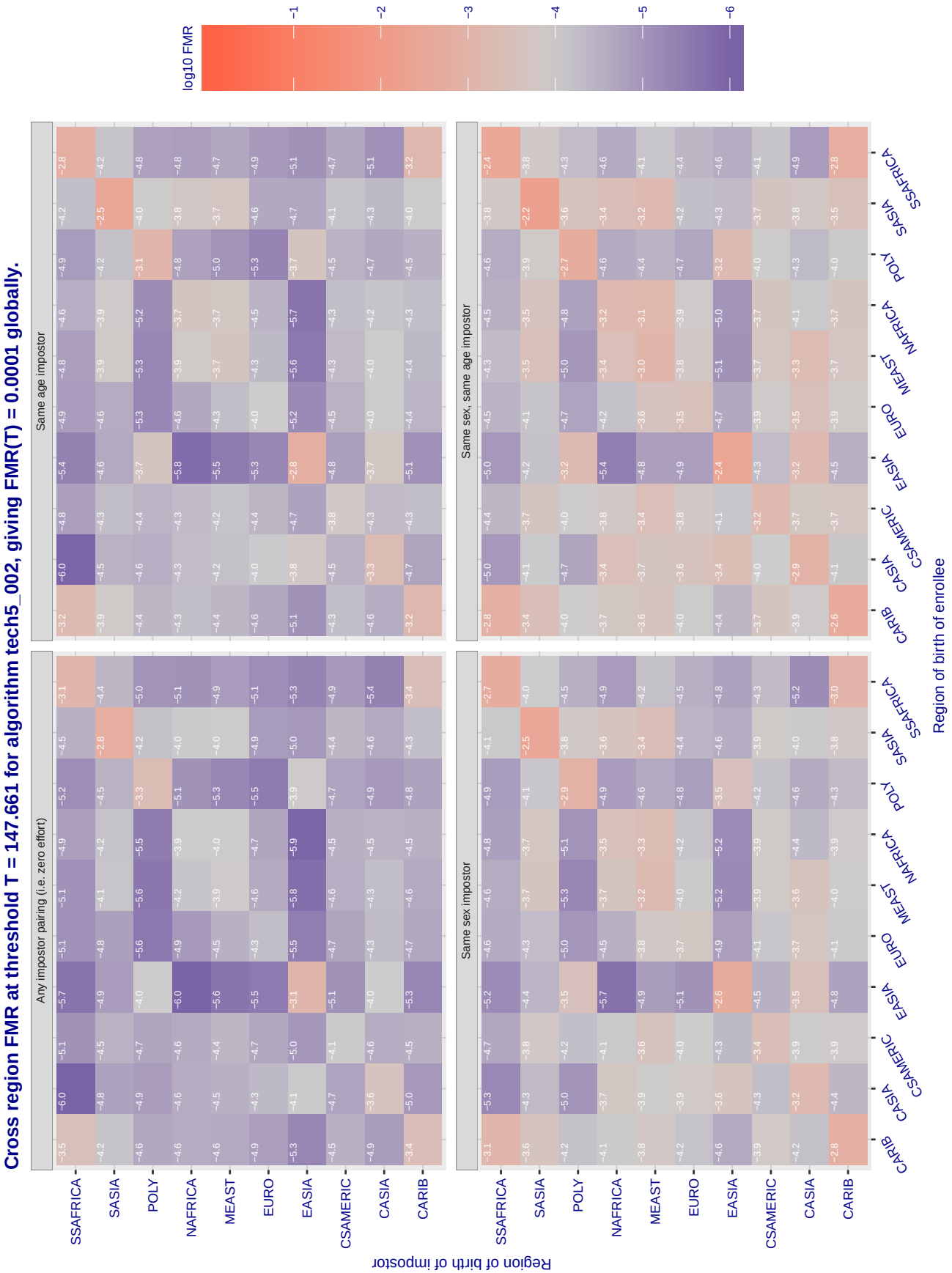


Figure 237: For algorithm tech5-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

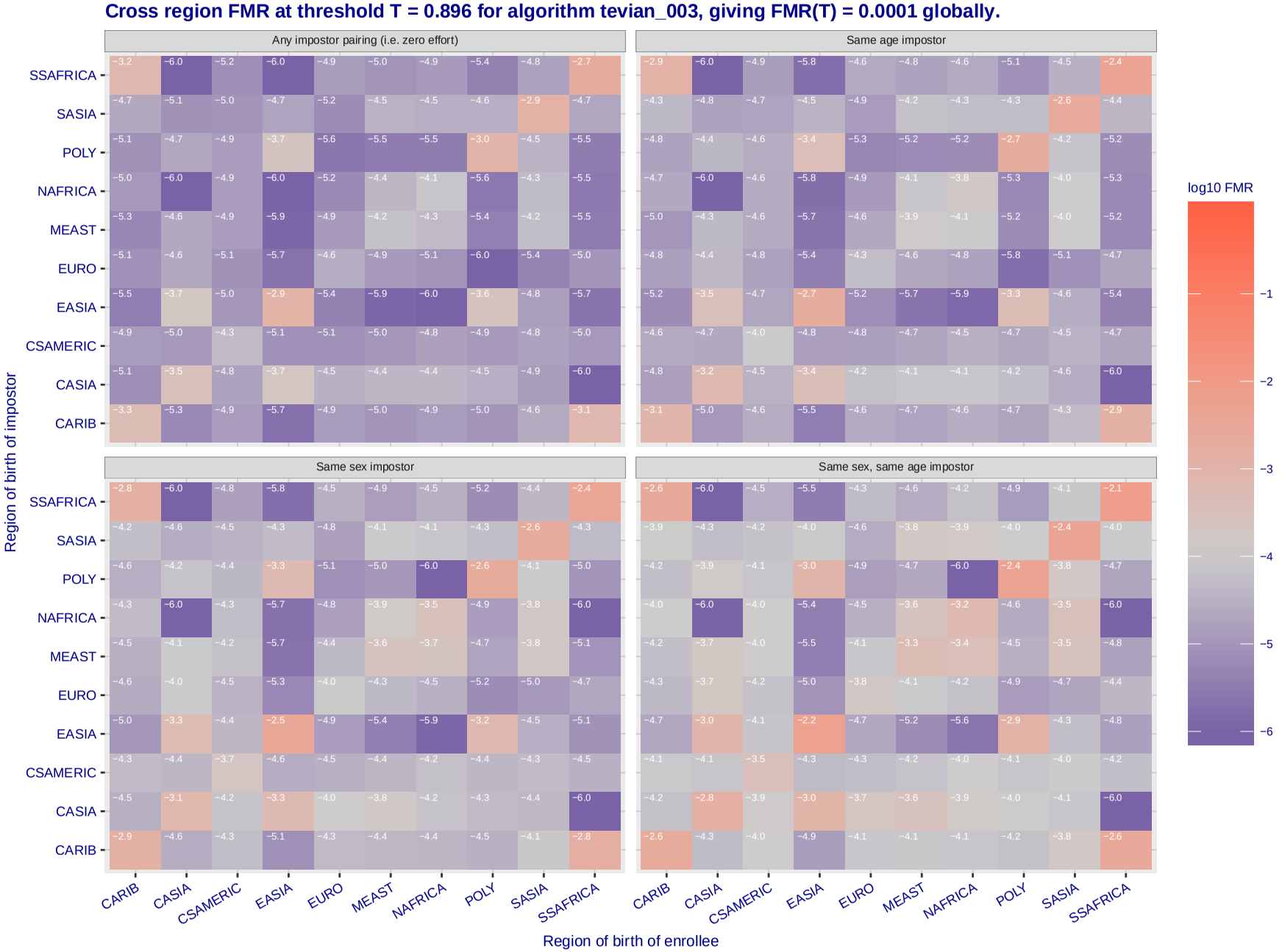


Figure 238: For algorithm tevian-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

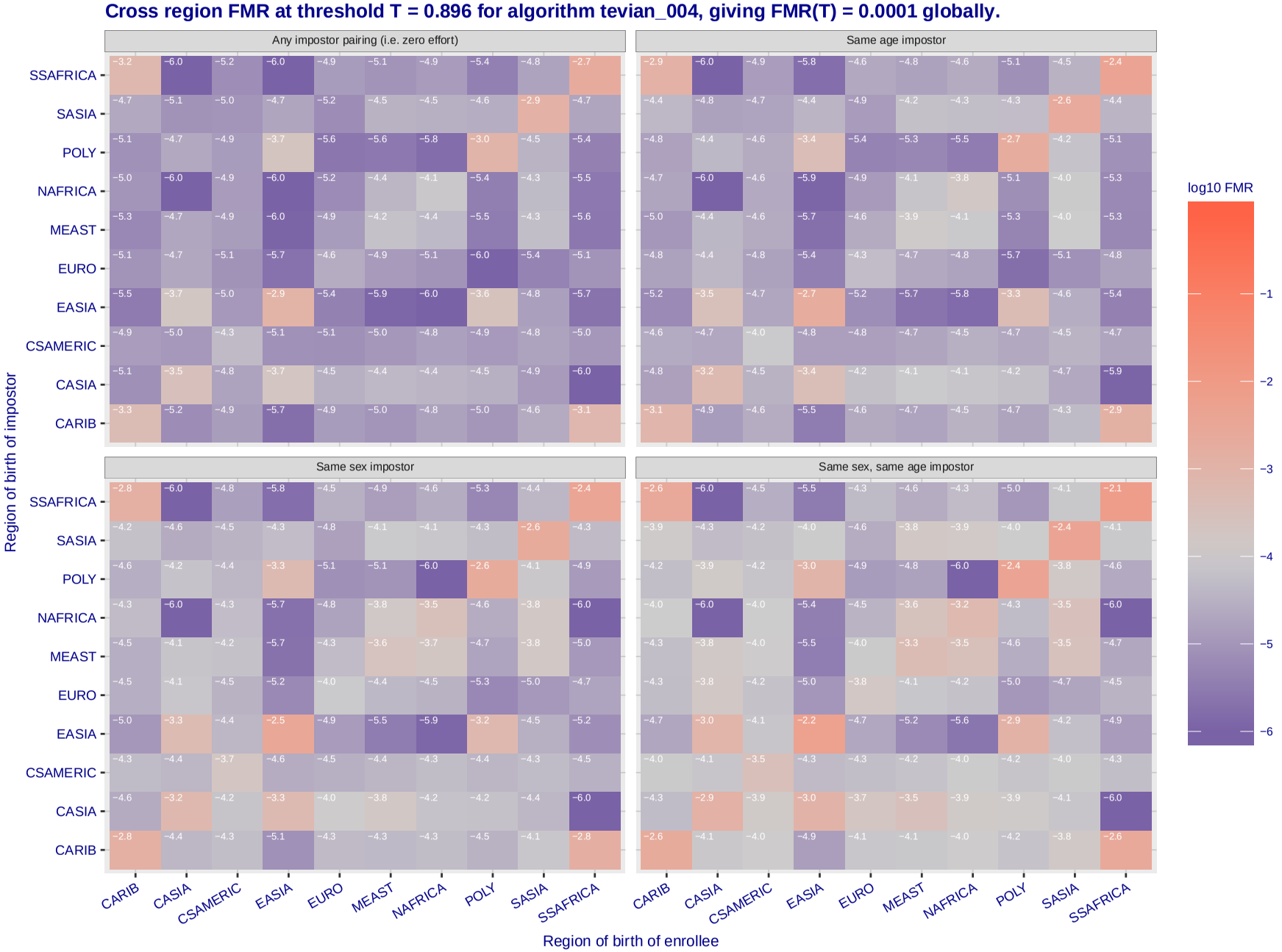


Figure 239: For algorithm tevian-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

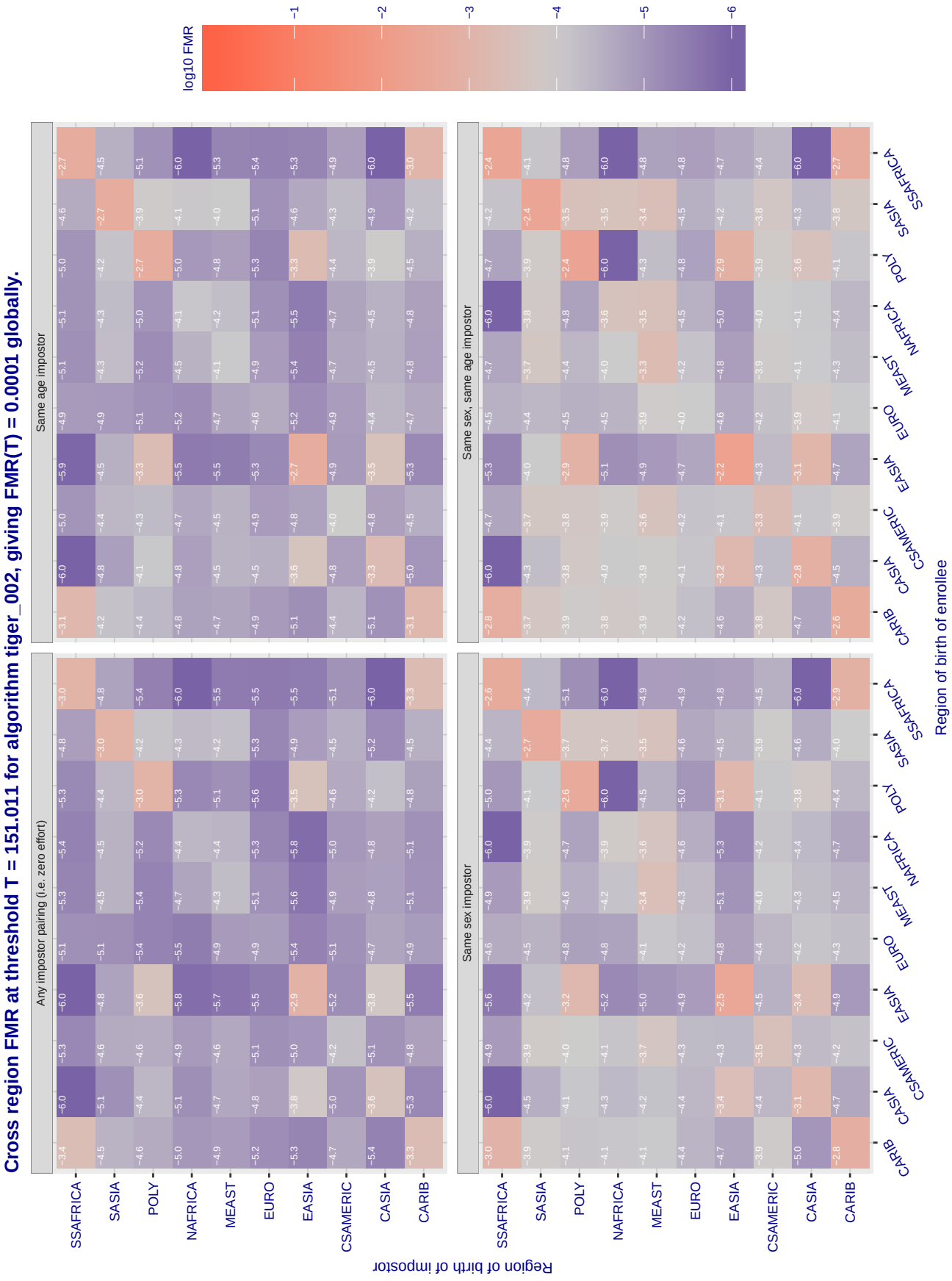


Figure 240: For algorithm tiger-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

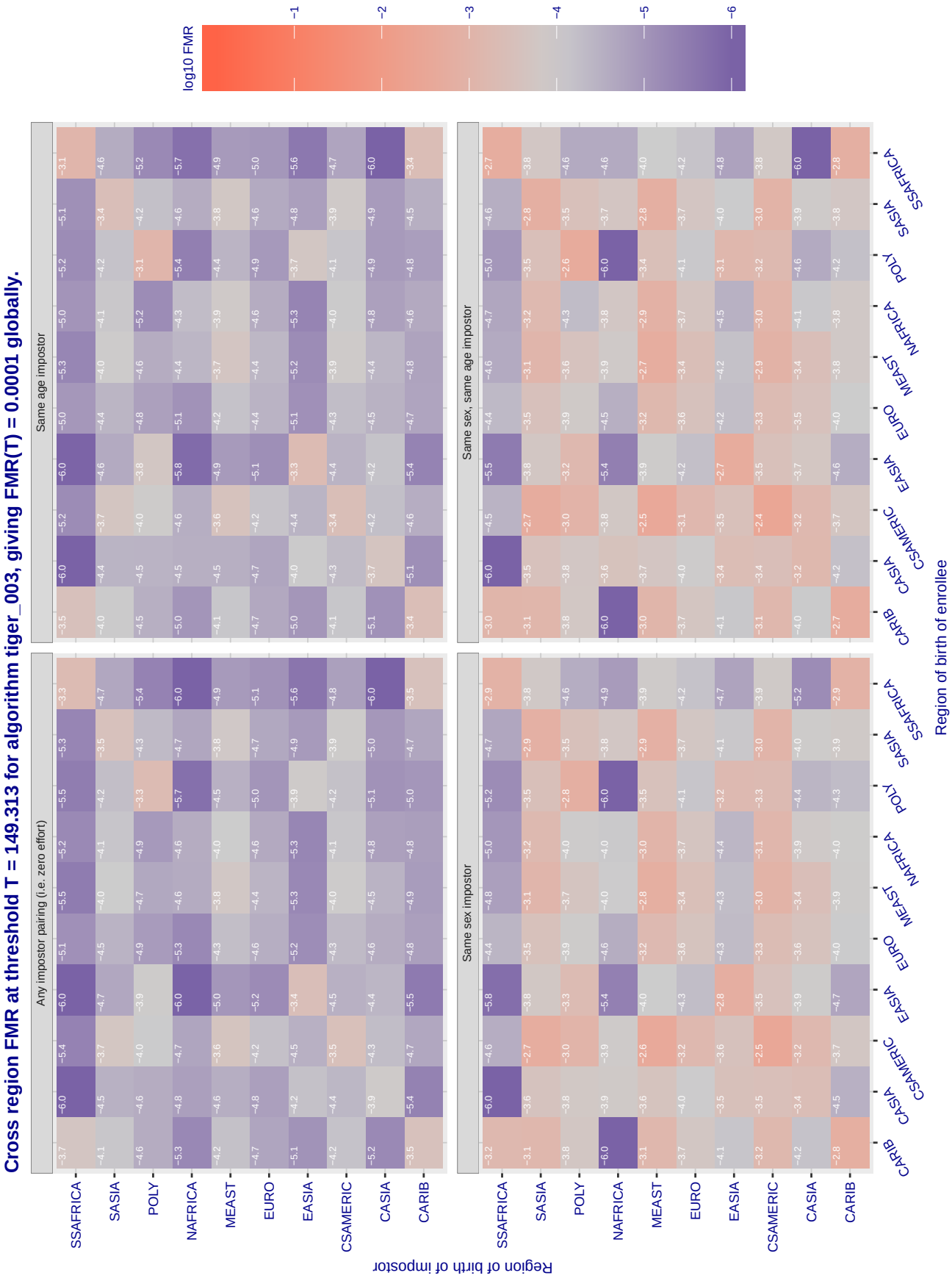


Figure 241: For algorithm tiger-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

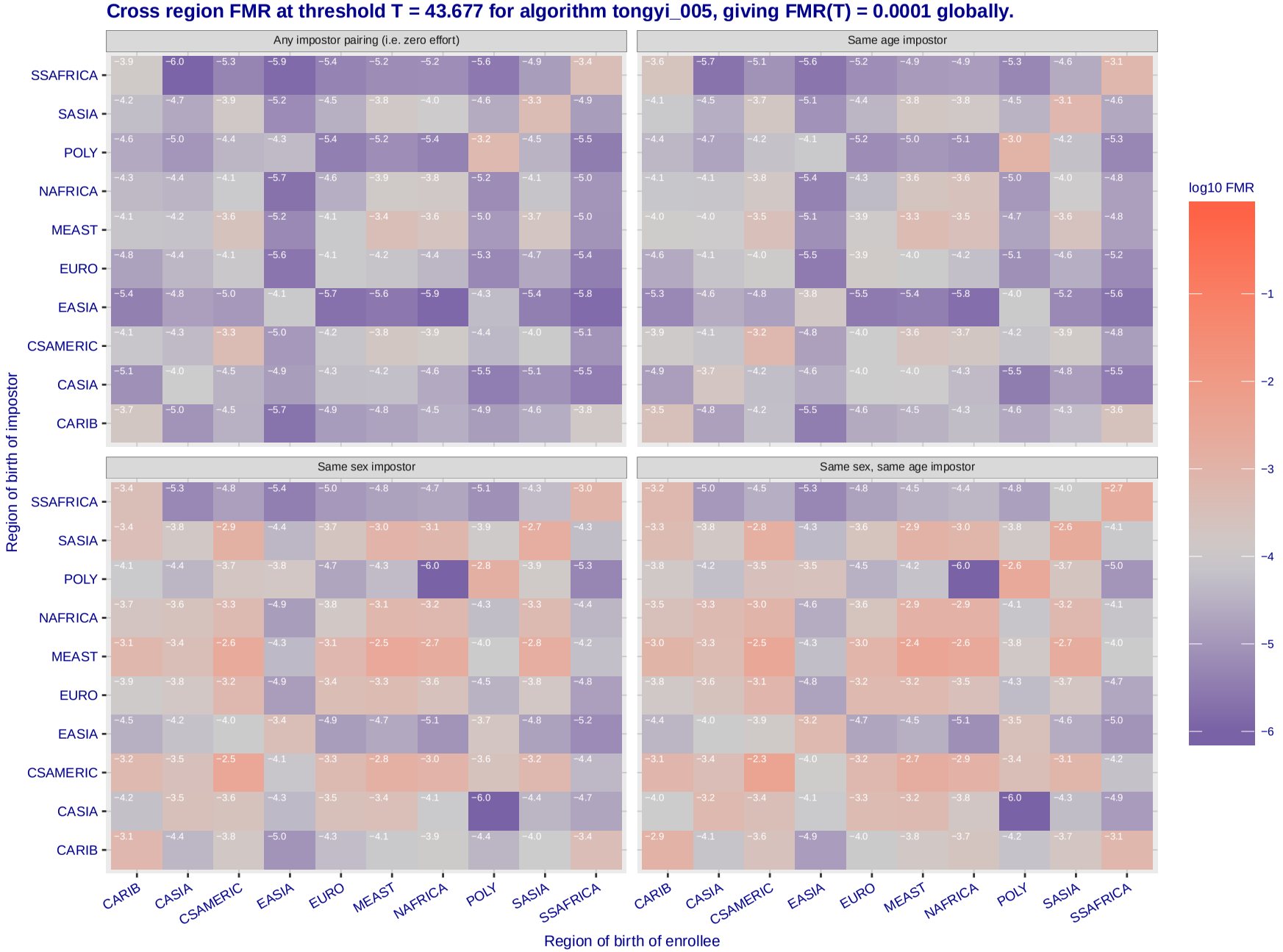


Figure 242: For algorithm tongyi-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

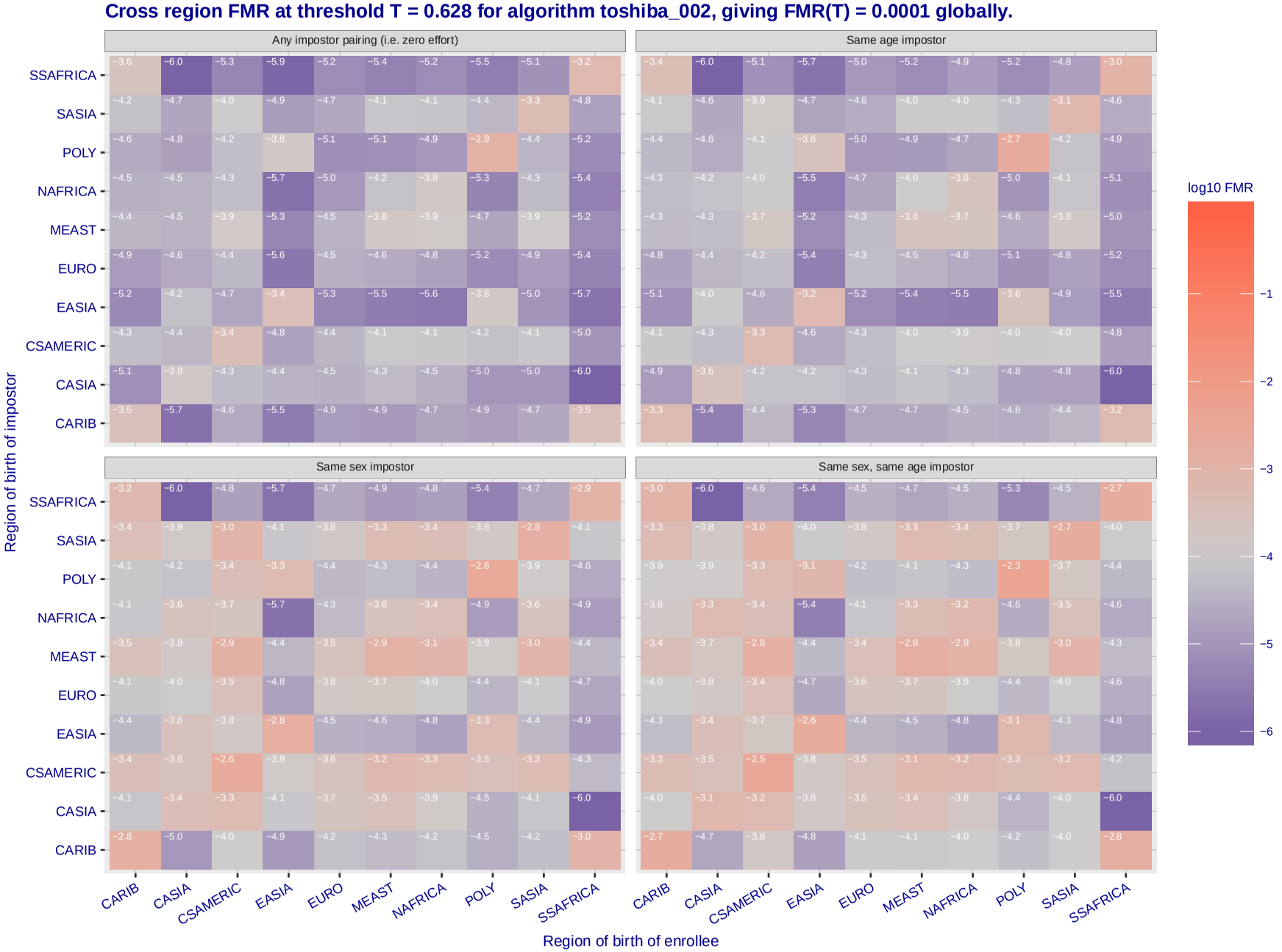


Figure 243: For algorithm toshiba-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

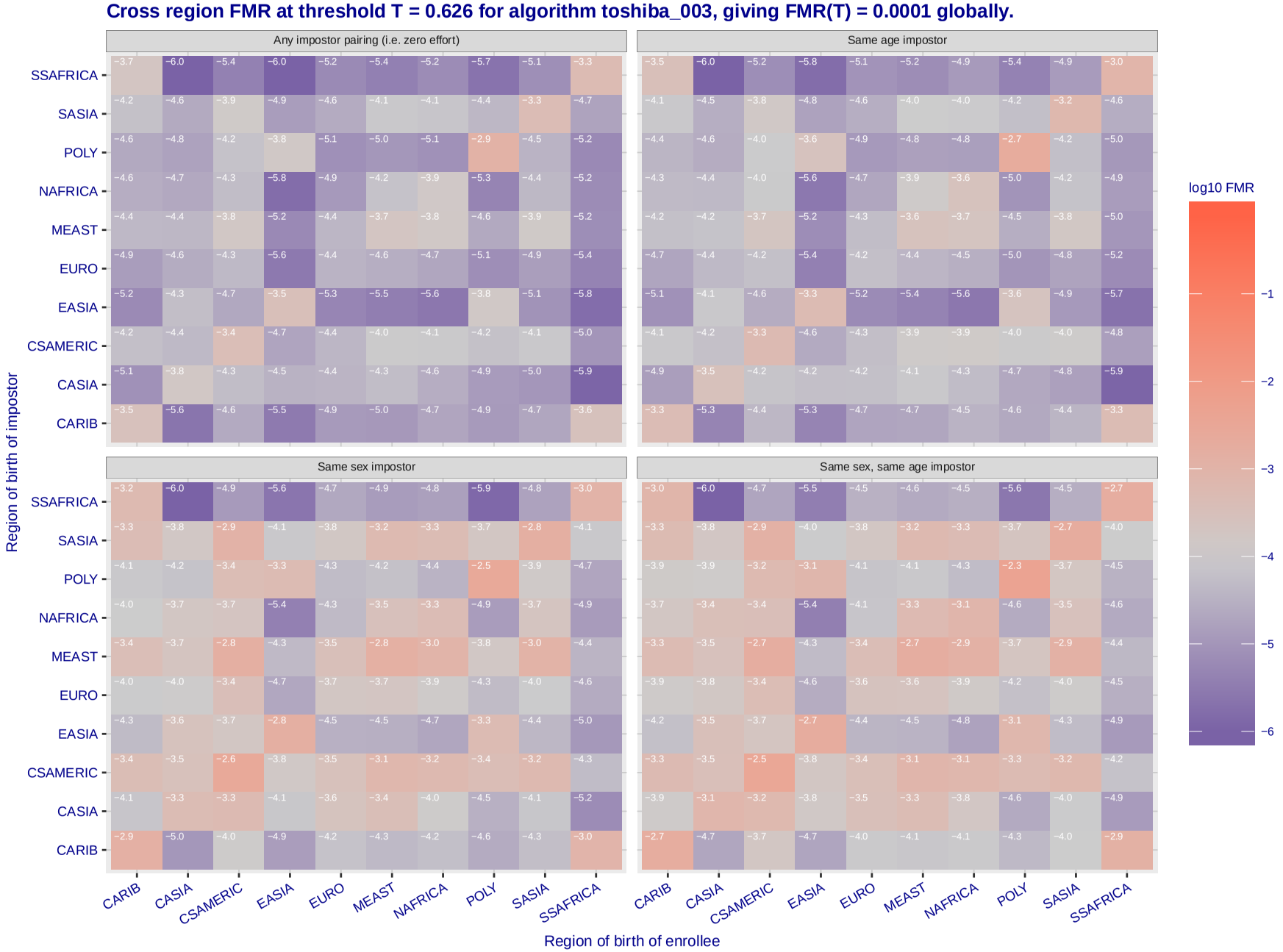


Figure 244: For algorithm toshiba-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

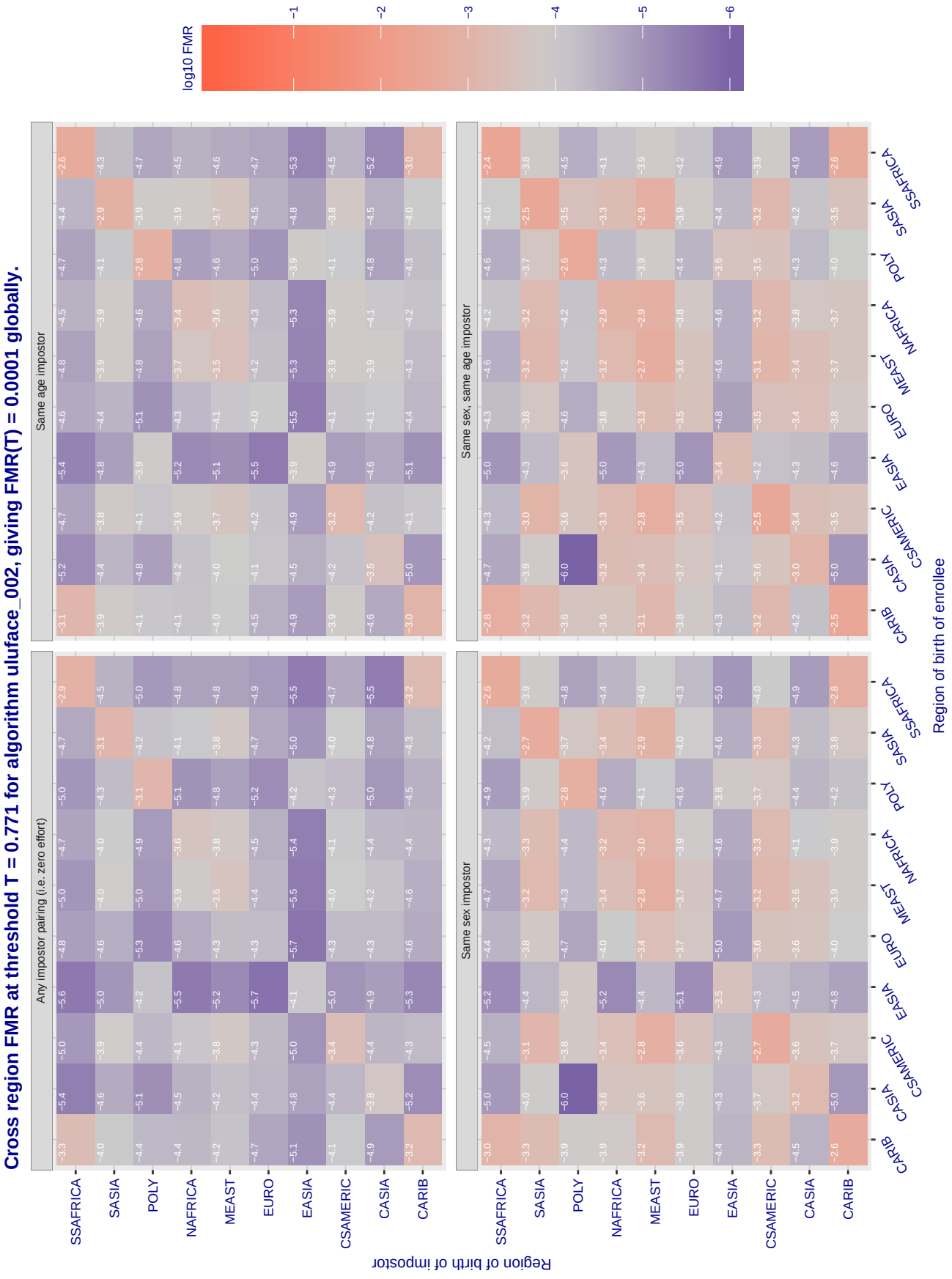


Figure 245: For algorithm uluface-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

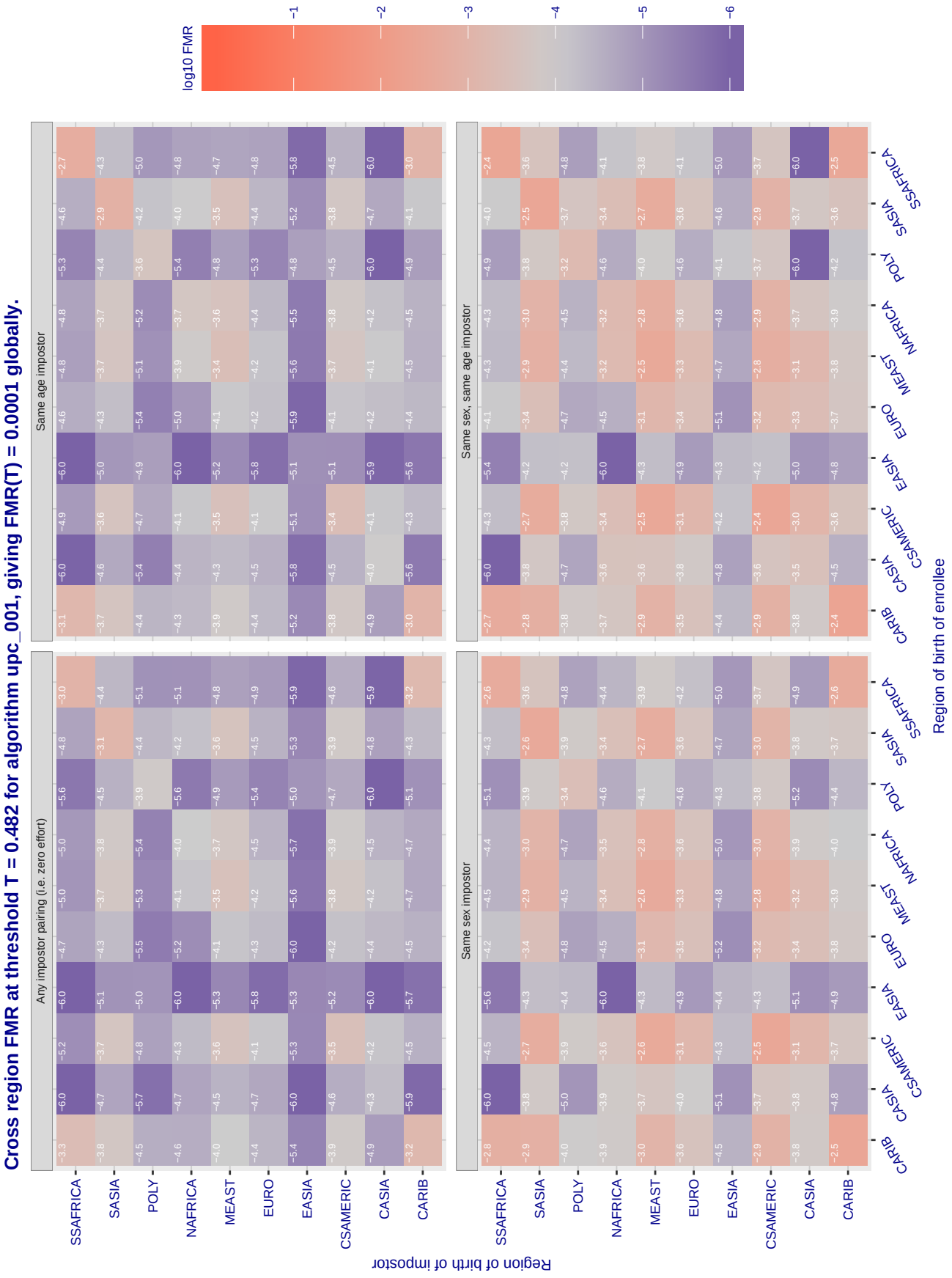


Figure 246: For algorithm upc-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

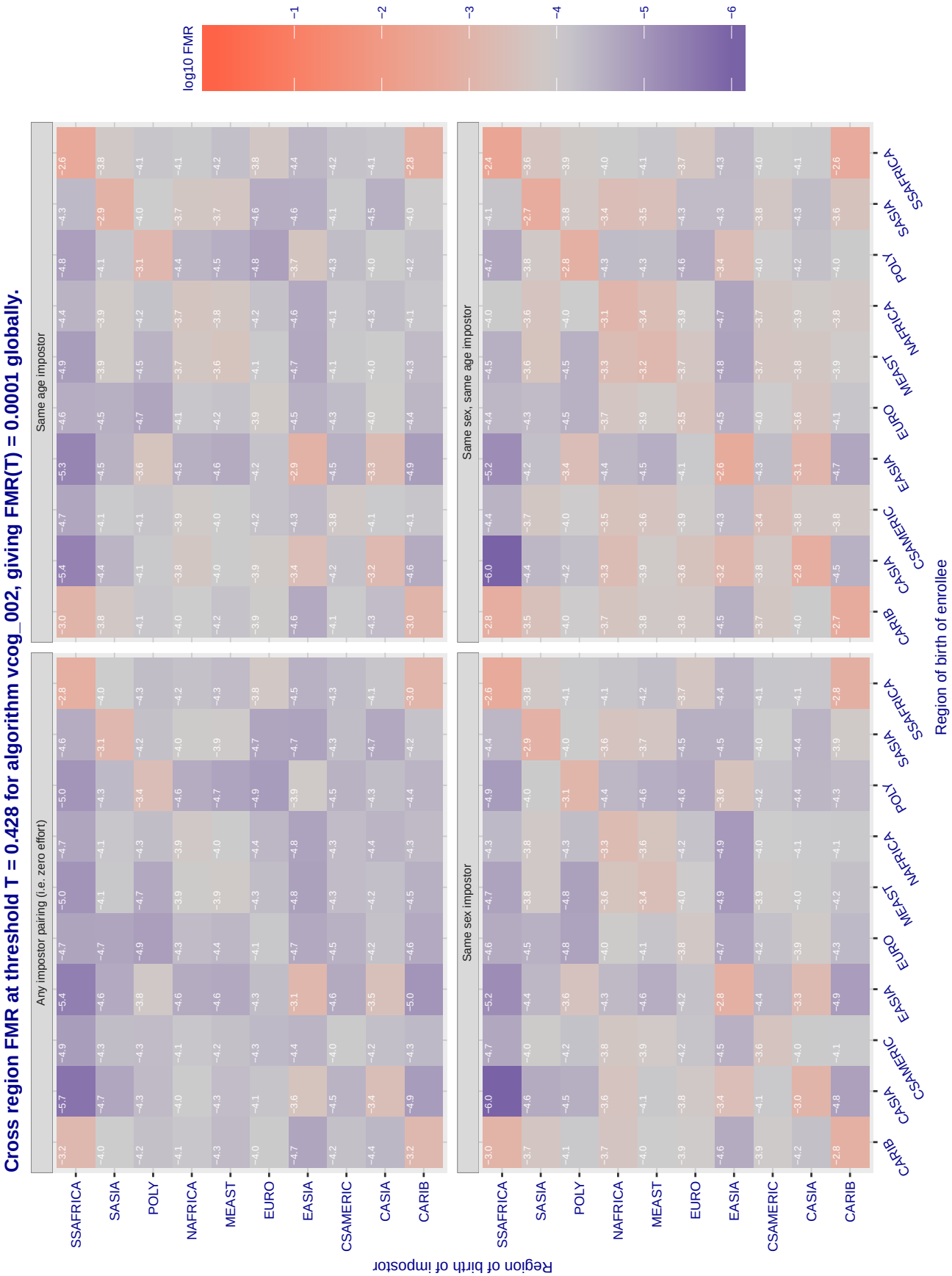


Figure 247: For algorithm vcog-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

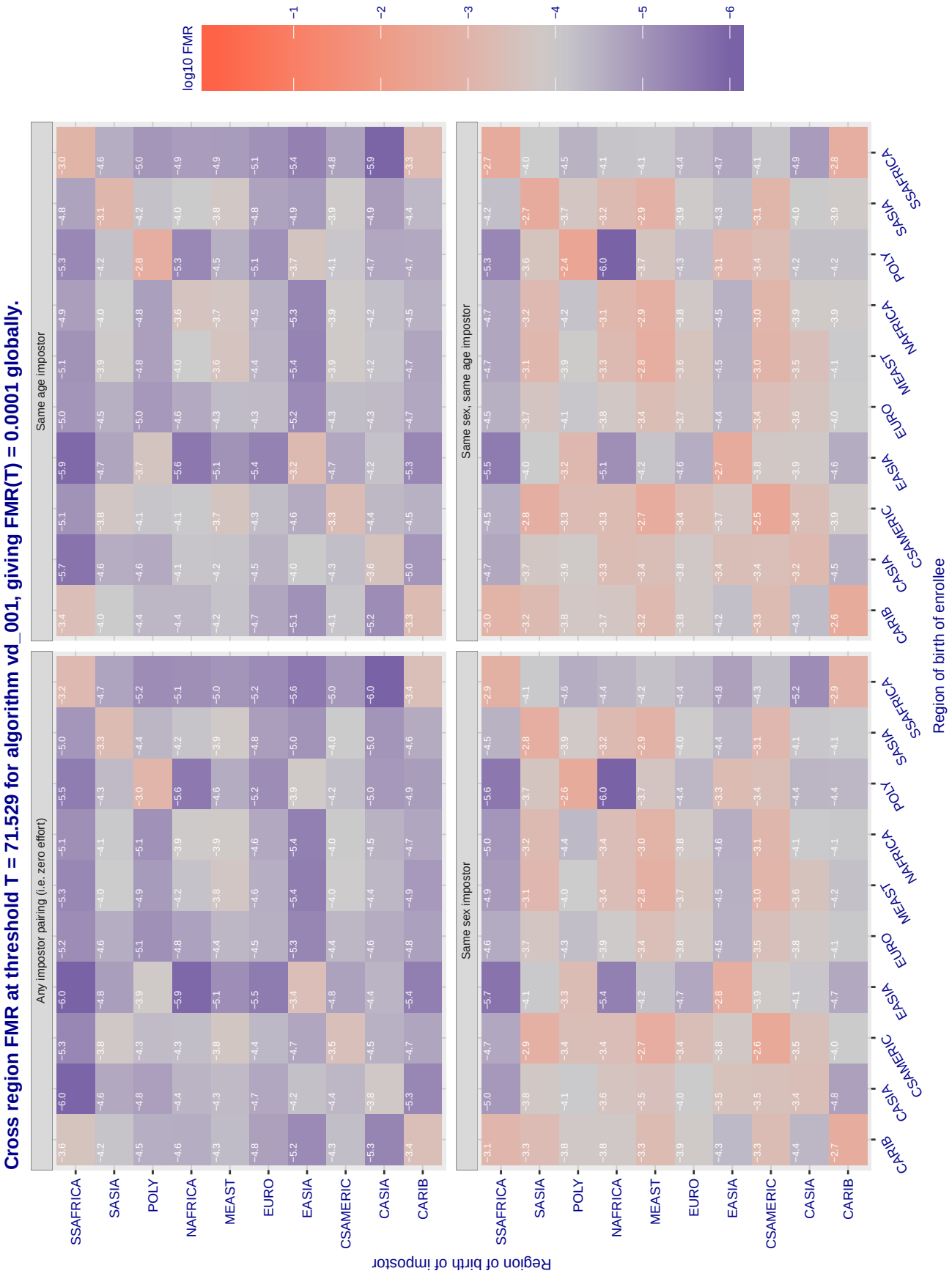


Figure 248: For algorithm vd-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

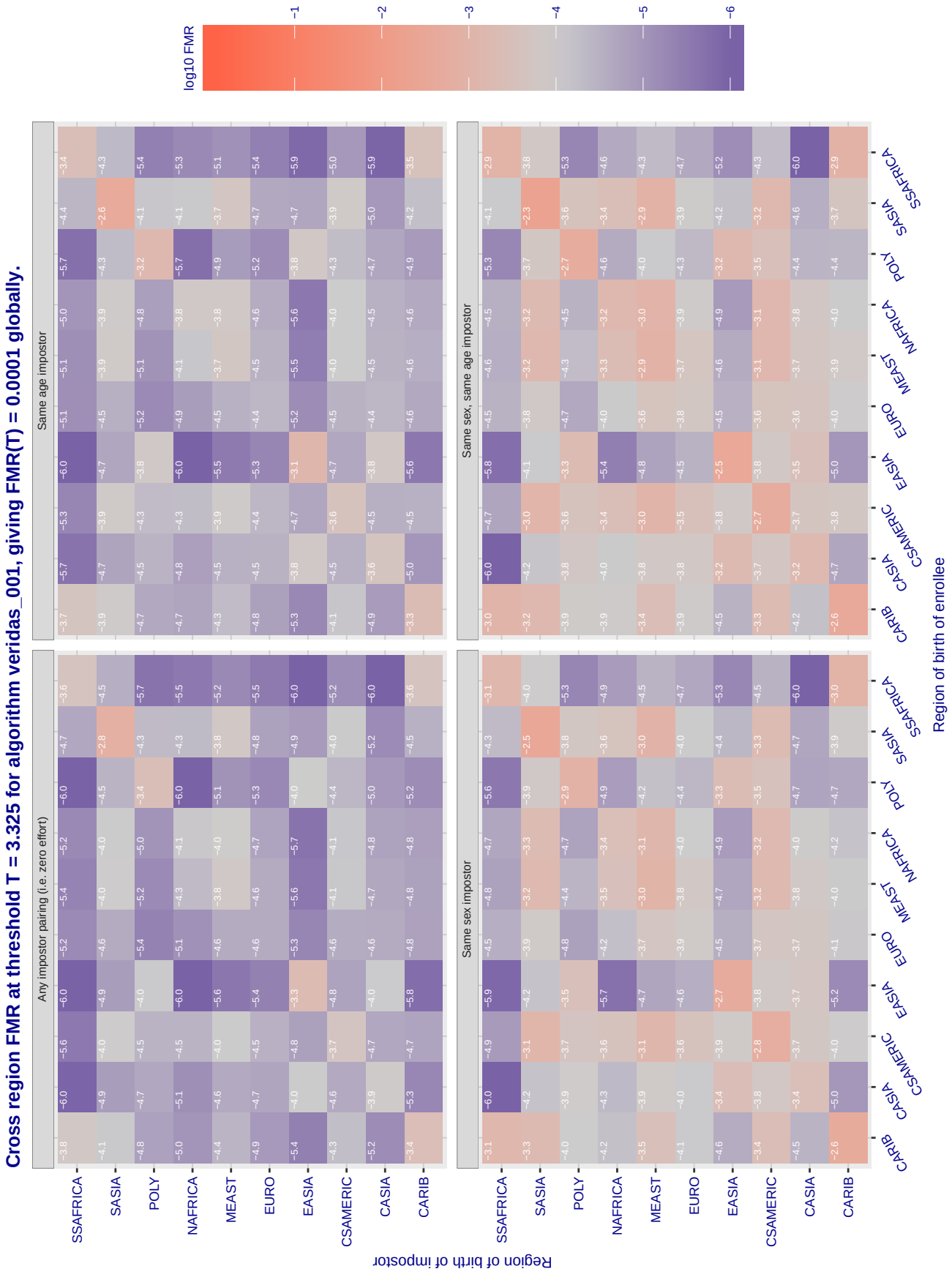


Figure 249: For algorithm veridas-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

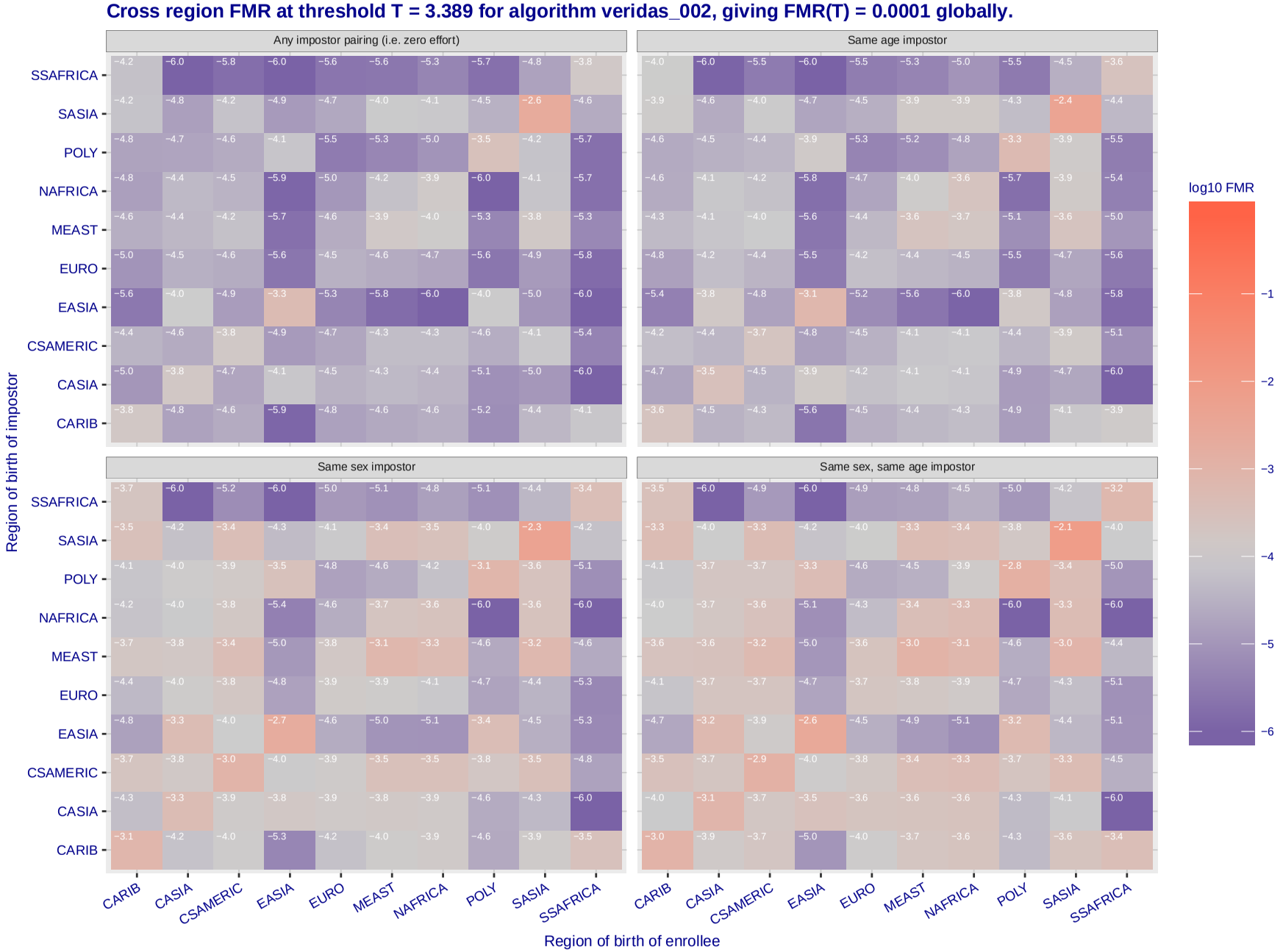


Figure 250: For algorithm veridas-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

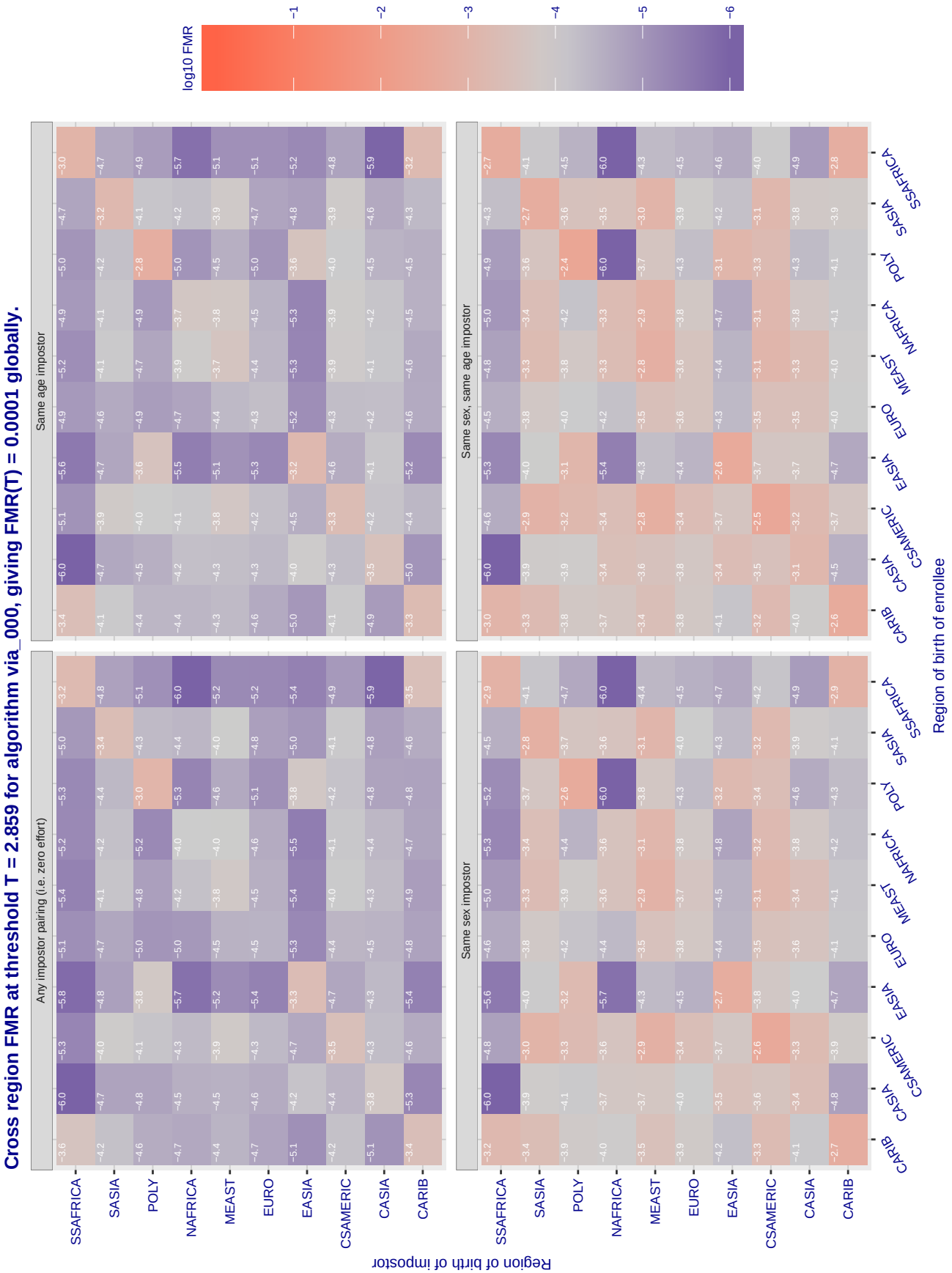


Figure 251: For algorithm via-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

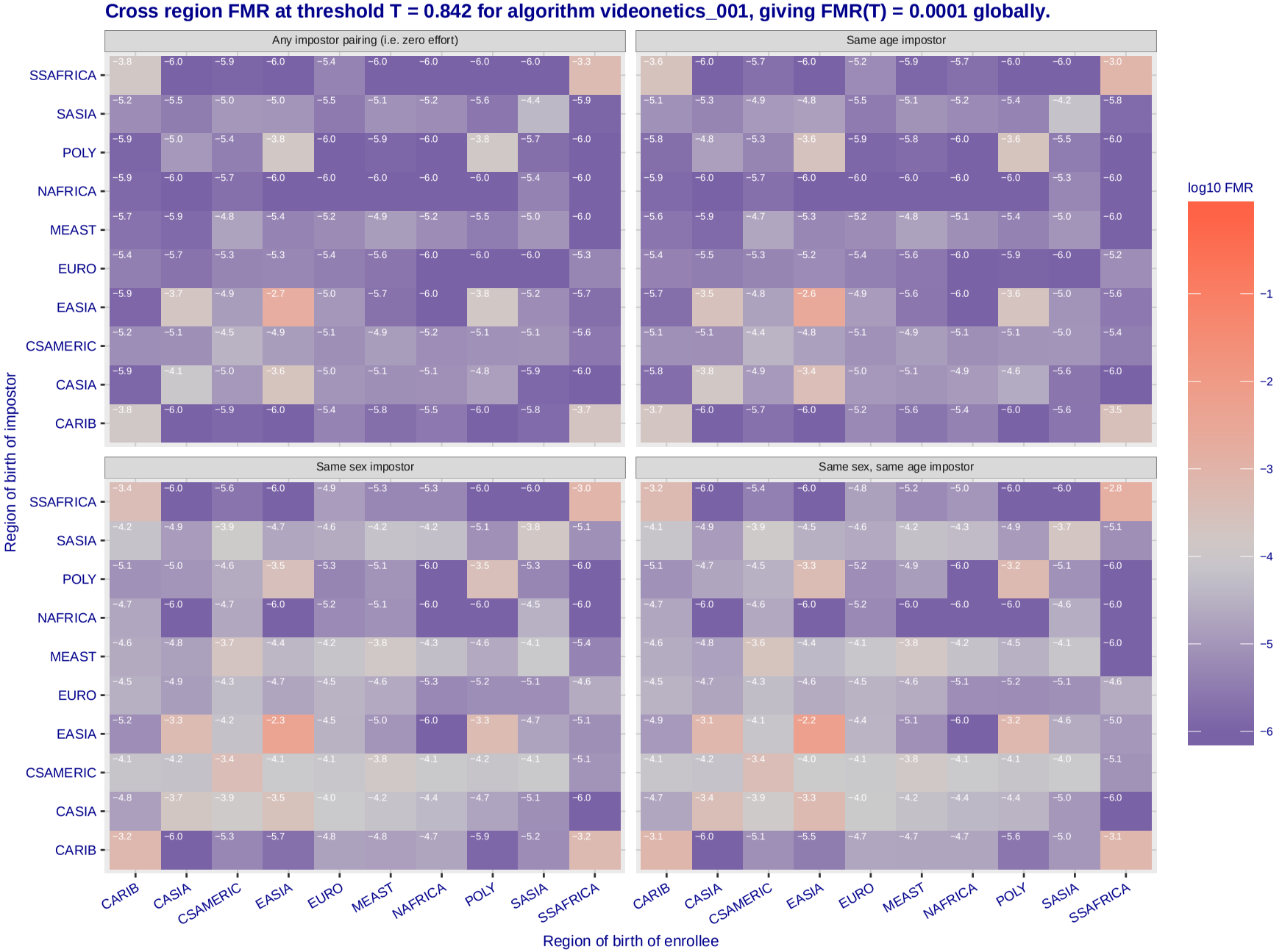


Figure 252: For algorithm videonetics-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

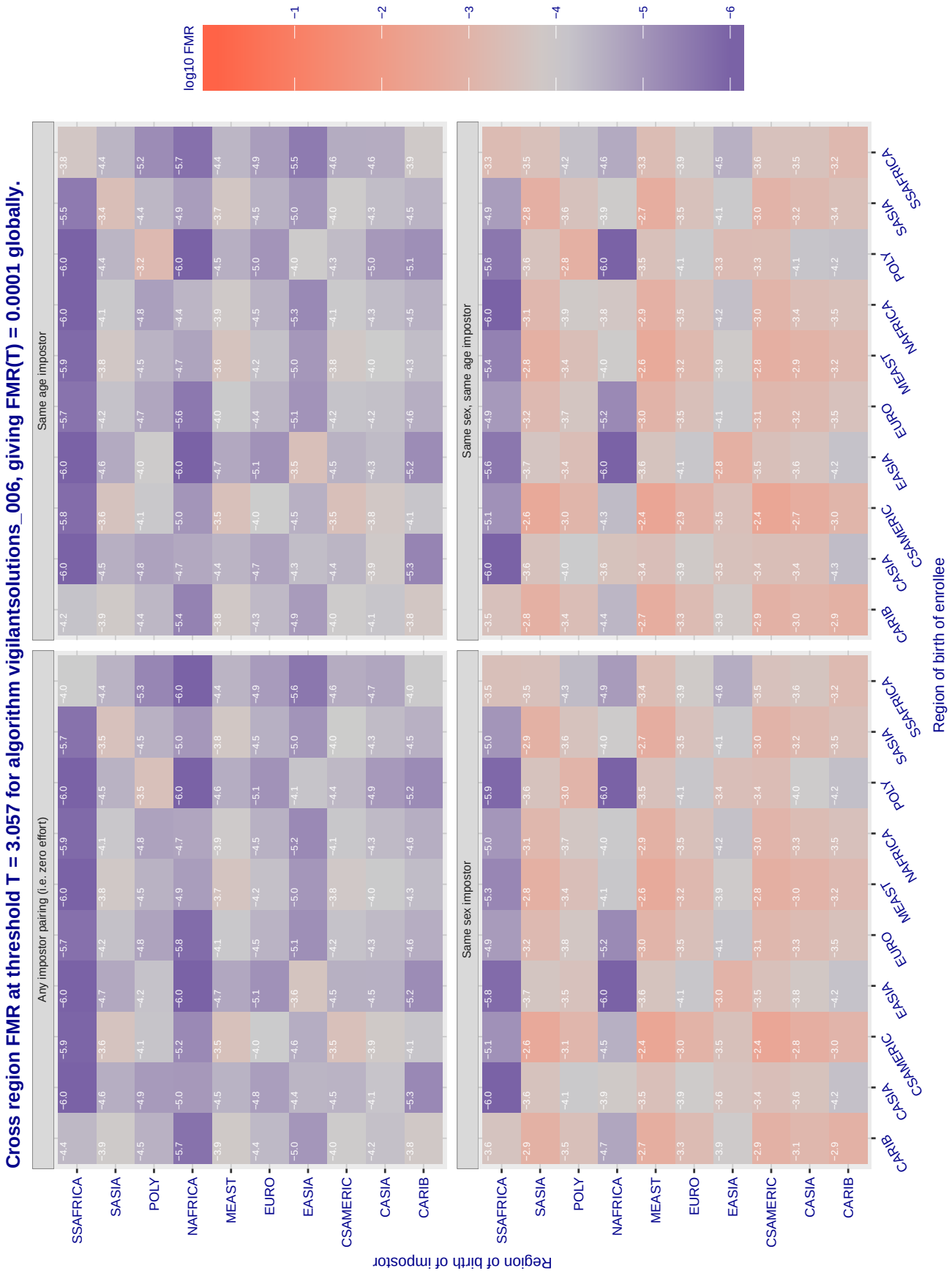


Figure 253: For algorithm vigilantsolutions-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

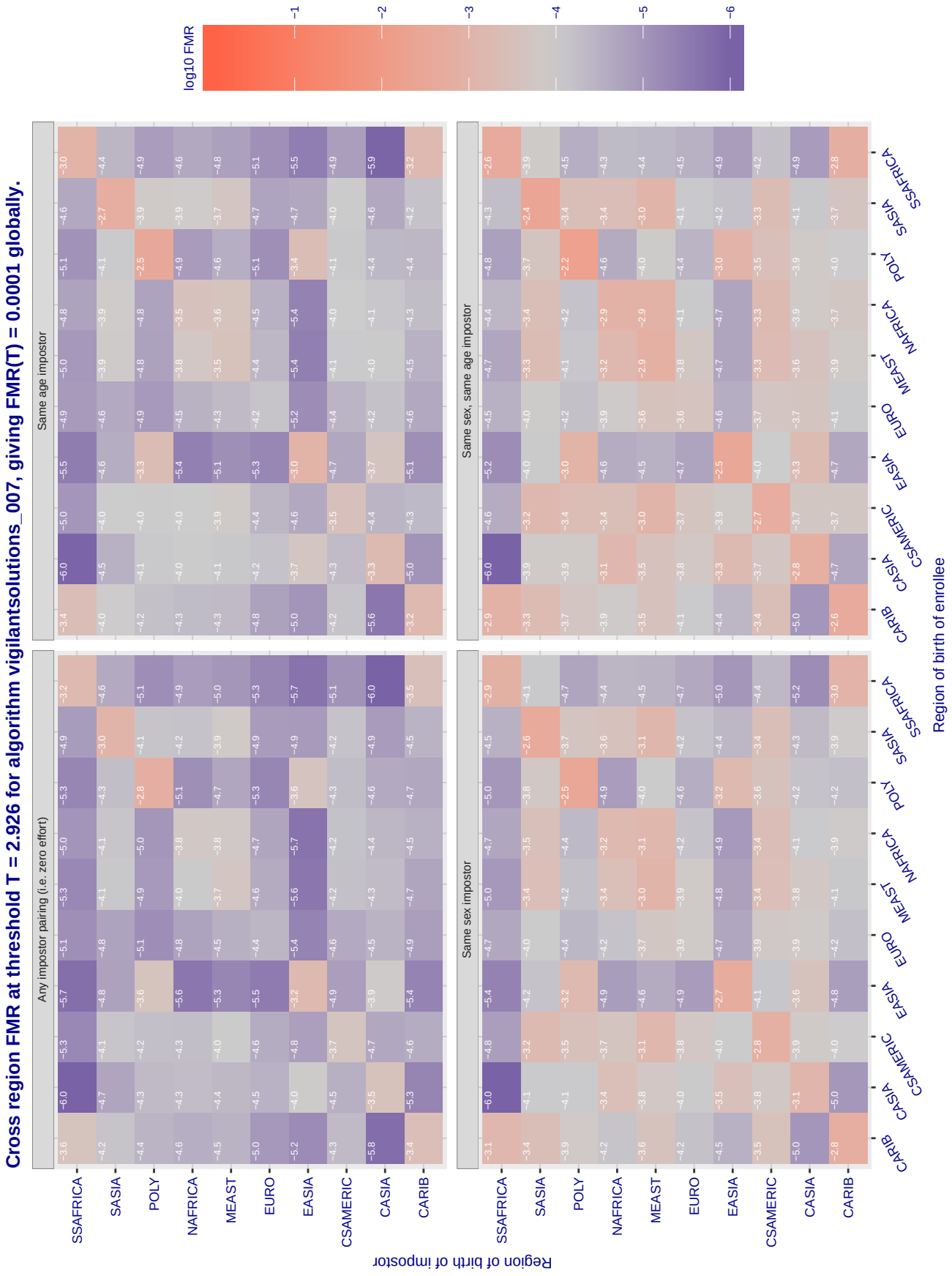


Figure 254: For algorithm vigilantsolutions-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

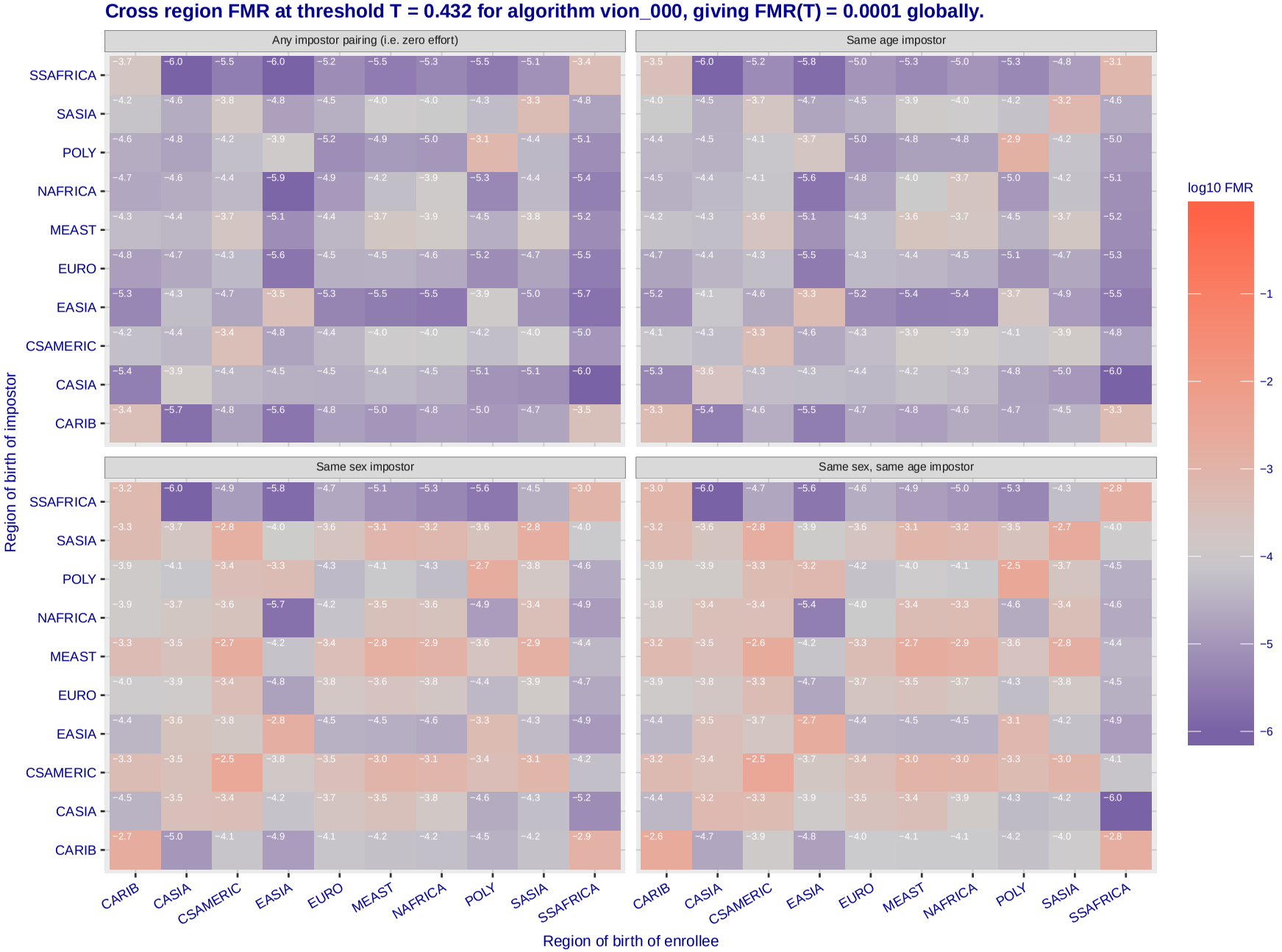


Figure 255: For algorithm vion-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

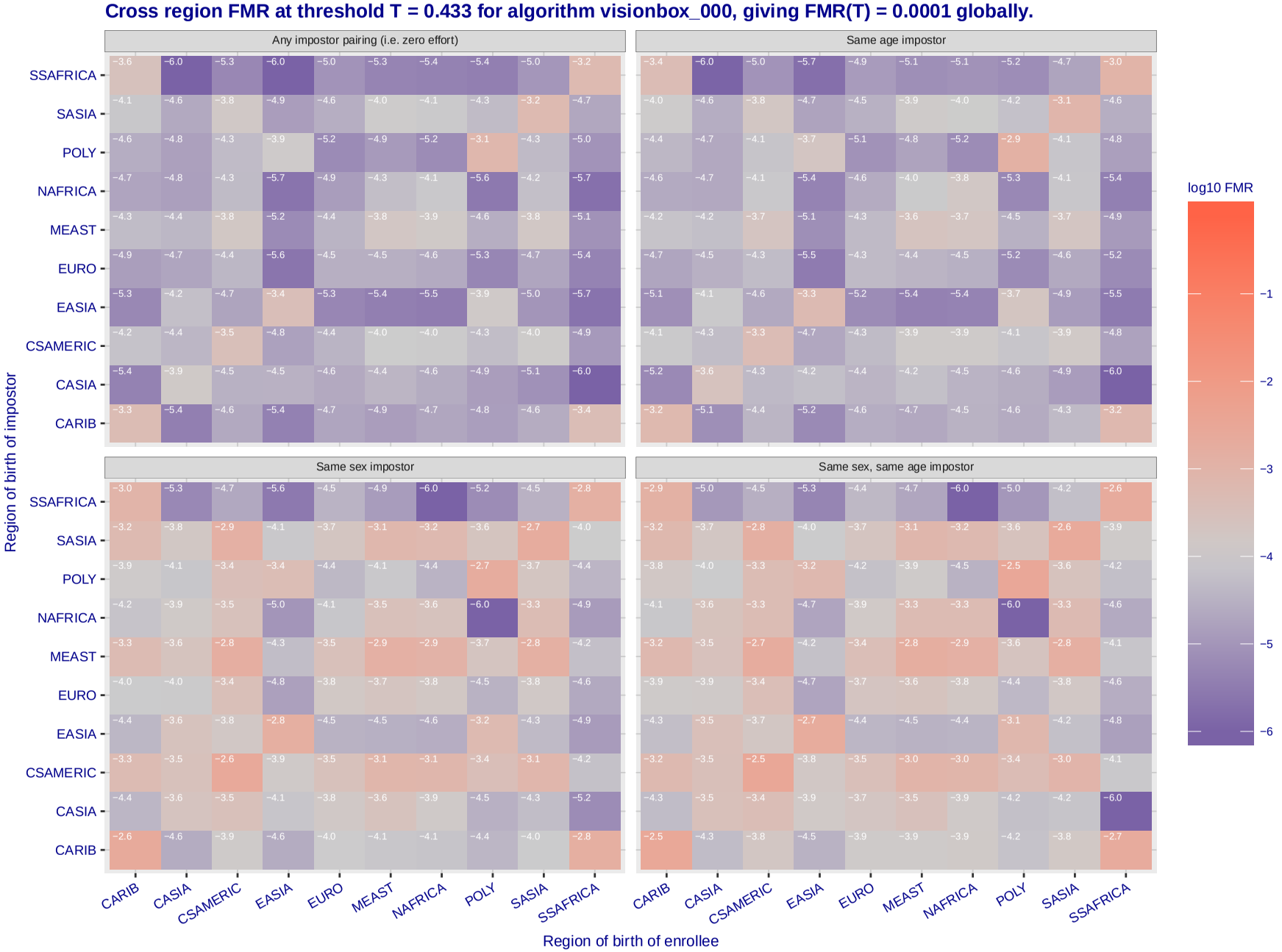


Figure 256: For algorithm visionbox-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

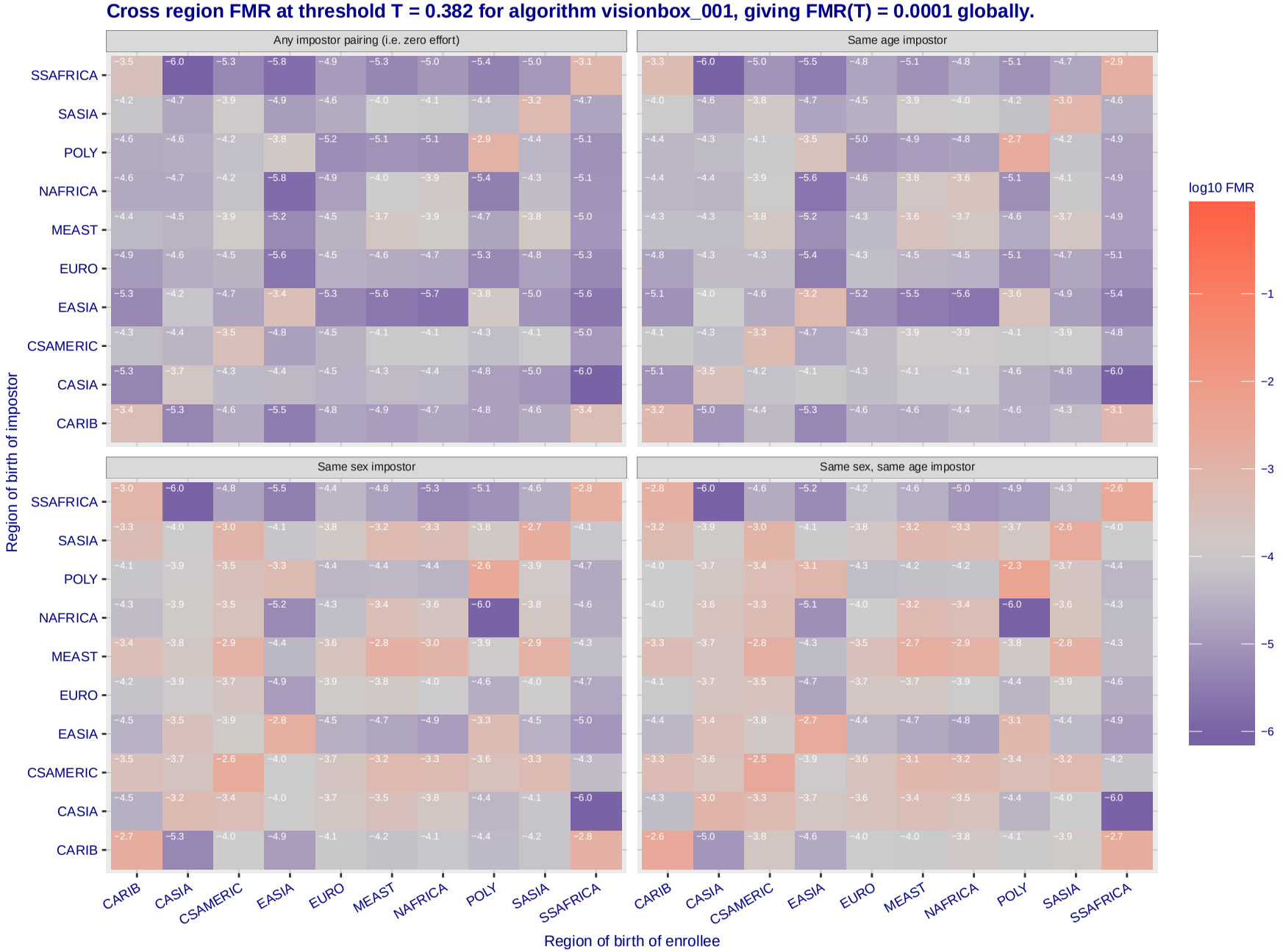


Figure 257: For algorithm visionbox-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

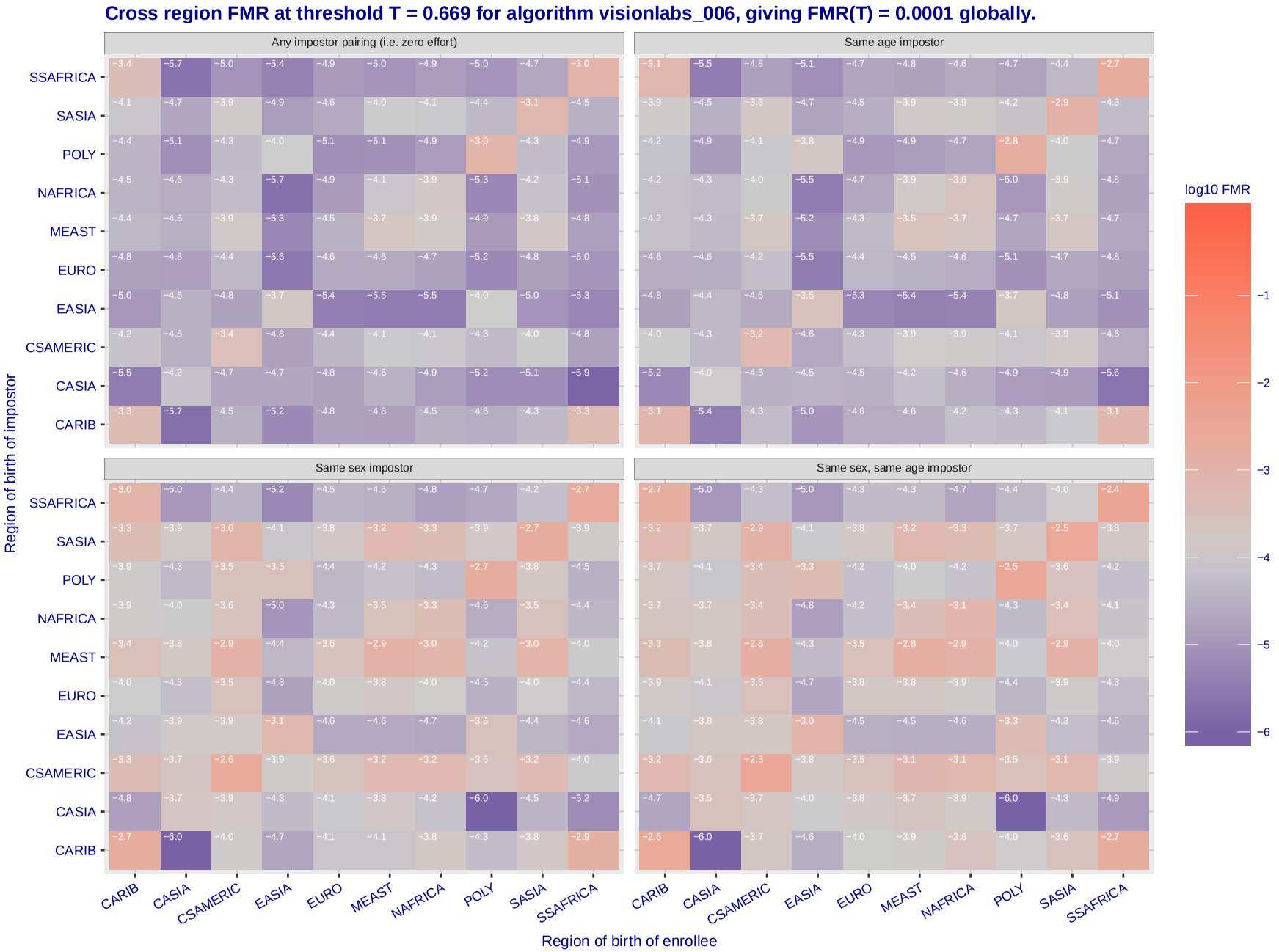


Figure 258: For algorithm visionlabs-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

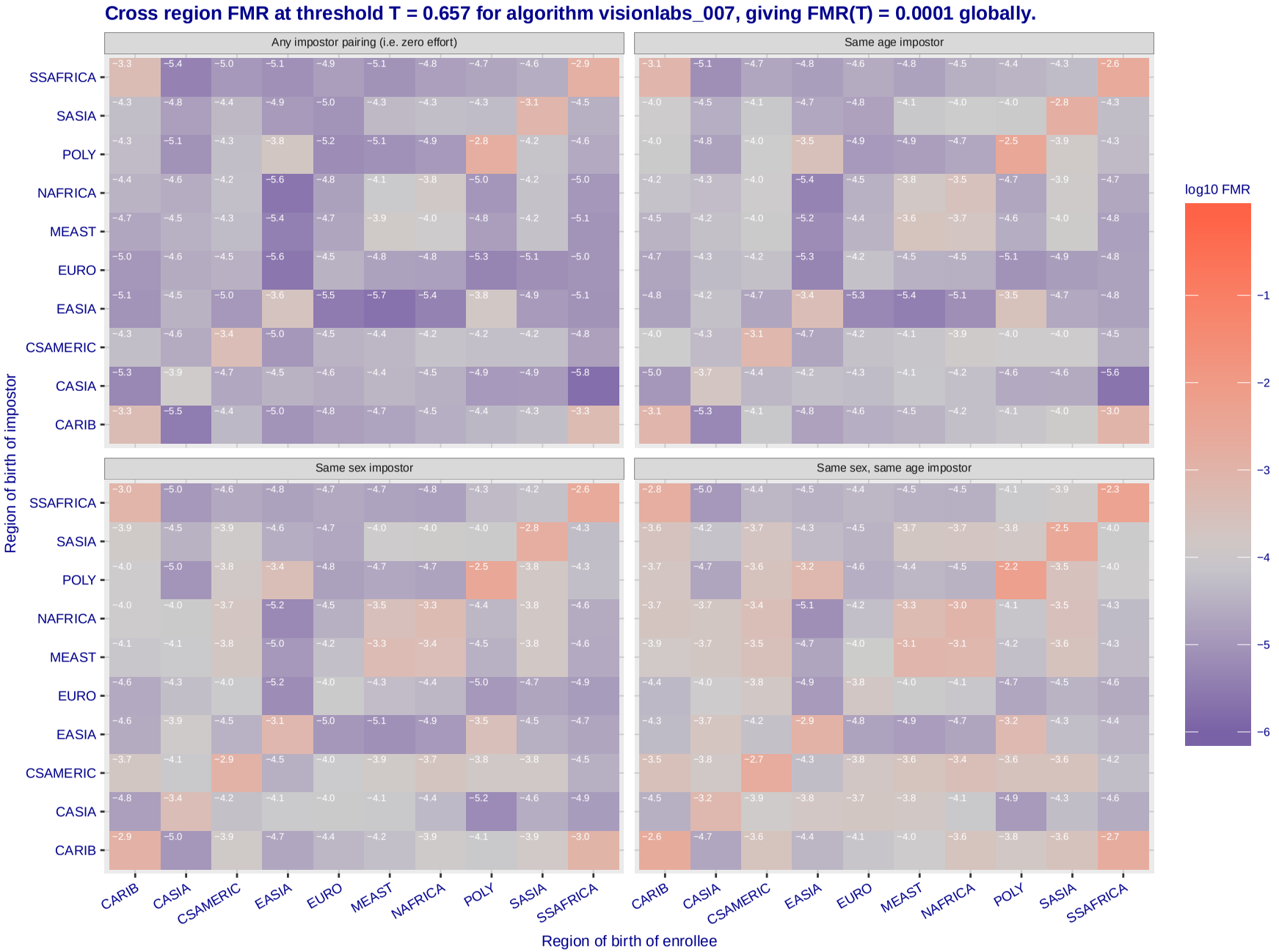


Figure 259: For algorithm visionlabs-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

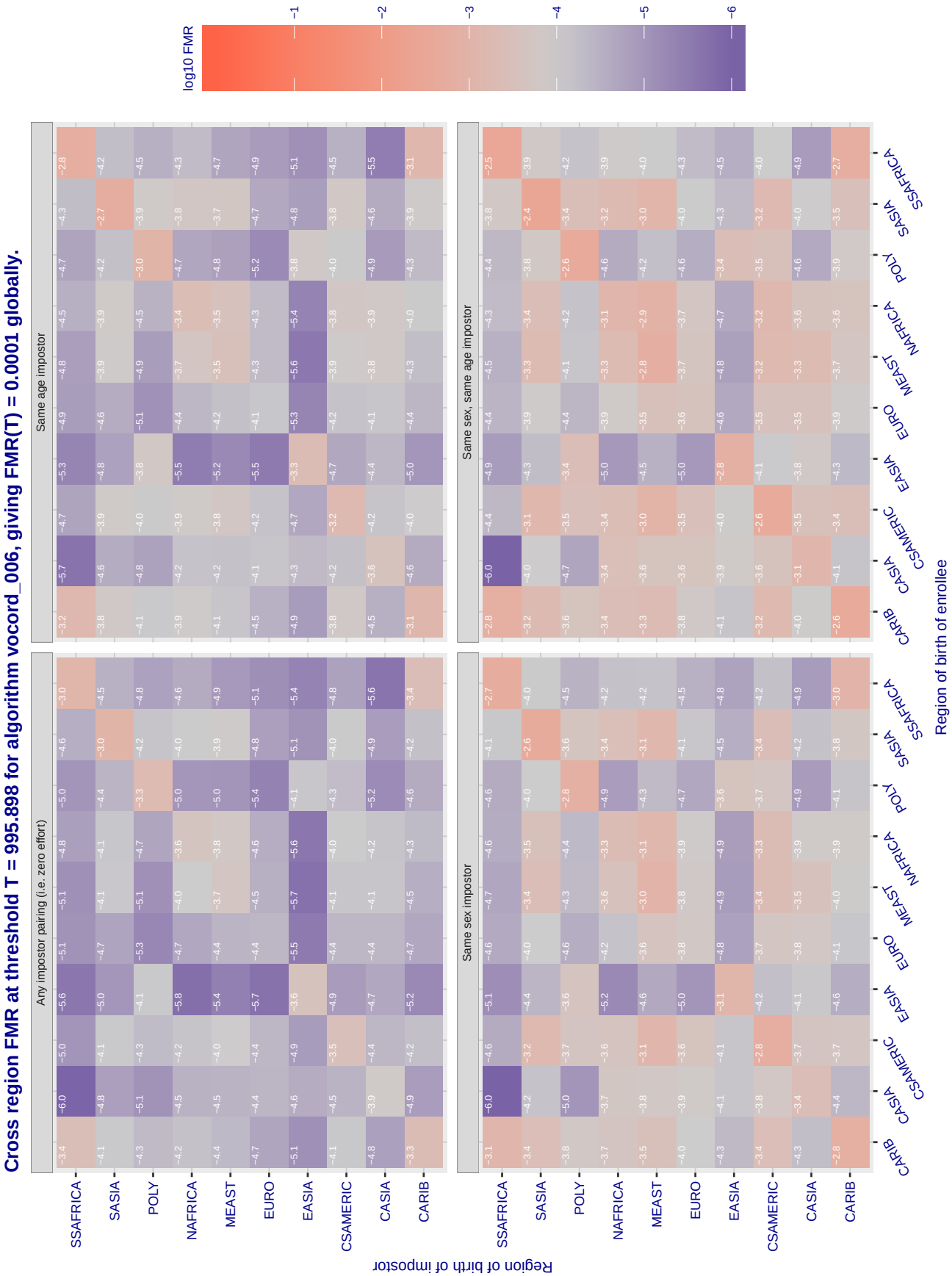


Figure 260: For algorithm vocord-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

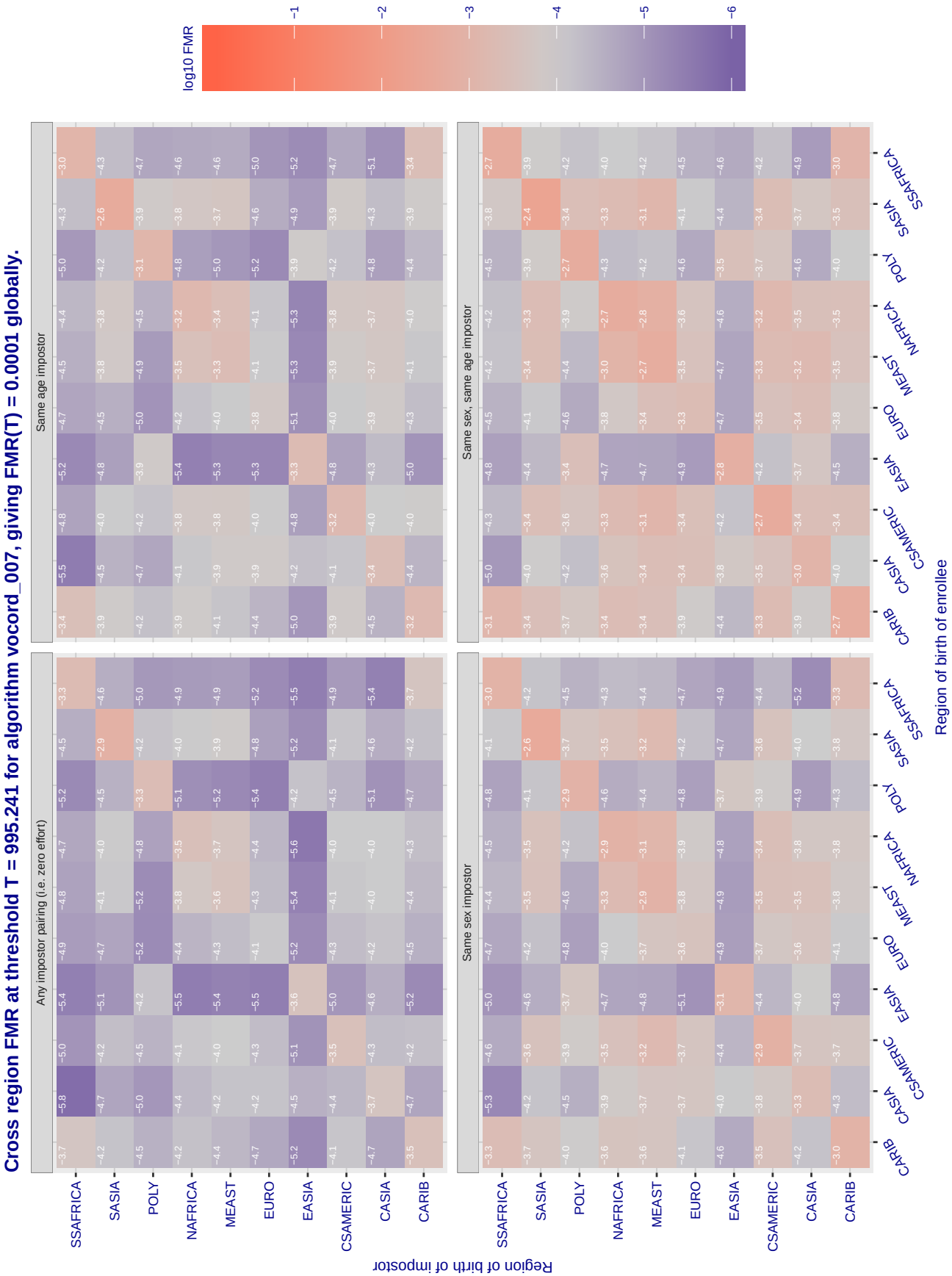


Figure 261: For algorithm vocord-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

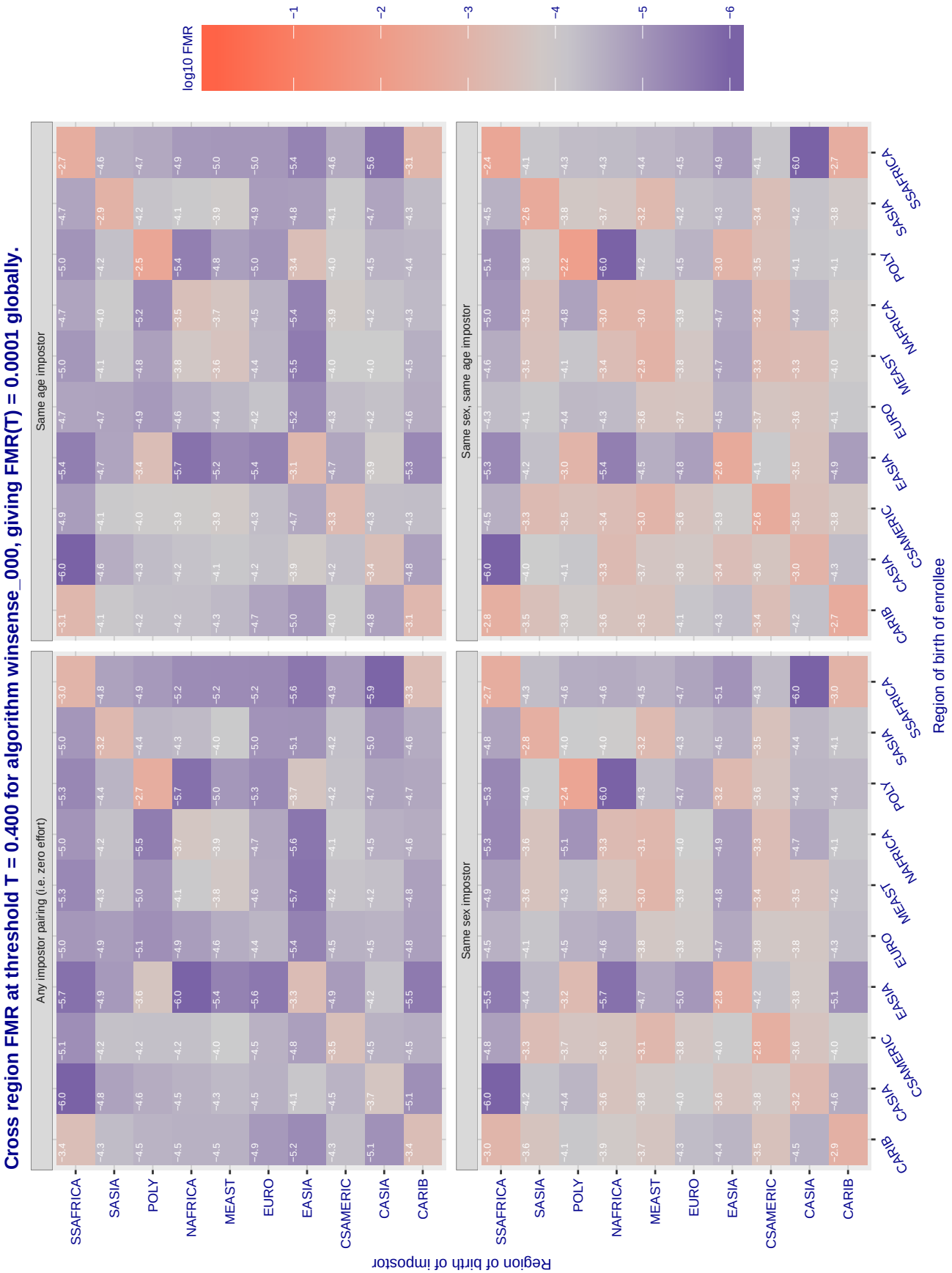


Figure 262: For algorithm winsense-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

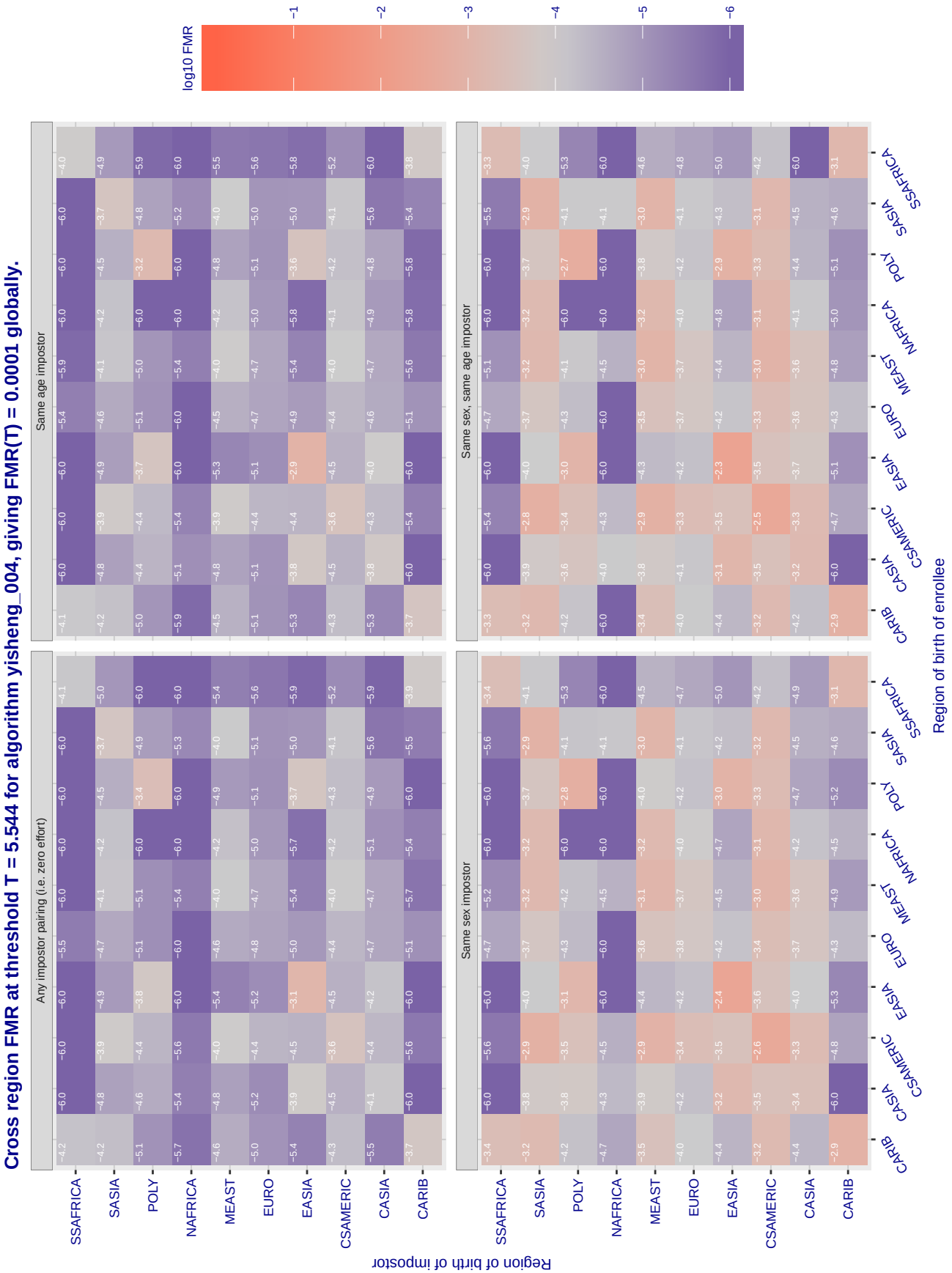


Figure 263: For algorithm yisheng-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

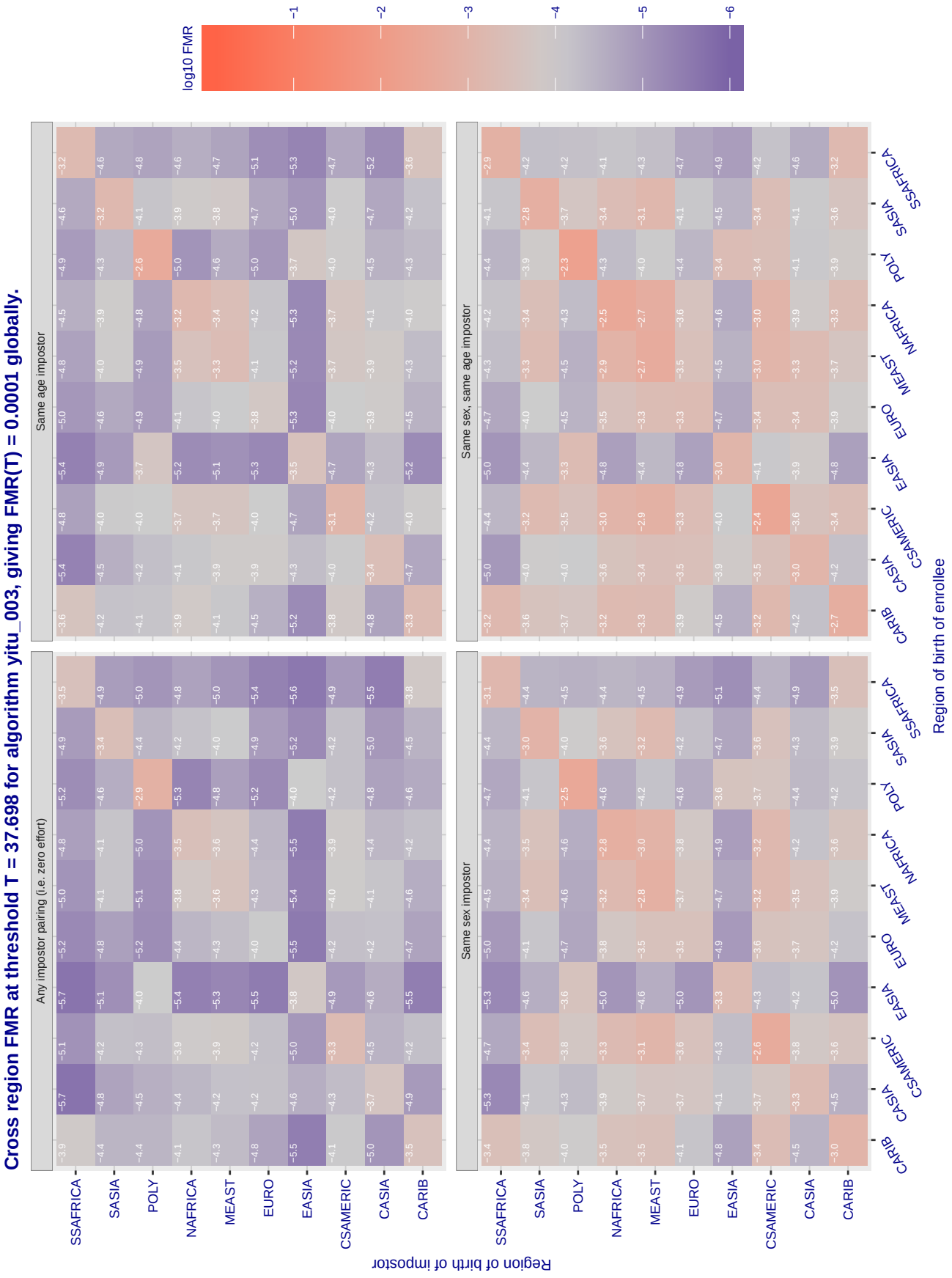


Figure 264: For algorithm yitu-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given region pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

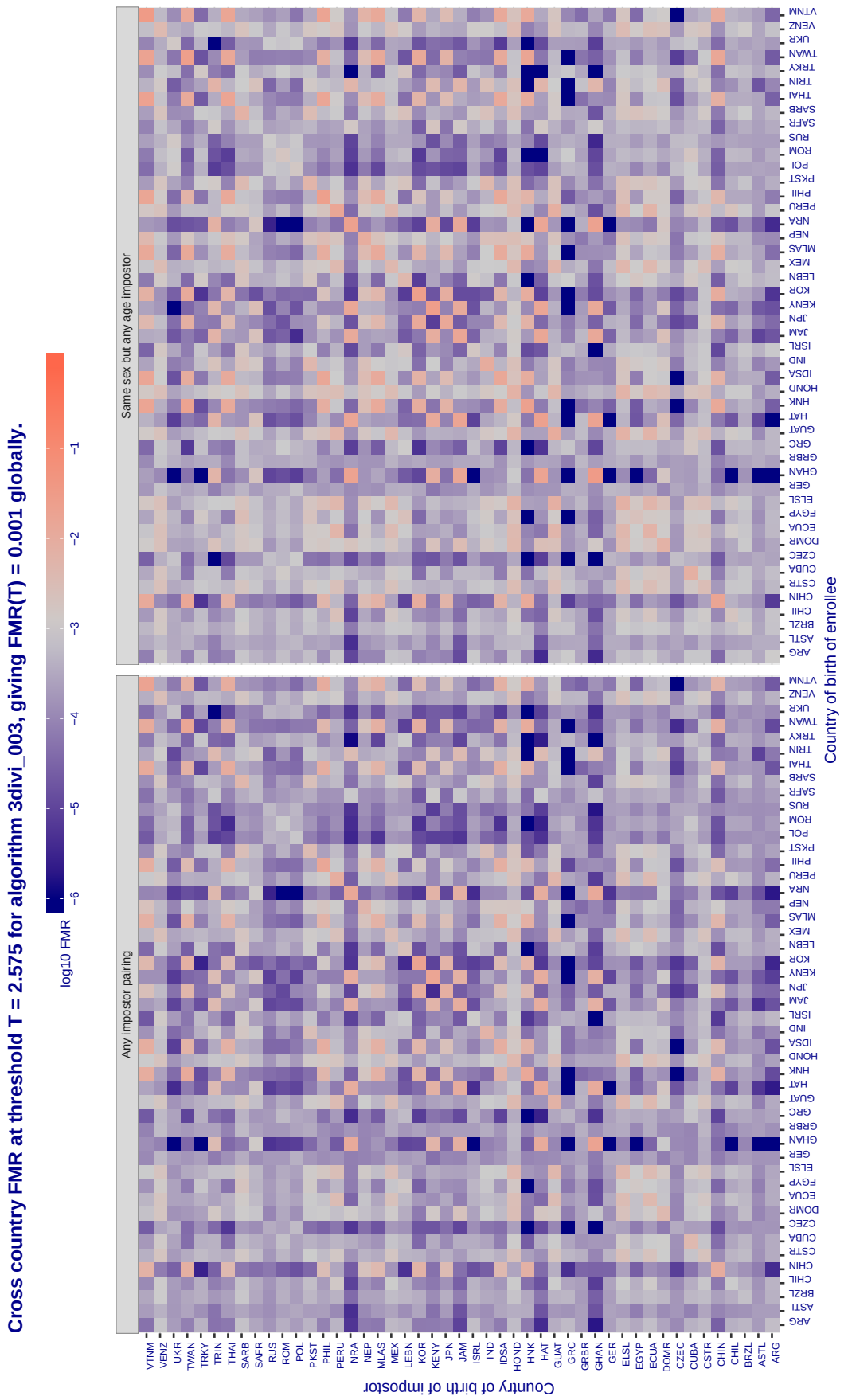


Figure 265: For algorithm 3divi-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

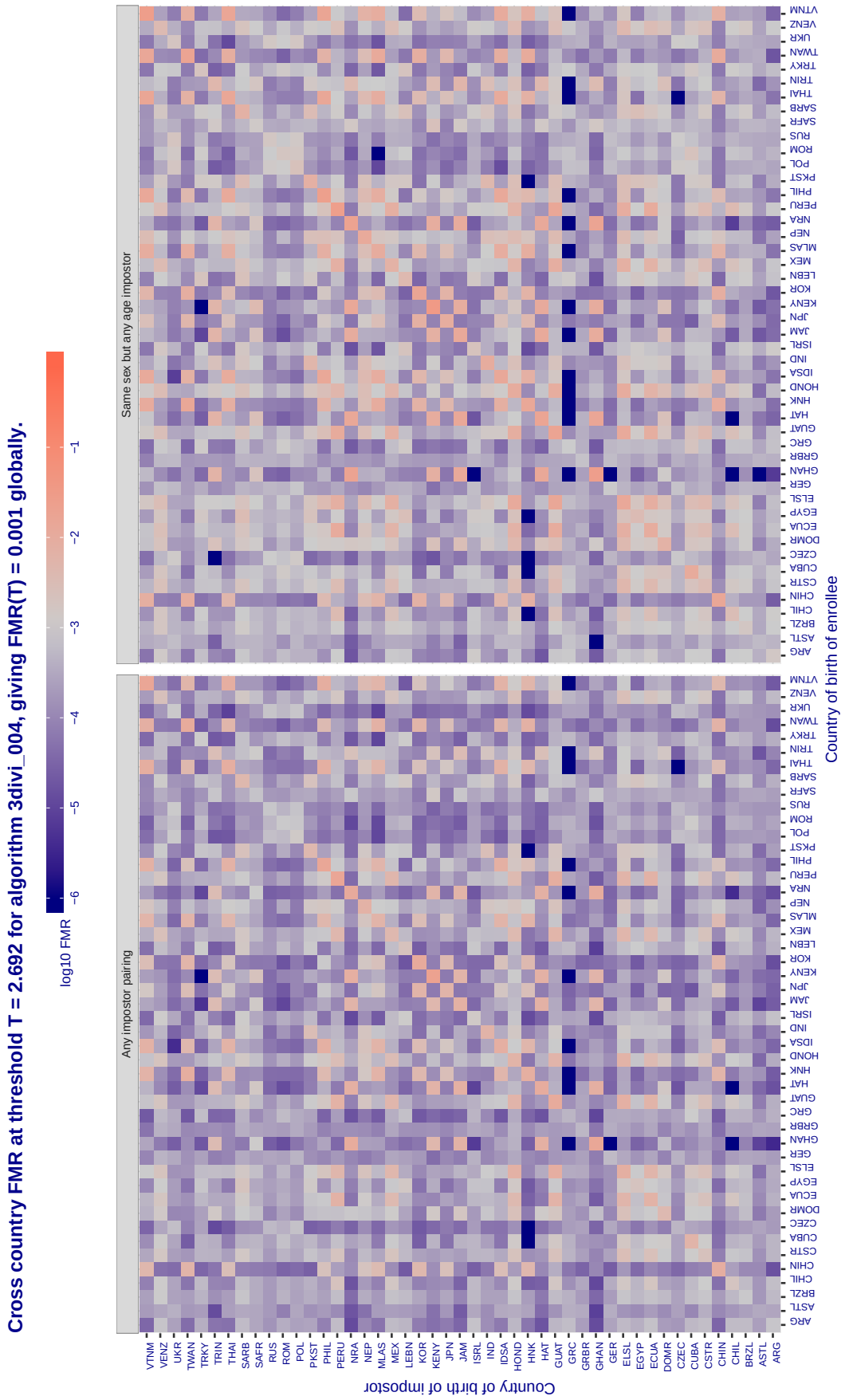


Figure 266: For algorithm 3divi-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

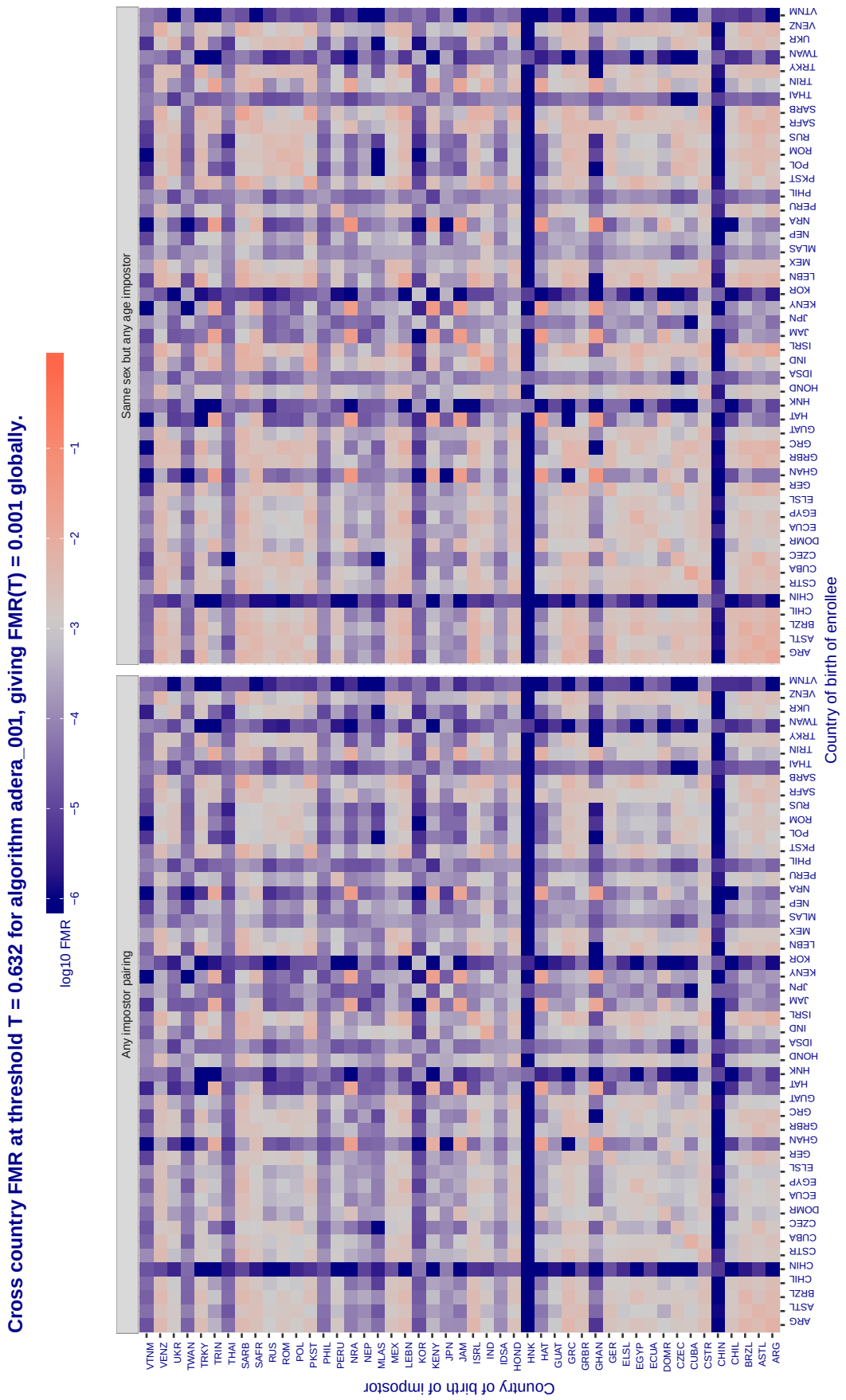


Figure 267: For algorithm adera-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

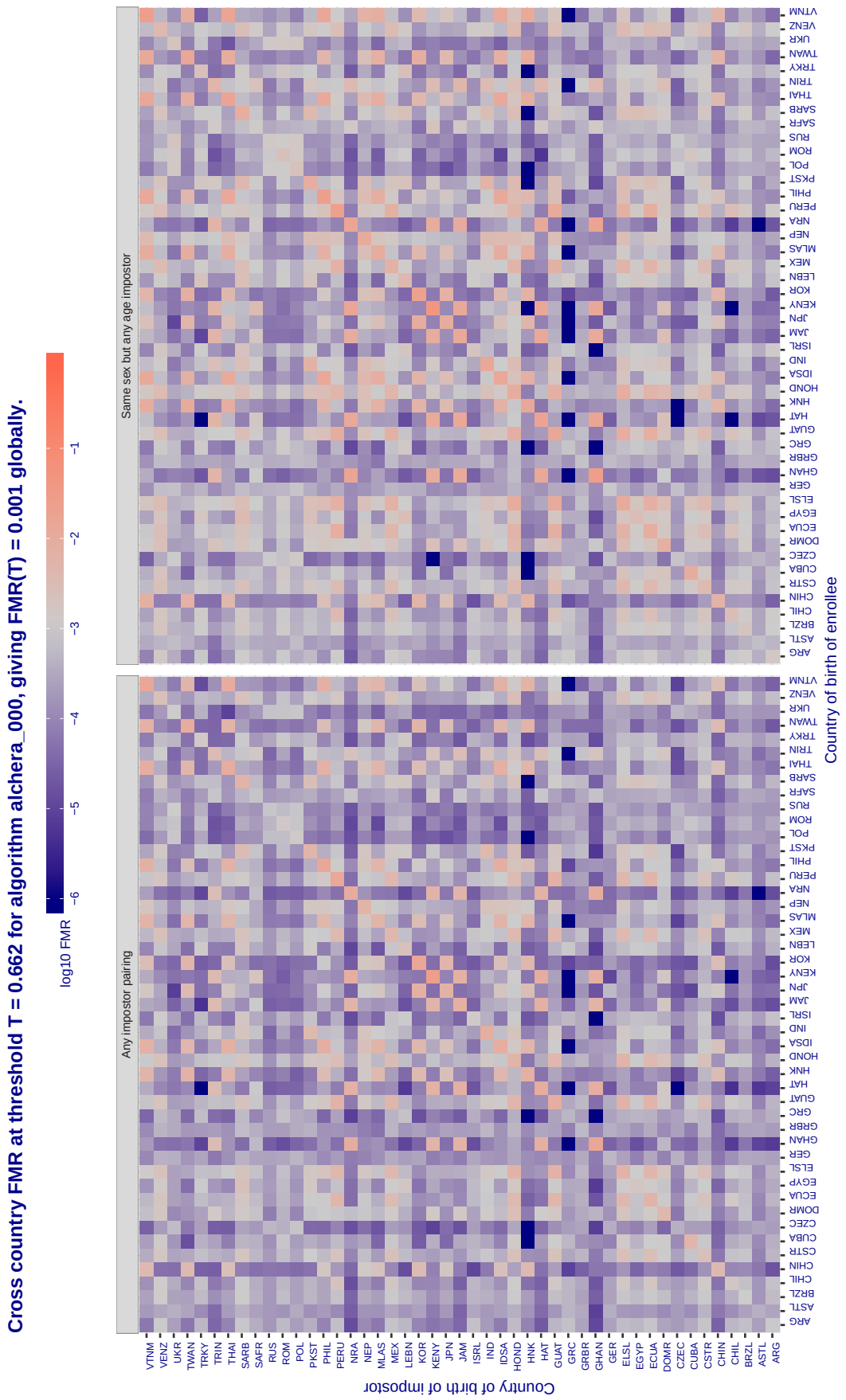


Figure 268: For algorithm alchera-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

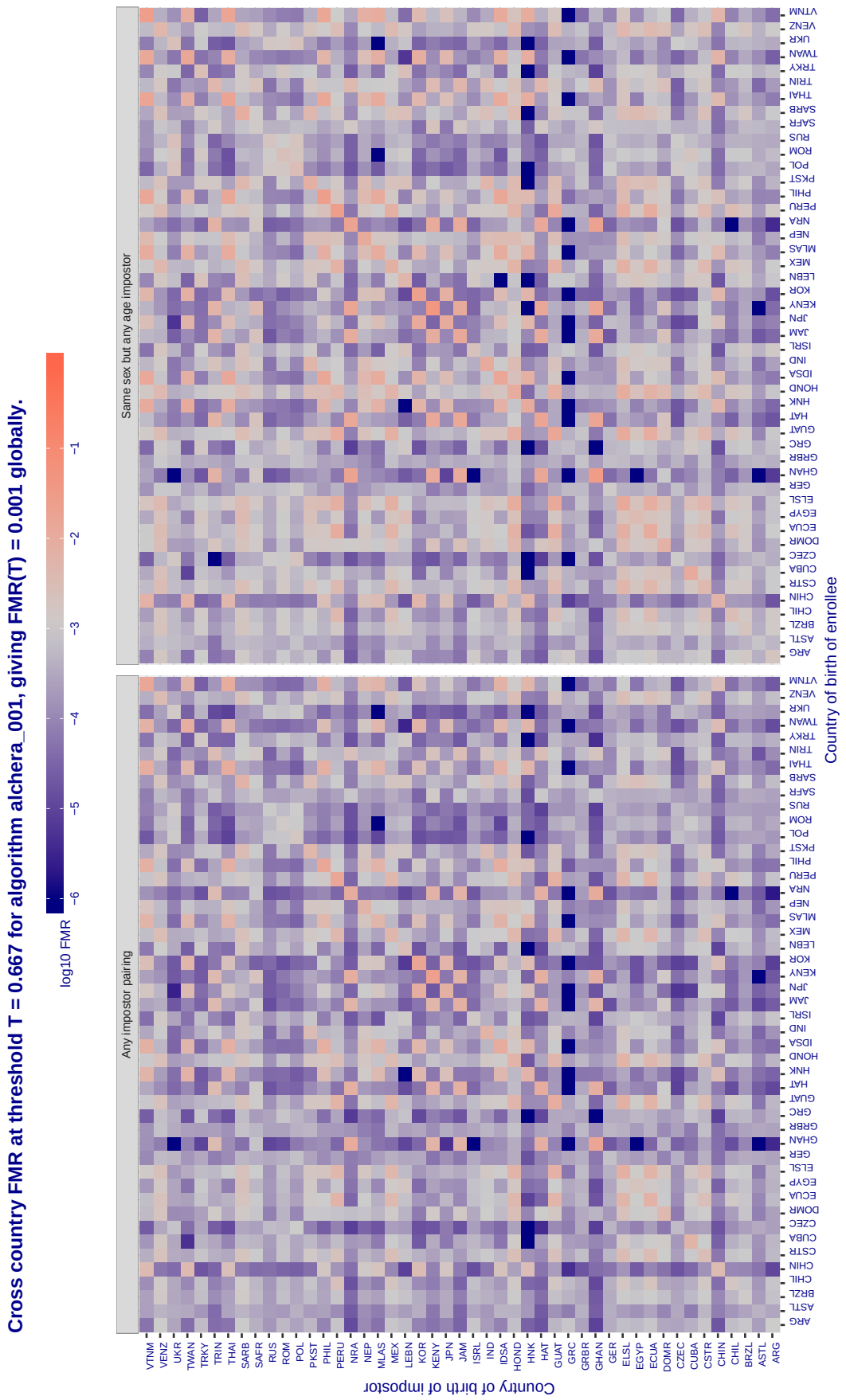


Figure 269: For algorithm alchera-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

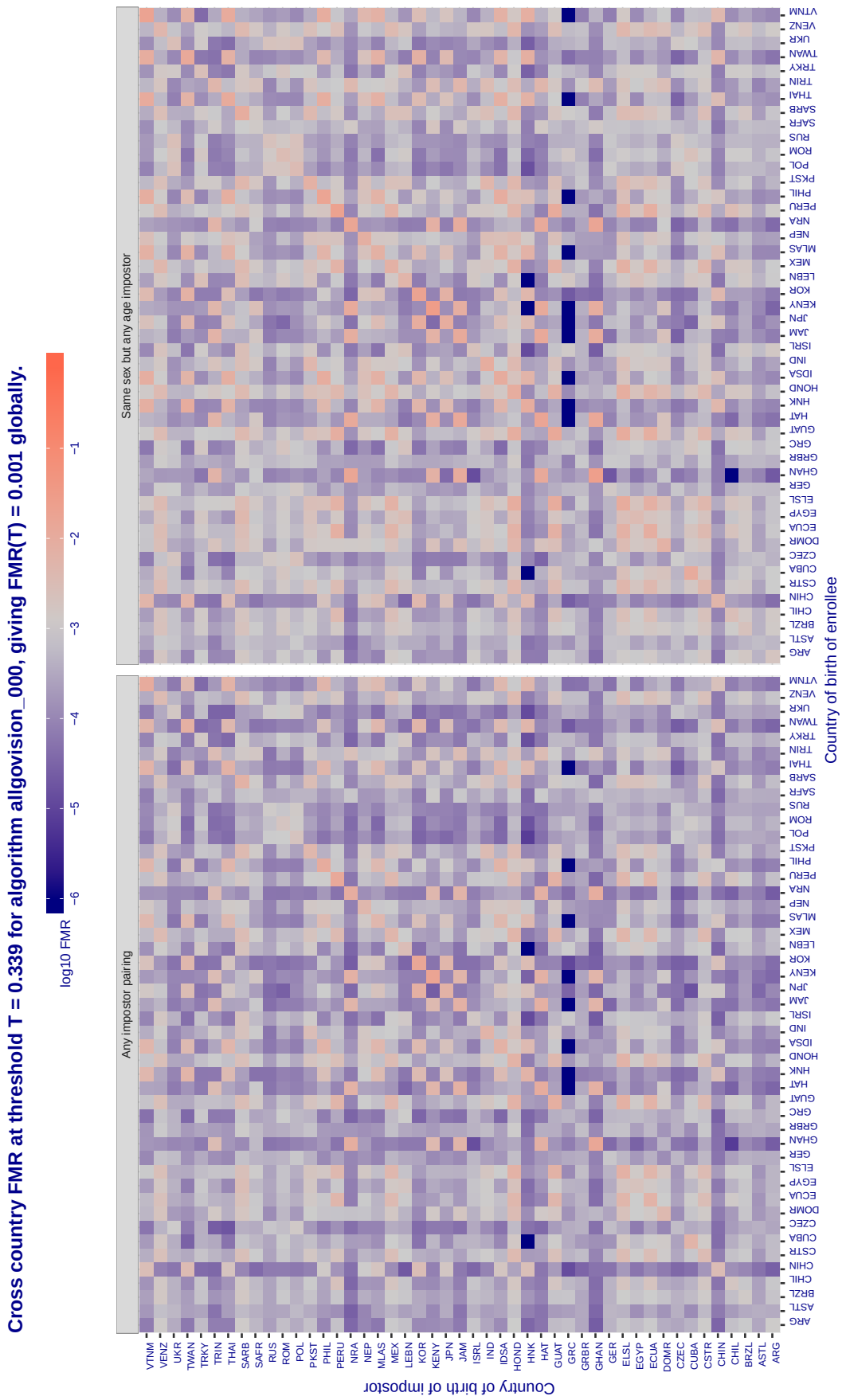


Figure 270: For algorithm allgovision-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

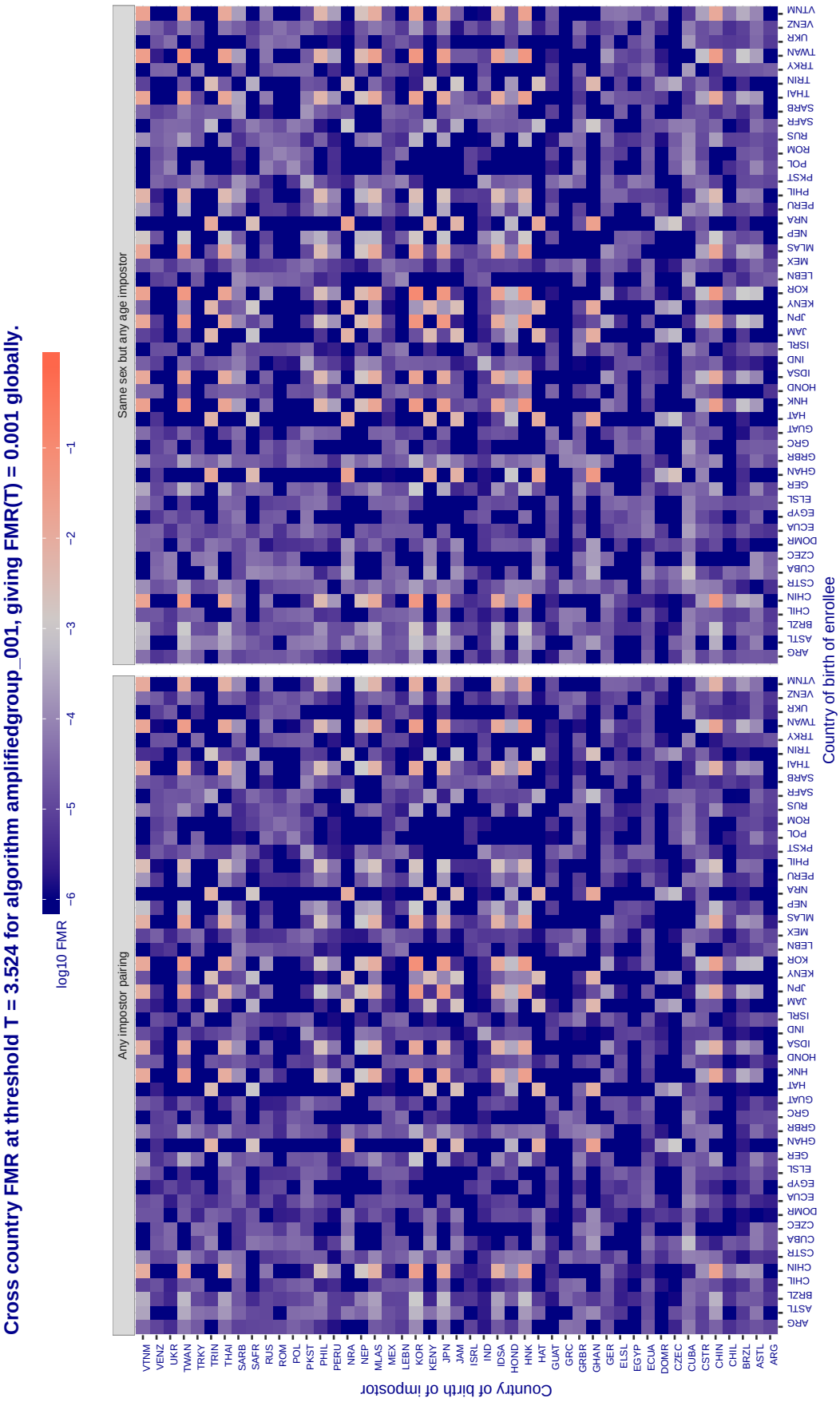


Figure 271: For algorithm amplifiedgroup-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

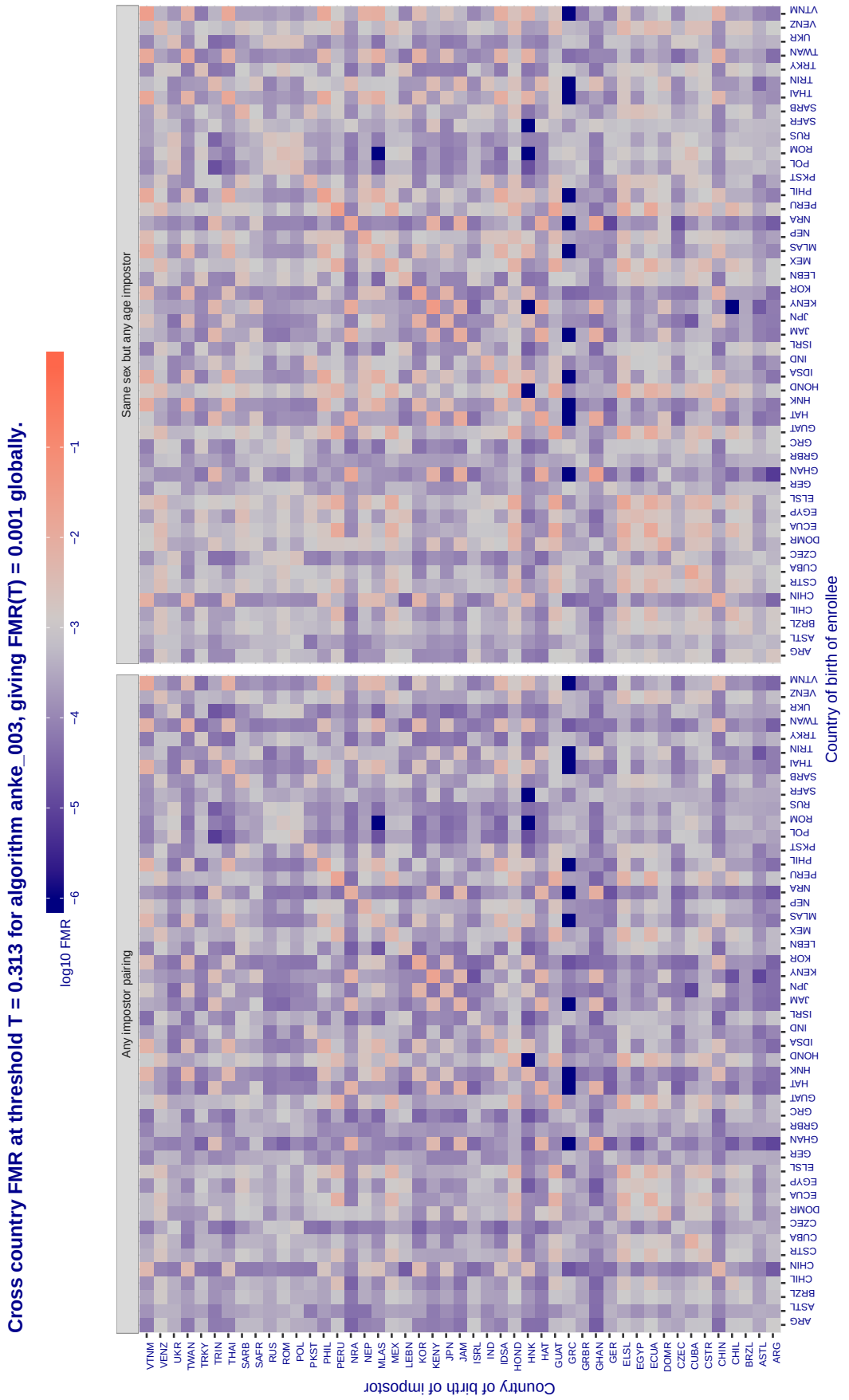


Figure 272: For algorithm anke-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

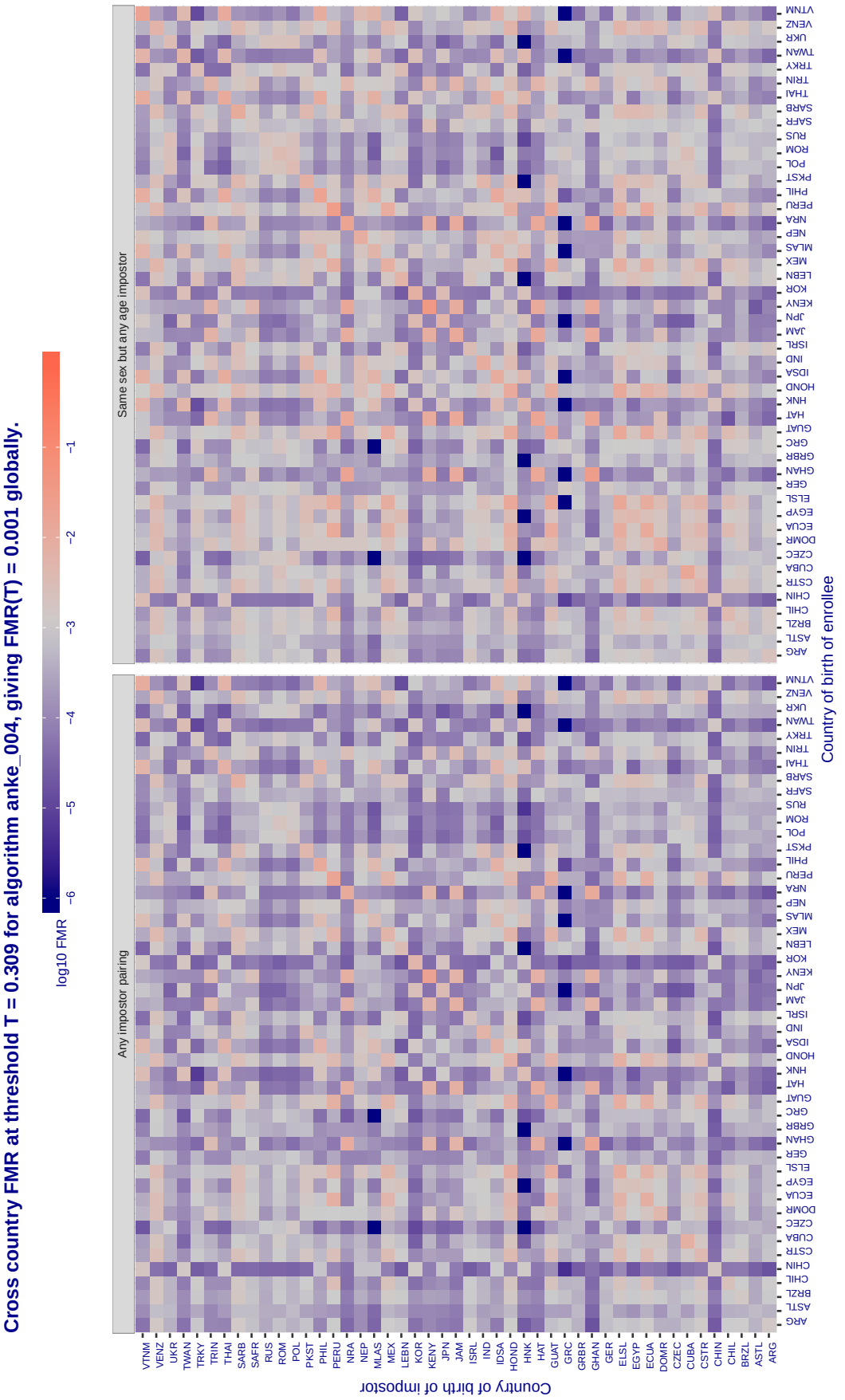


Figure 273: For algorithm anke-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

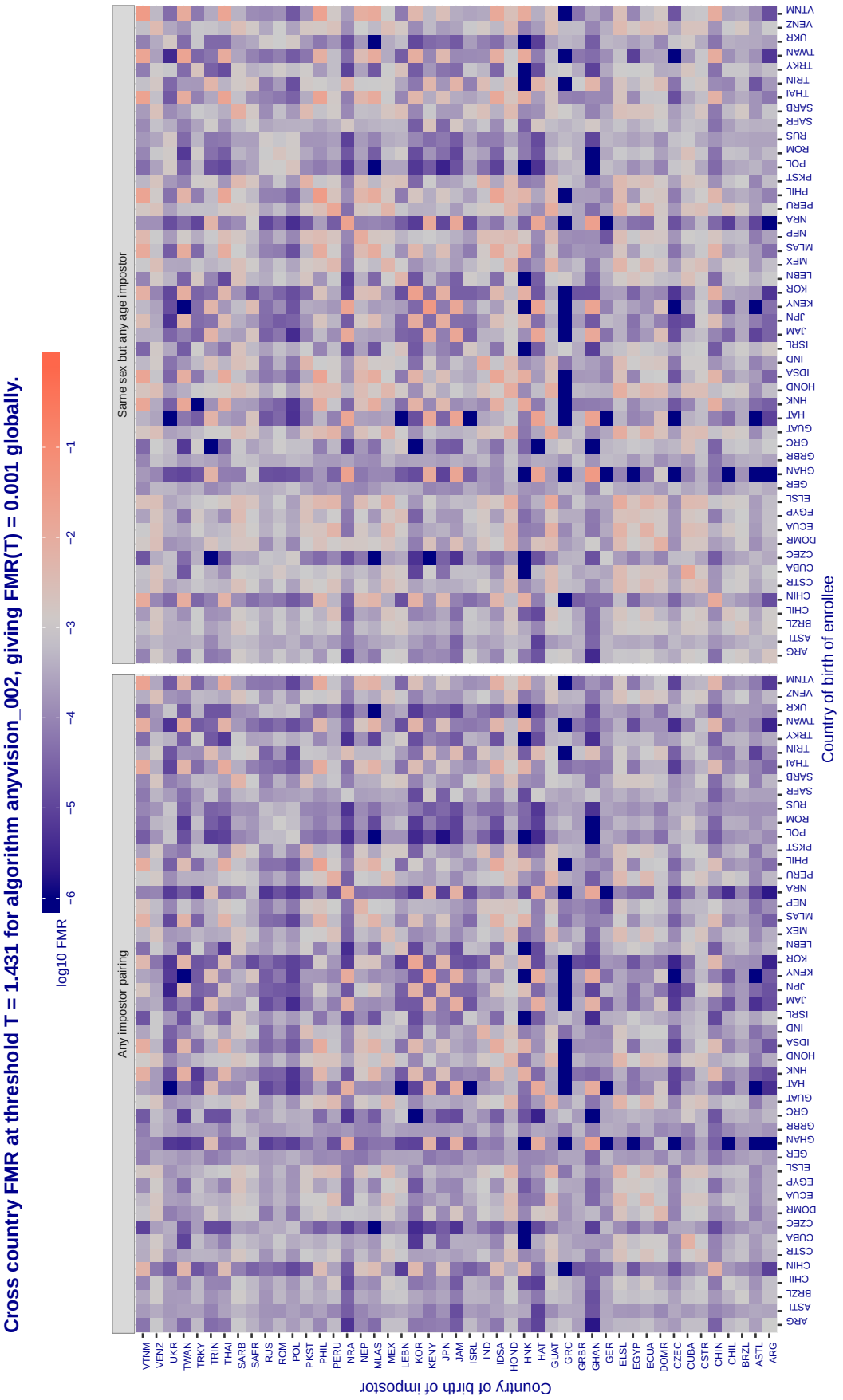


Figure 274: For algorithm anyvision-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

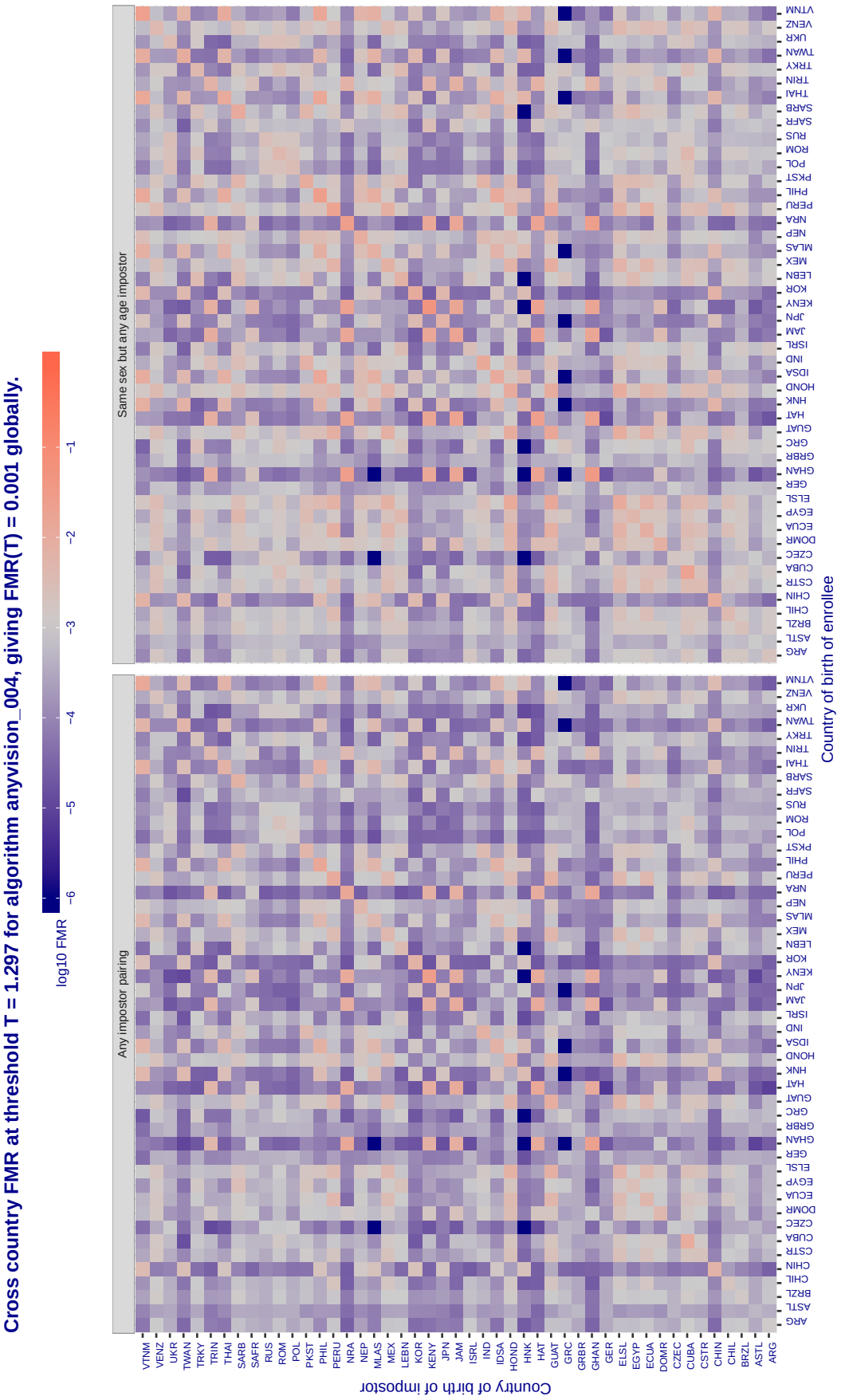


Figure 275: For algorithm anyvision-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

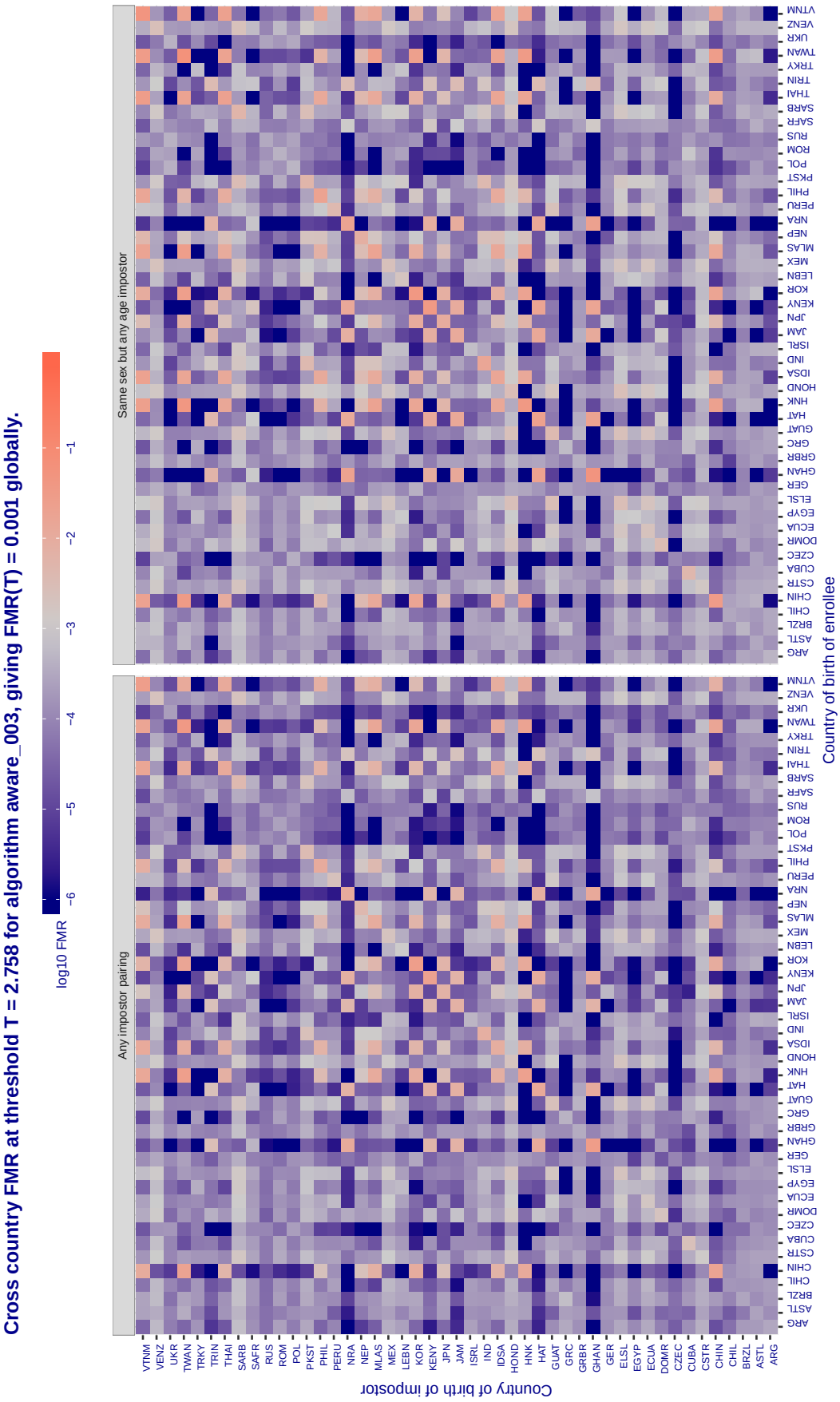


Figure 276: For algorithm aware-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

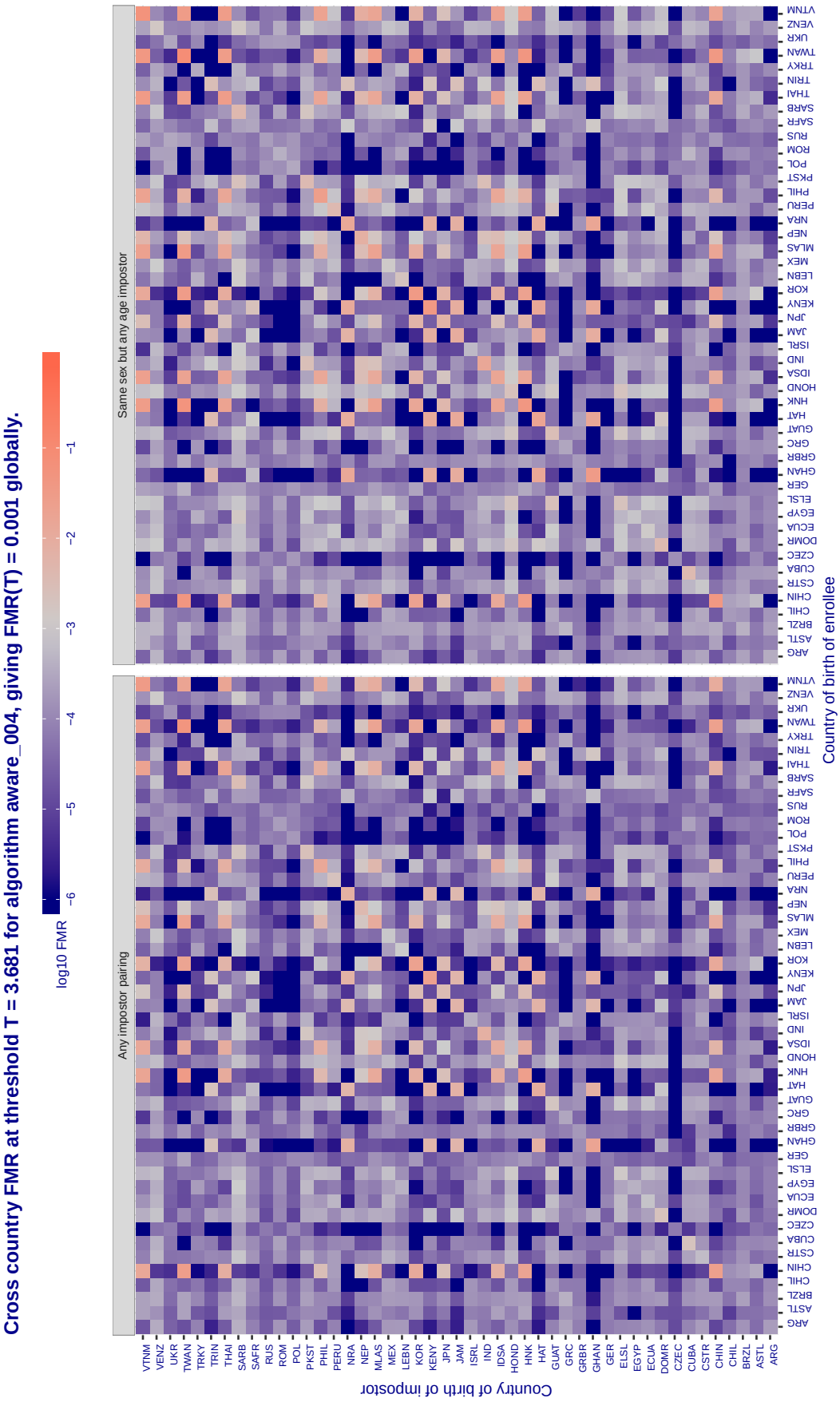


Figure 277: For algorithm aware-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

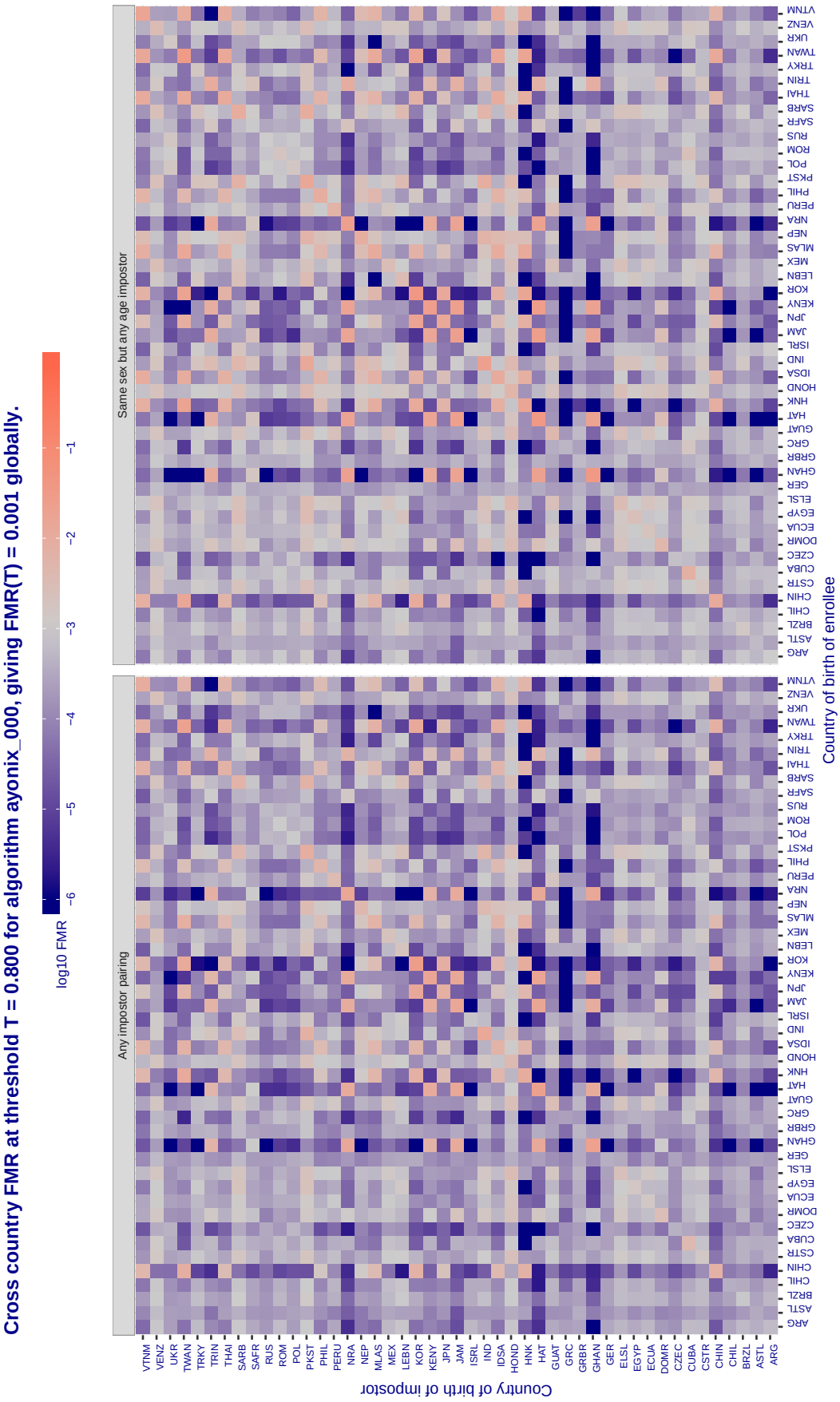


Figure 278: For algorithm ayonix-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

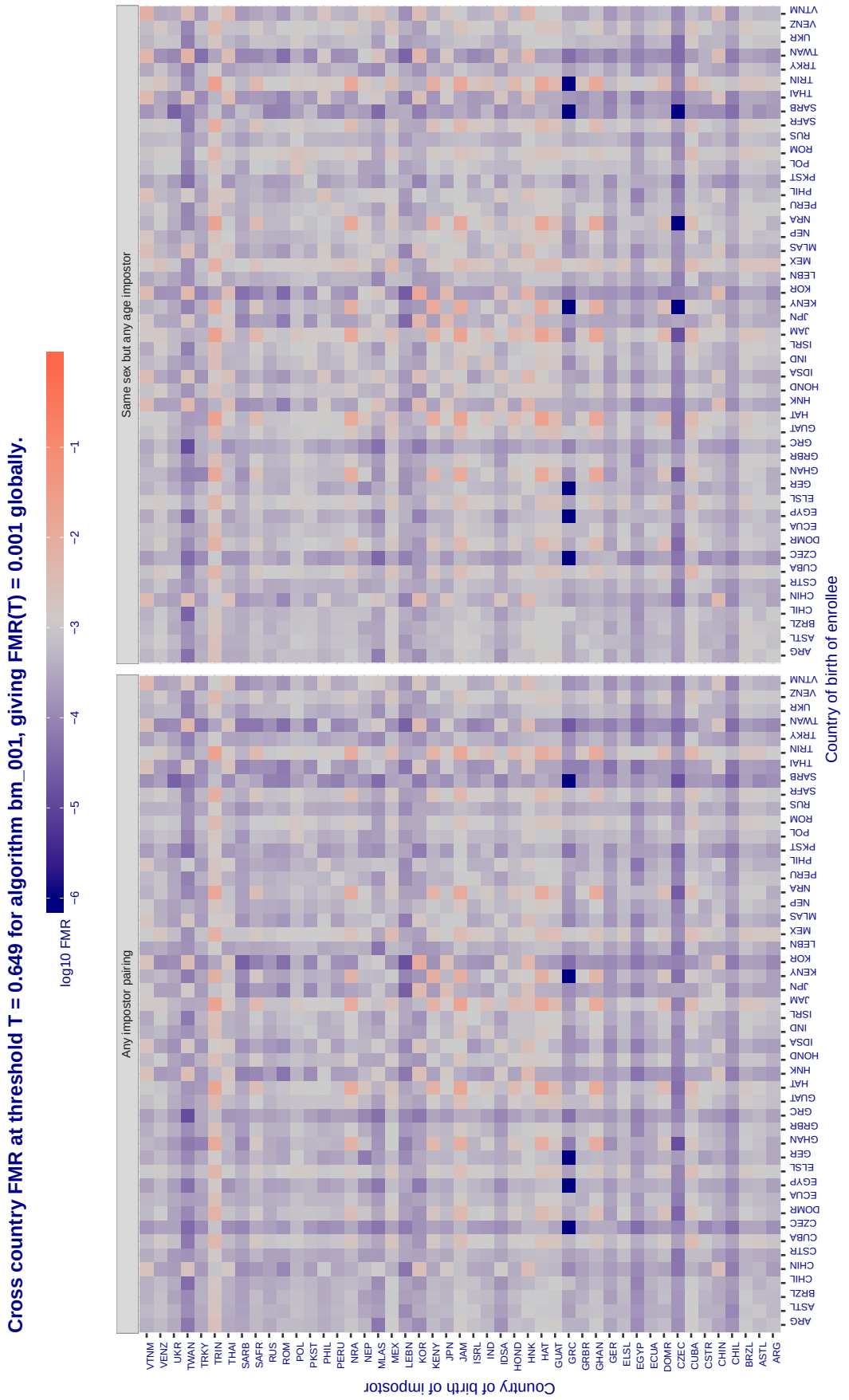


Figure 279: For algorithm bm-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

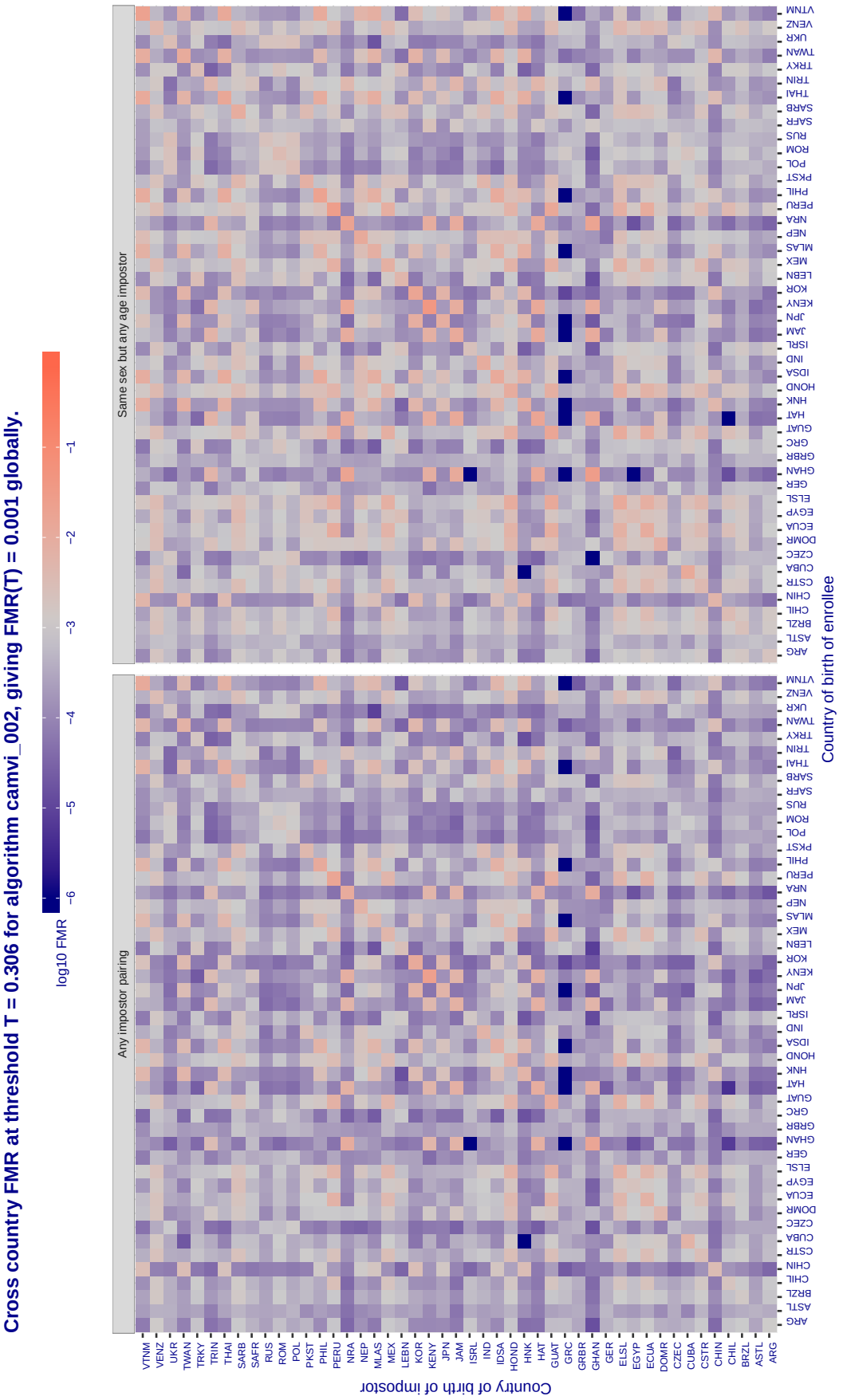


Figure 280: For algorithm camvi-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

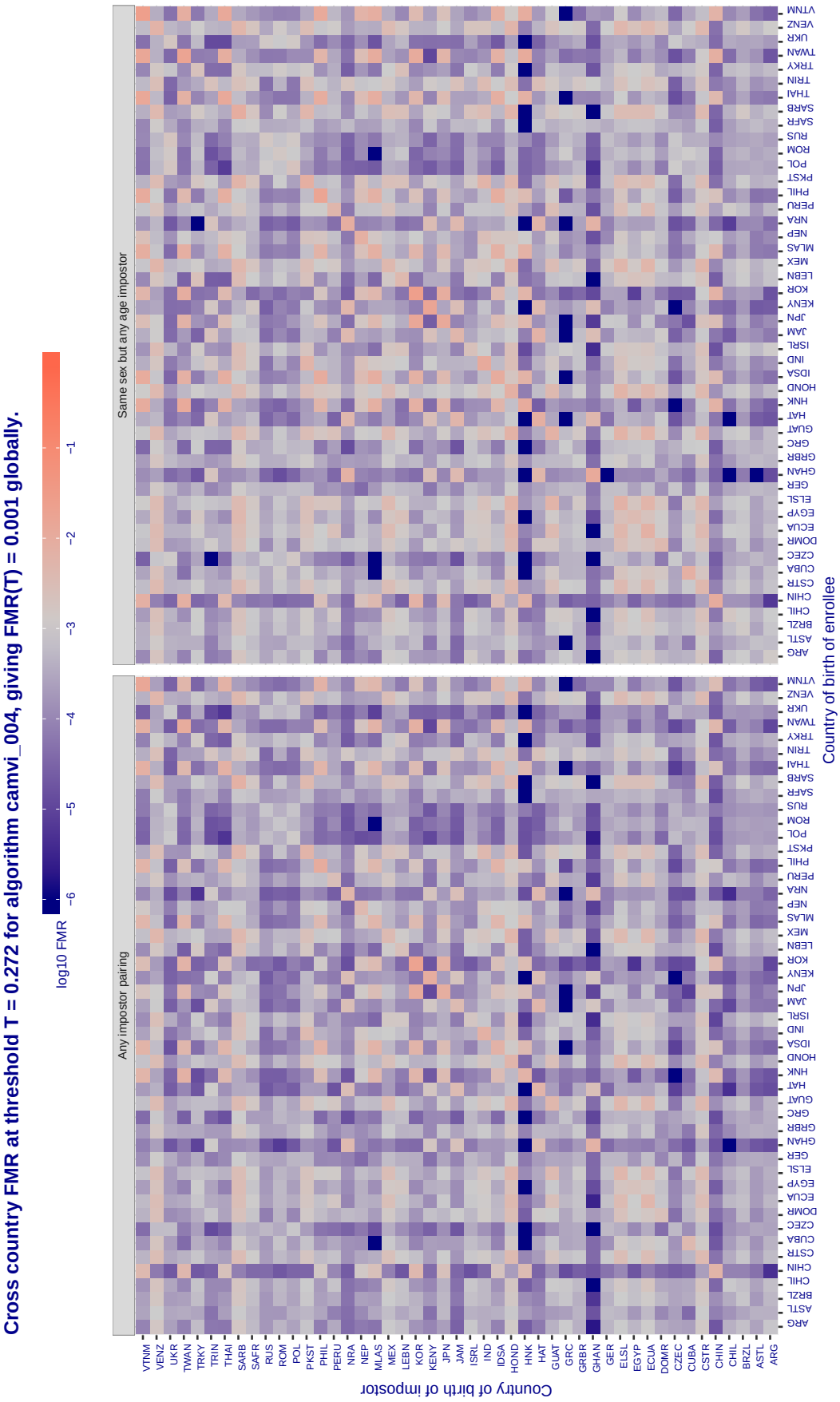


Figure 281: For algorithm camvi-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

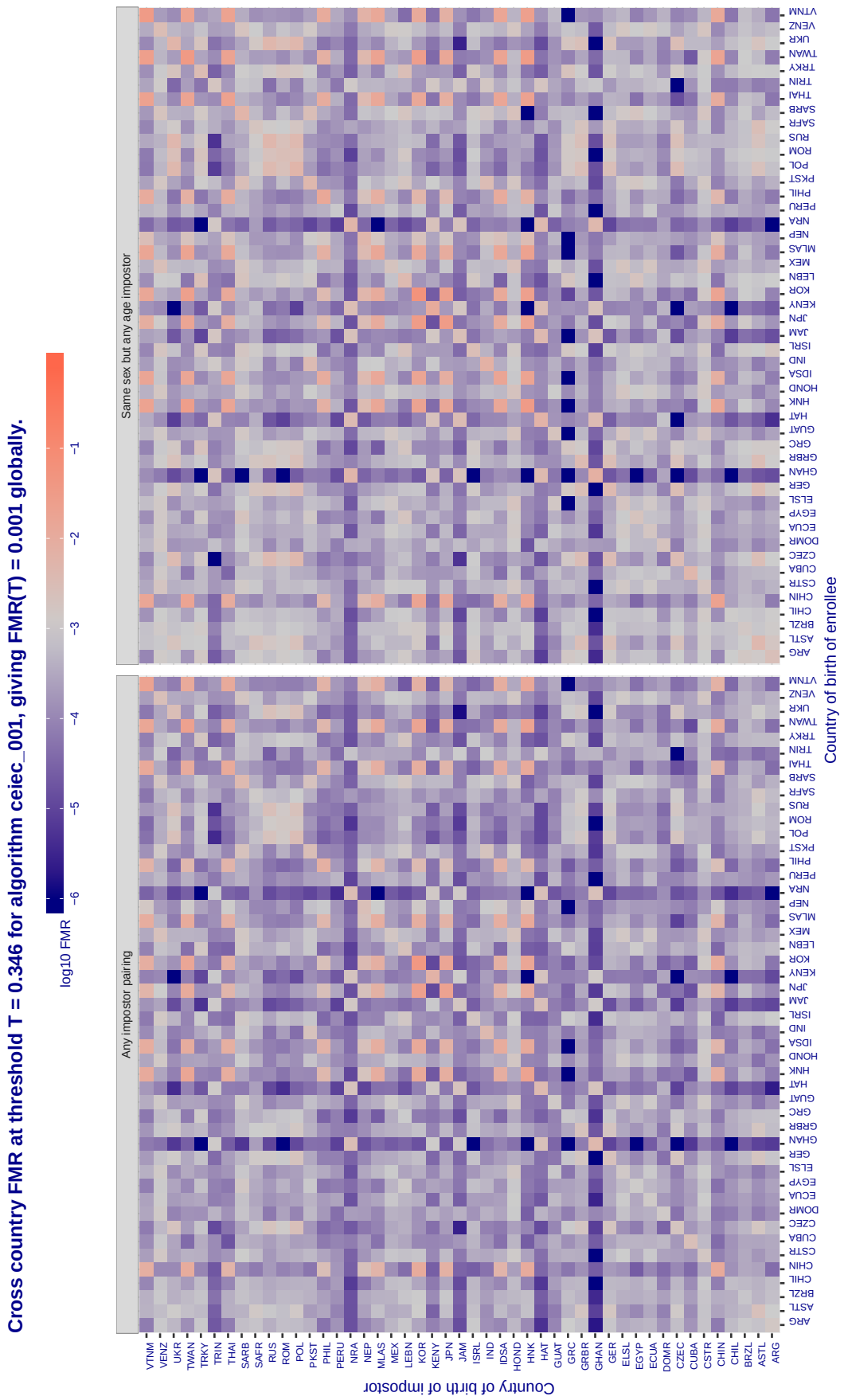


Figure 282: For algorithm ceiec-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

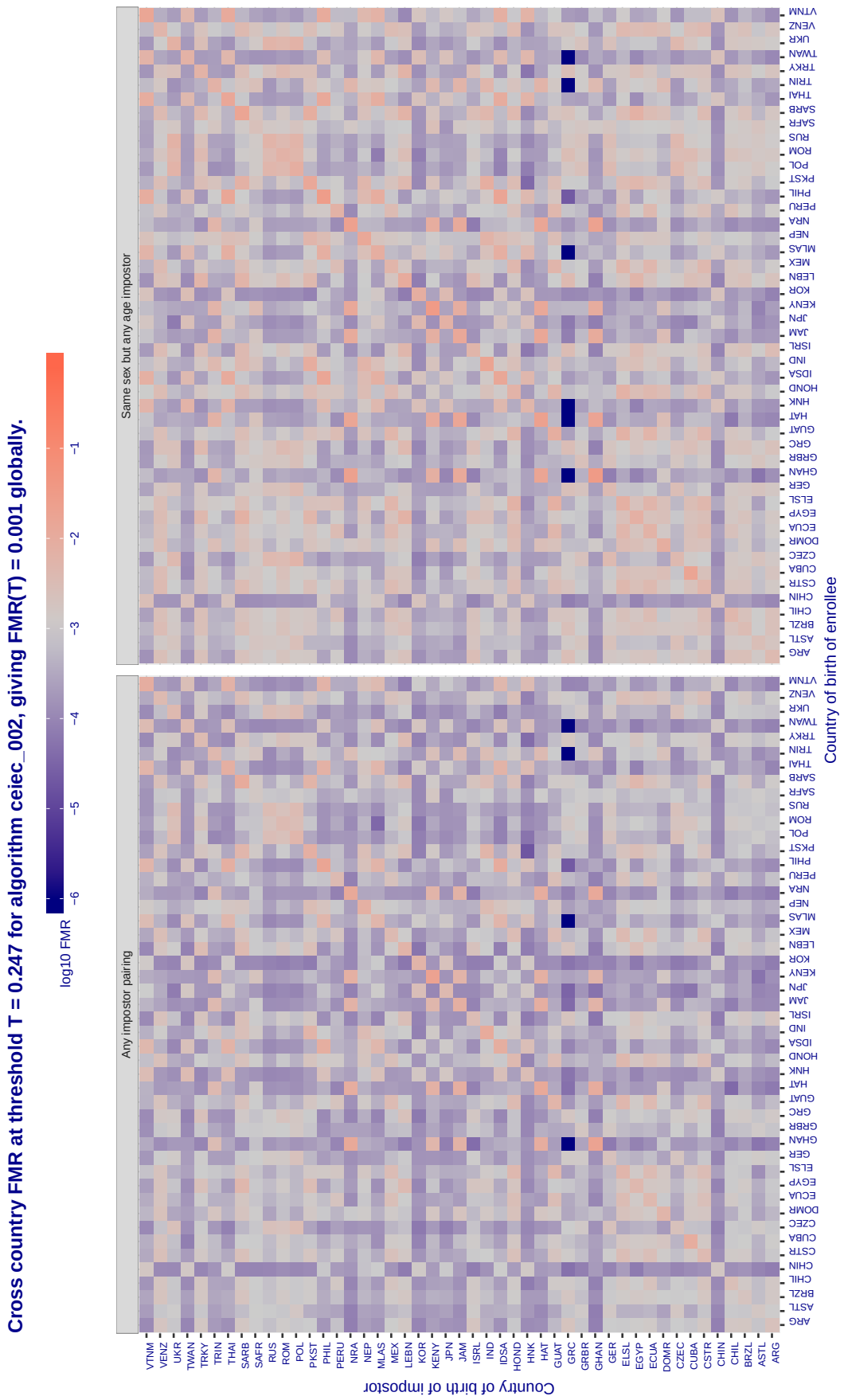


Figure 283: For algorithm ceiec-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

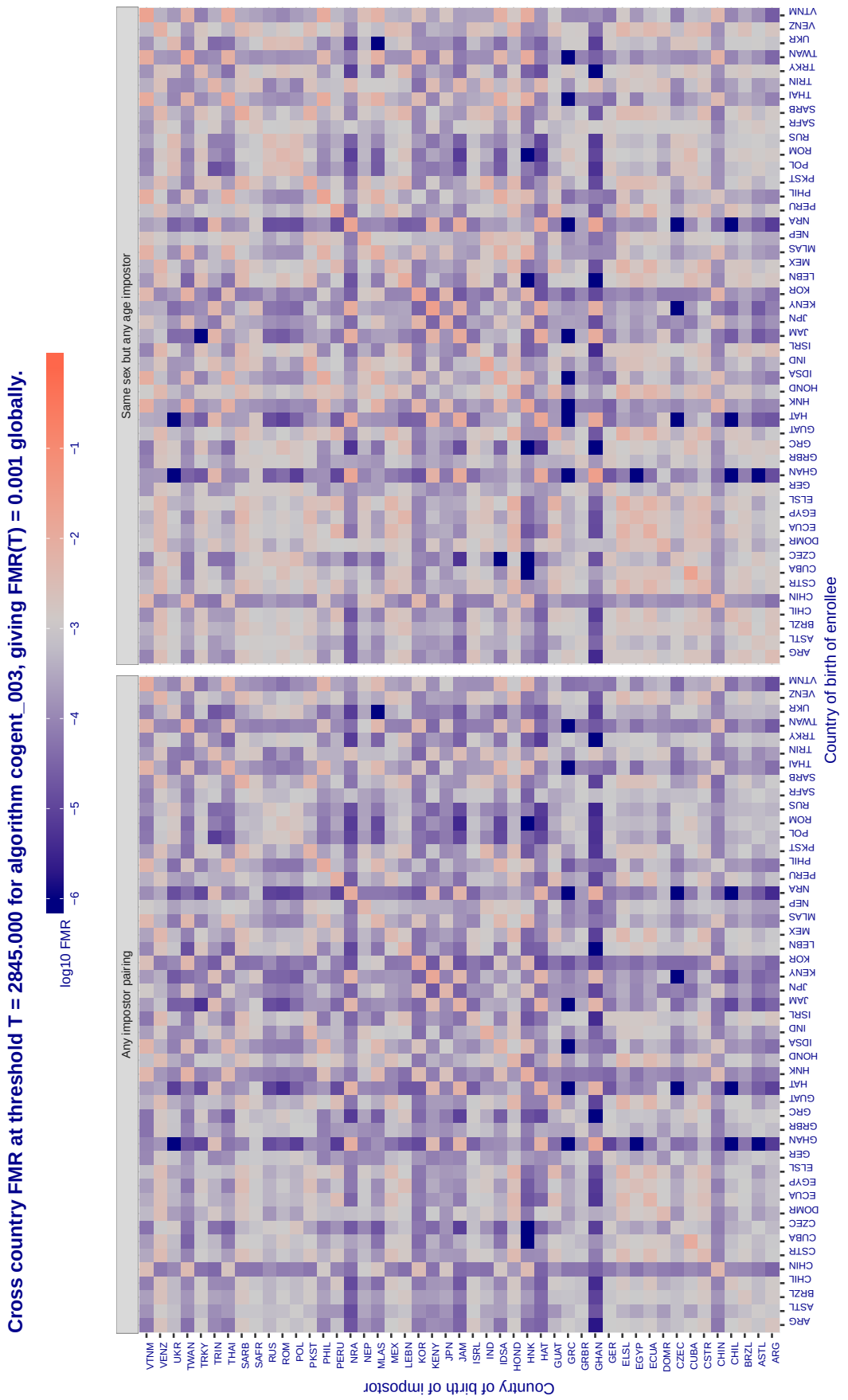


Figure 284: For algorithm cogent-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

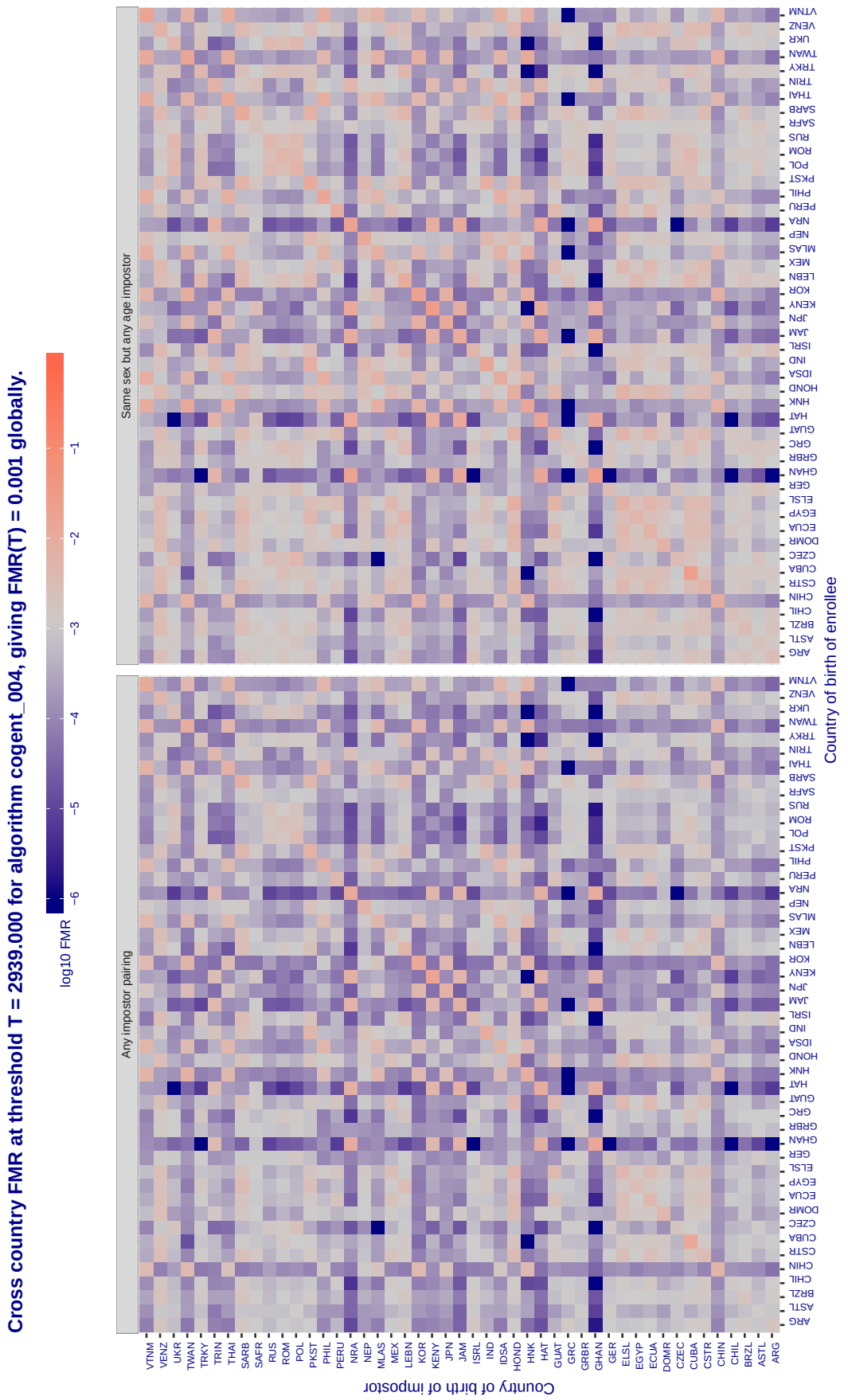


Figure 285: For algorithm cogent-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

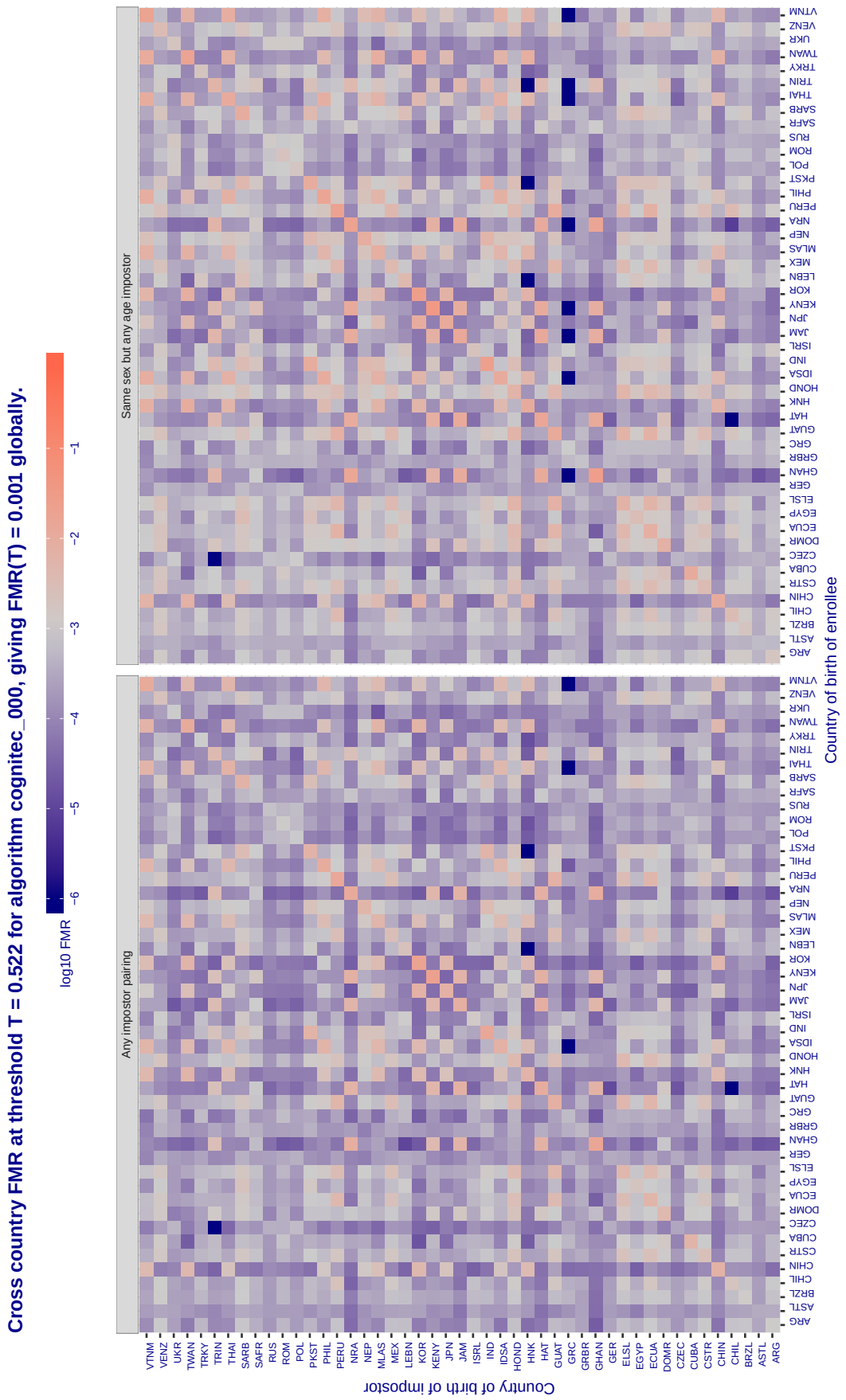


Figure 286: For algorithm cognitec-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

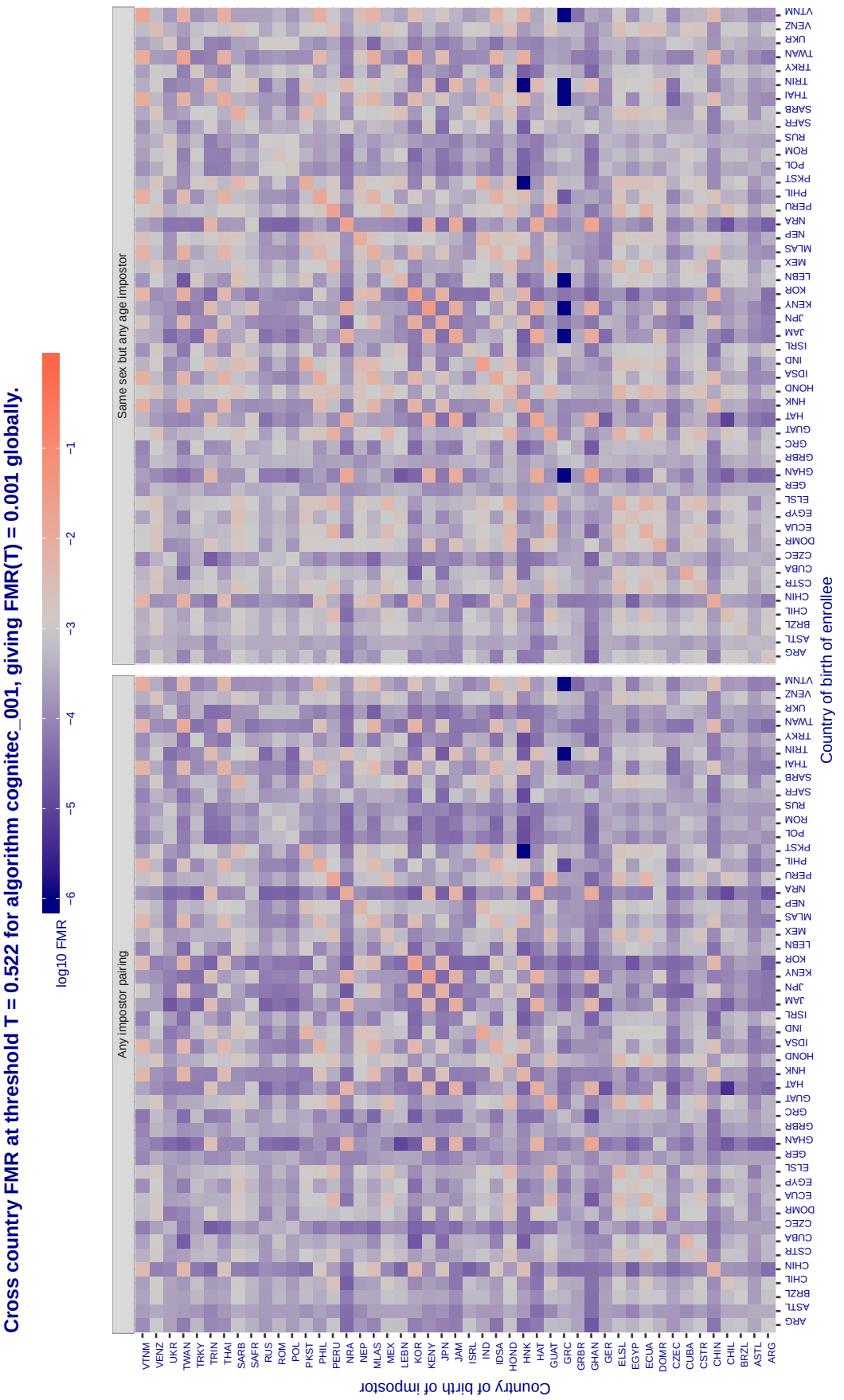


Figure 287: For algorithm cognitec-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

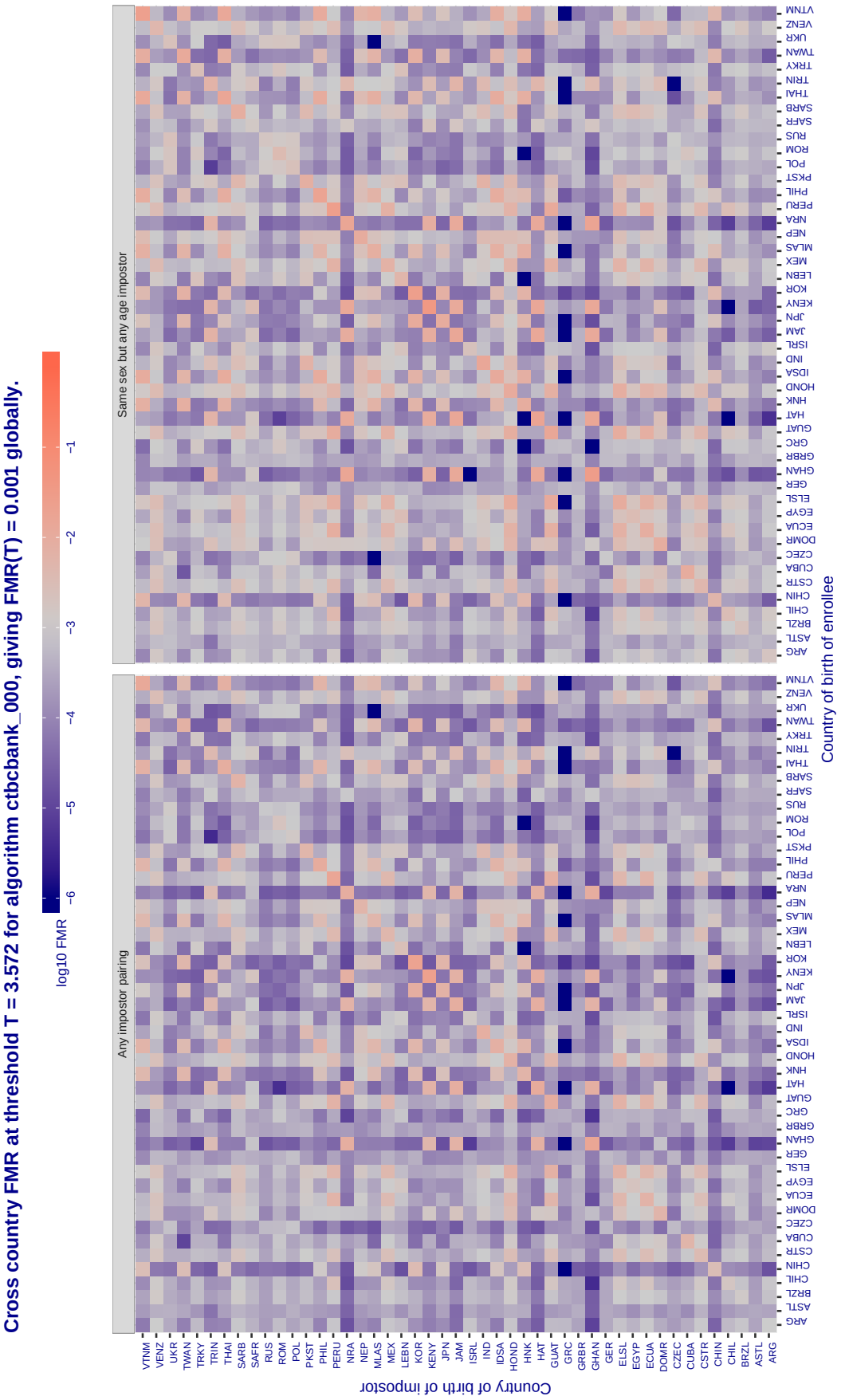


Figure 288: For algorithm ctbcbank-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

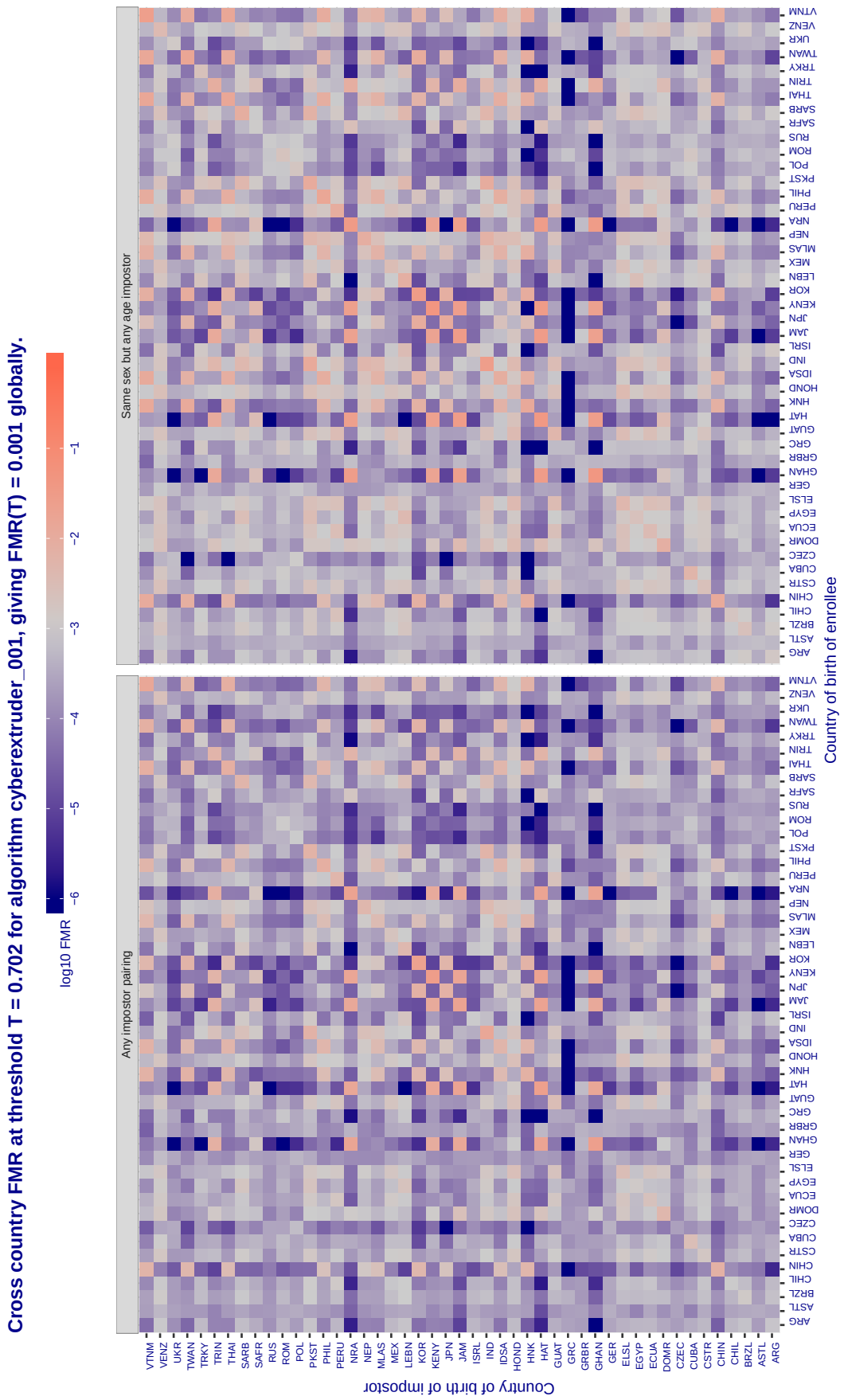


Figure 289: For algorithm cyberextruder-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

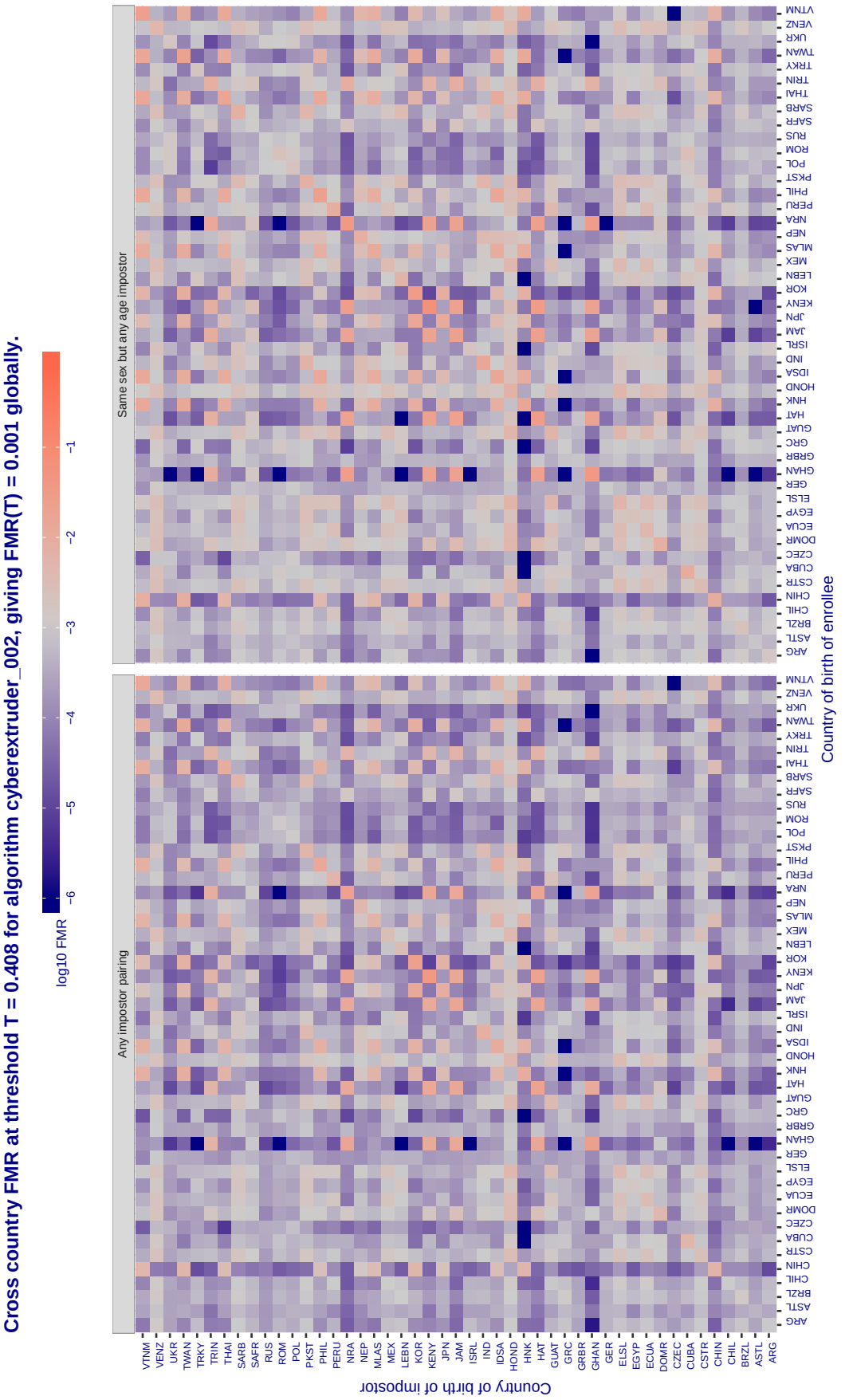


Figure 290: For algorithm cyberextruder-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

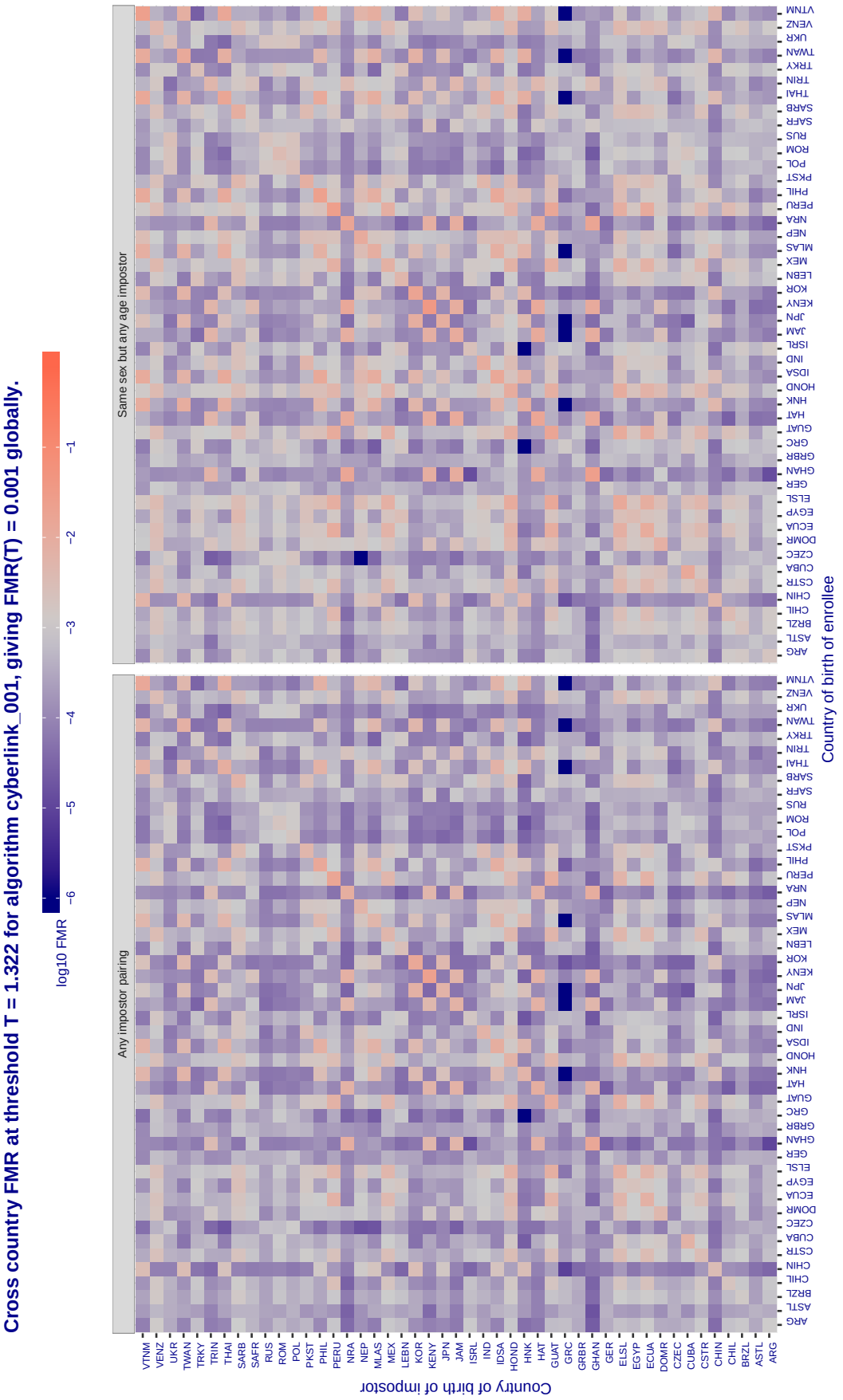


Figure 291: For algorithm cyberlink-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

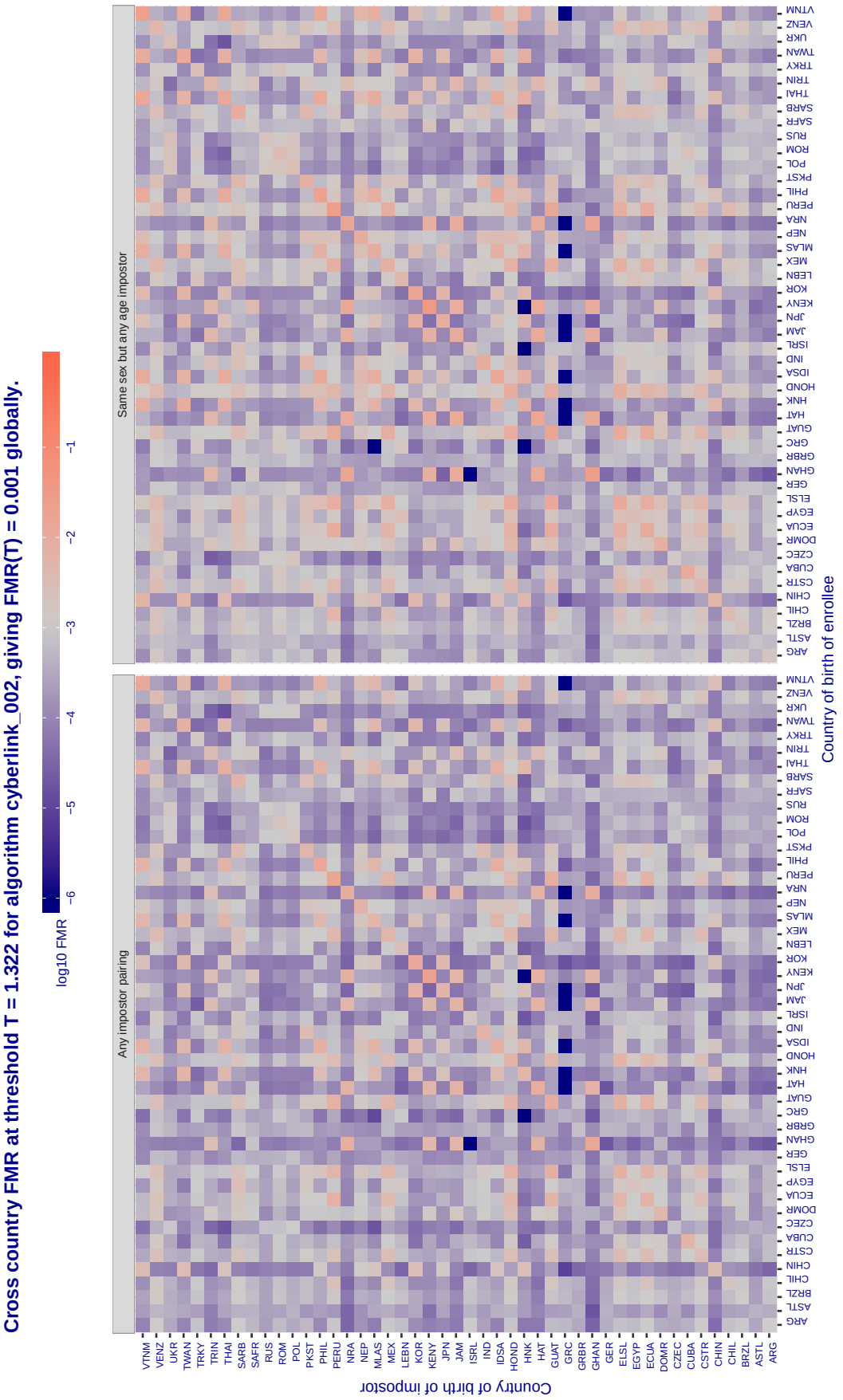


Figure 292: For algorithm cyberlink-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

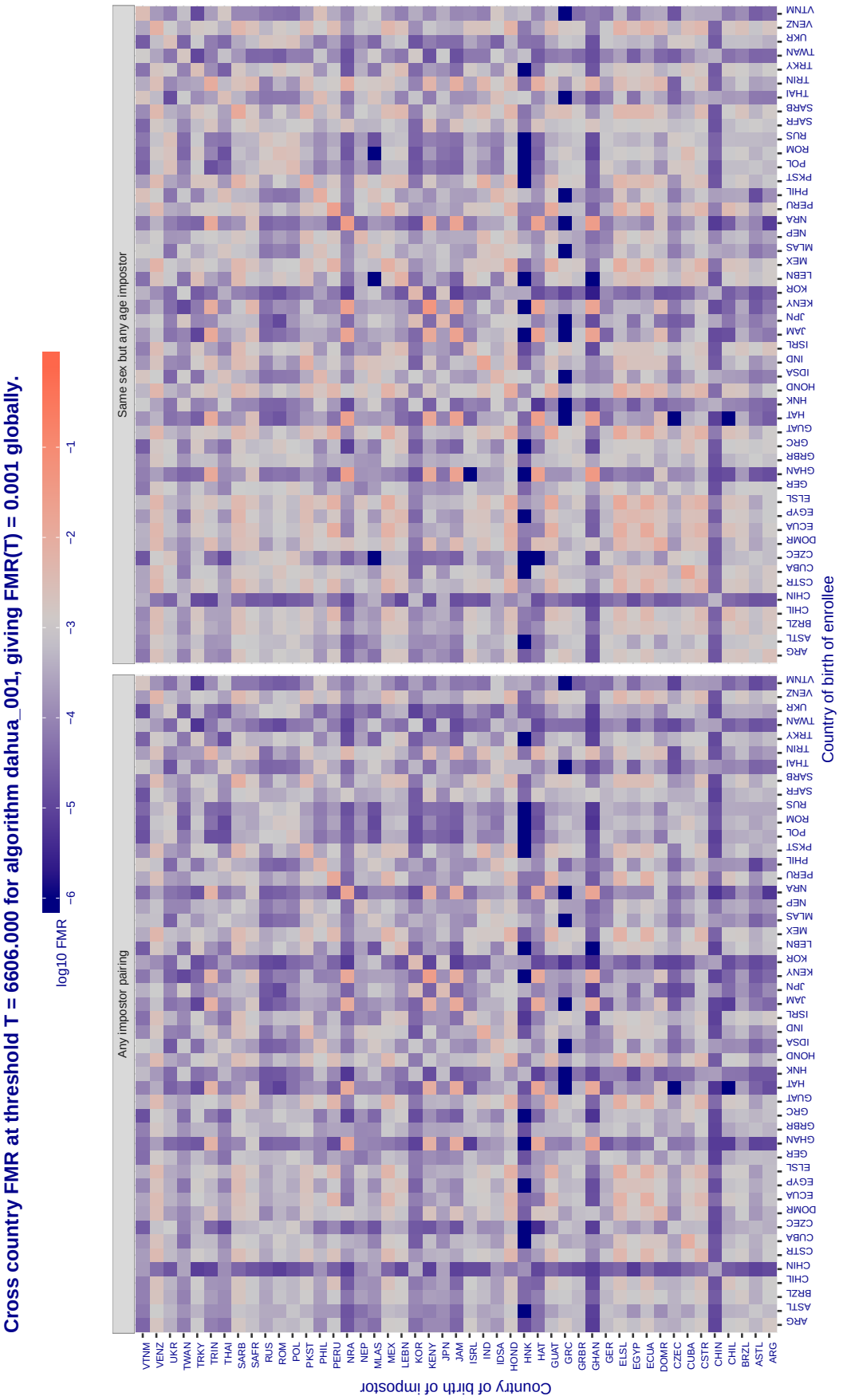


Figure 293: For algorithm dahua-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

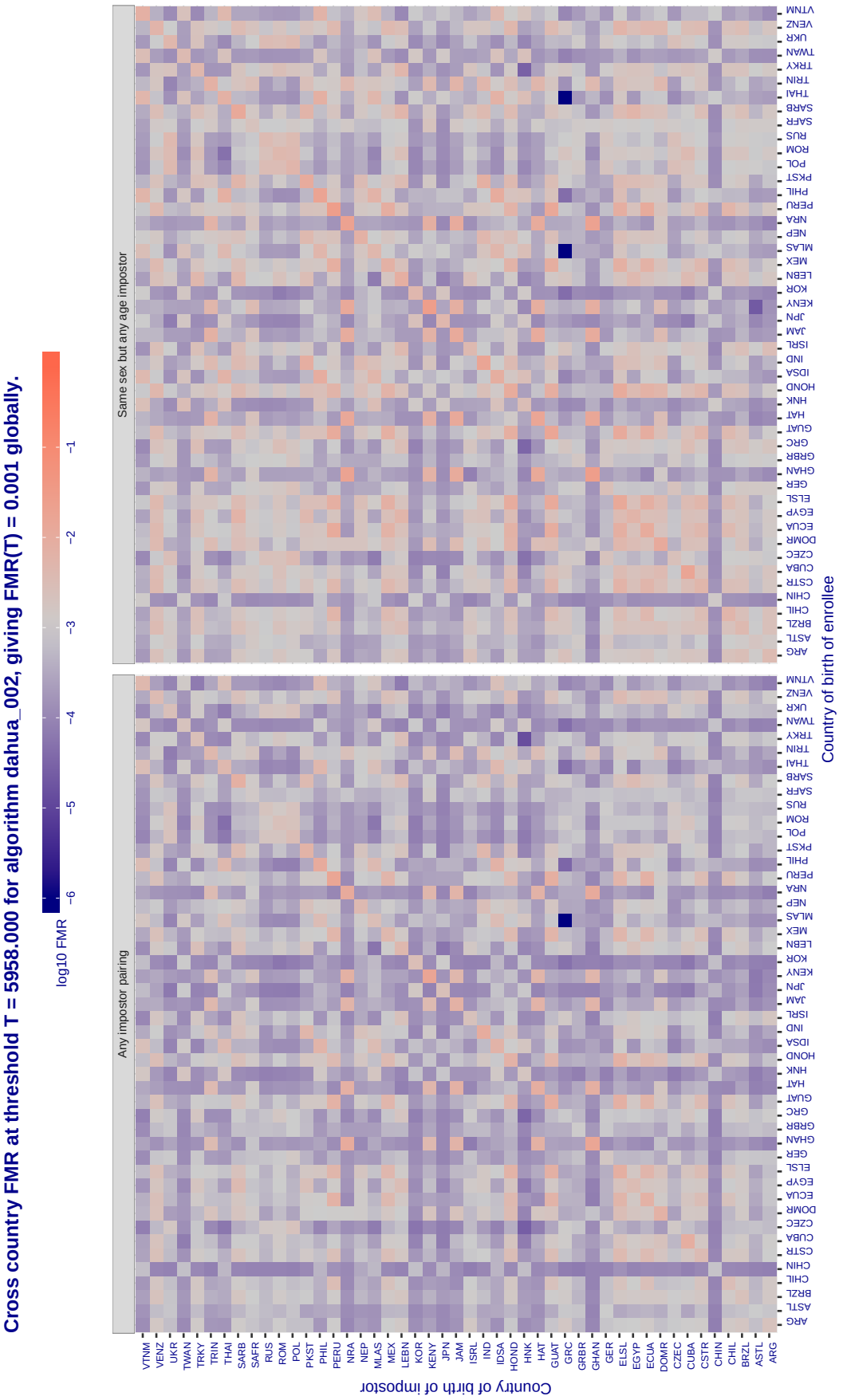


Figure 294: For algorithm dahua-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

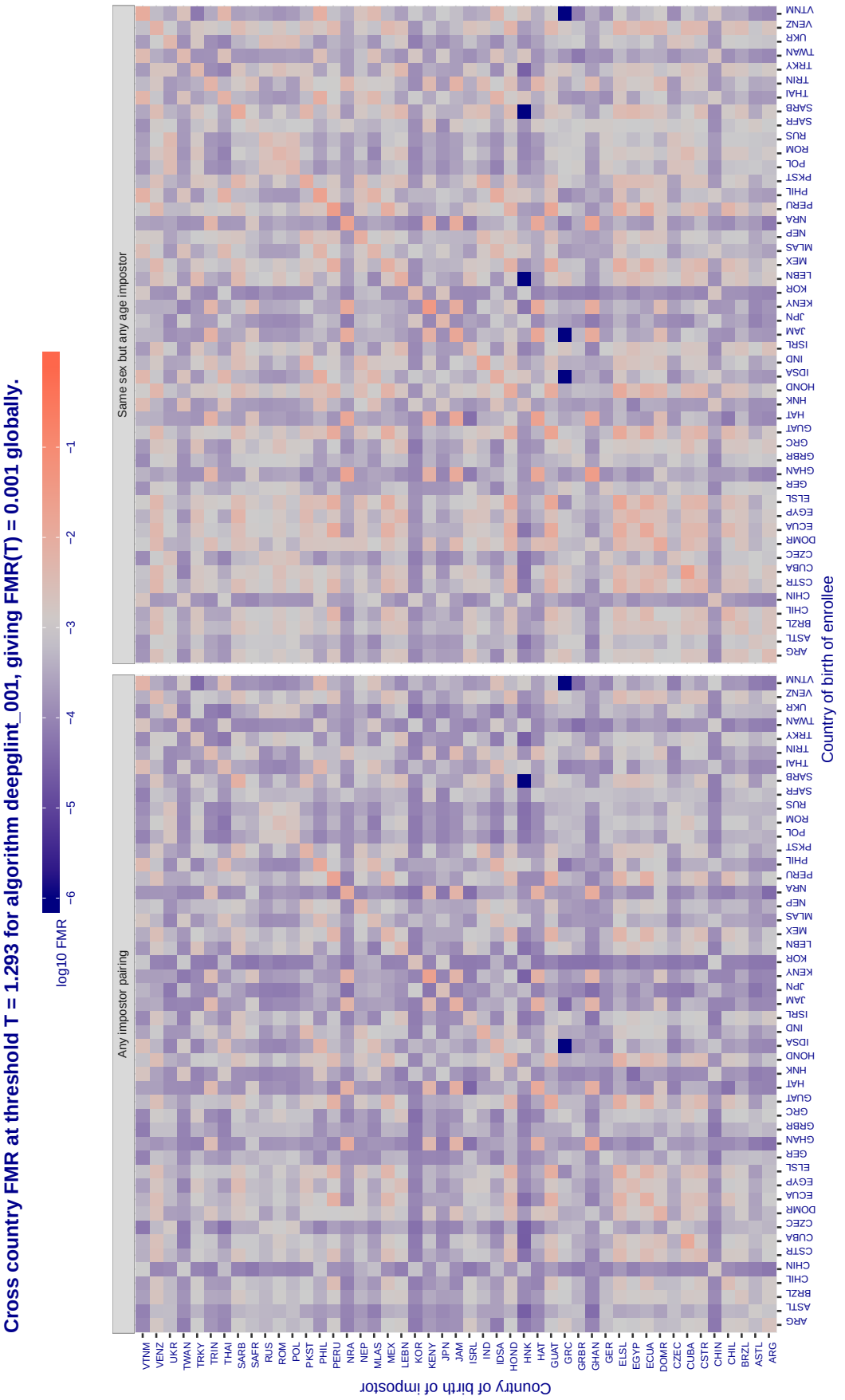


Figure 295: For algorithm deepglint-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

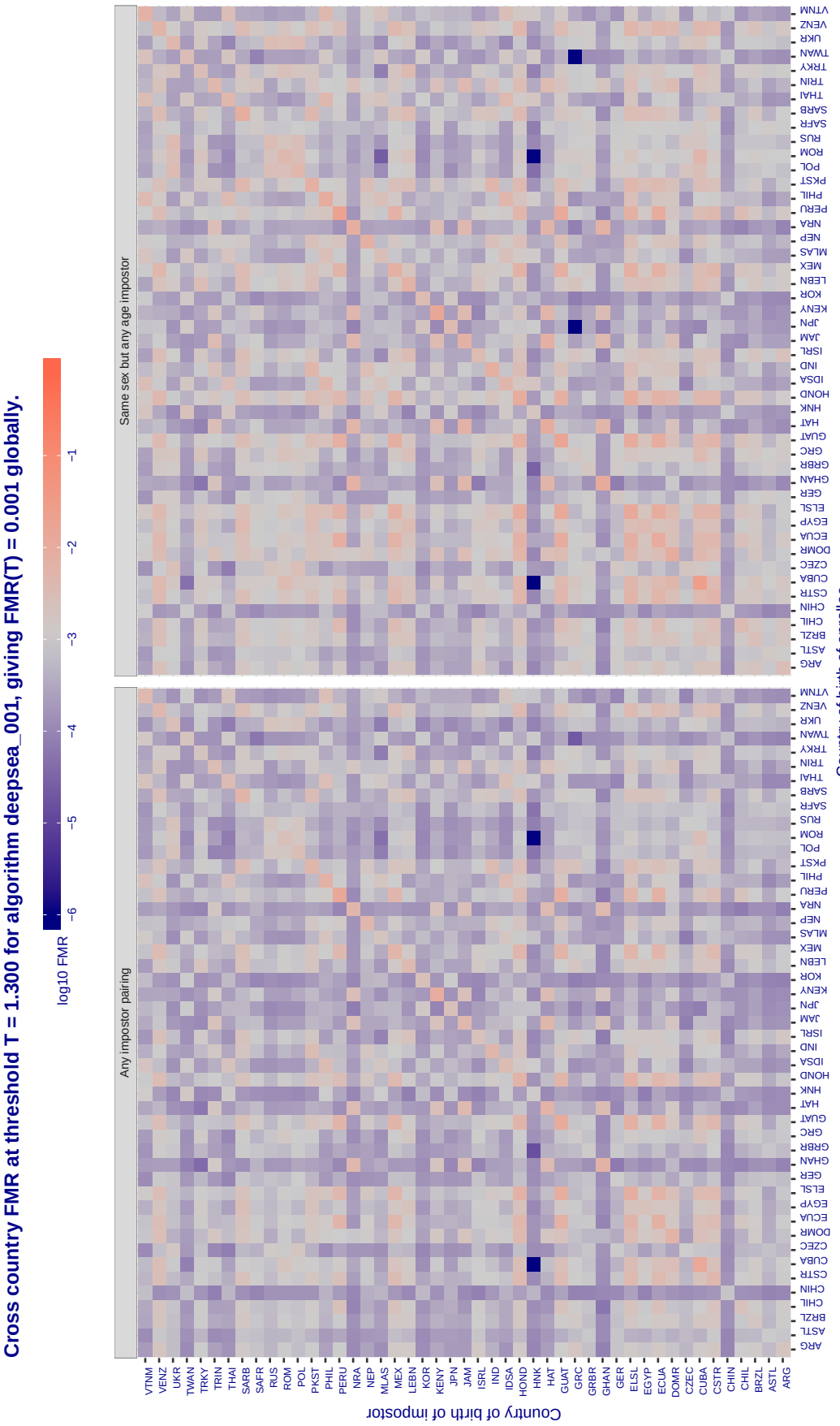


Figure 296: For algorithm deepsea-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

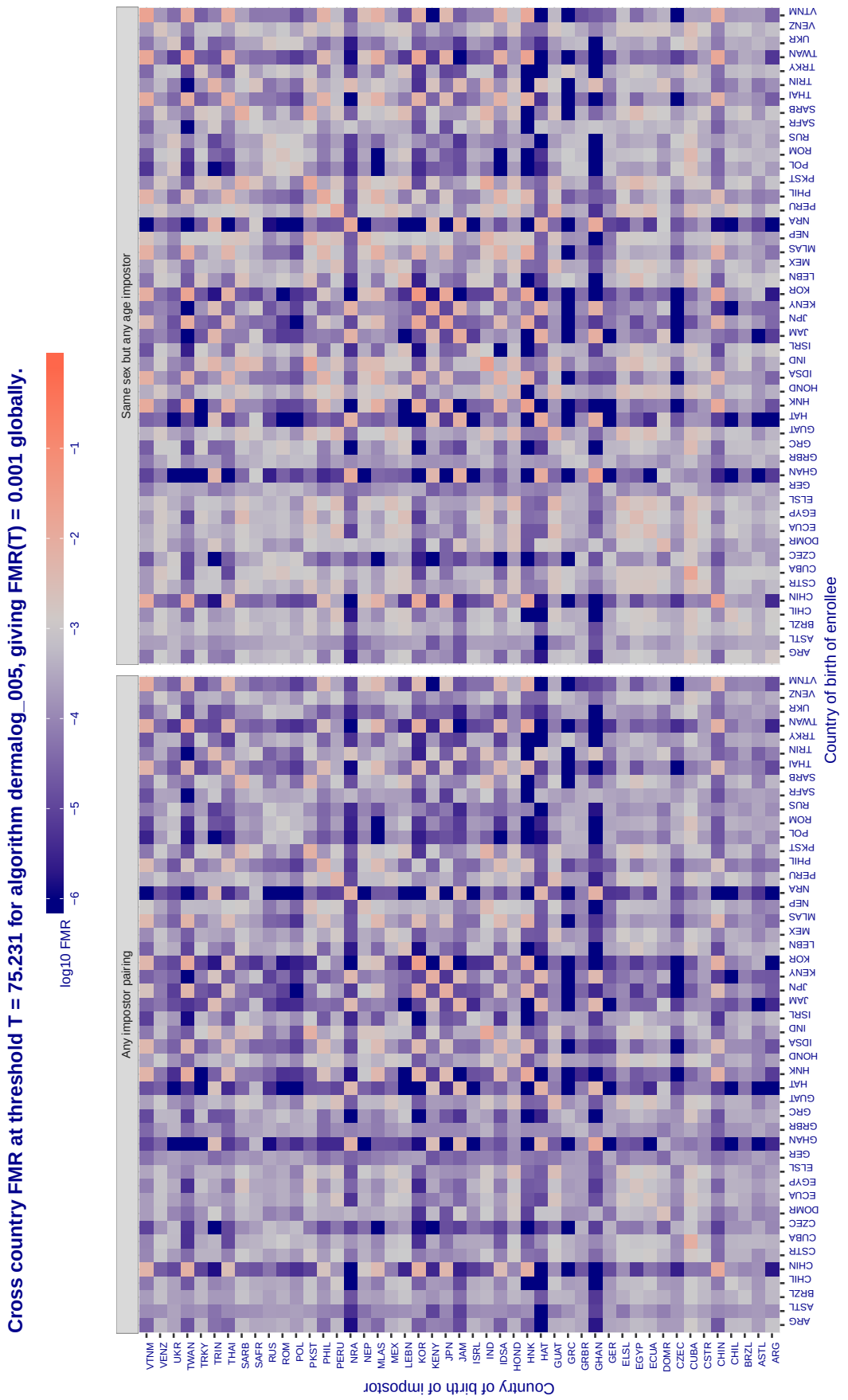


Figure 297: For algorithm dermalog-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

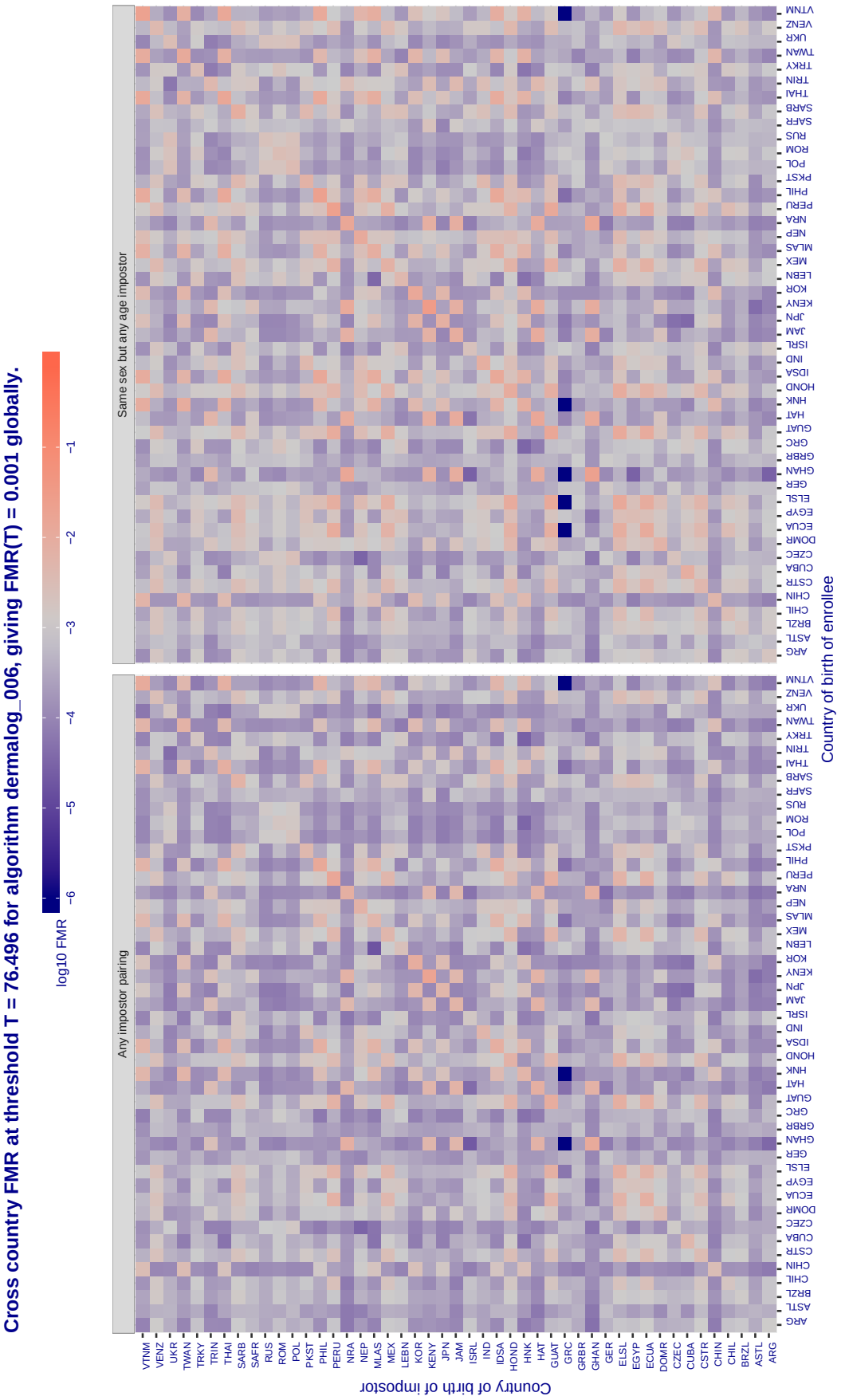


Figure 298: For algorithm dermalog-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

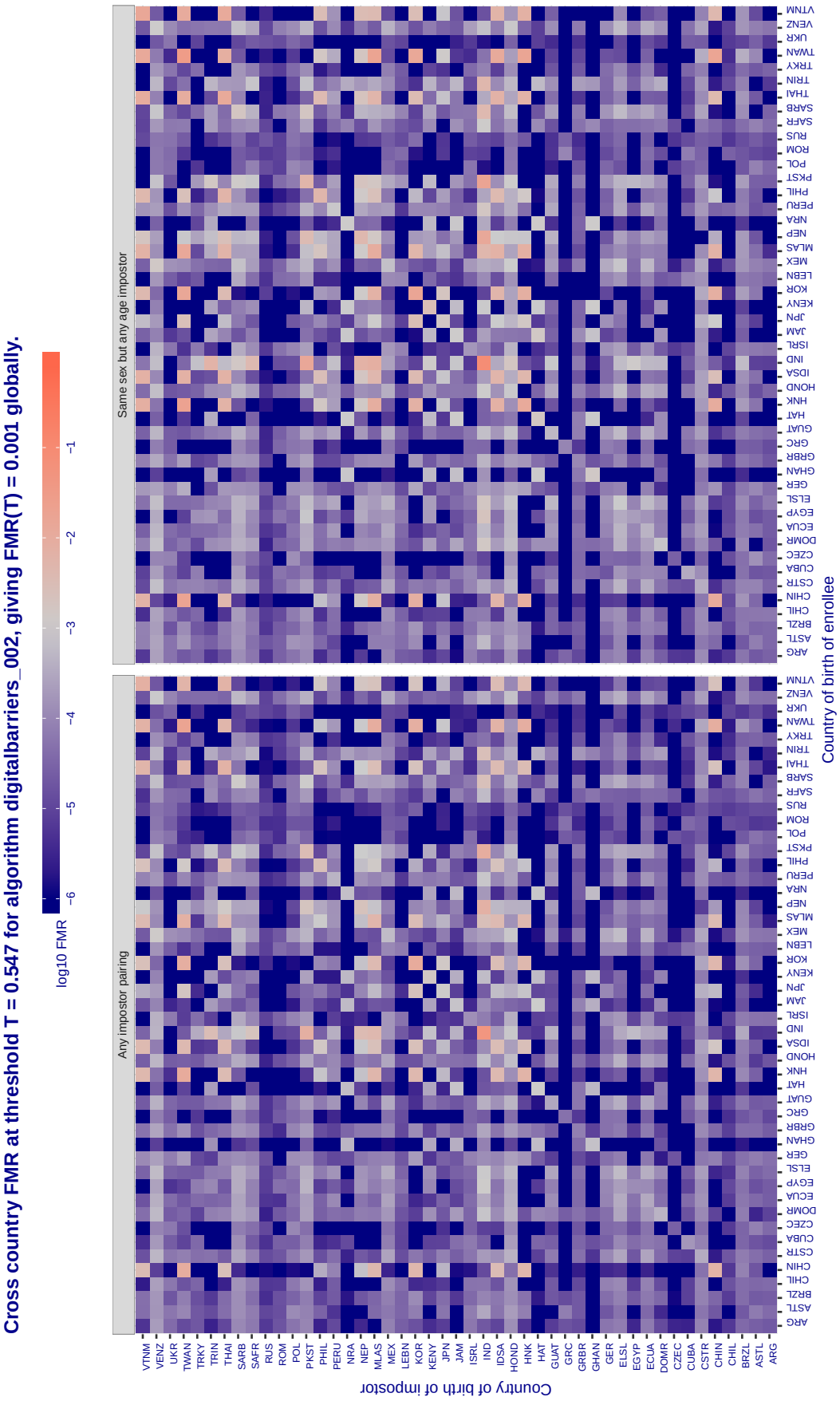


Figure 299: For algorithm digitalbarriers-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

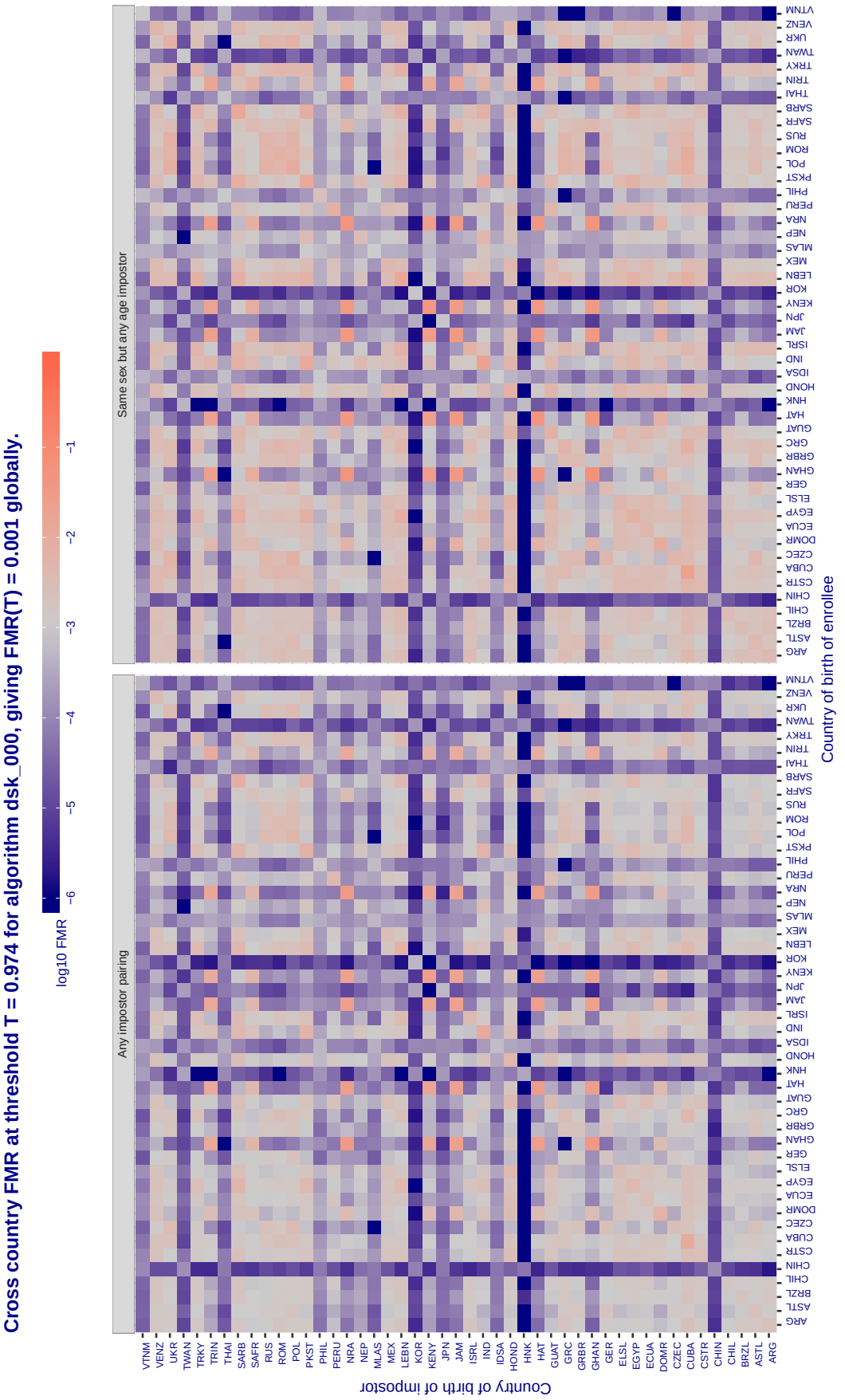


Figure 300: For algorithm dsk-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

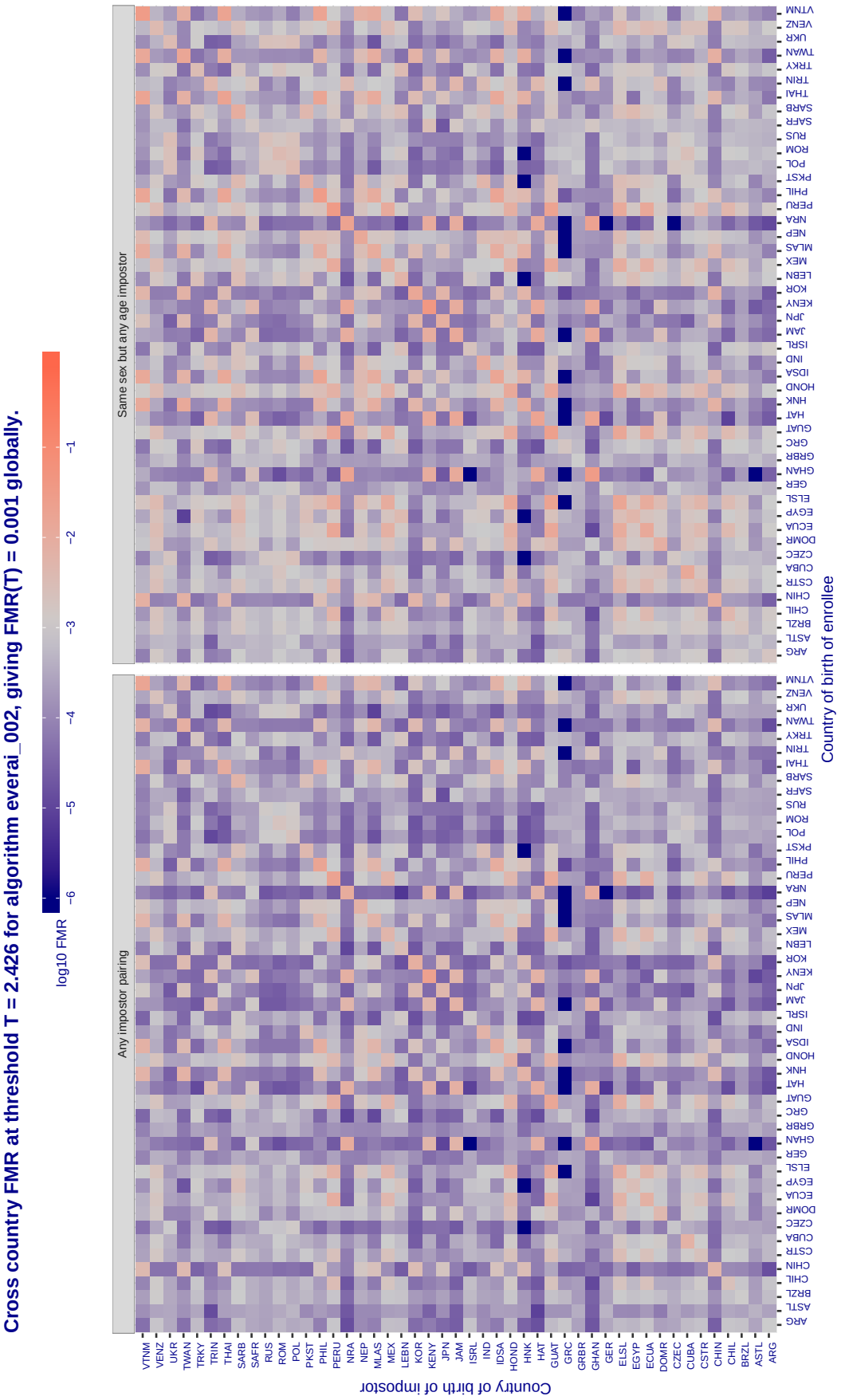


Figure 301: For algorithm everai-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

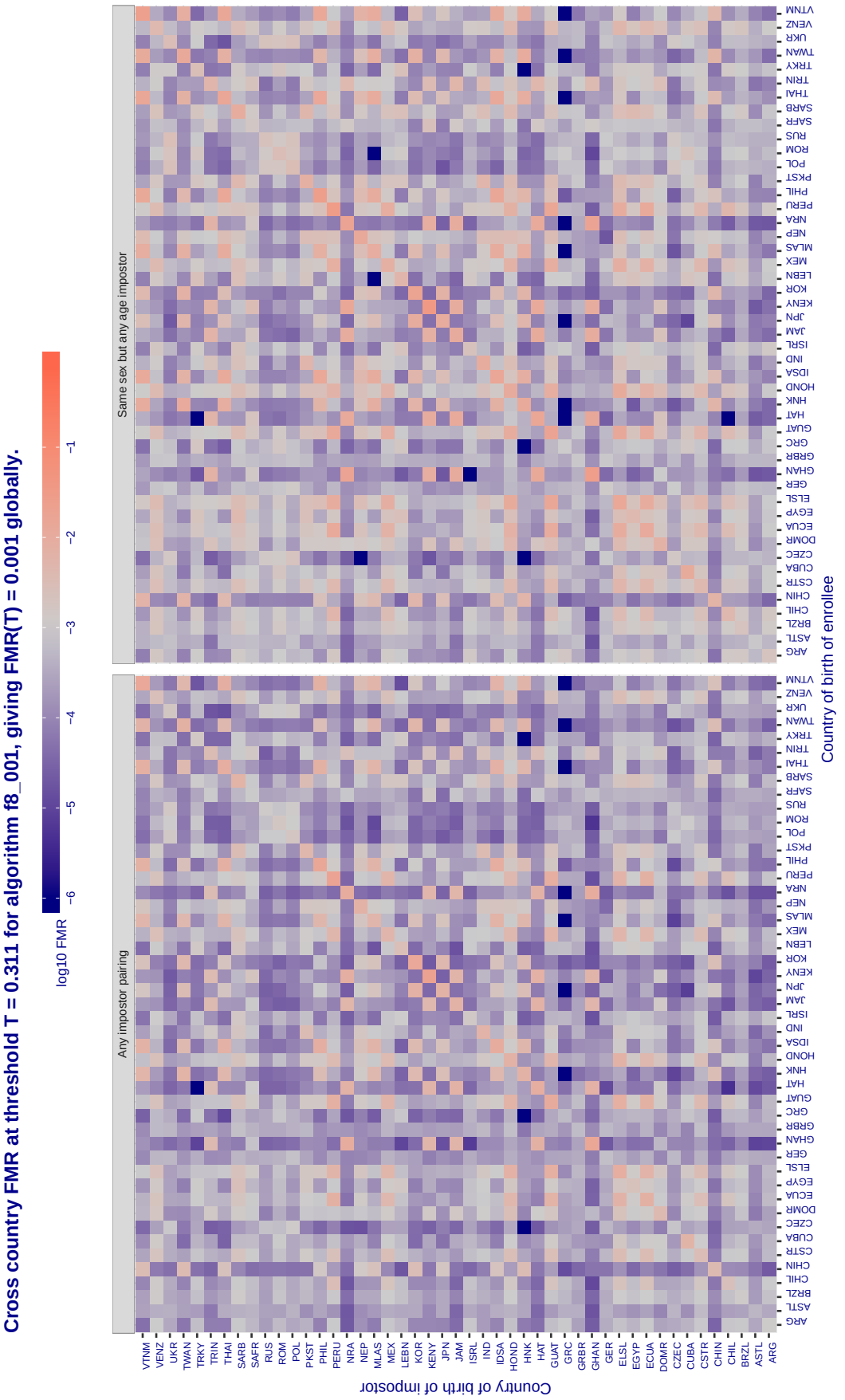


Figure 302: For algorithm f8-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

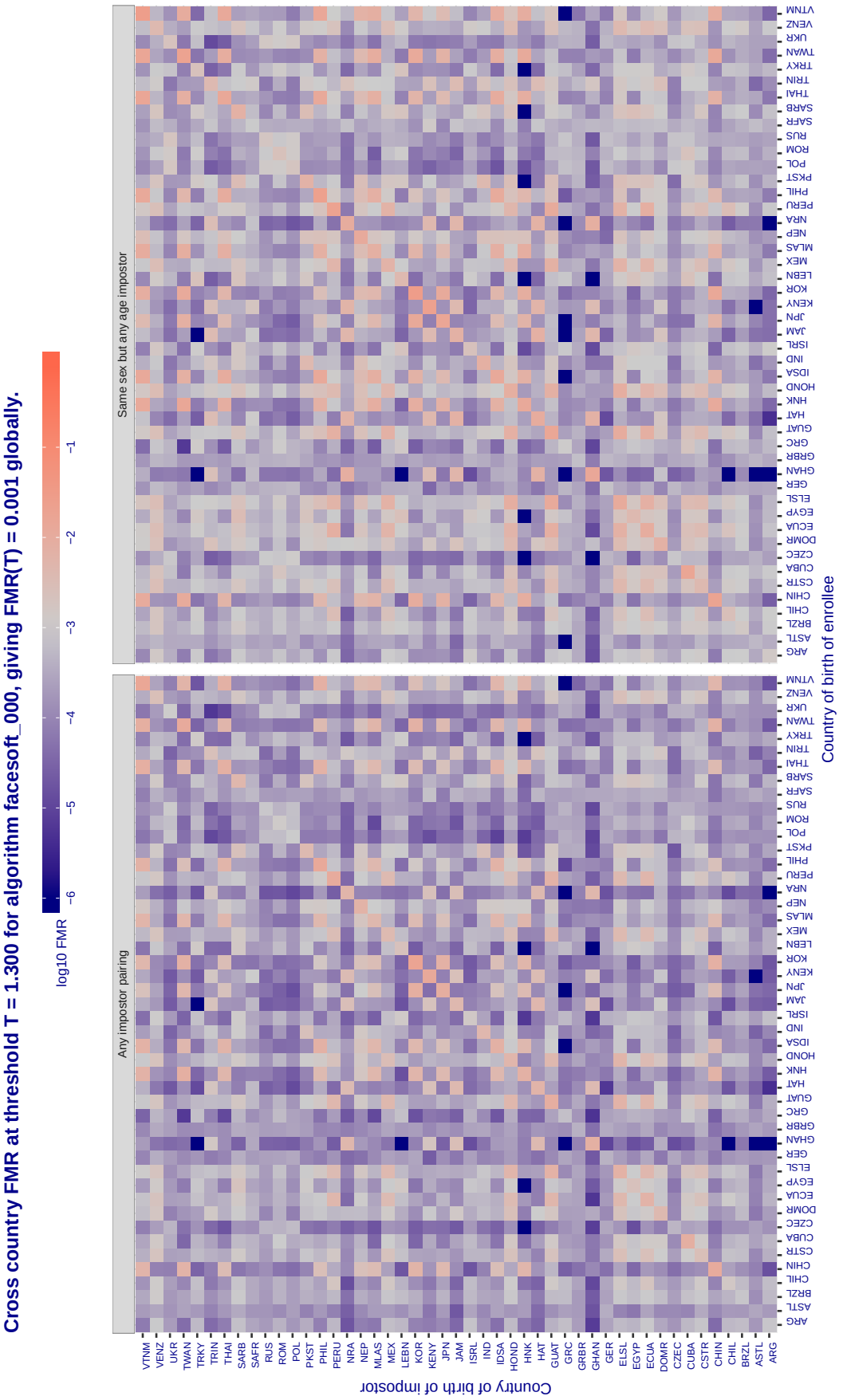


Figure 303: For algorithm facesoft-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

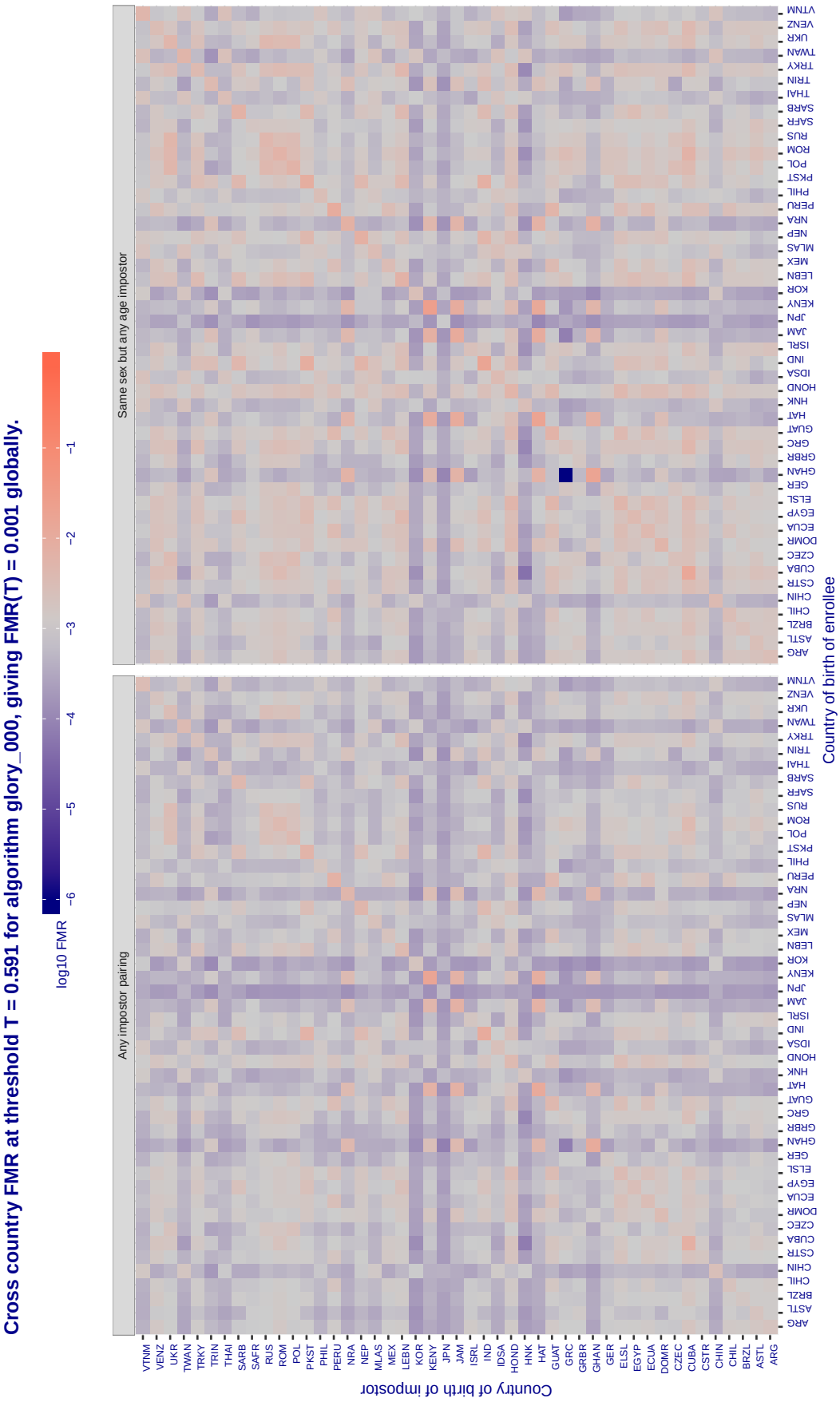


Figure 304: For algorithm glory-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

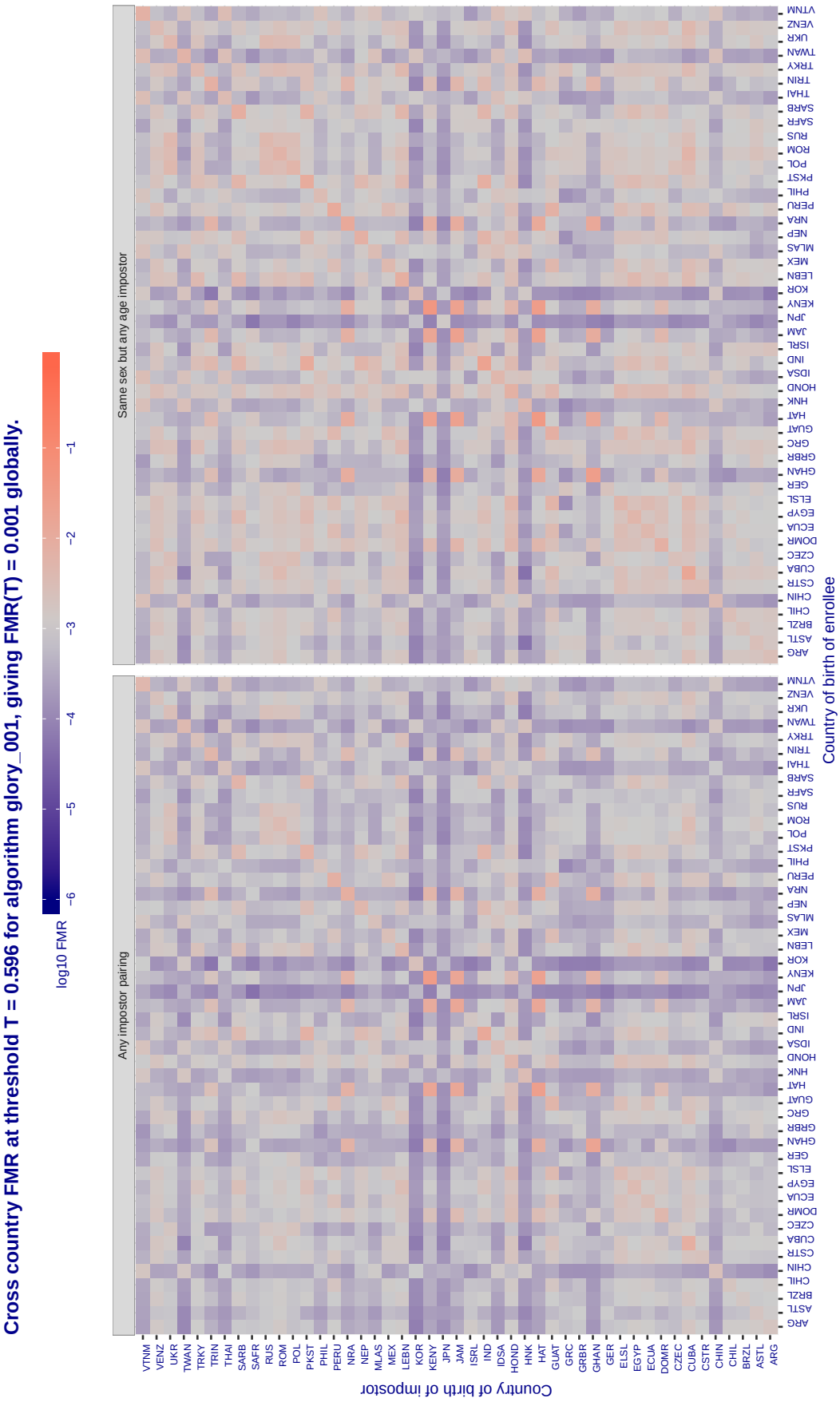


Figure 305: For algorithm glory-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

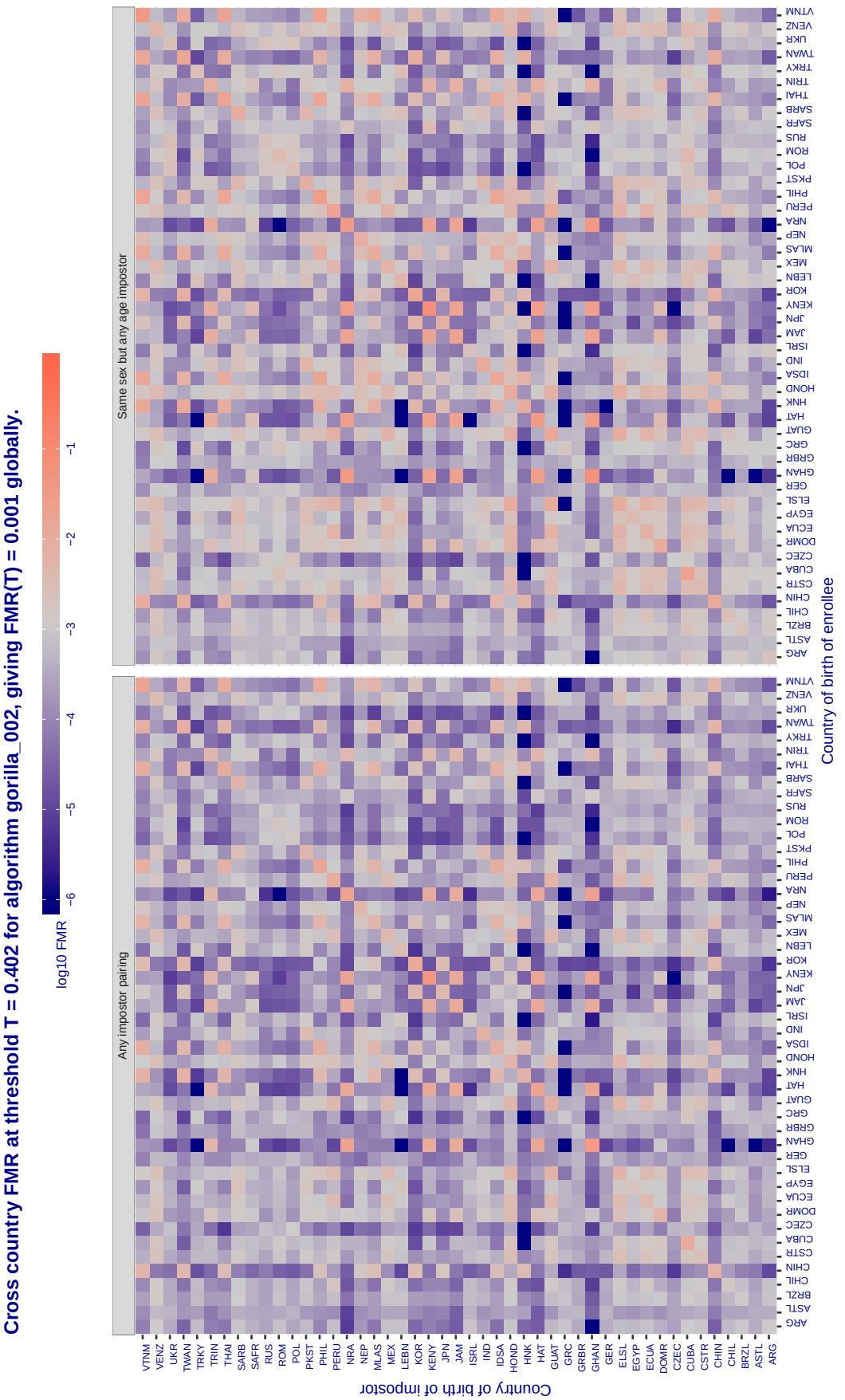


Figure 306: For algorithm gorilla-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

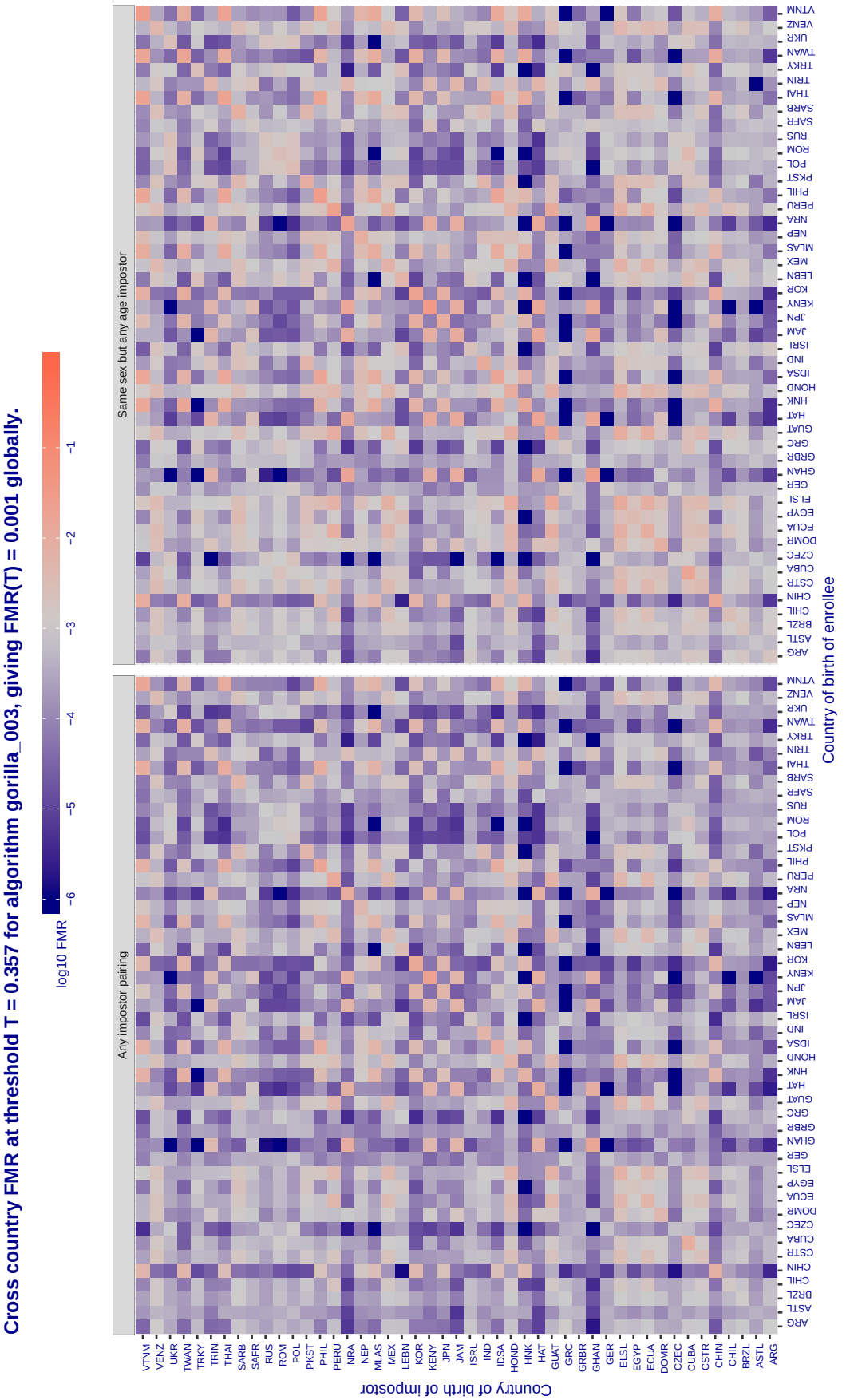


Figure 307: For algorithm gorilla-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

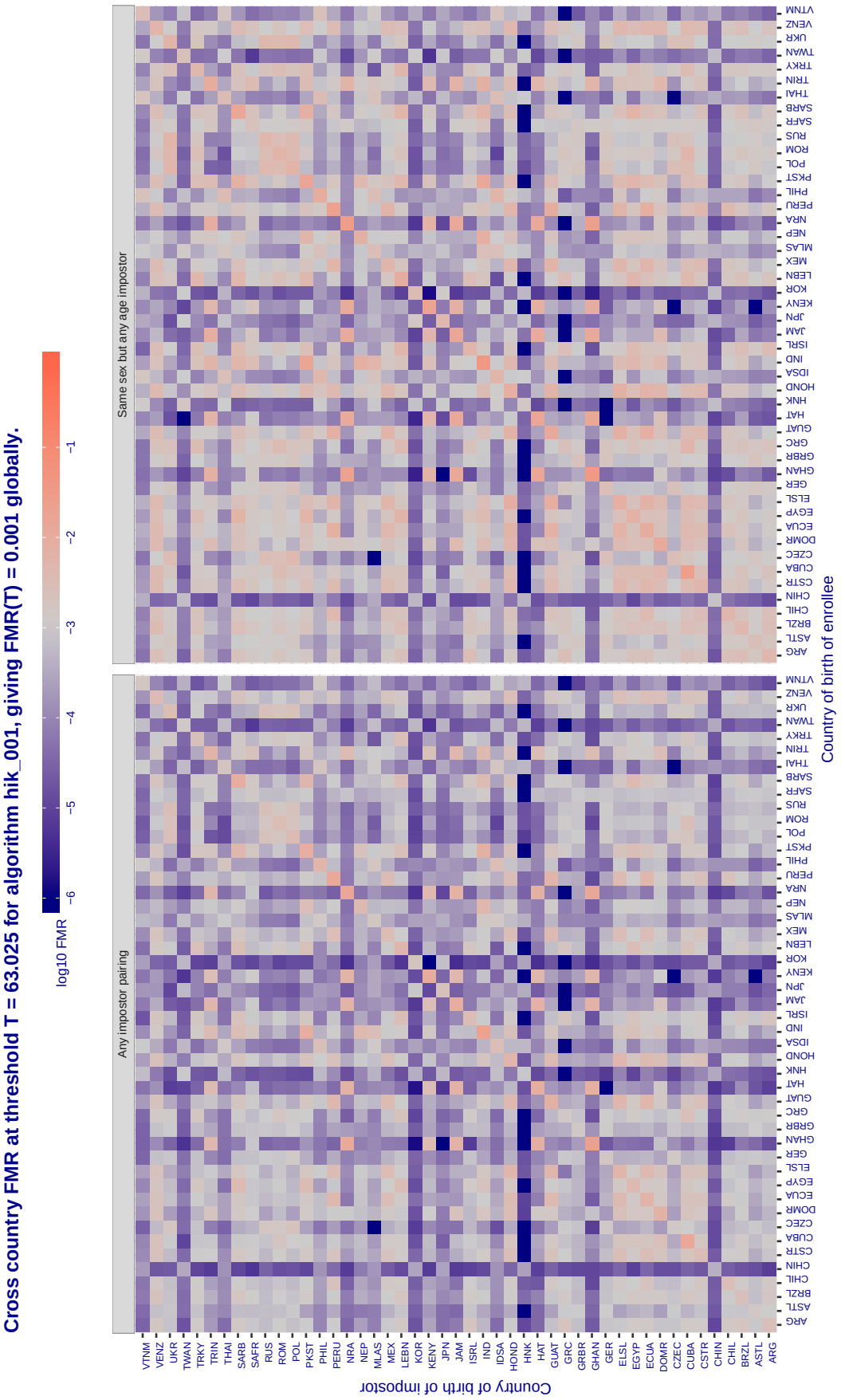


Figure 308: For algorithm hik-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

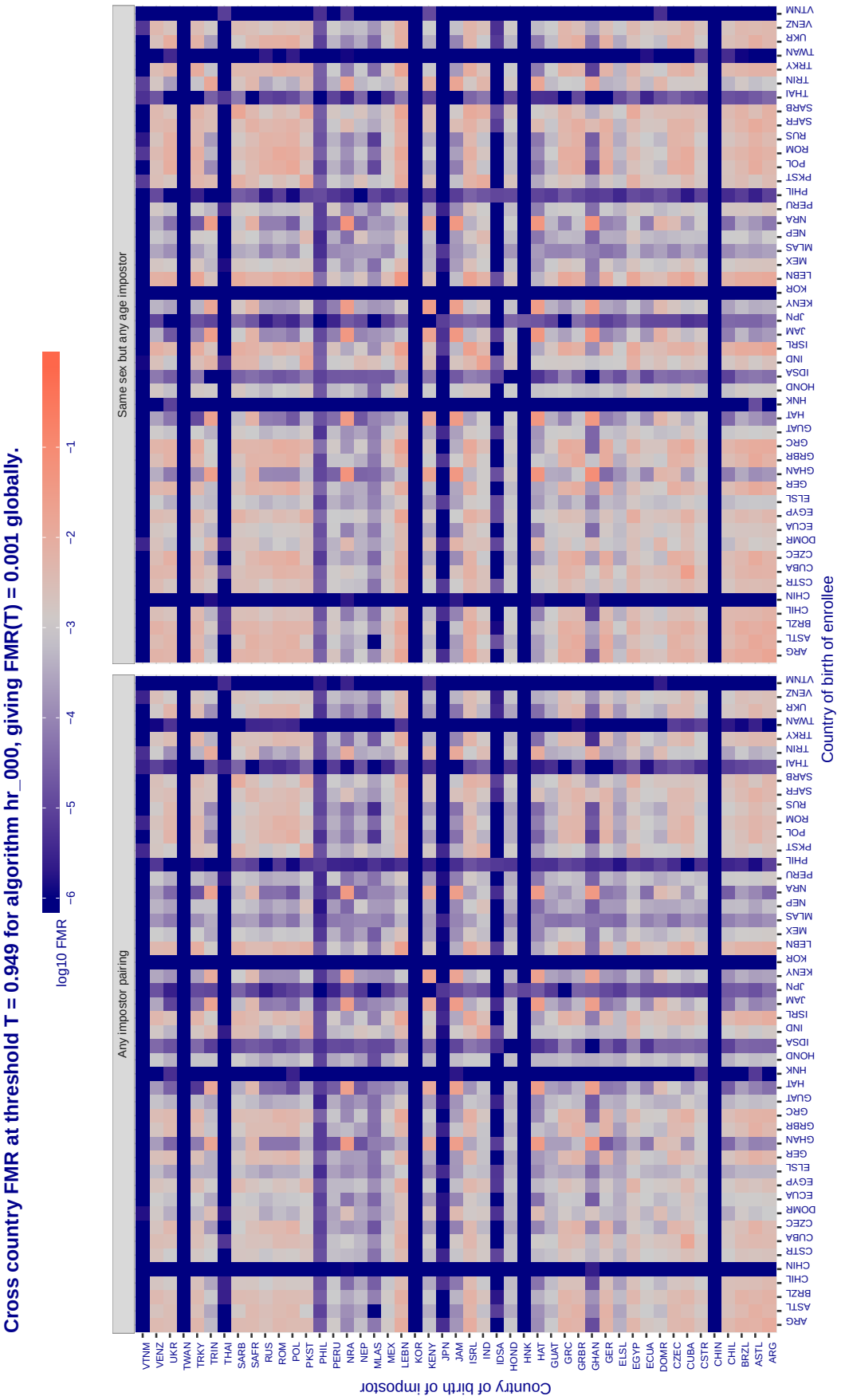


Figure 309: For algorithm hr-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

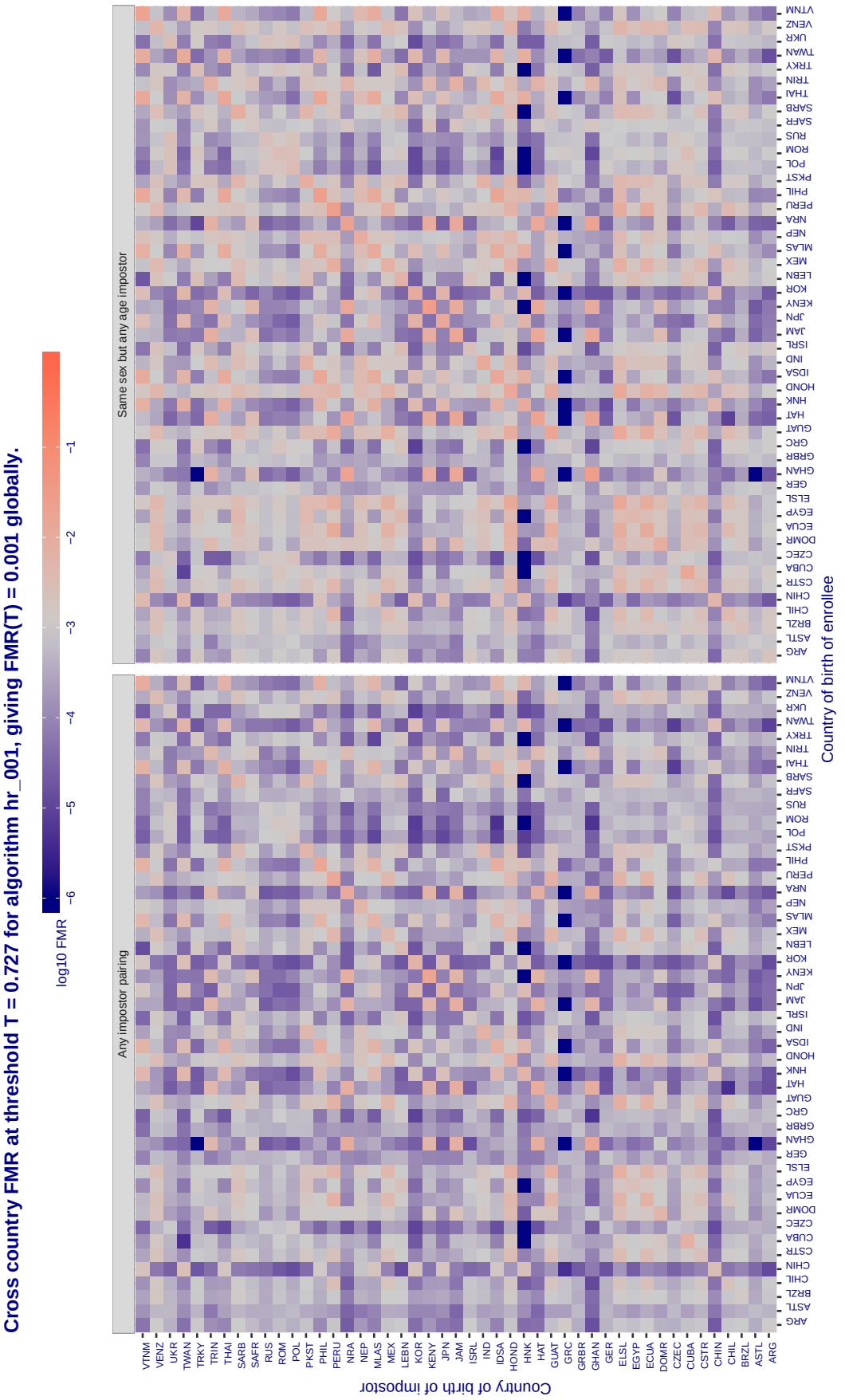


Figure 310: For algorithm hr-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

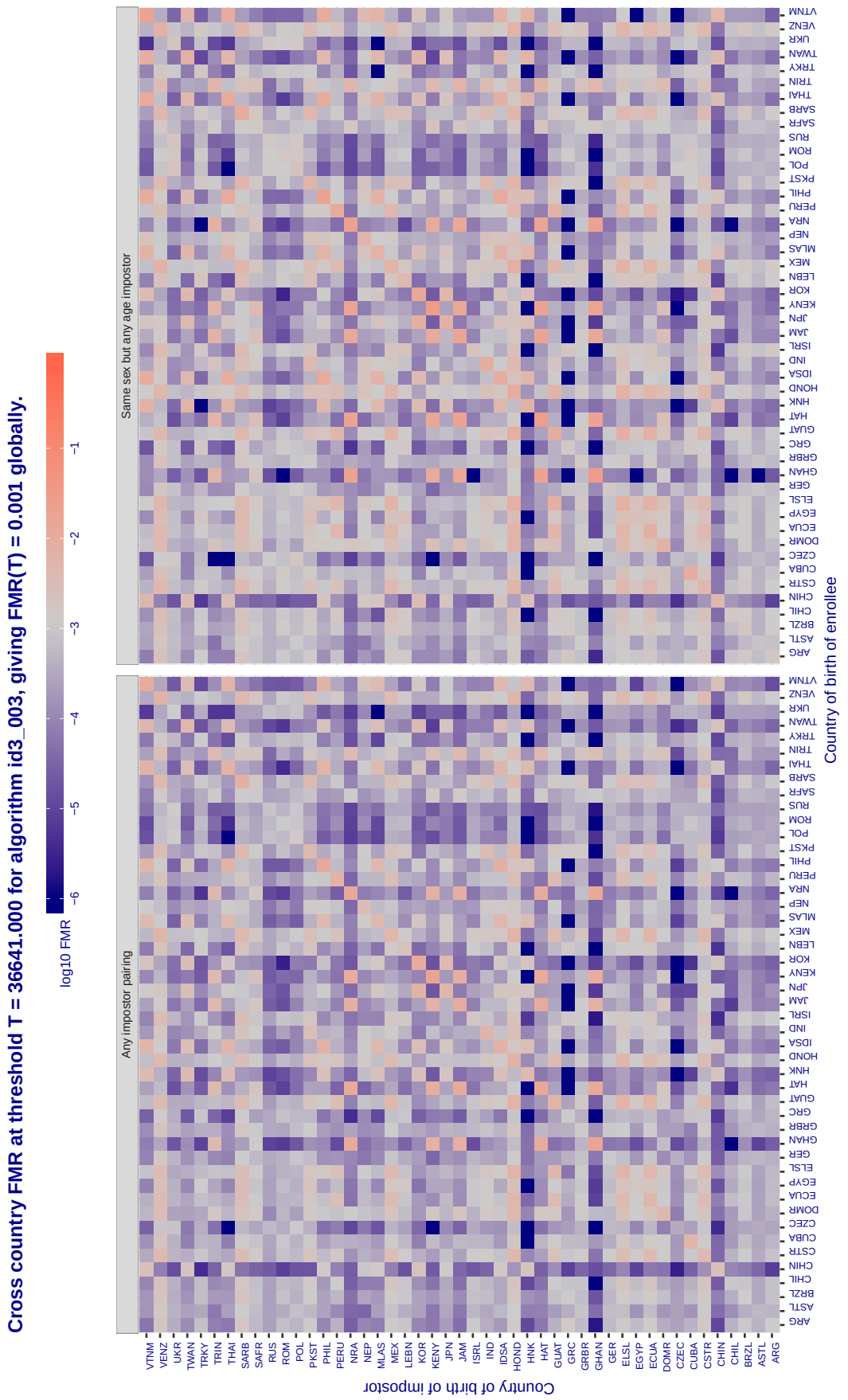


Figure 311: For algorithm id3-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

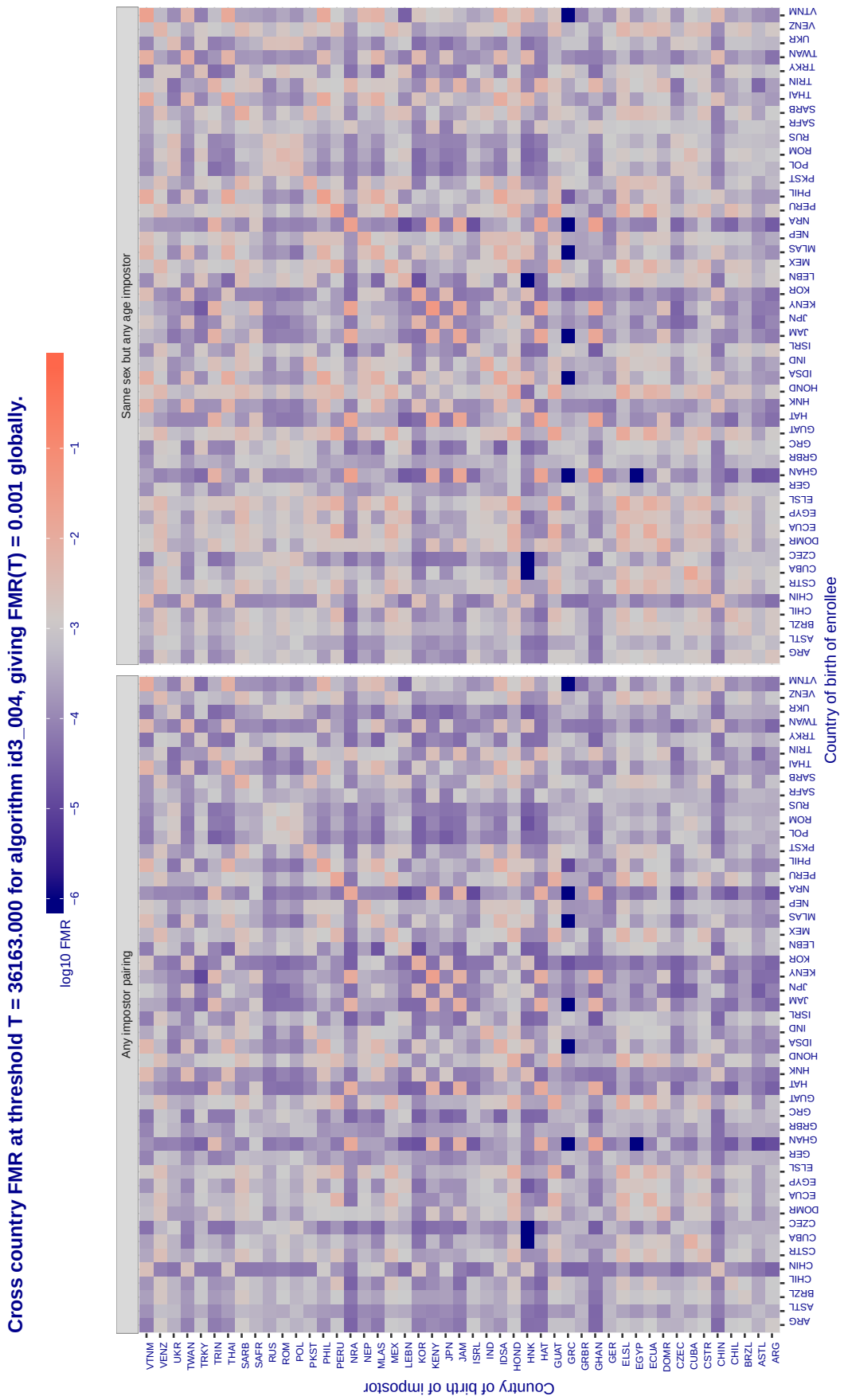


Figure 312: For algorithm id3-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

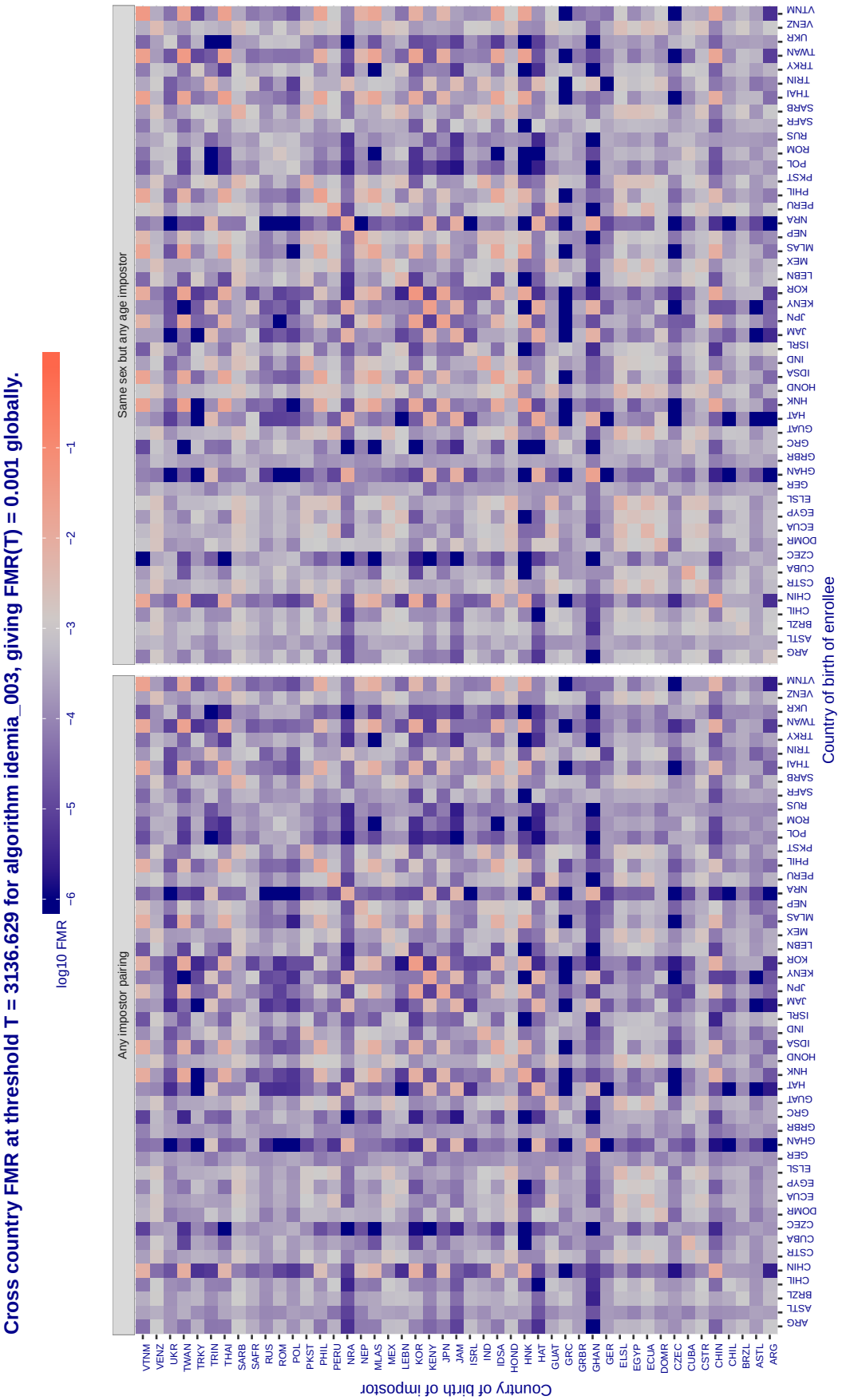


Figure 313: For algorithm idemia-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

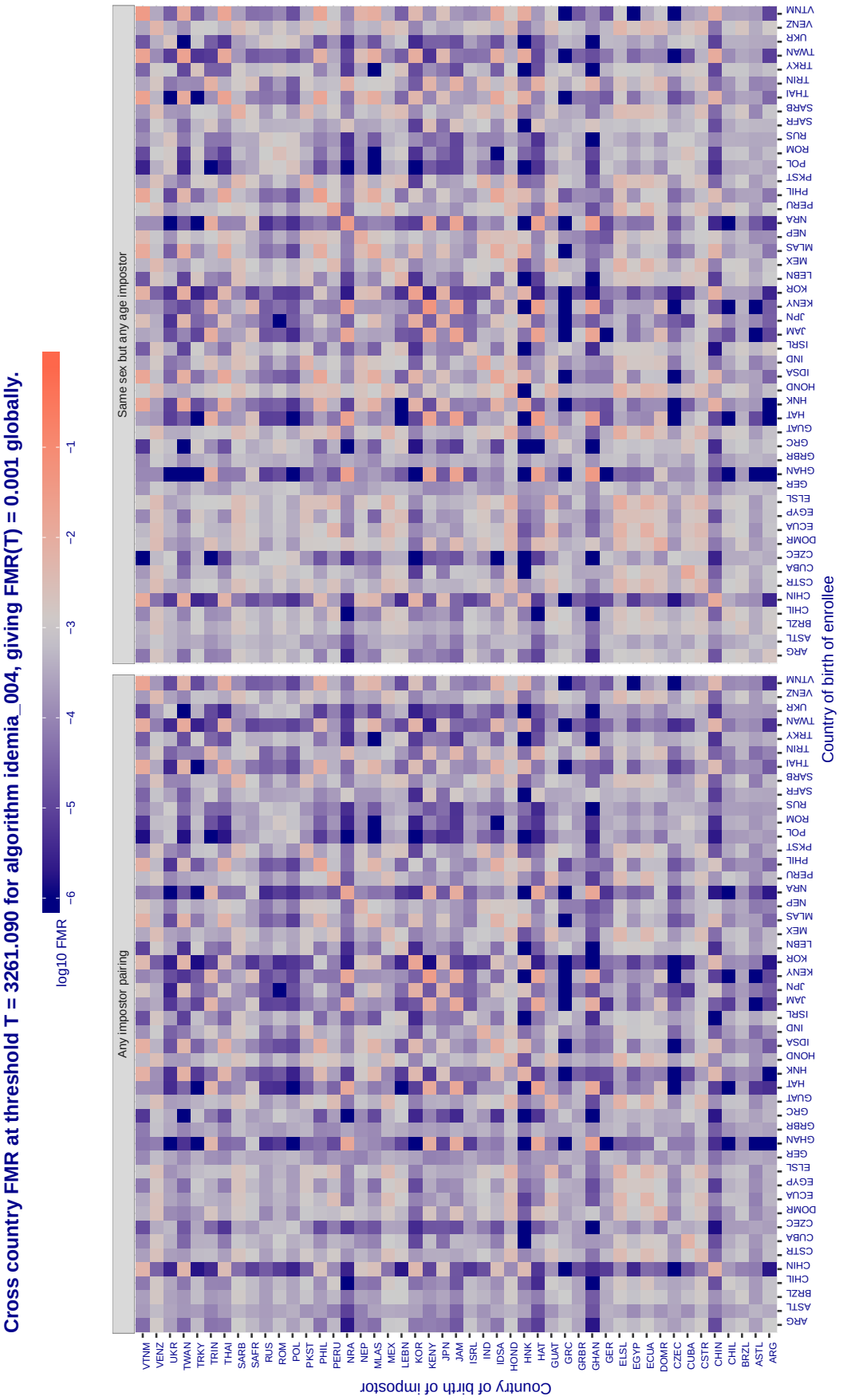


Figure 314: For algorithm idemia-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

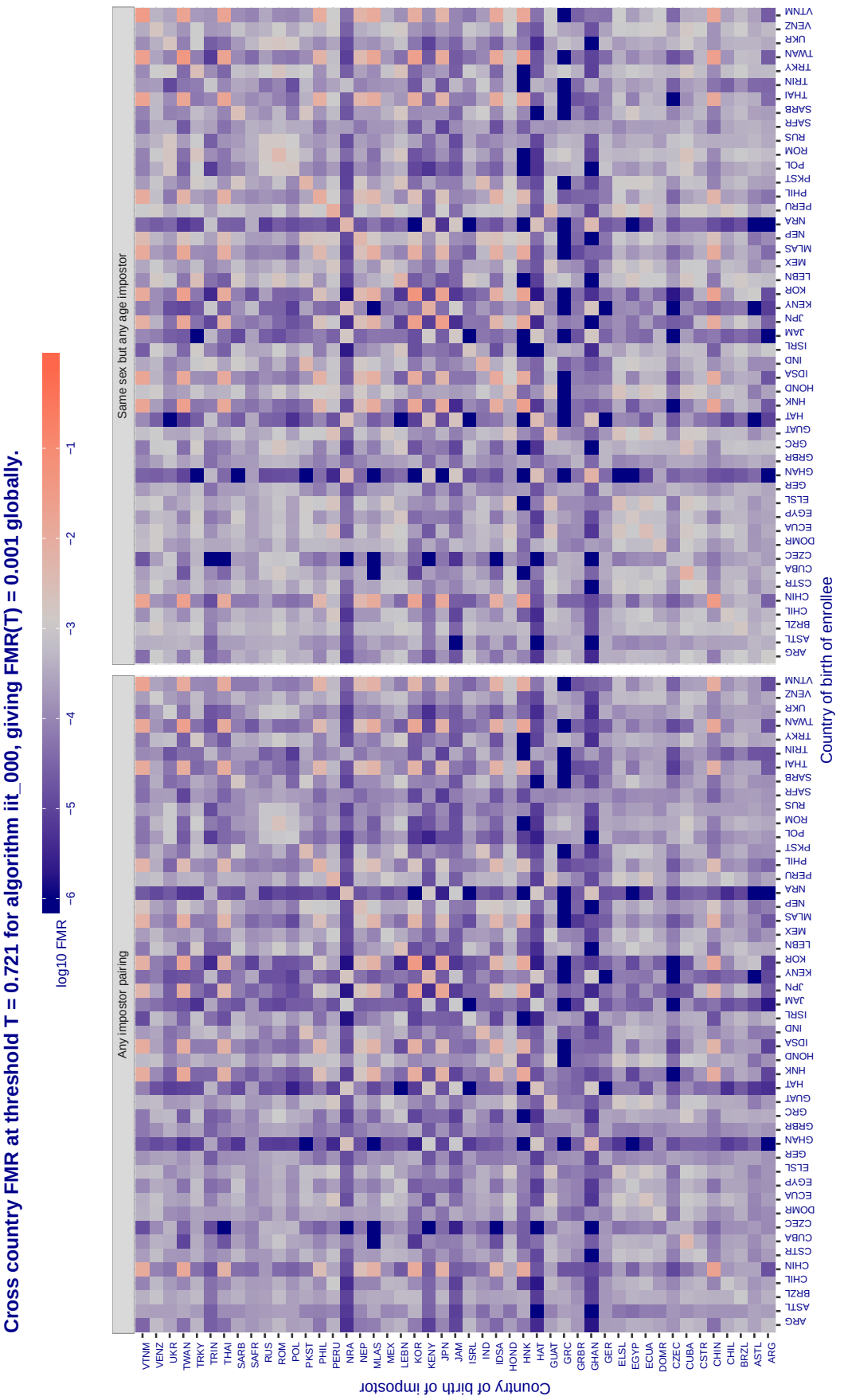


Figure 315: For algorithm iit-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

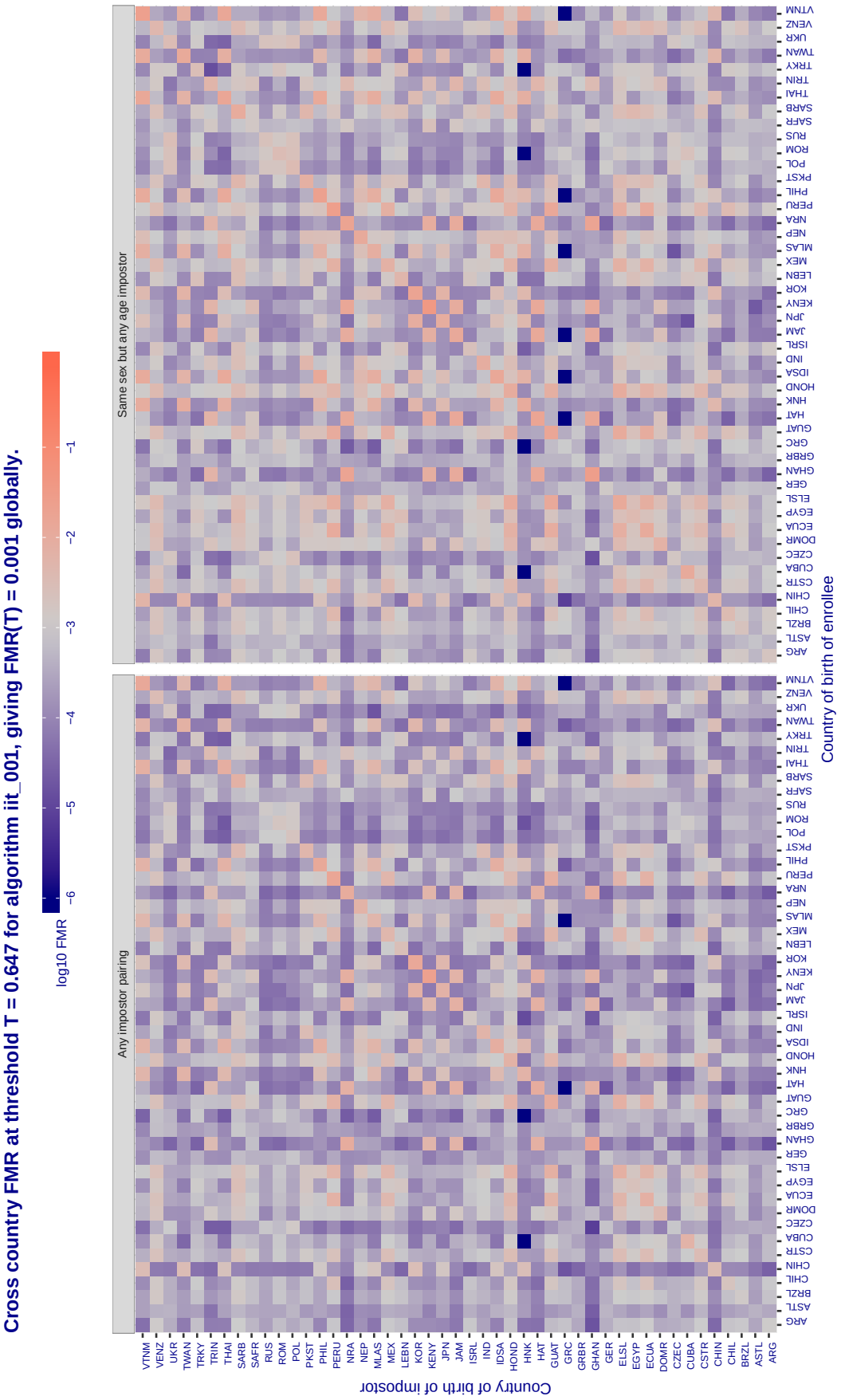


Figure 316: For algorithm iit-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

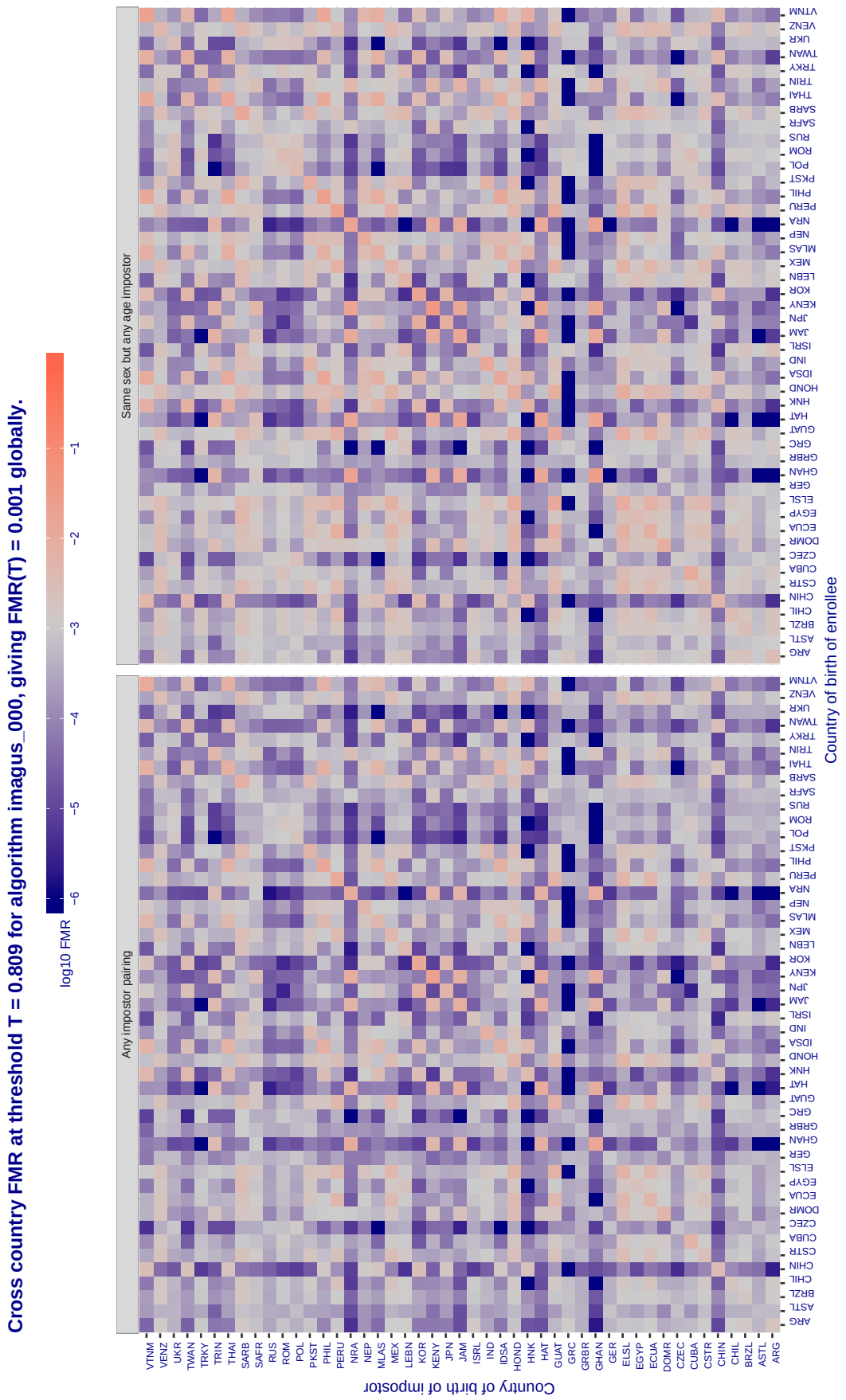


Figure 317: For algorithm imagus-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

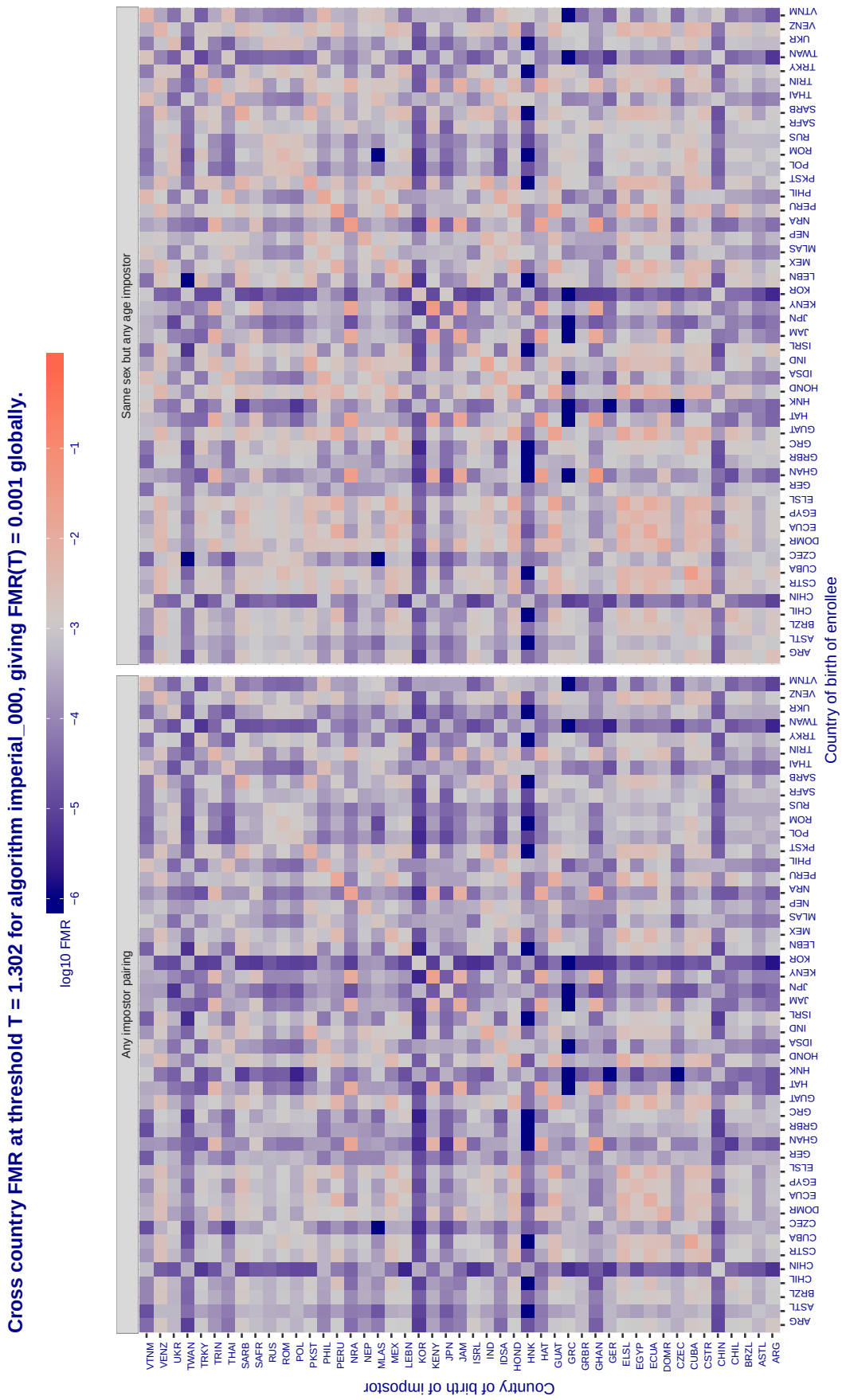


Figure 318: For algorithm imperial-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

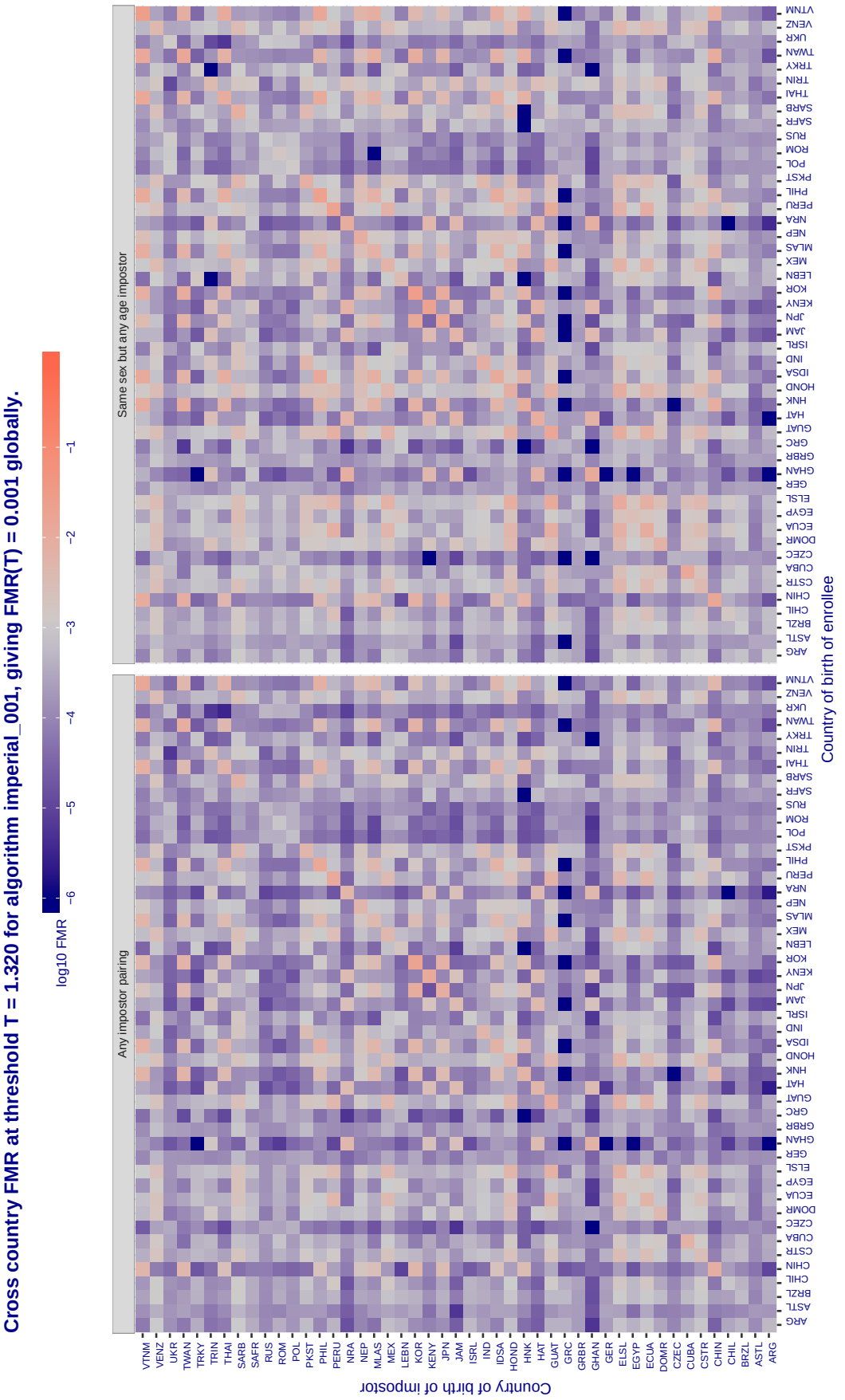


Figure 319: For algorithm imperial-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

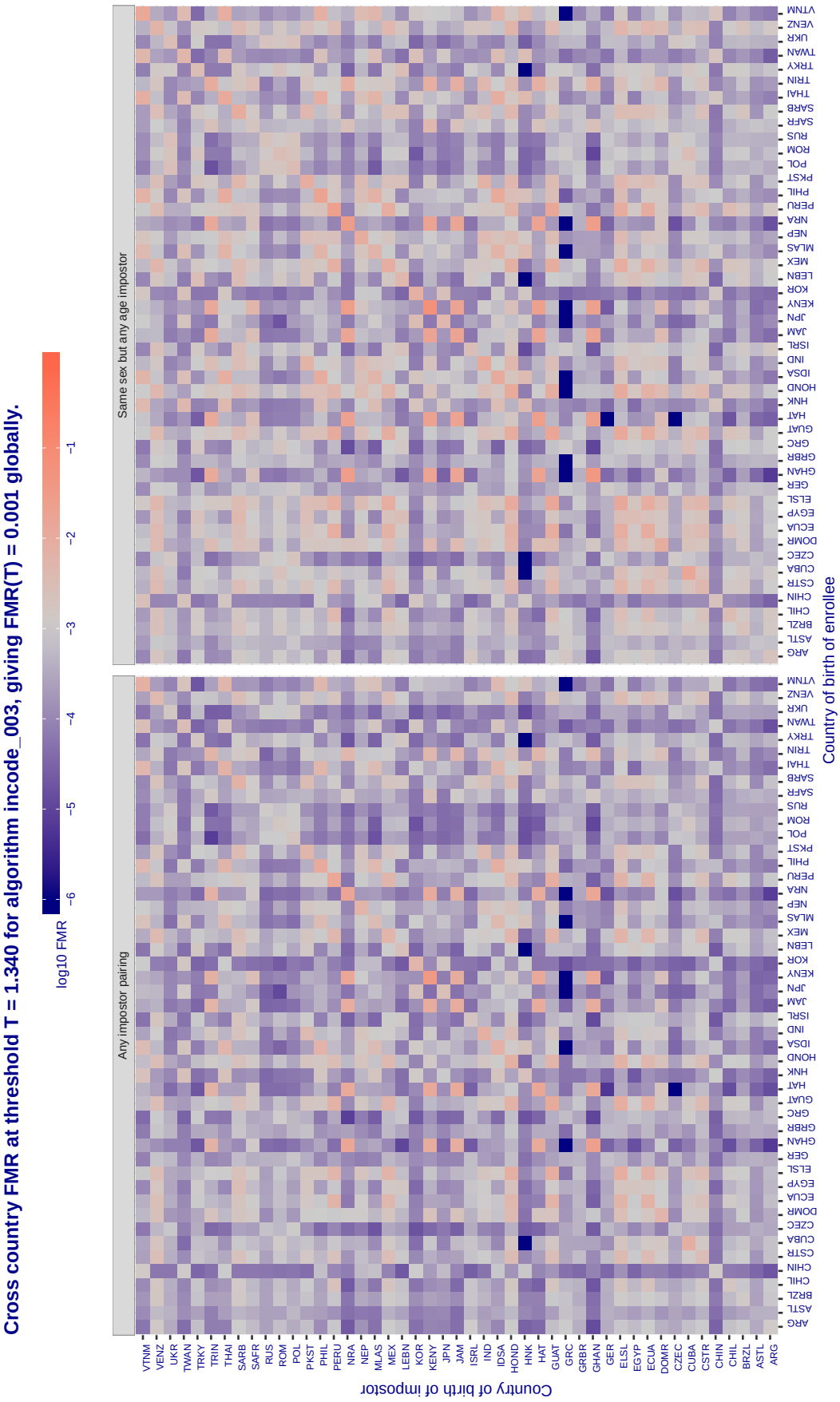


Figure 320: For algorithm incode-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

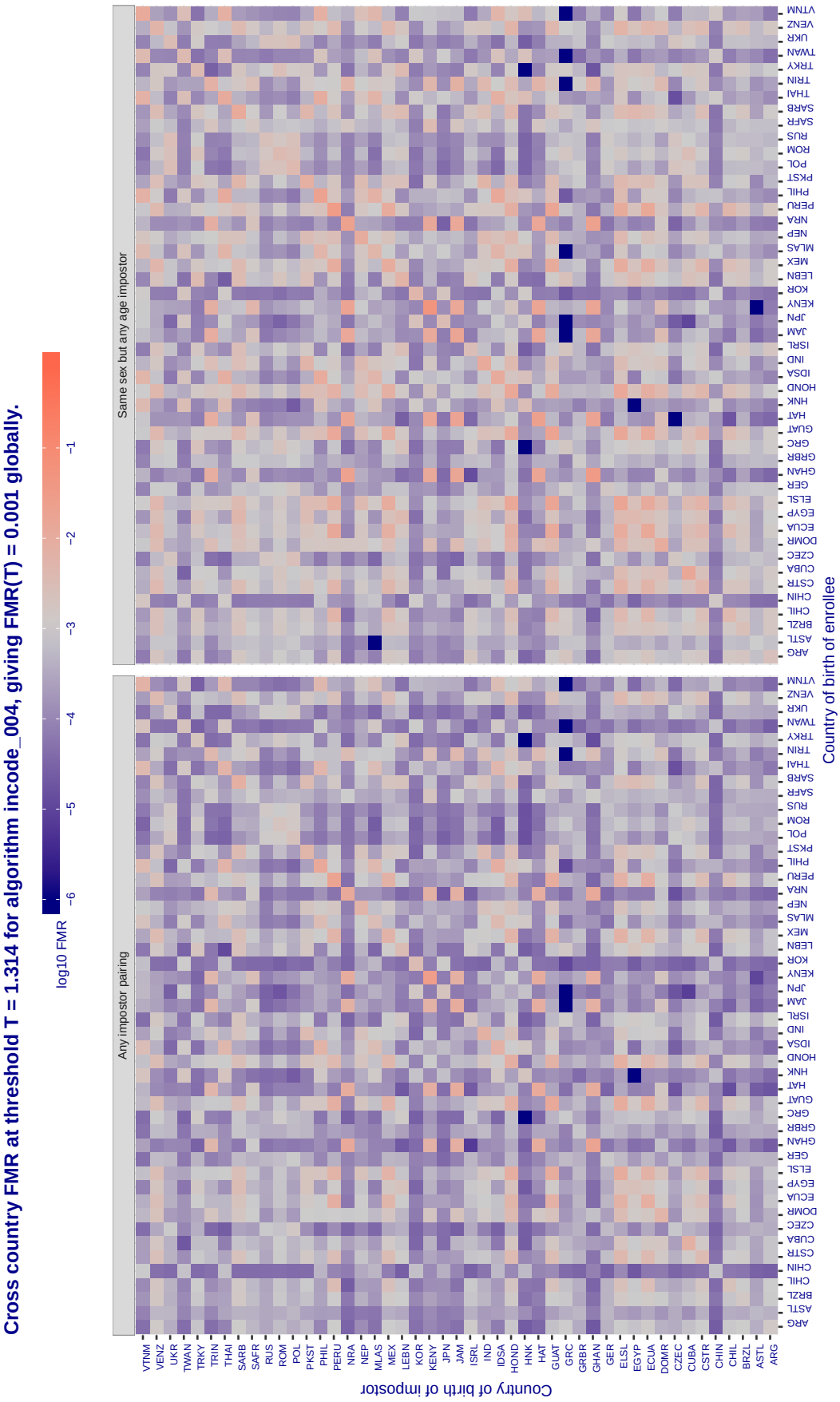


Figure 321: For algorithm incode-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

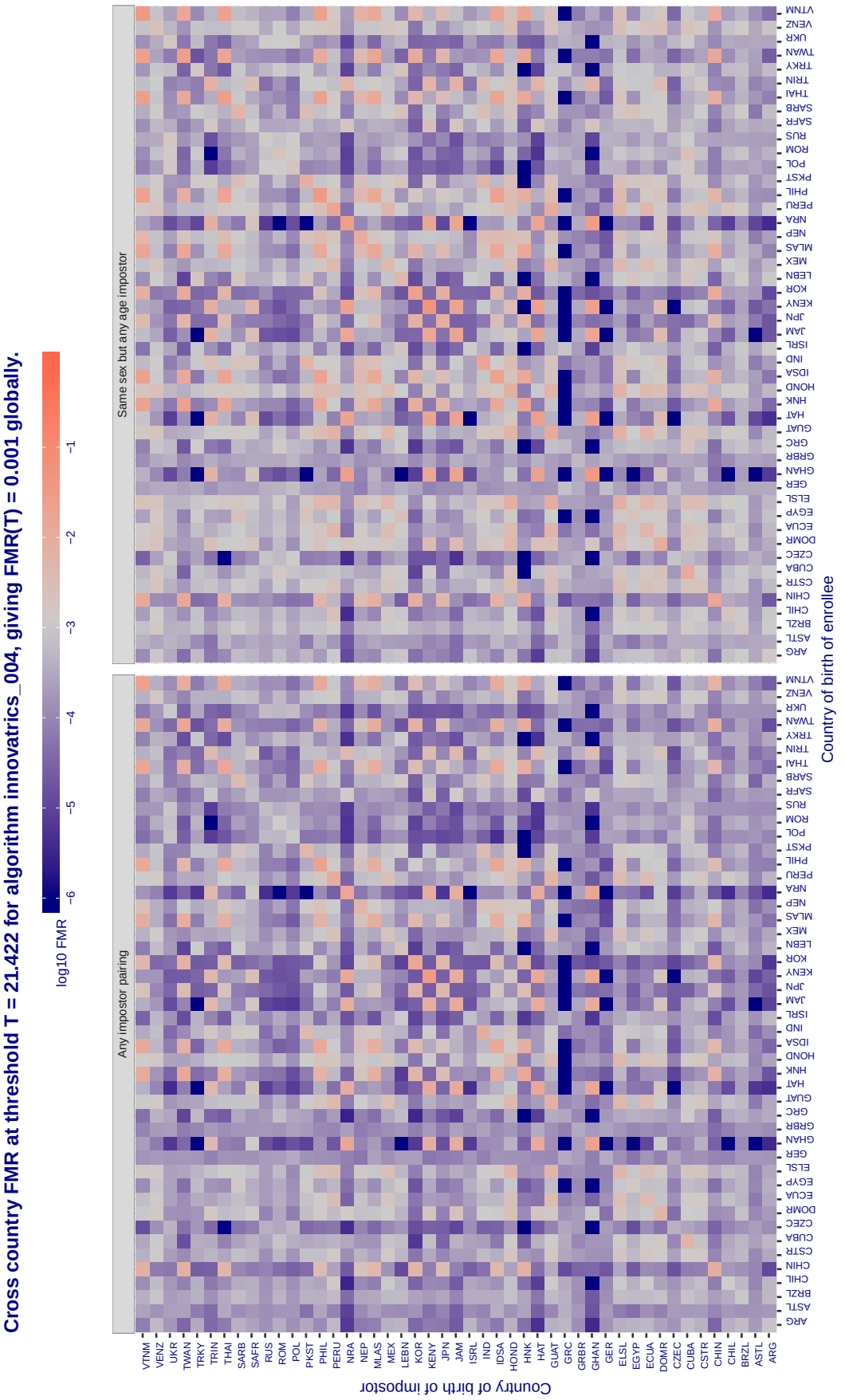


Figure 322: For algorithm innovatrics-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

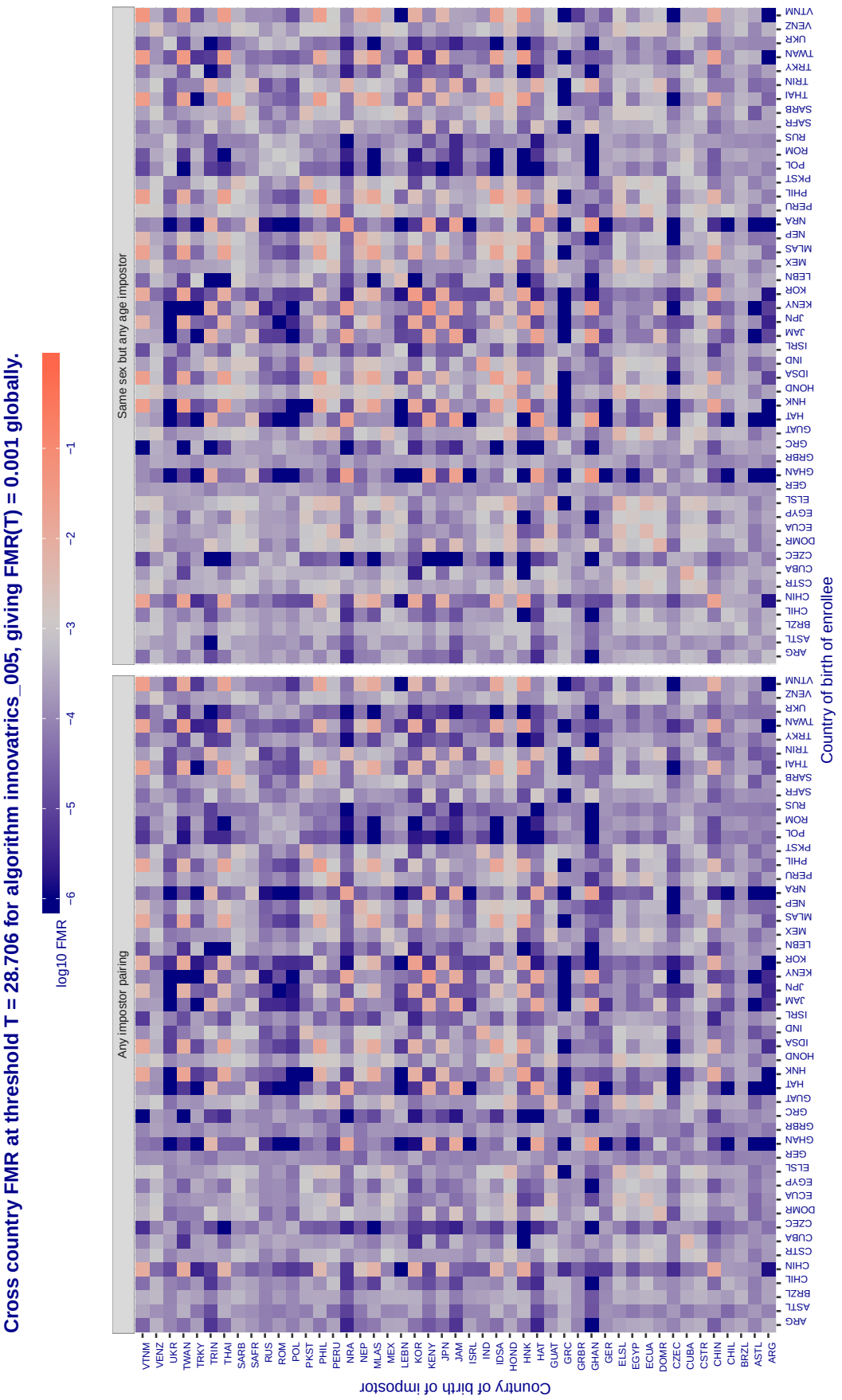


Figure 323: For algorithm innovatrics-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

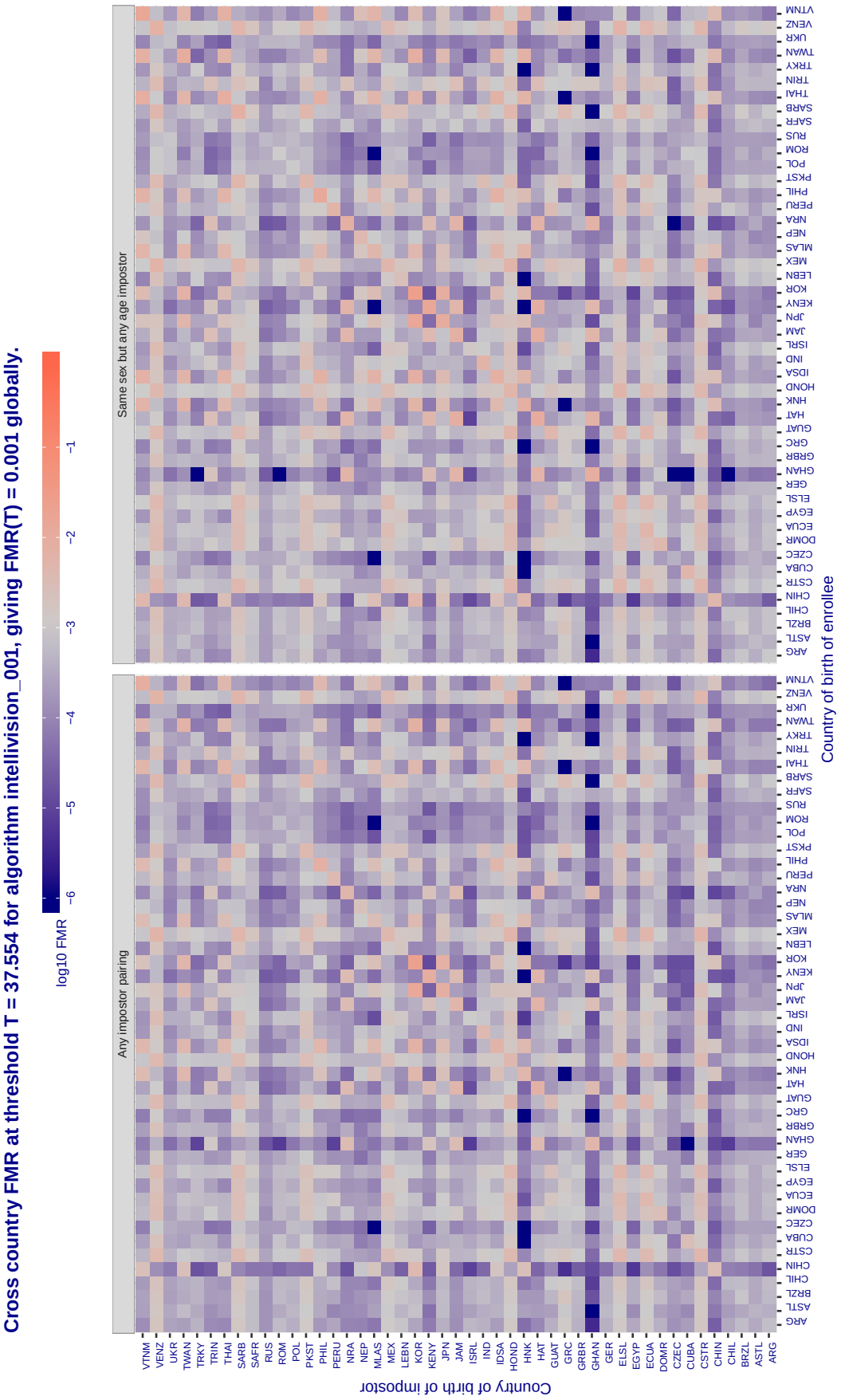


Figure 324: For algorithm intellivision-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

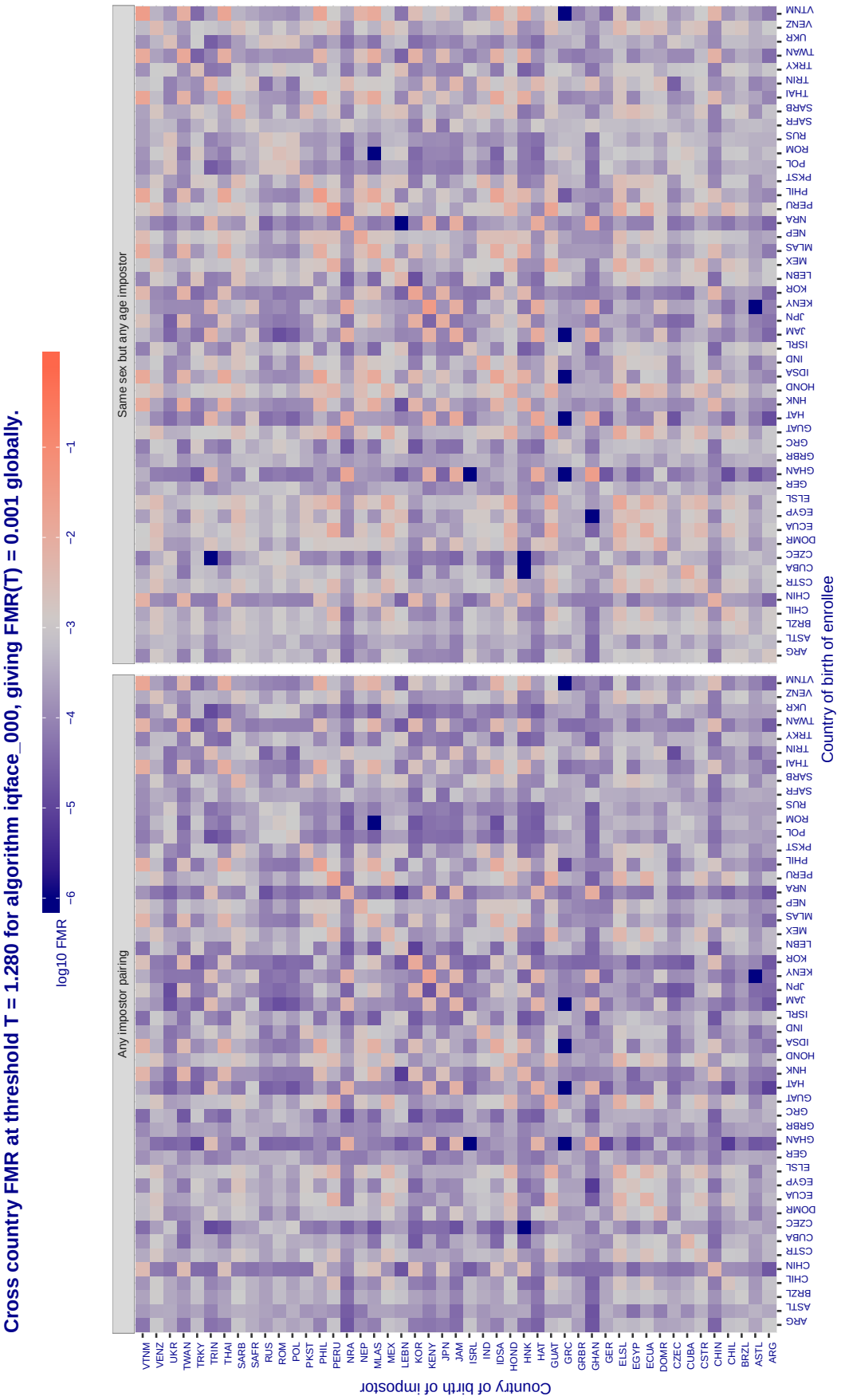


Figure 325: For algorithm iqface-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

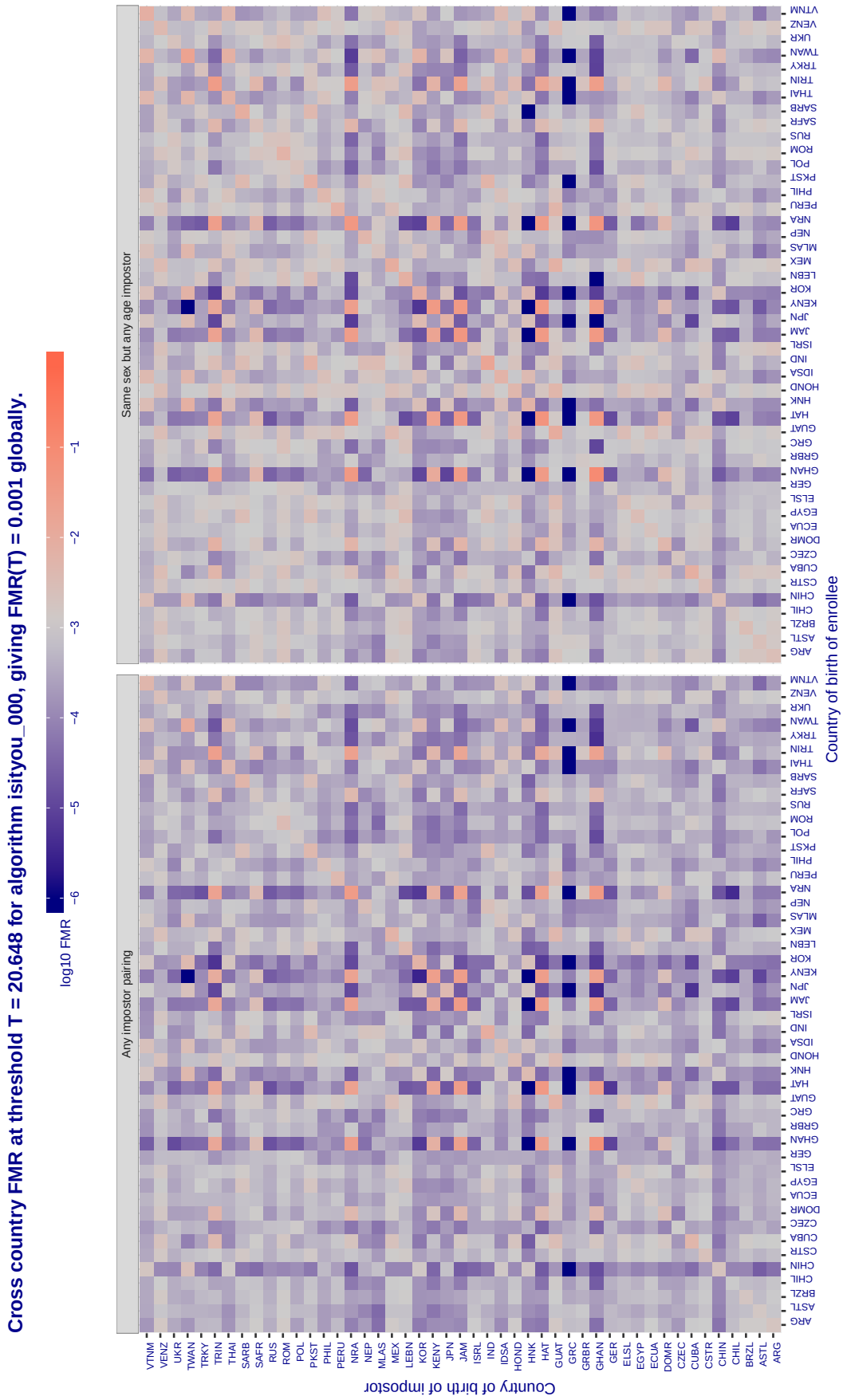


Figure 326: For algorithm isityou-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

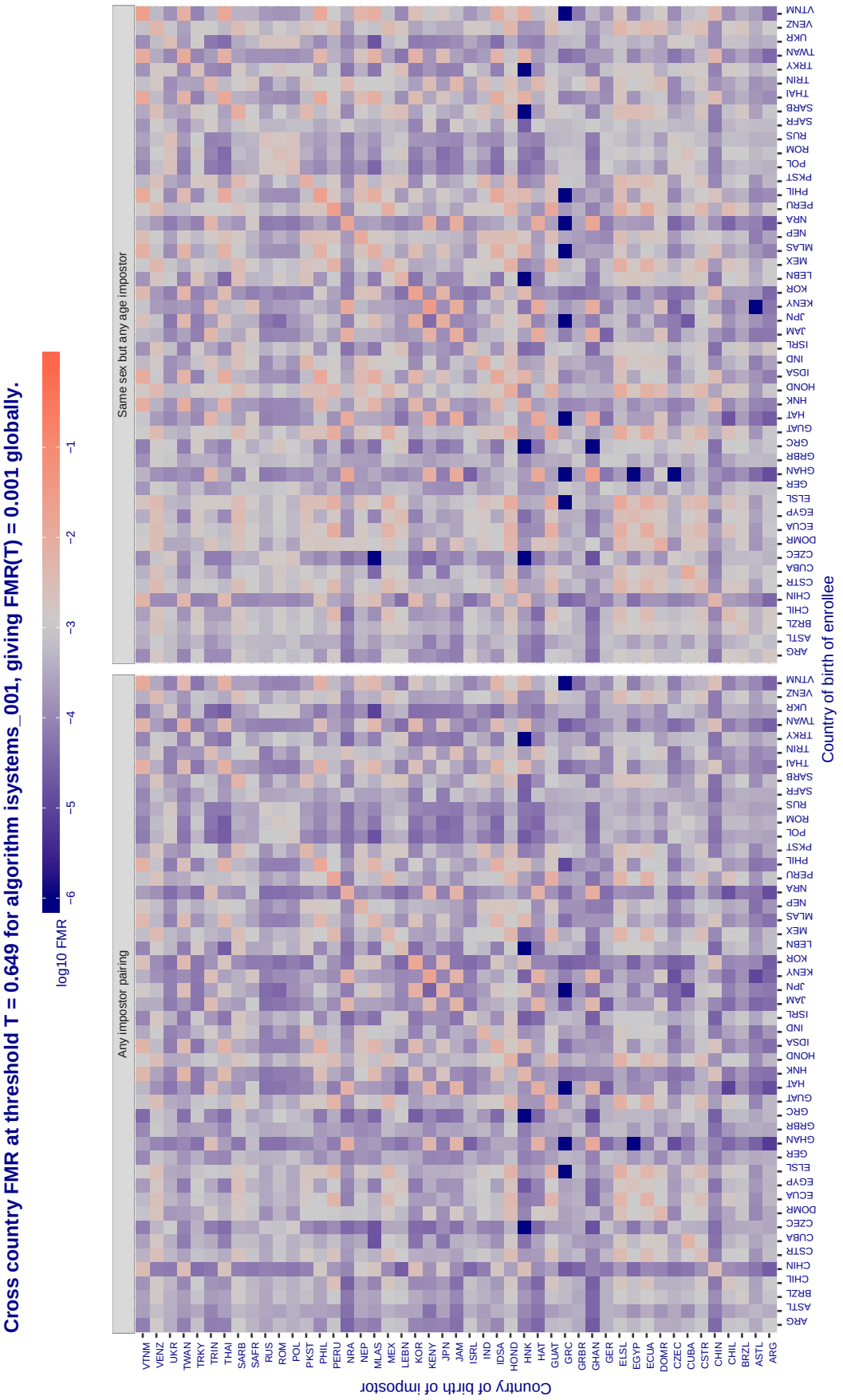


Figure 327: For algorithm isystems-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

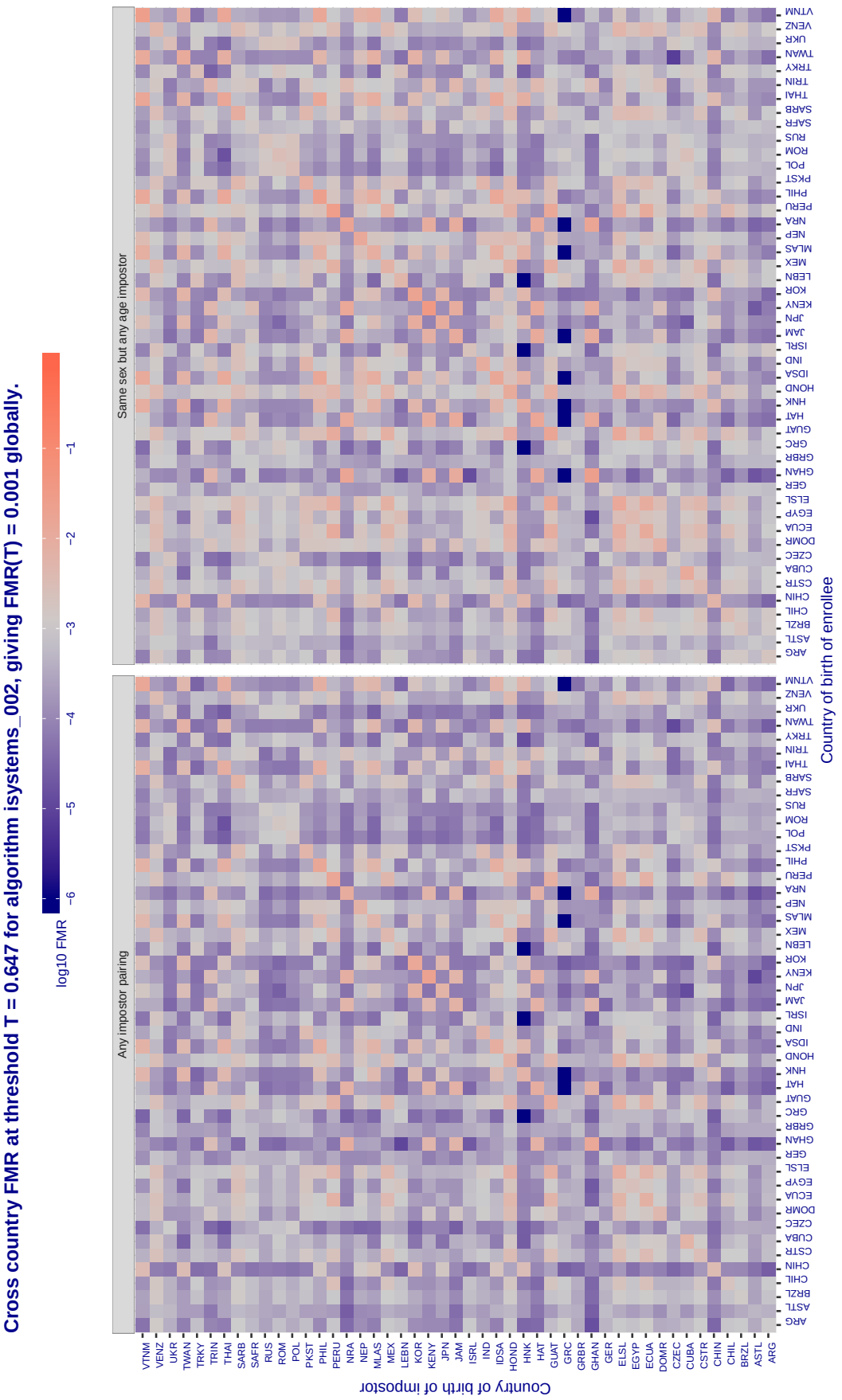


Figure 328: For algorithm isystems-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

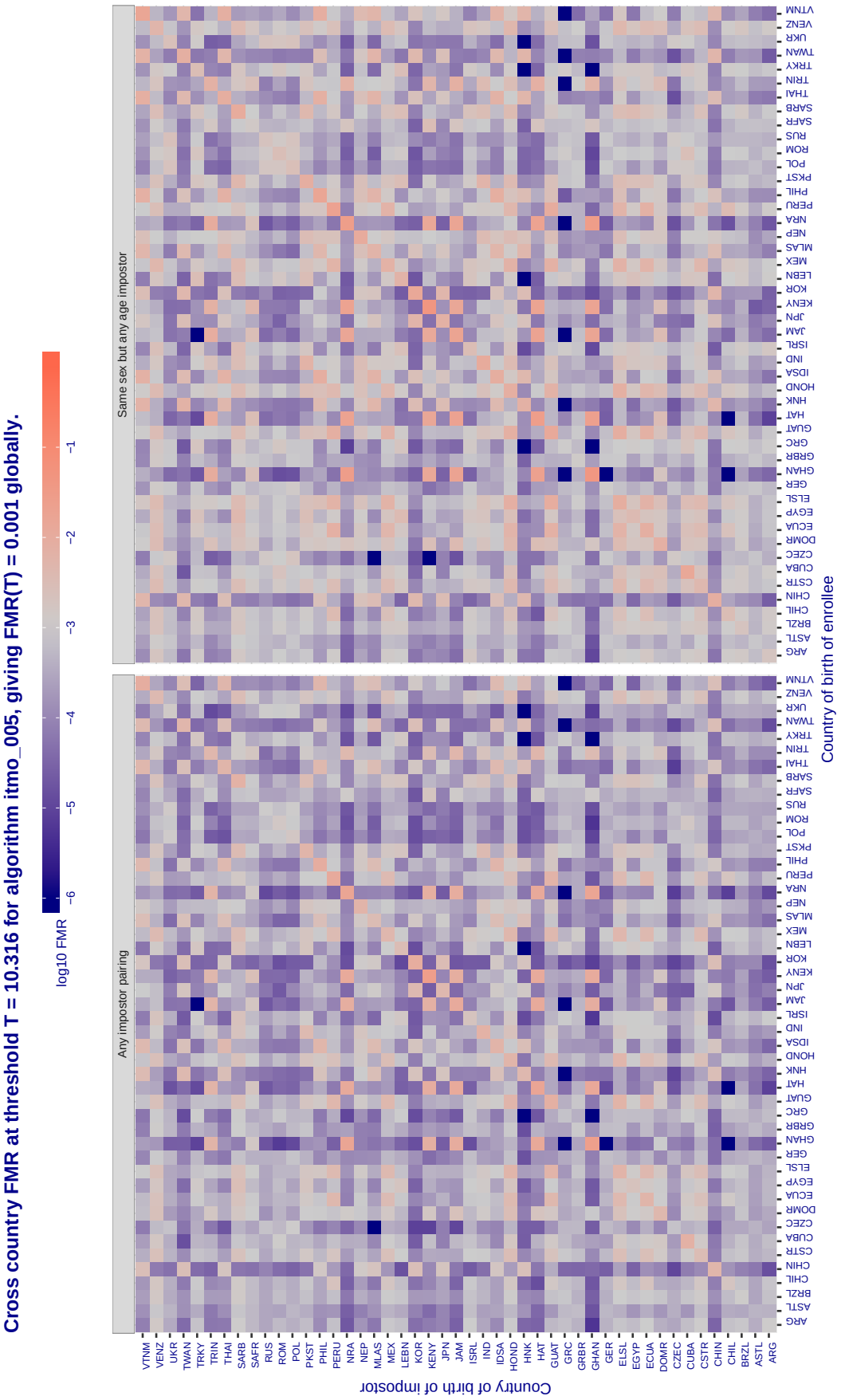


Figure 329: For algorithm itmo-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

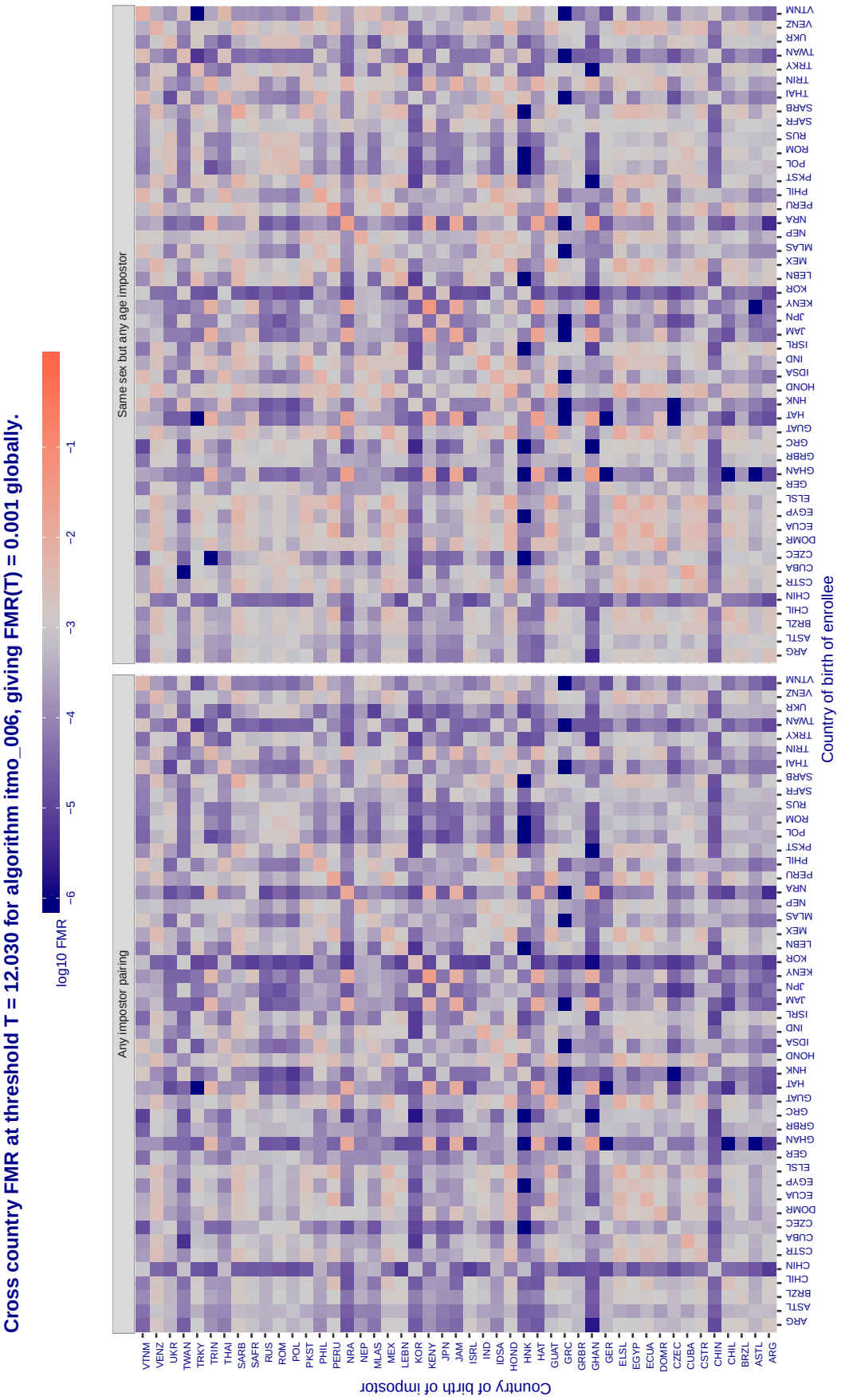


Figure 330: For algorithm itmo-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

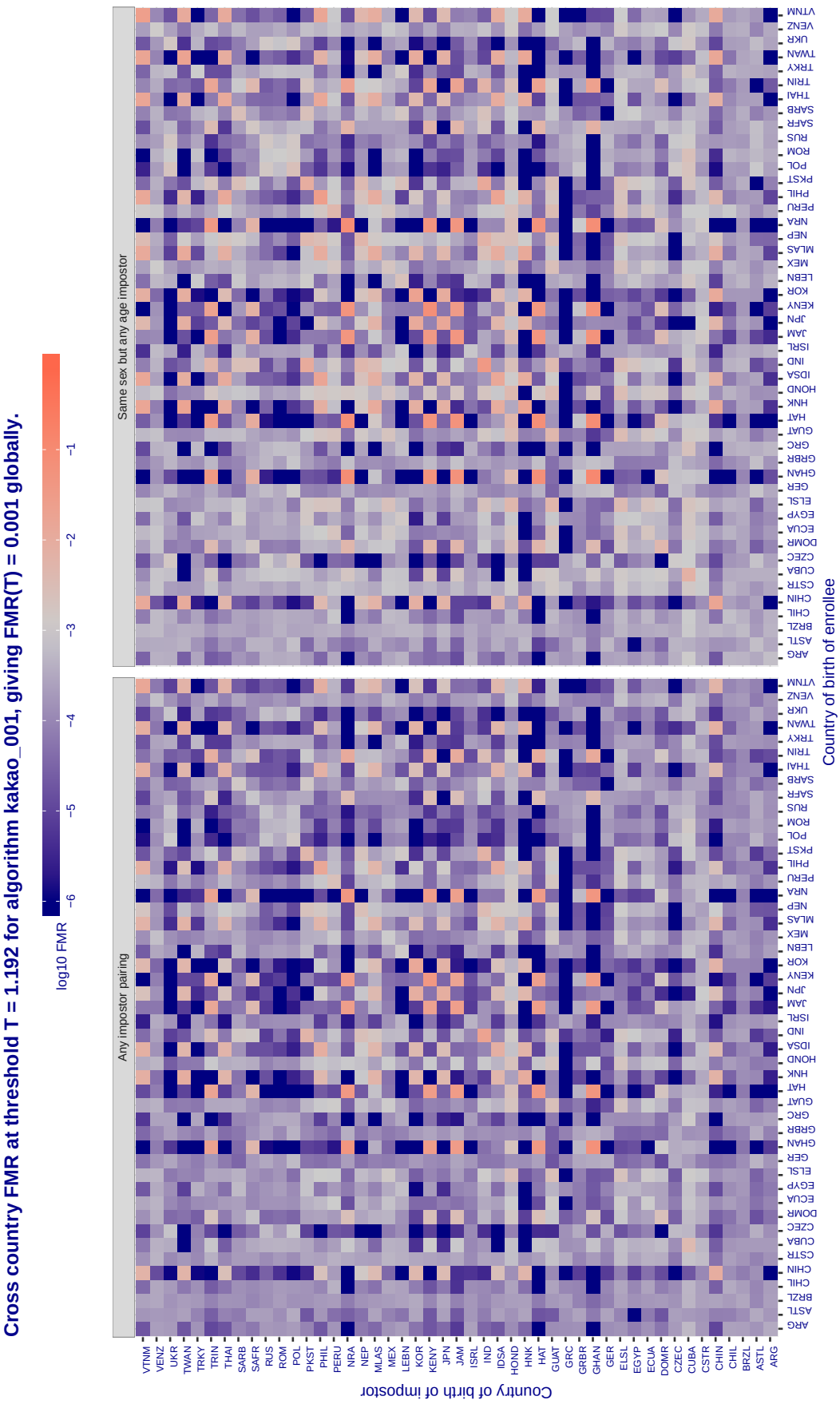


Figure 331: For algorithm kakao-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

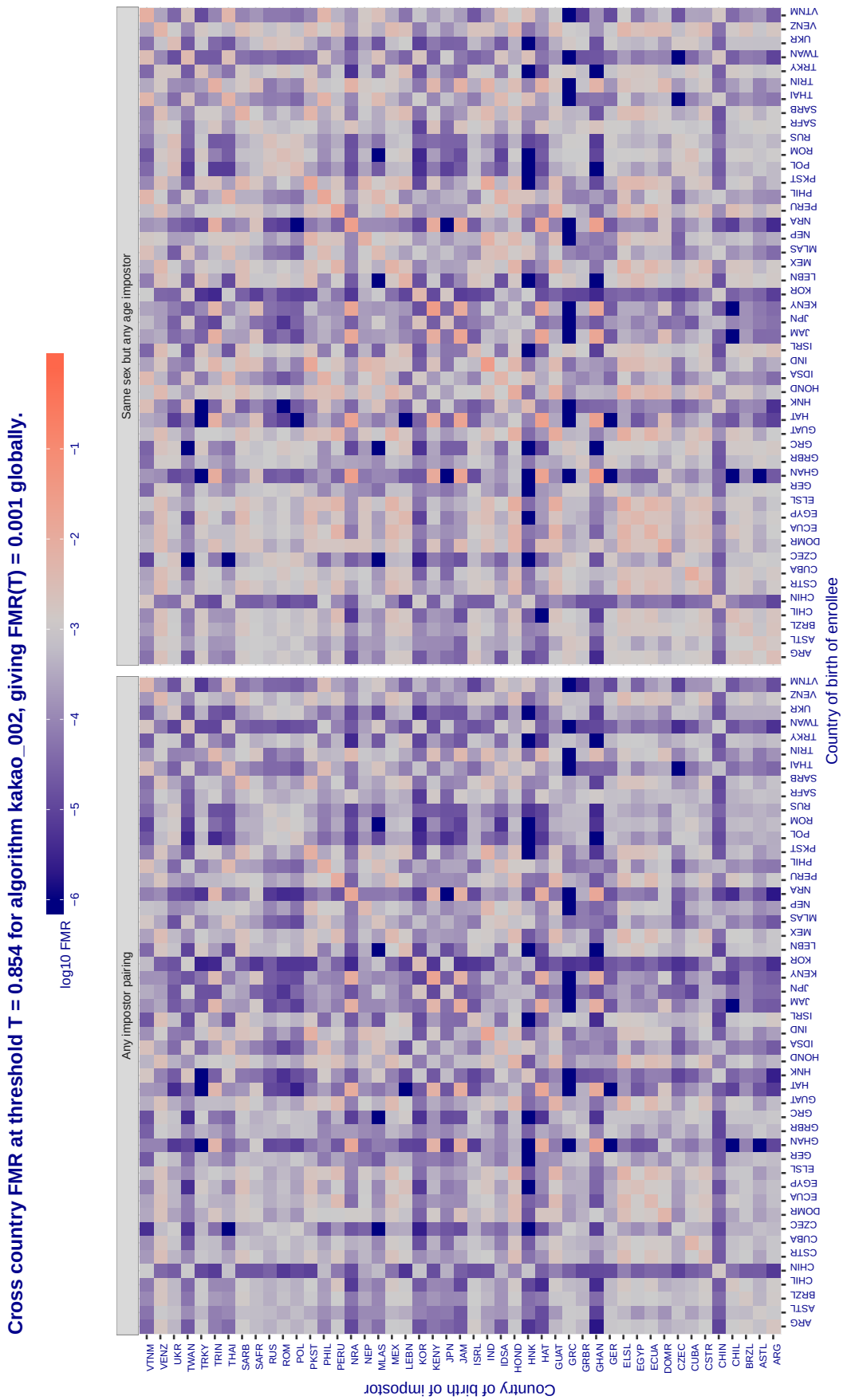


Figure 332: For algorithm kakao-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

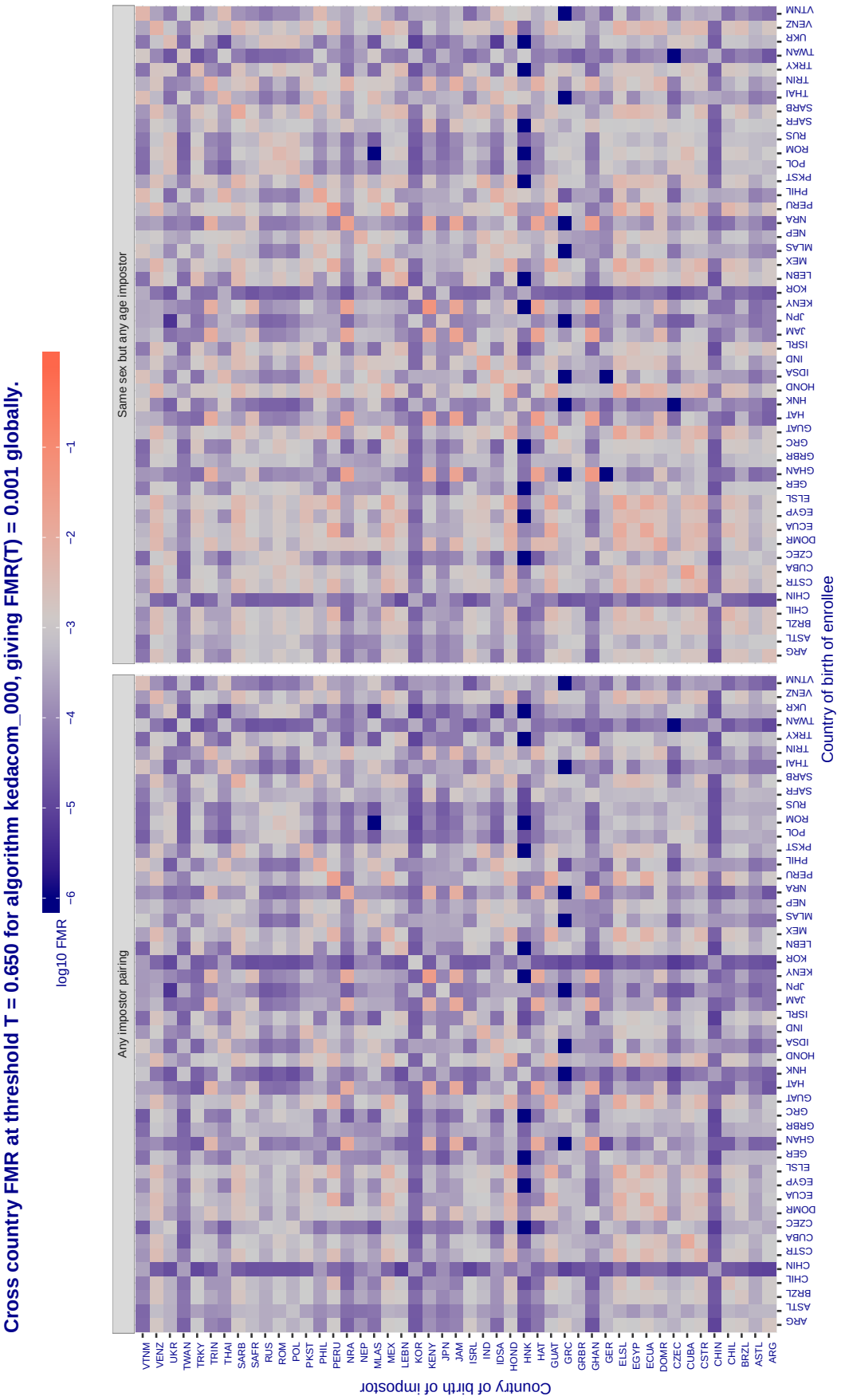


Figure 333: For algorithm kedacom-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

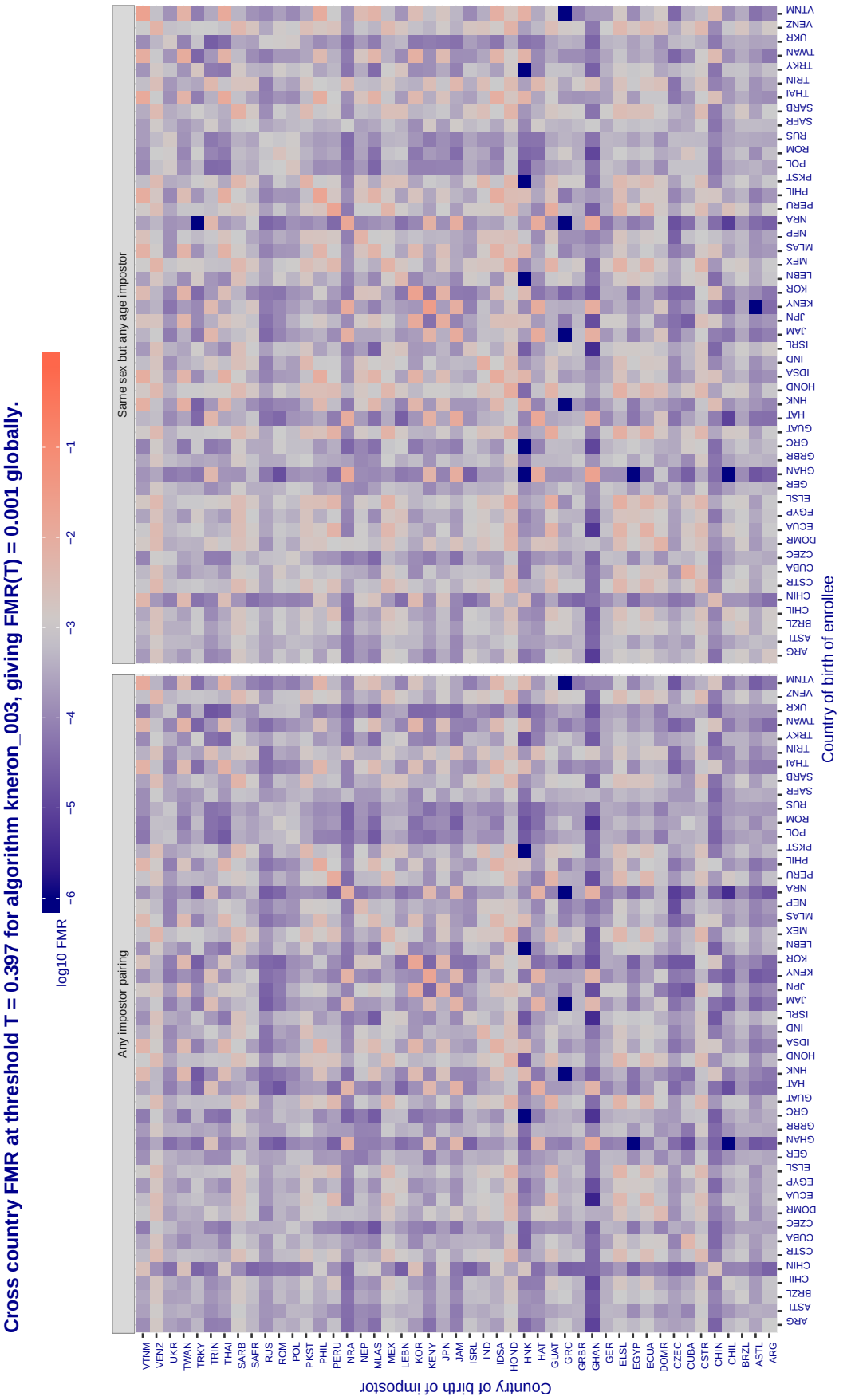


Figure 334: For algorithm kneron-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

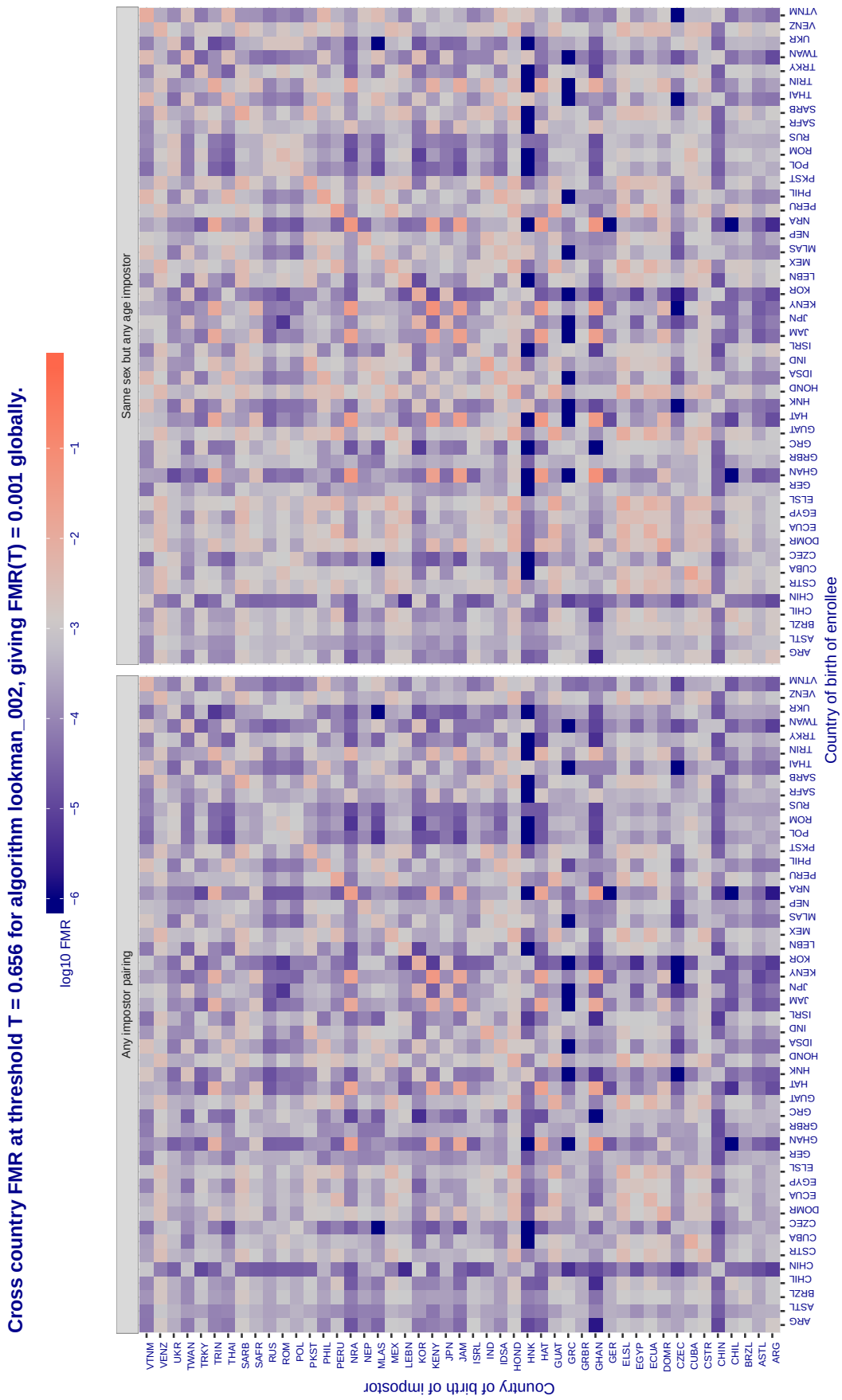


Figure 335: For algorithm lookman-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

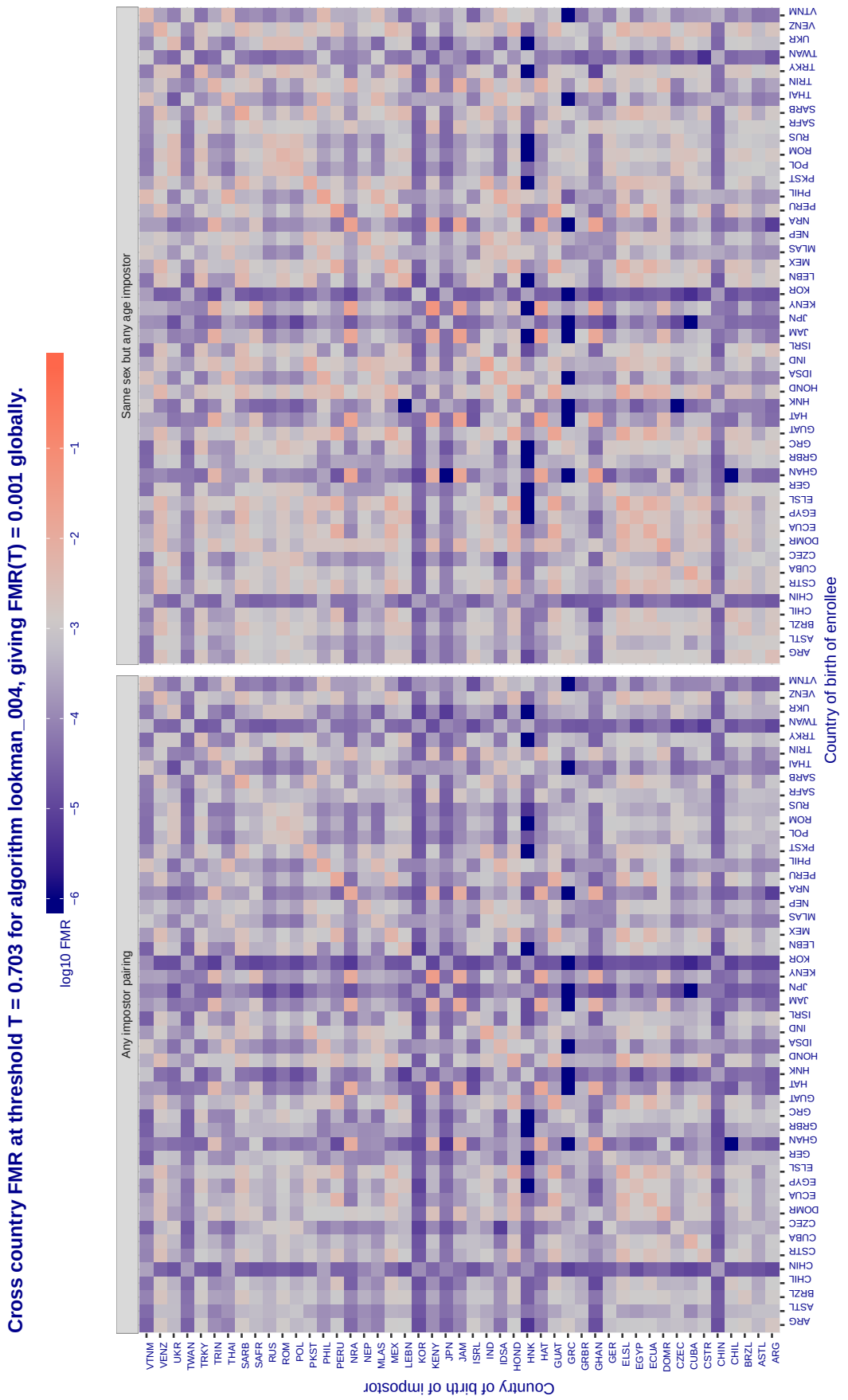


Figure 336: For algorithm lookman-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

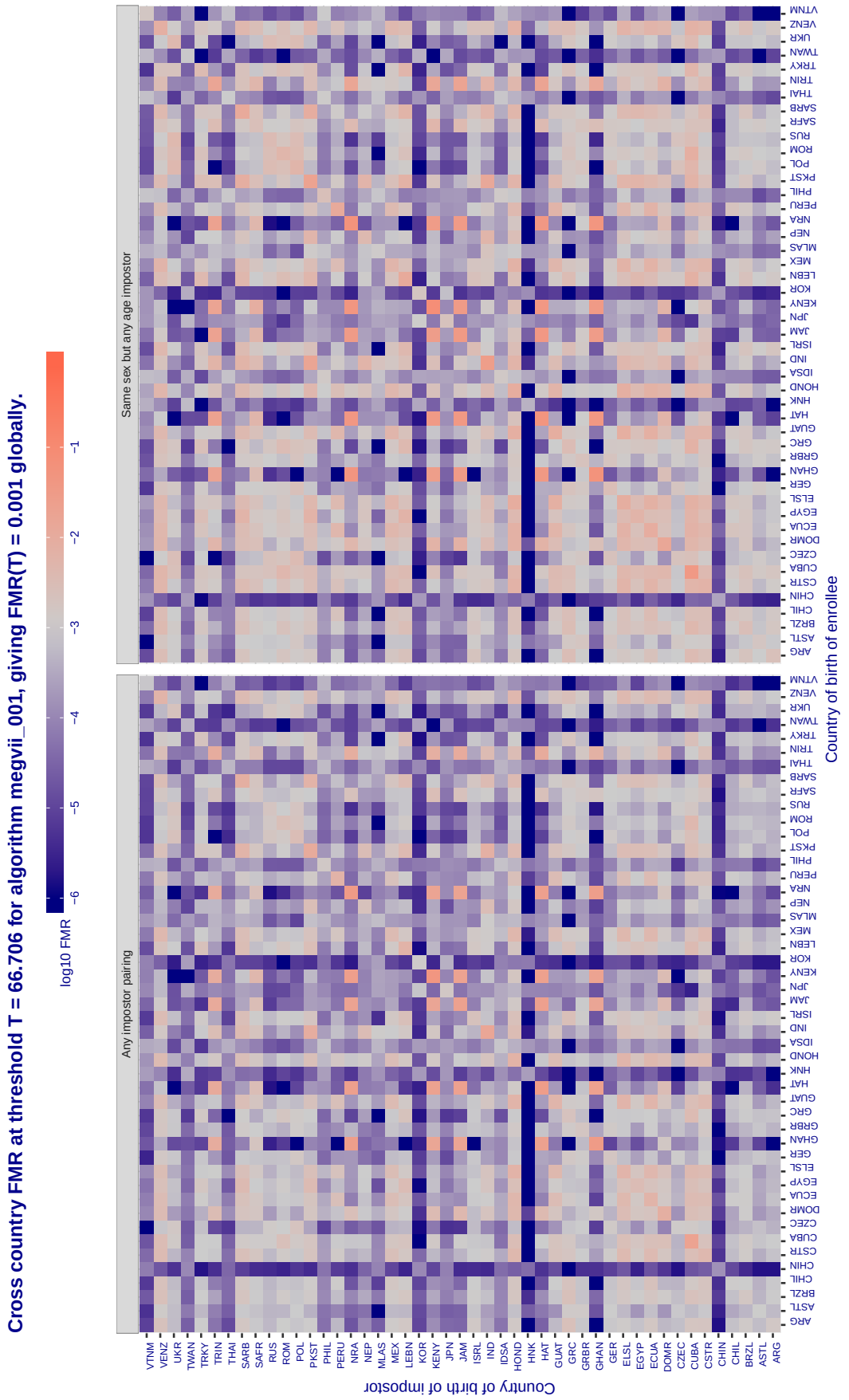


Figure 337: For algorithm megvii-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

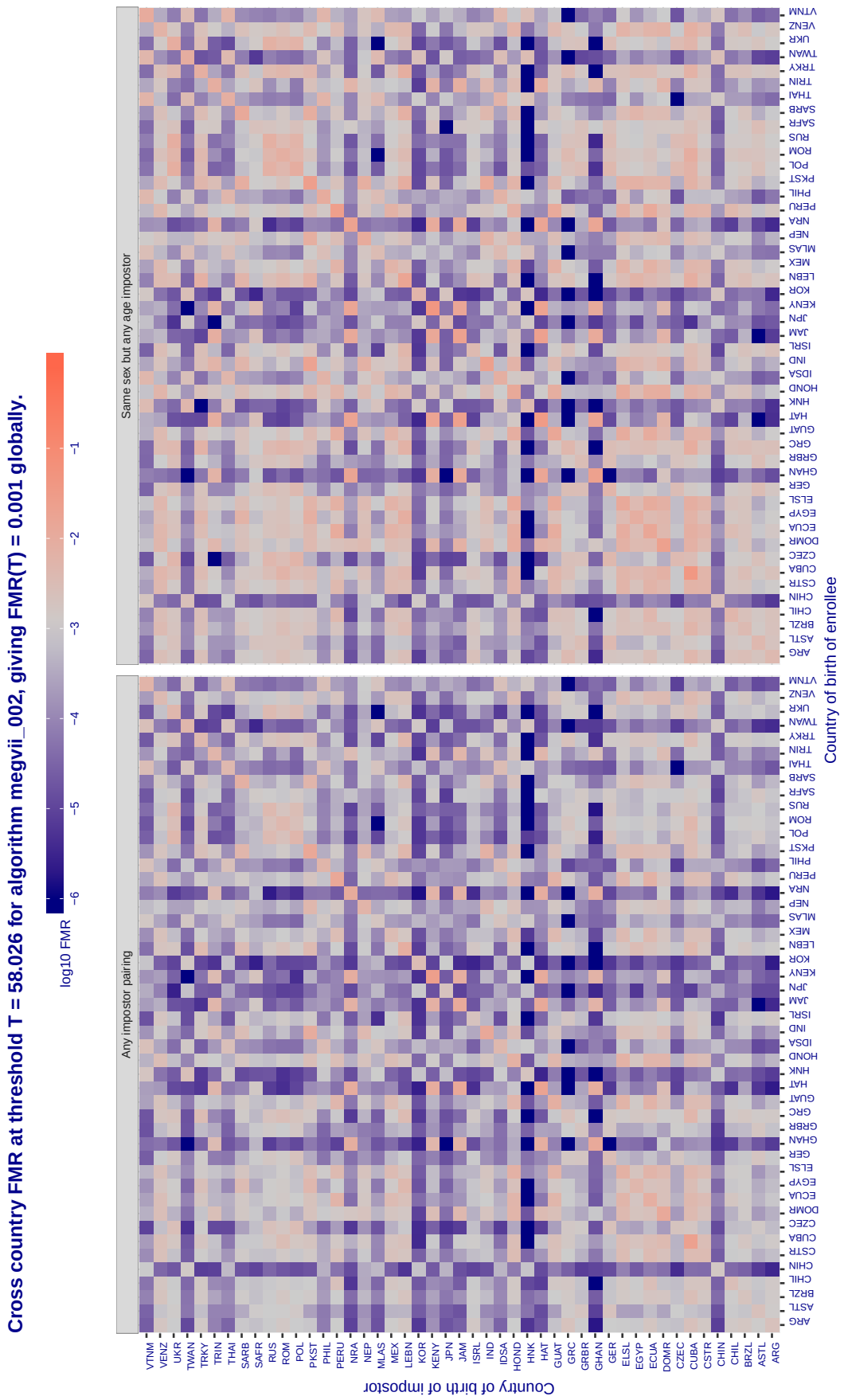


Figure 338: For algorithm megvii-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

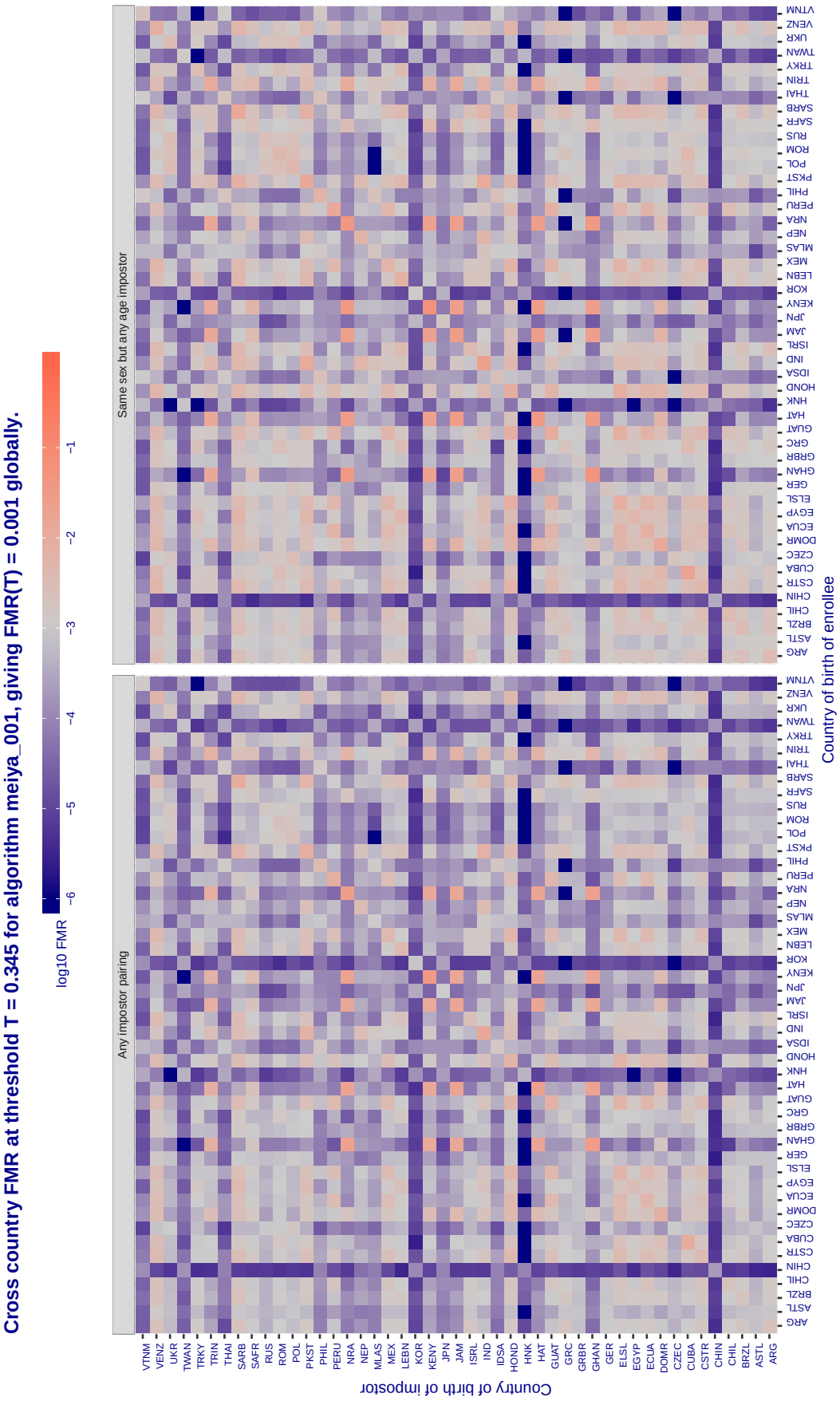


Figure 339: For algorithm meiya-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

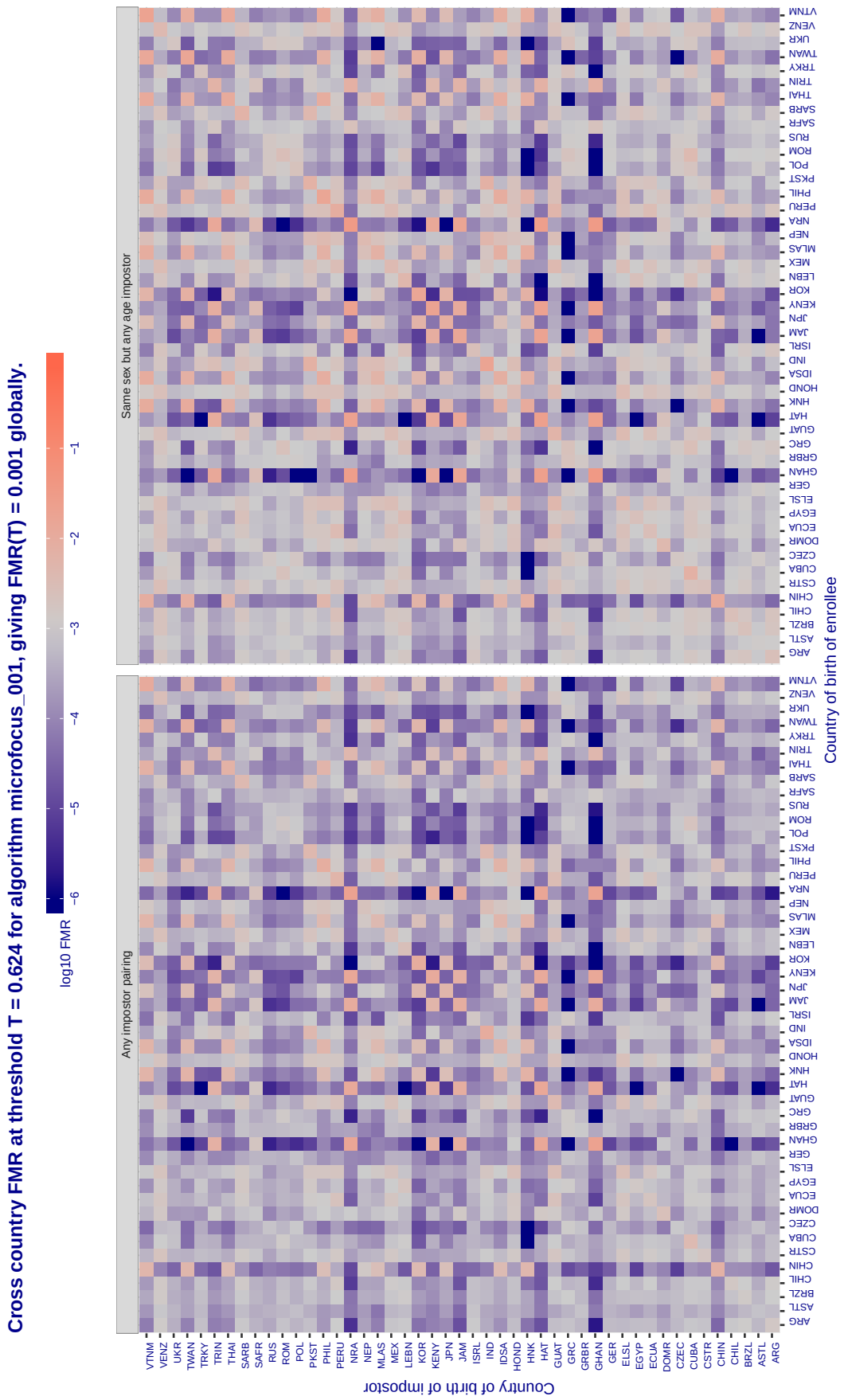


Figure 340: For algorithm microfocus-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

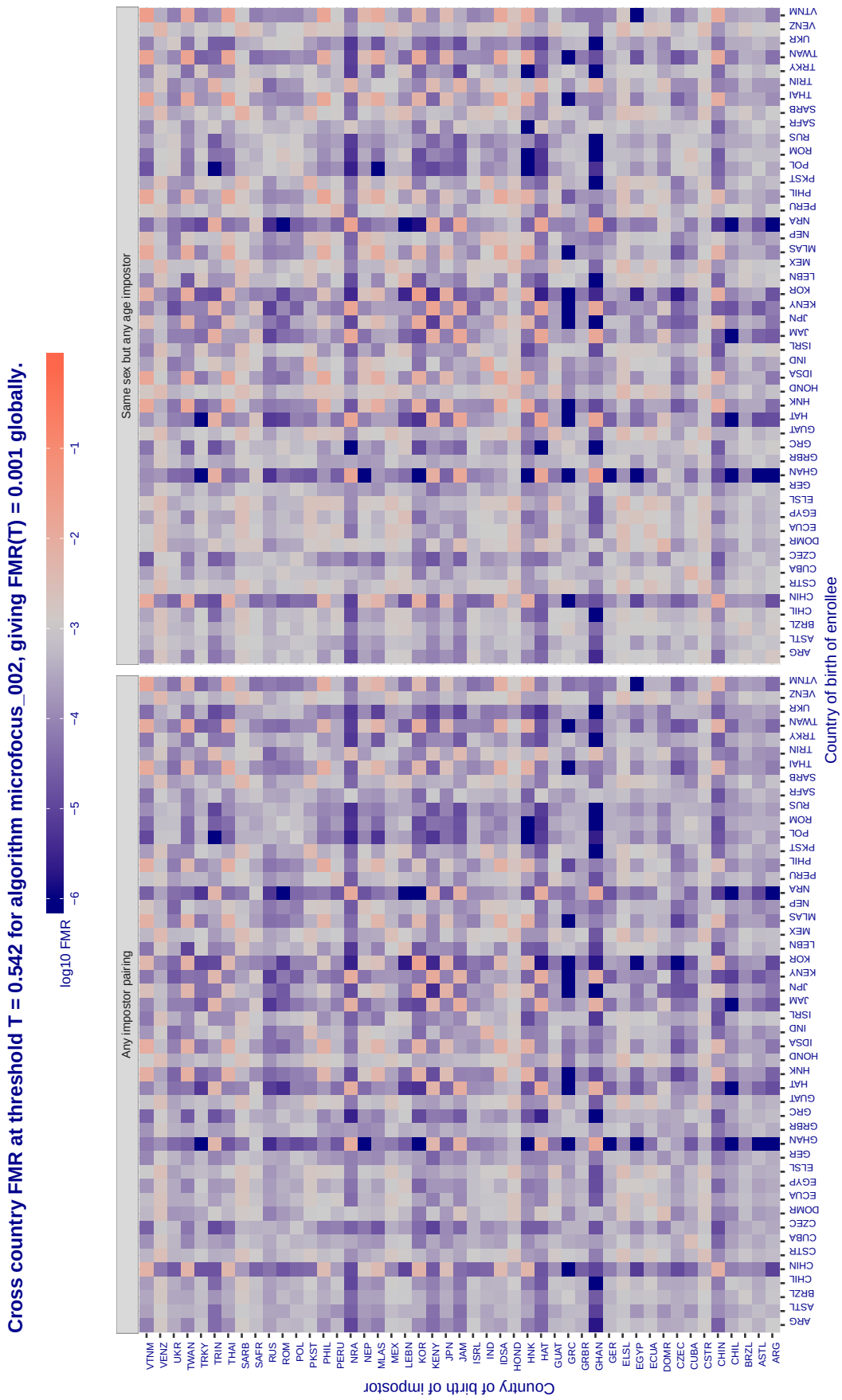


Figure 341: For algorithm microfocus-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

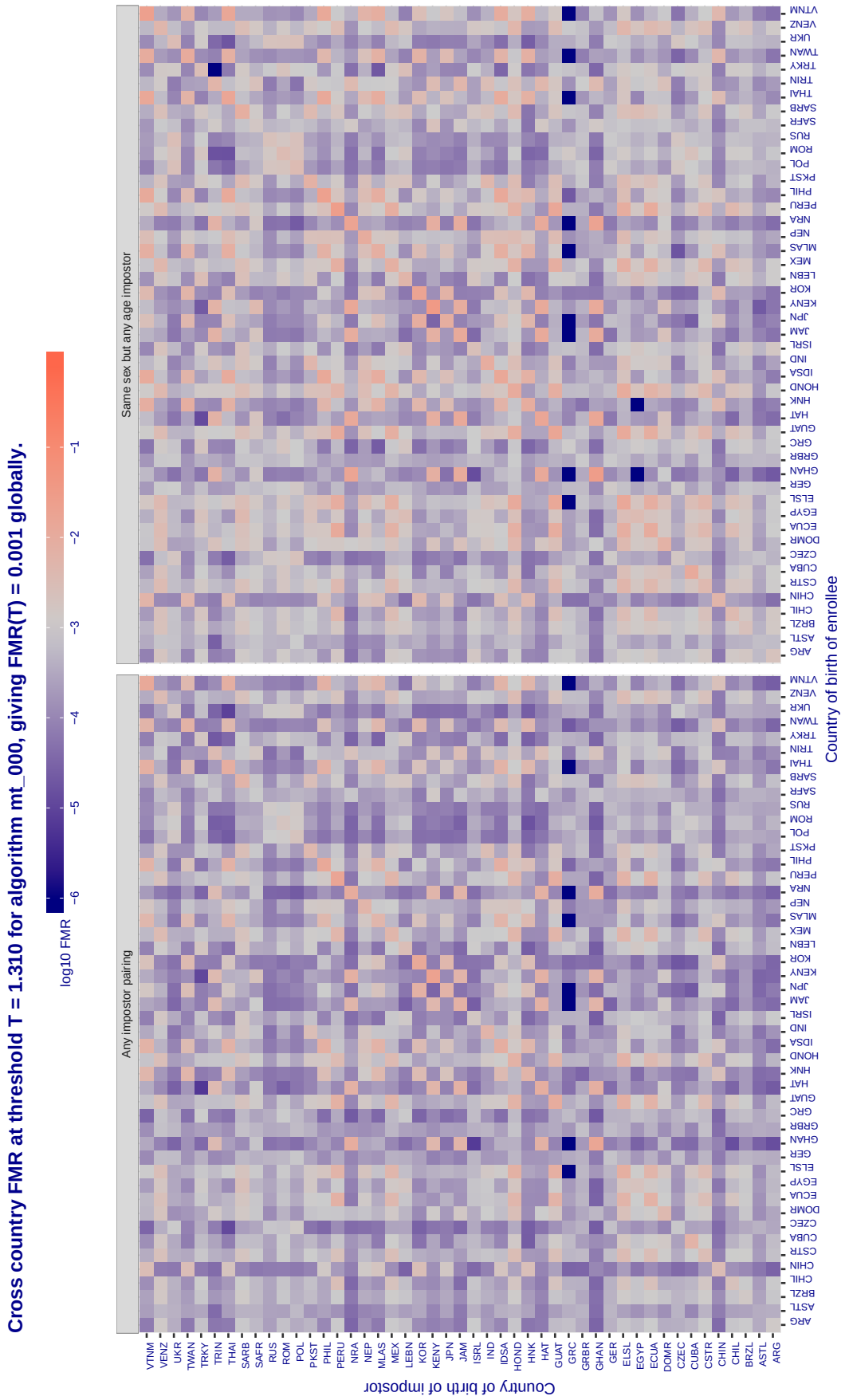


Figure 342: For algorithm mt-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

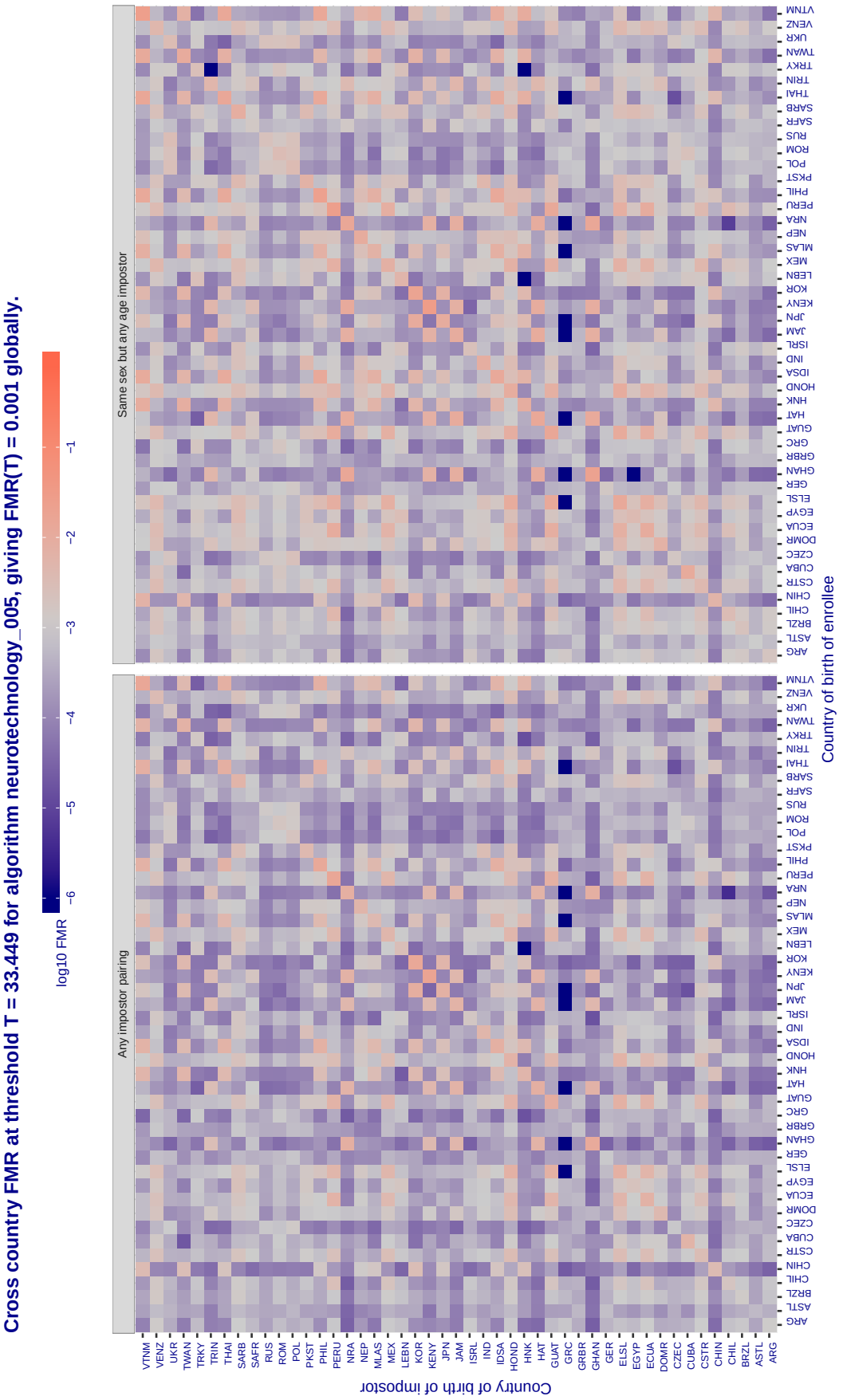


Figure 343: For algorithm neurotechnology-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

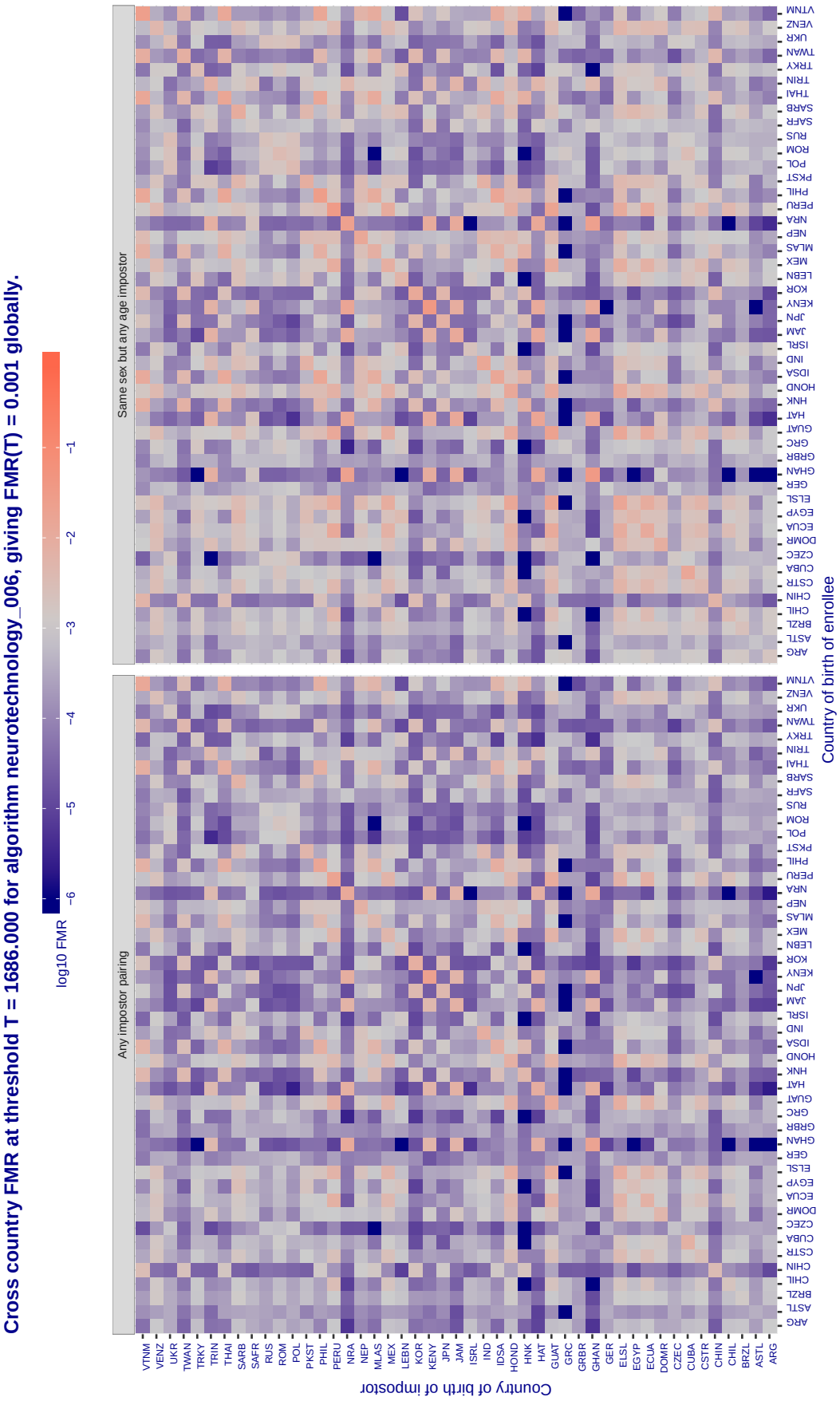


Figure 344: For algorithm neurotechnology-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

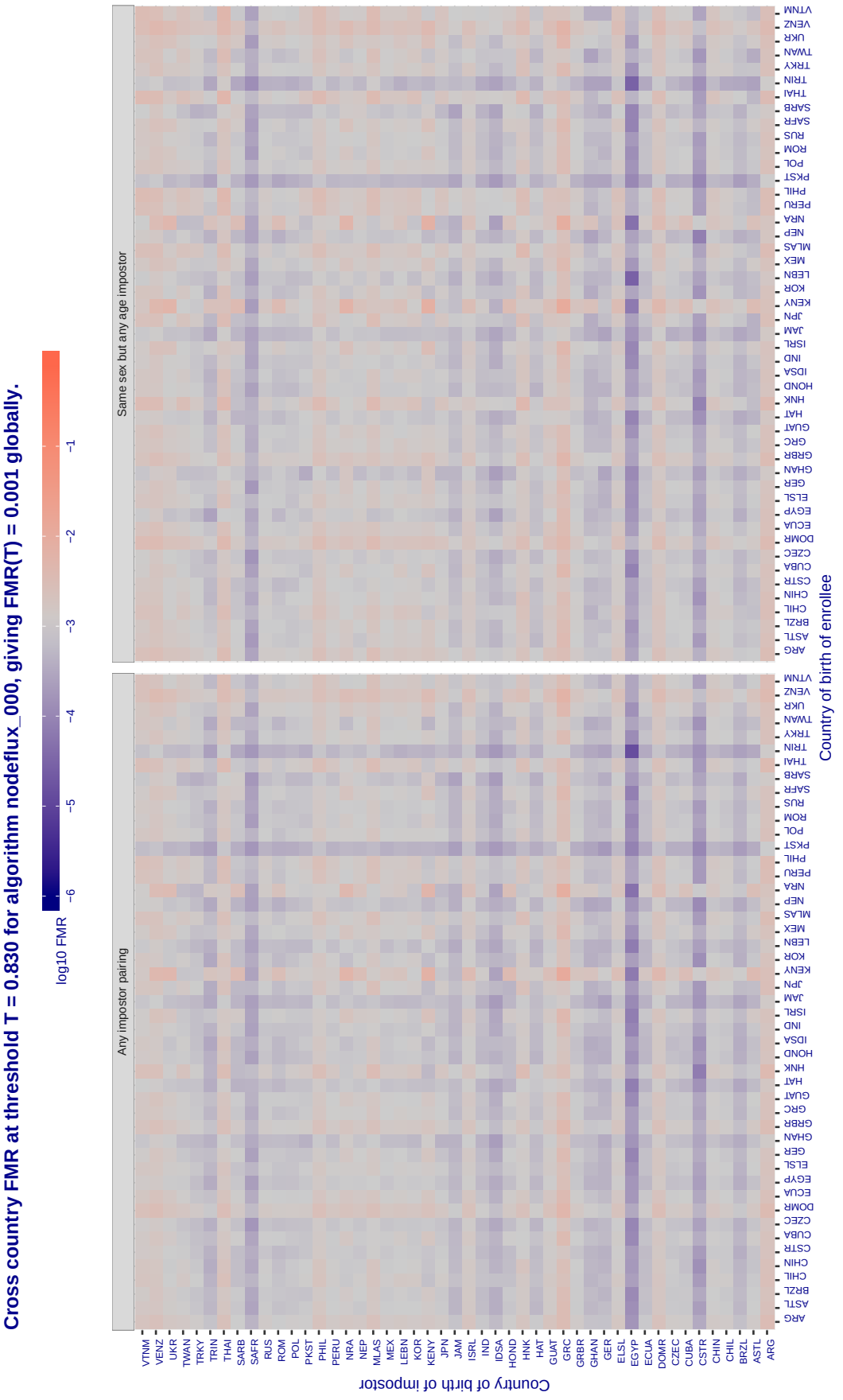


Figure 345: For algorithm nodeflux-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

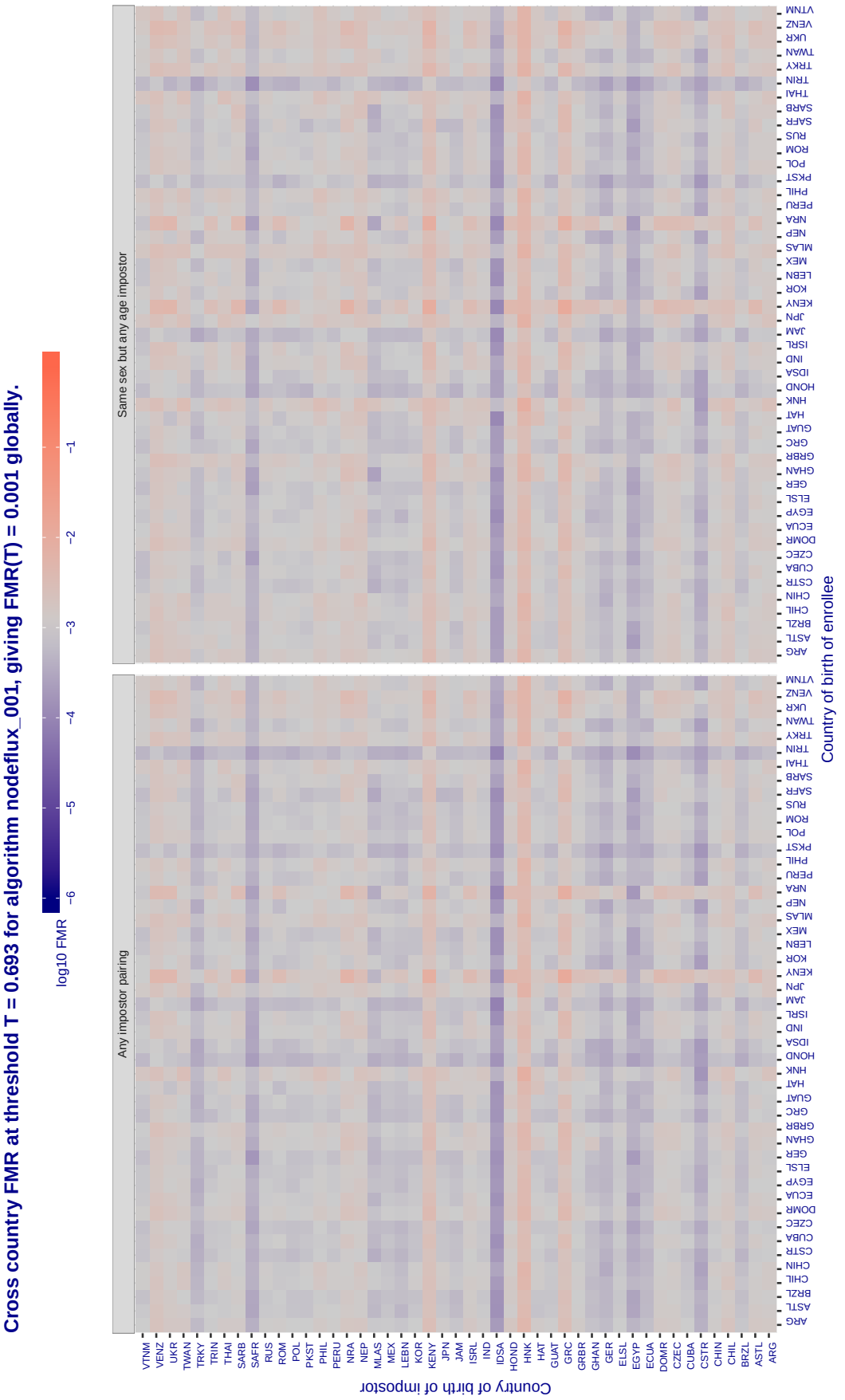


Figure 346: For algorithm nodeflux-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

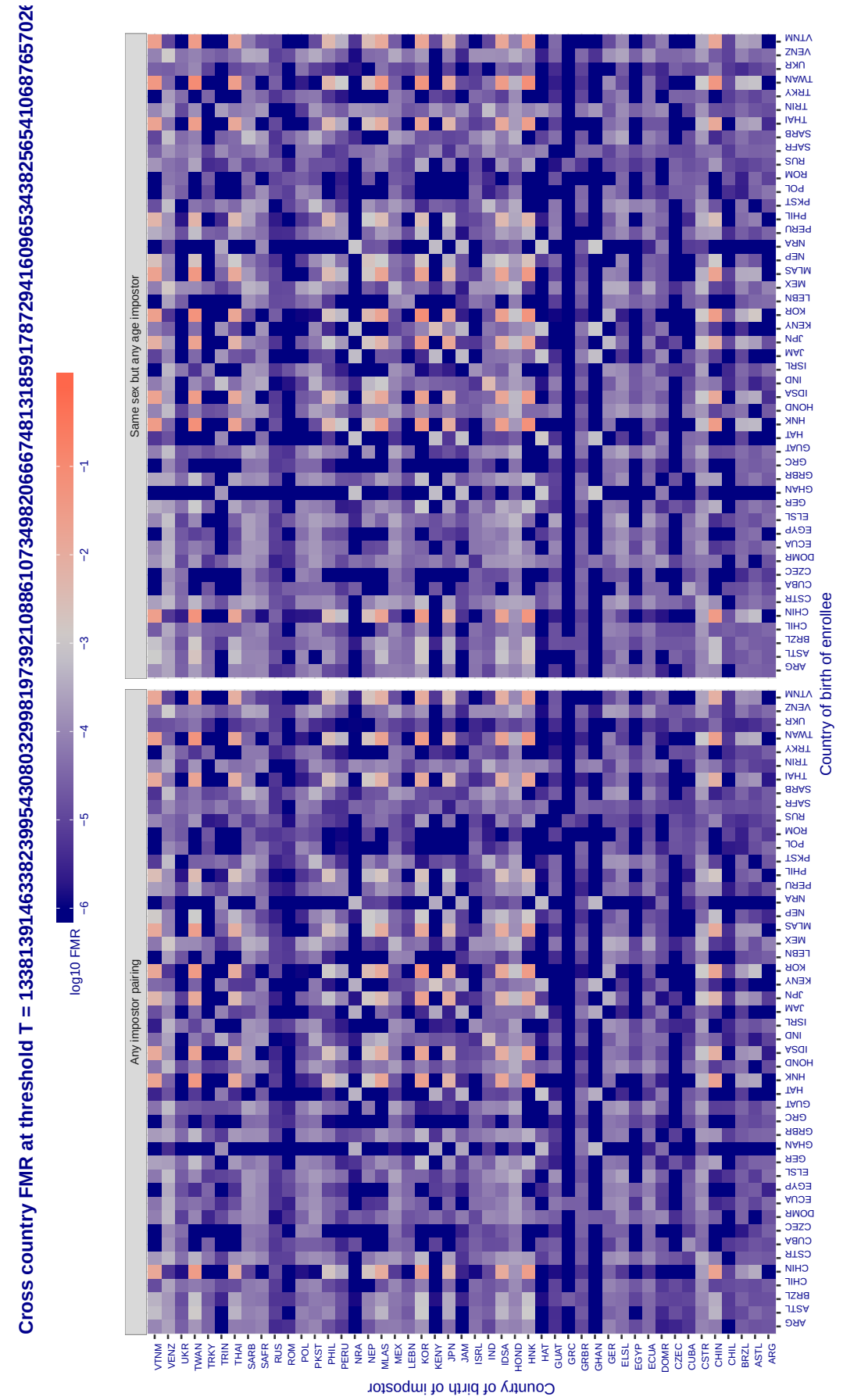


Figure 347: For algorithm notiontag-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

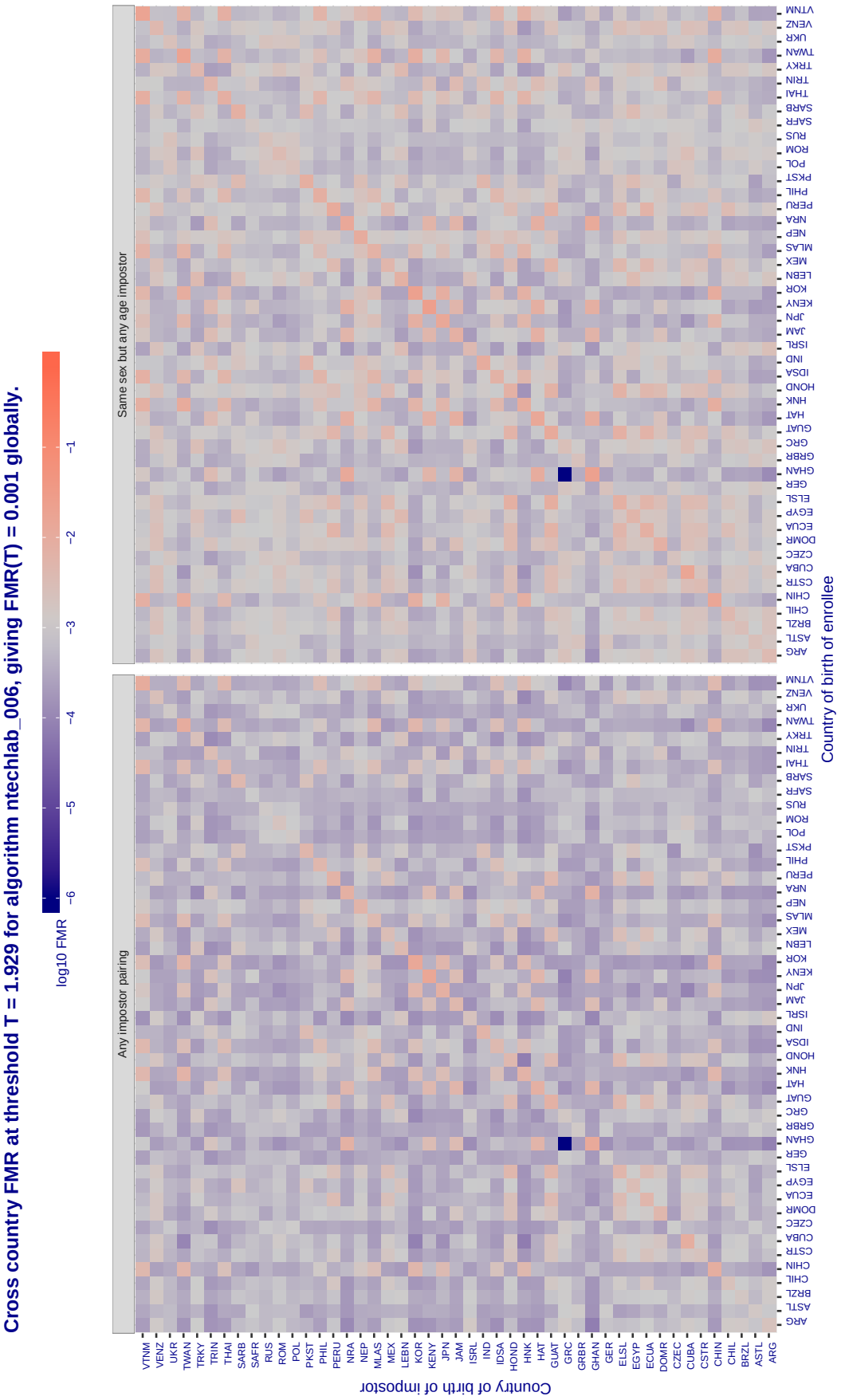


Figure 348: For algorithm ntechlab-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

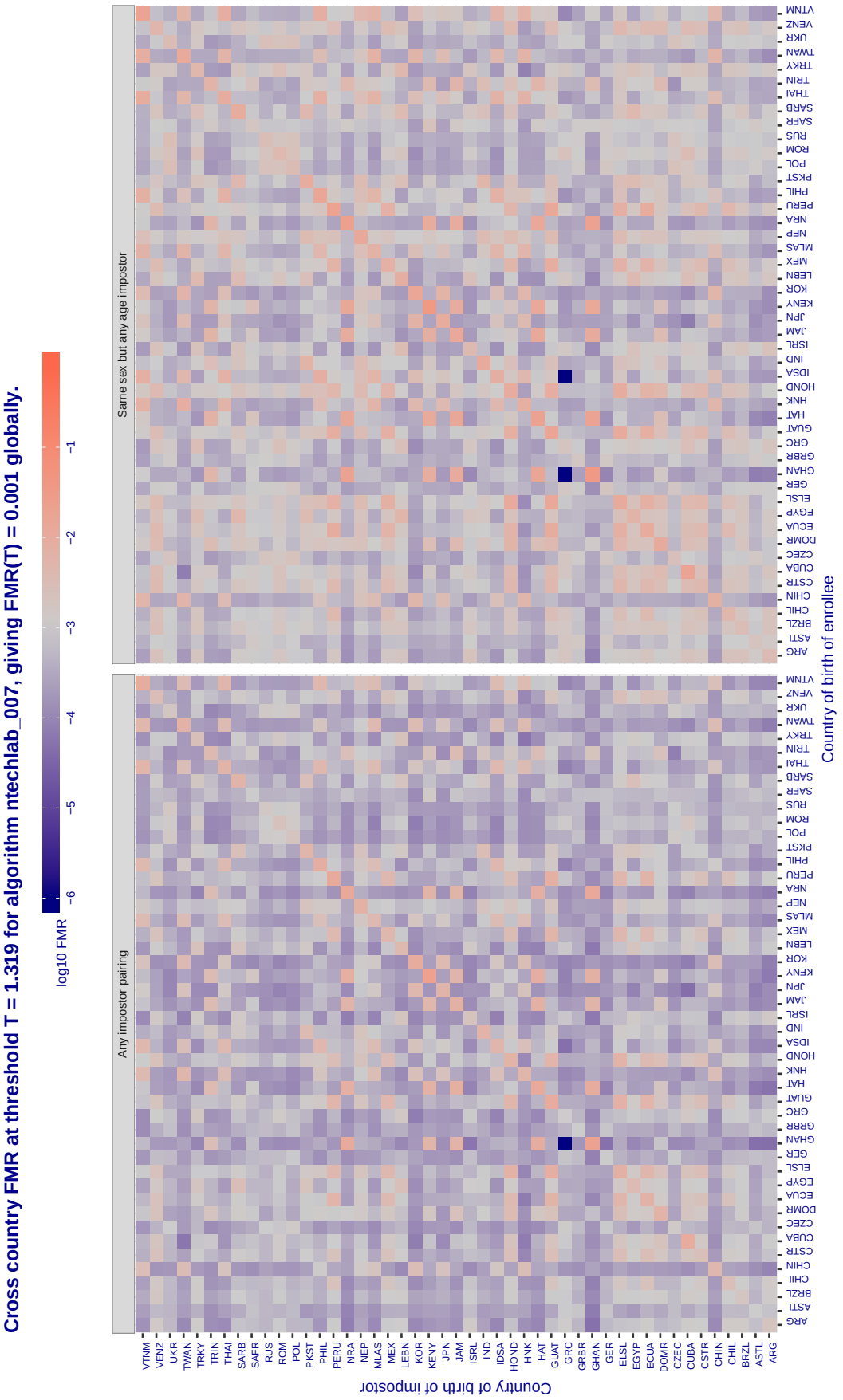


Figure 349: For algorithm ntechlab-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

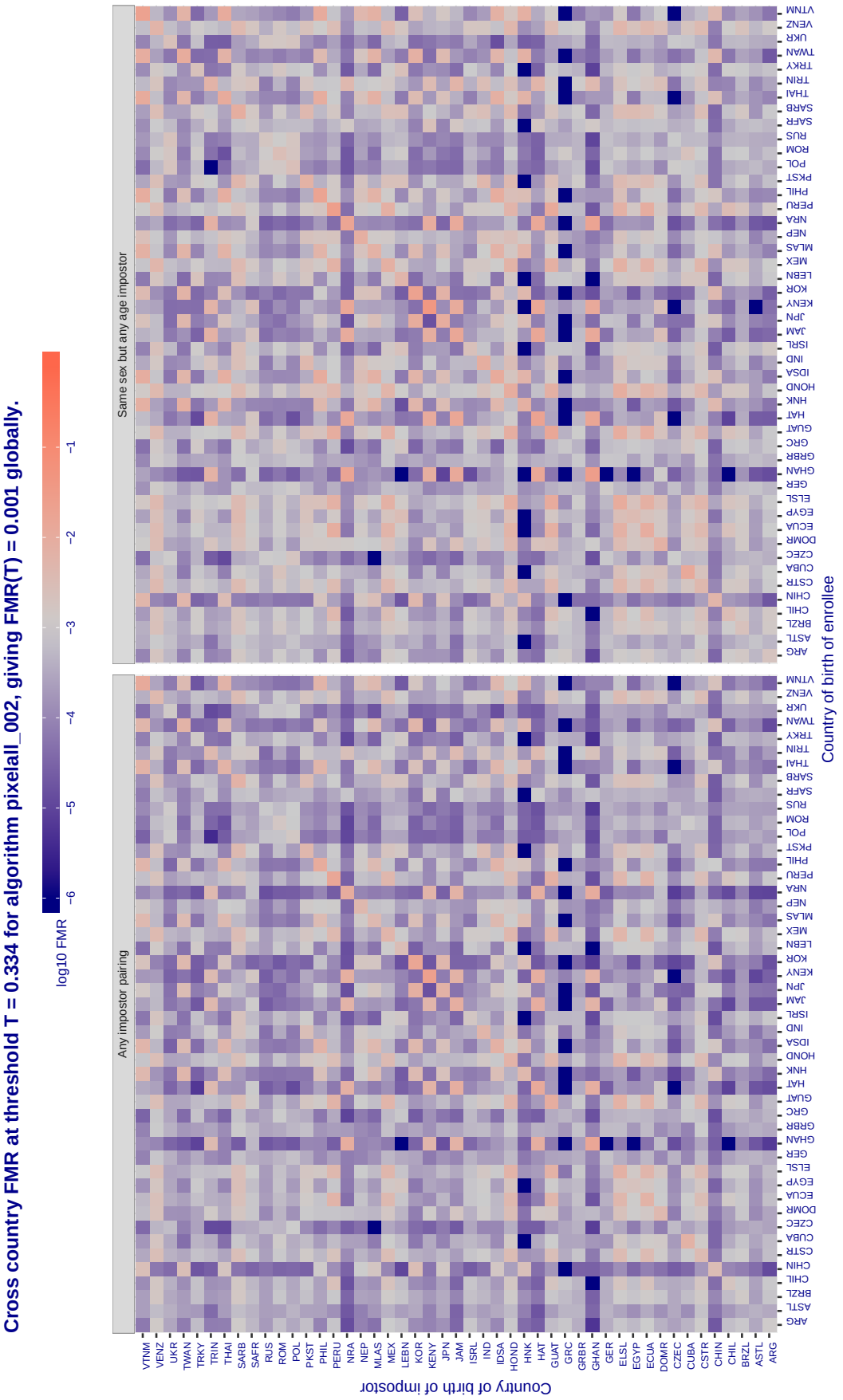


Figure 350: For algorithm pixelall-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

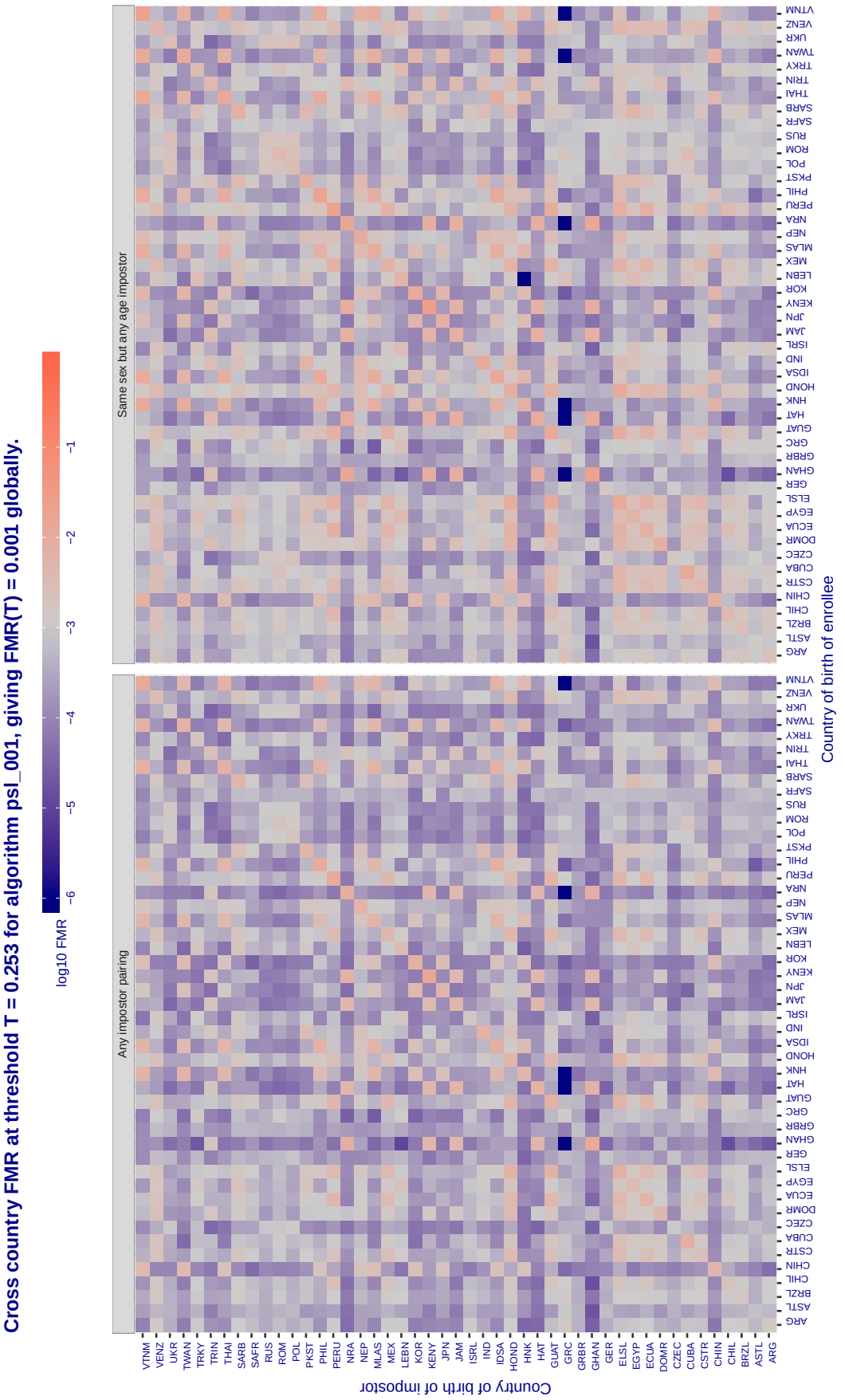


Figure 351: For algorithm psl-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

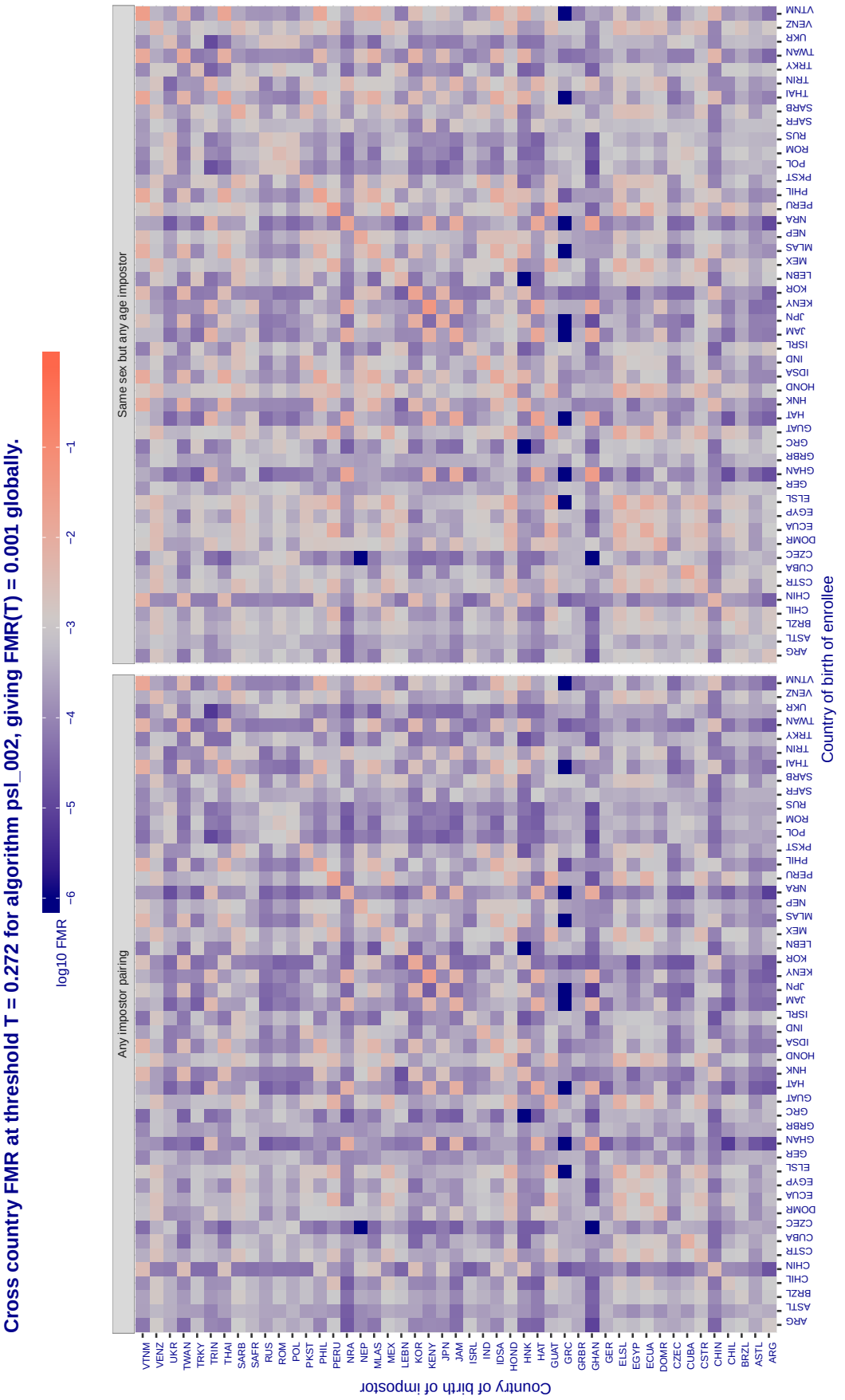


Figure 352: For algorithm psl-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

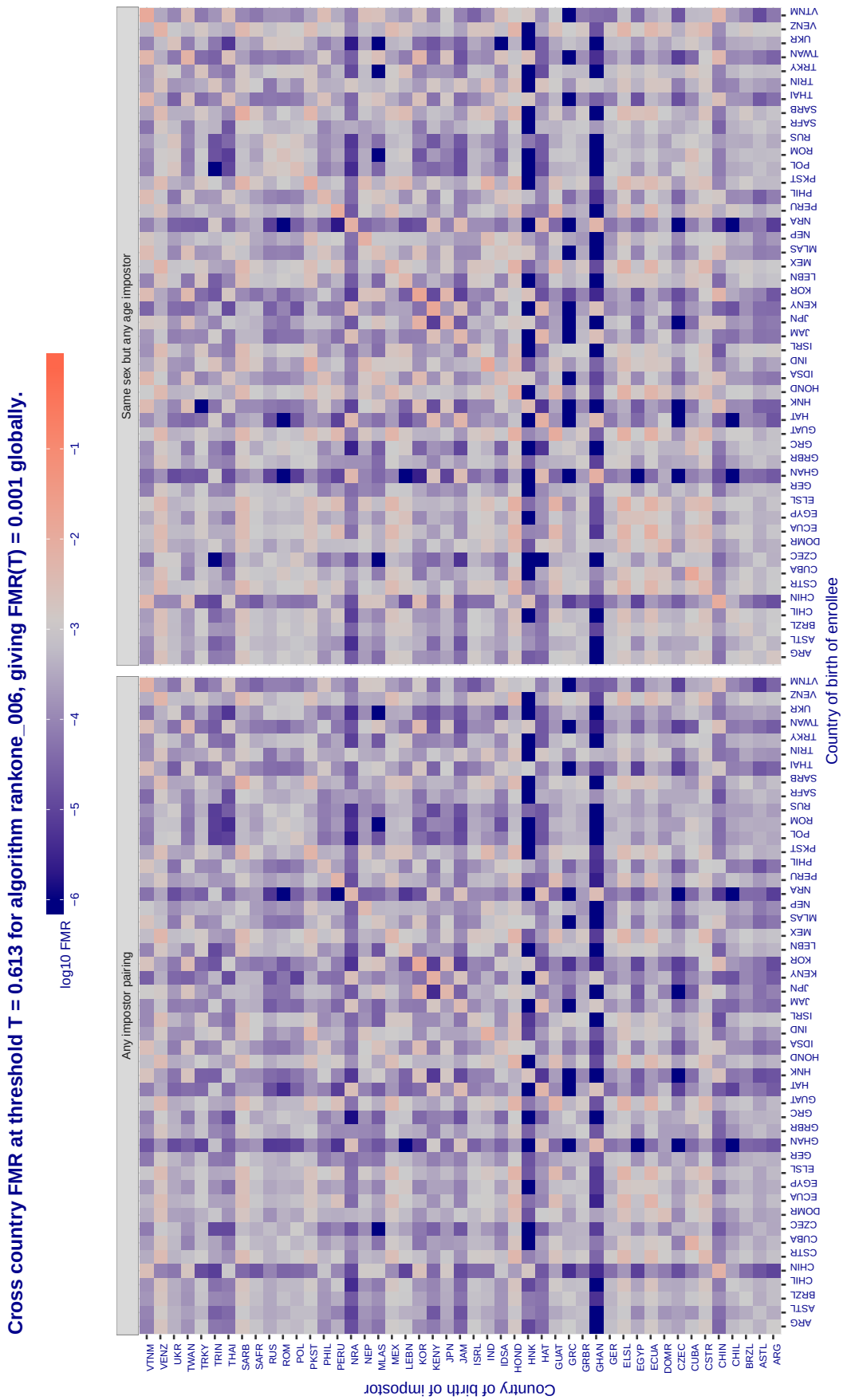


Figure 353: For algorithm rankone-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

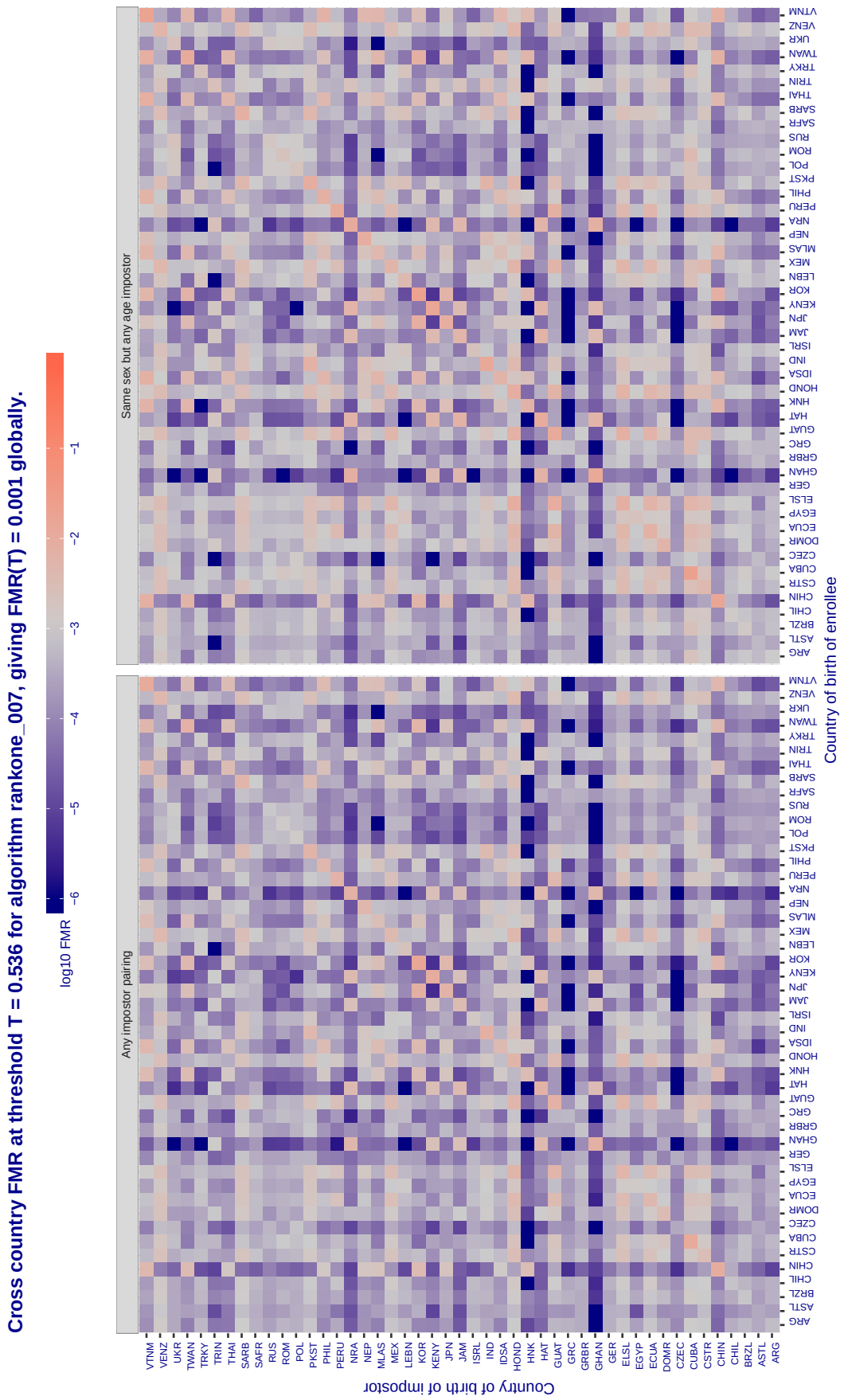


Figure 354: For algorithm rankone-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

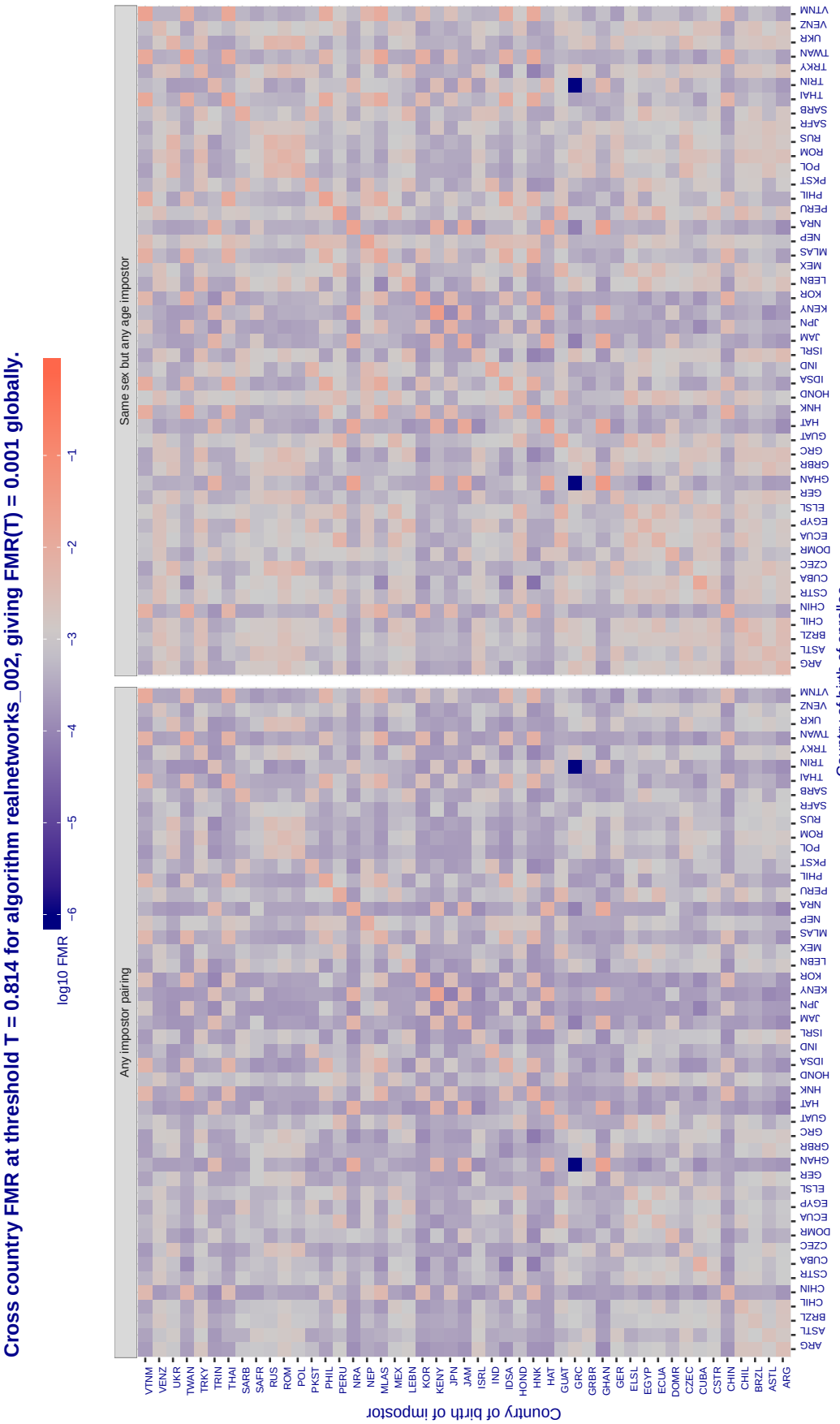


Figure 355: For algorithm realnetworks-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

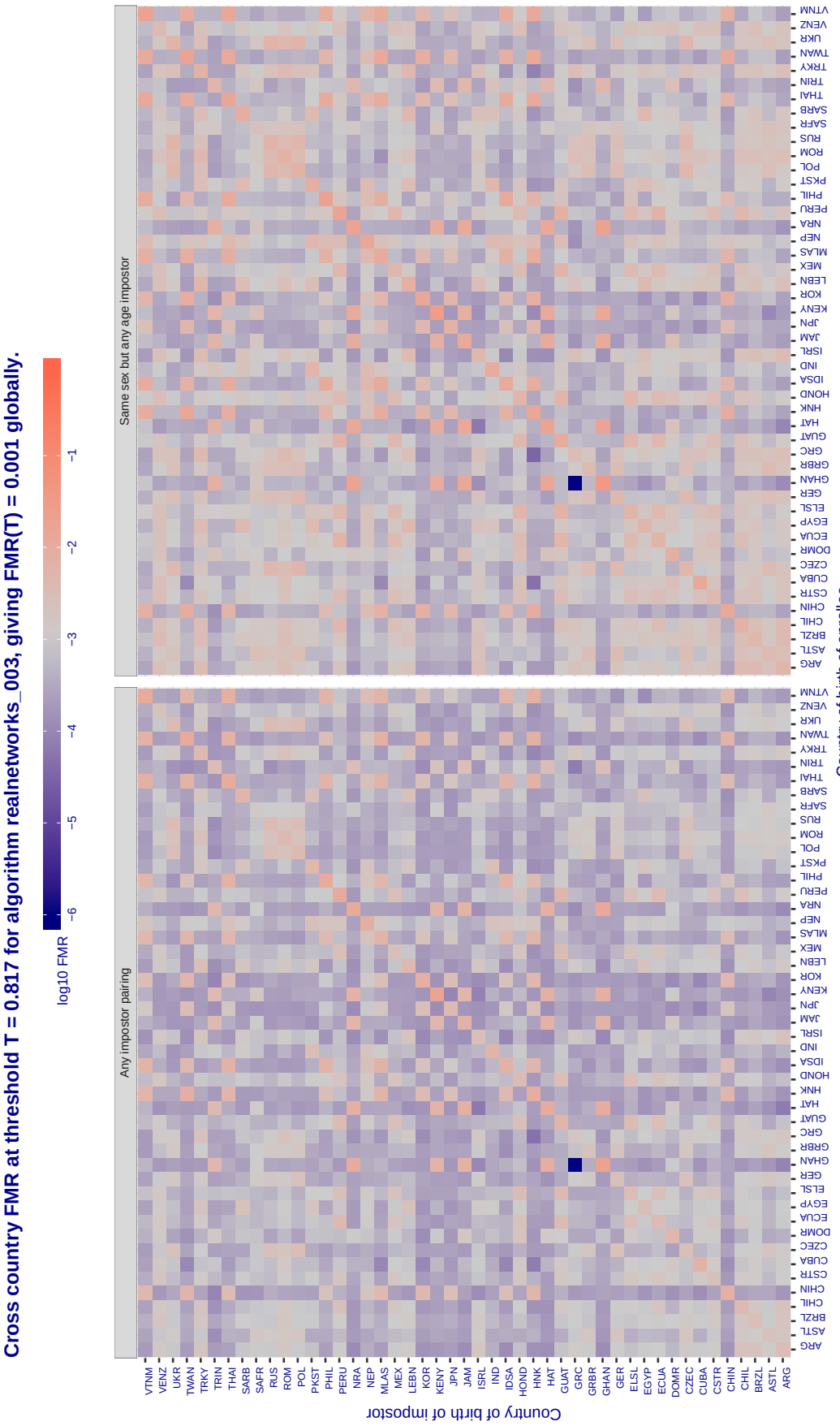


Figure 356: For algorithm realnetworks-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

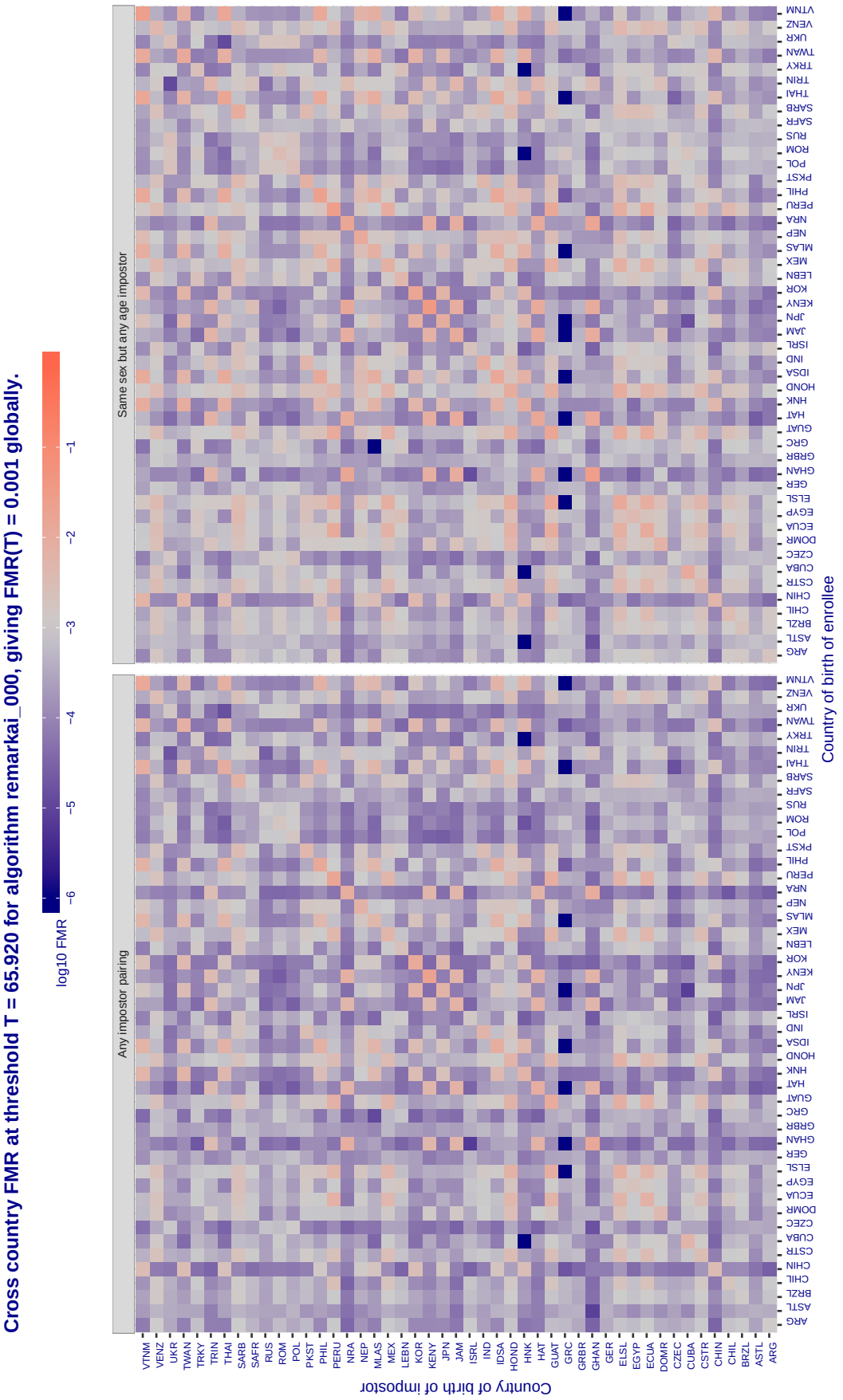


Figure 357: For algorithm remarkai-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

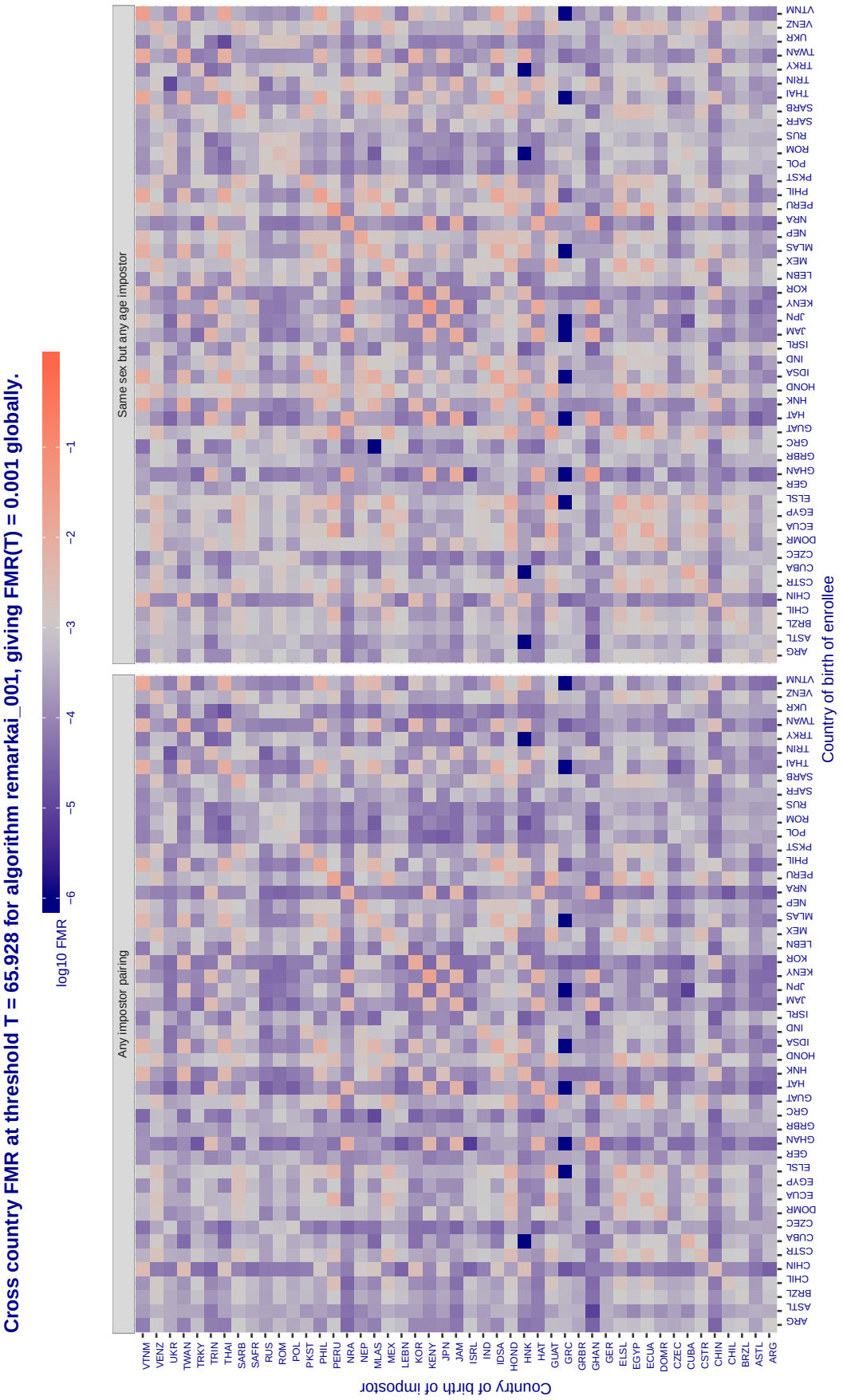


Figure 358: For algorithm remarkai-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

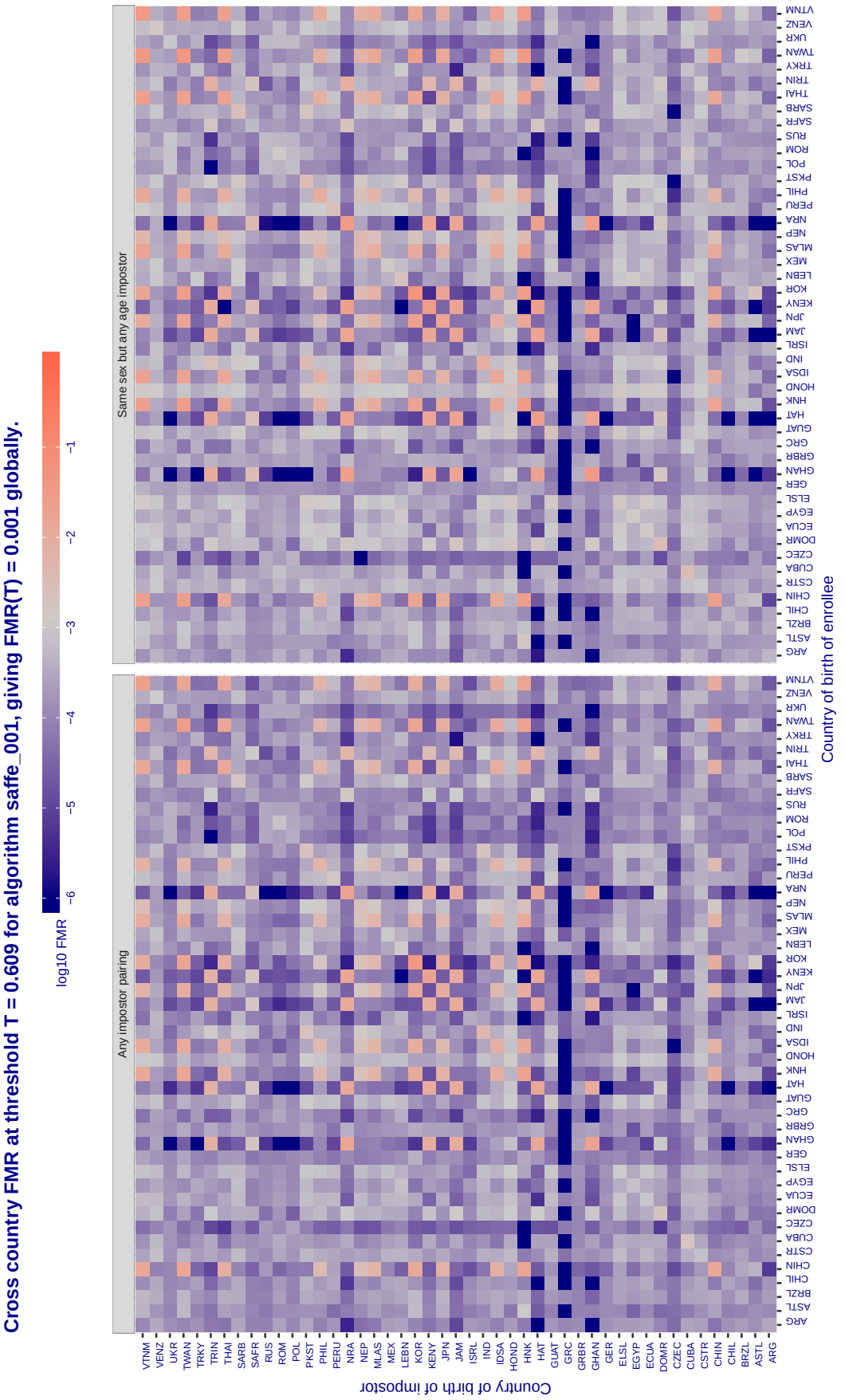


Figure 359: For algorithm saffe-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

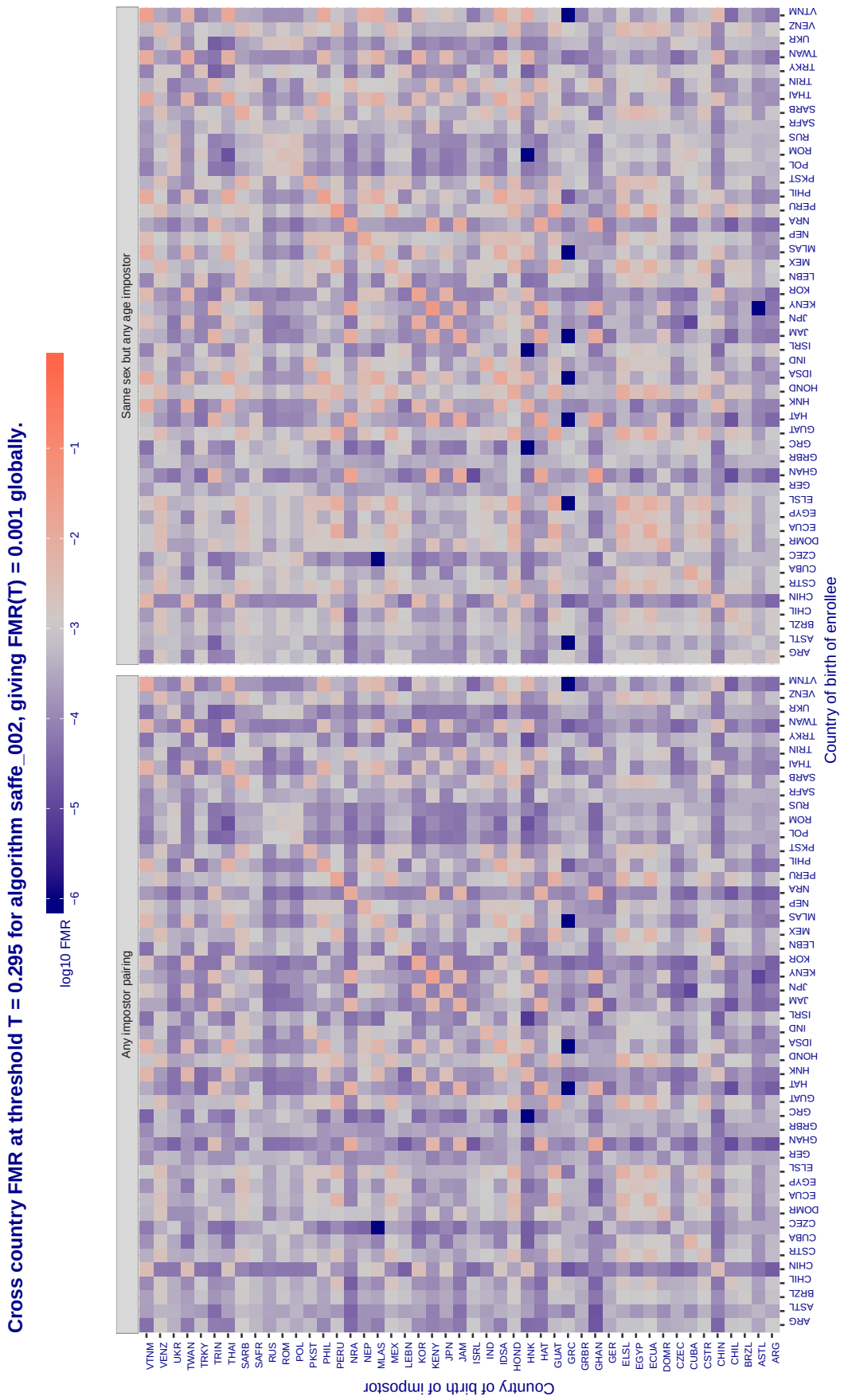


Figure 360: For algorithm saffe-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

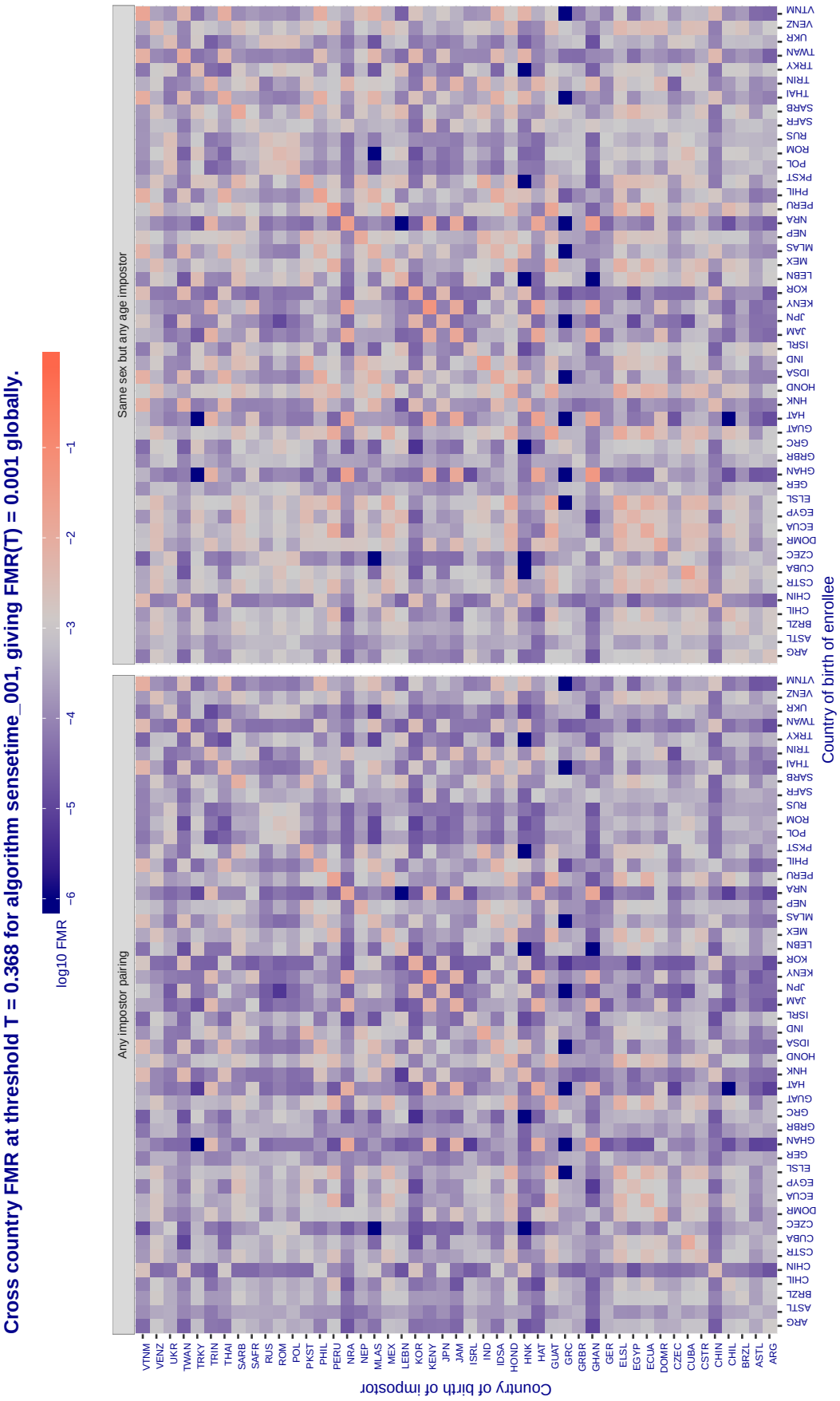


Figure 361: For algorithm sensetime-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

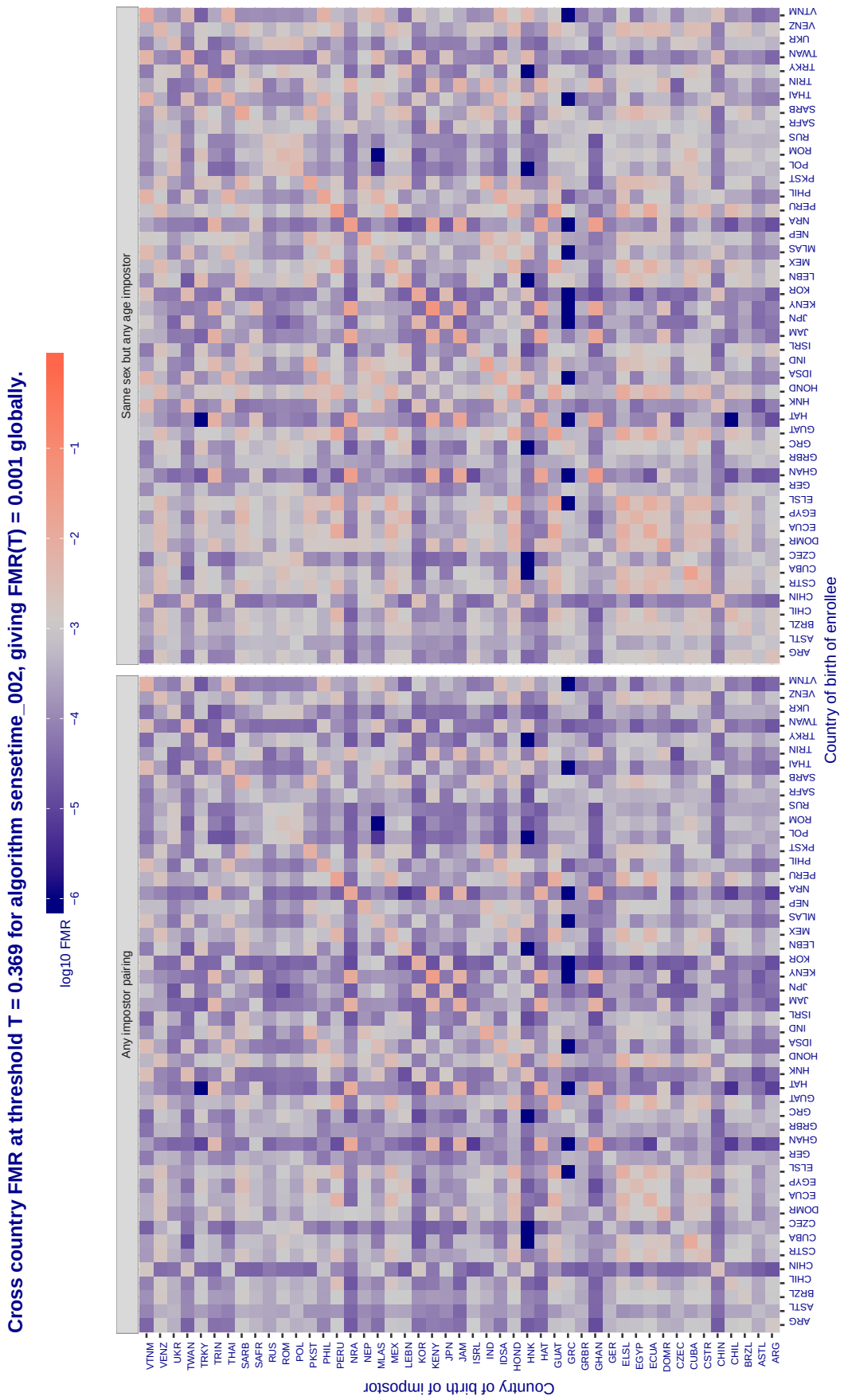


Figure 362: For algorithm sensetime-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

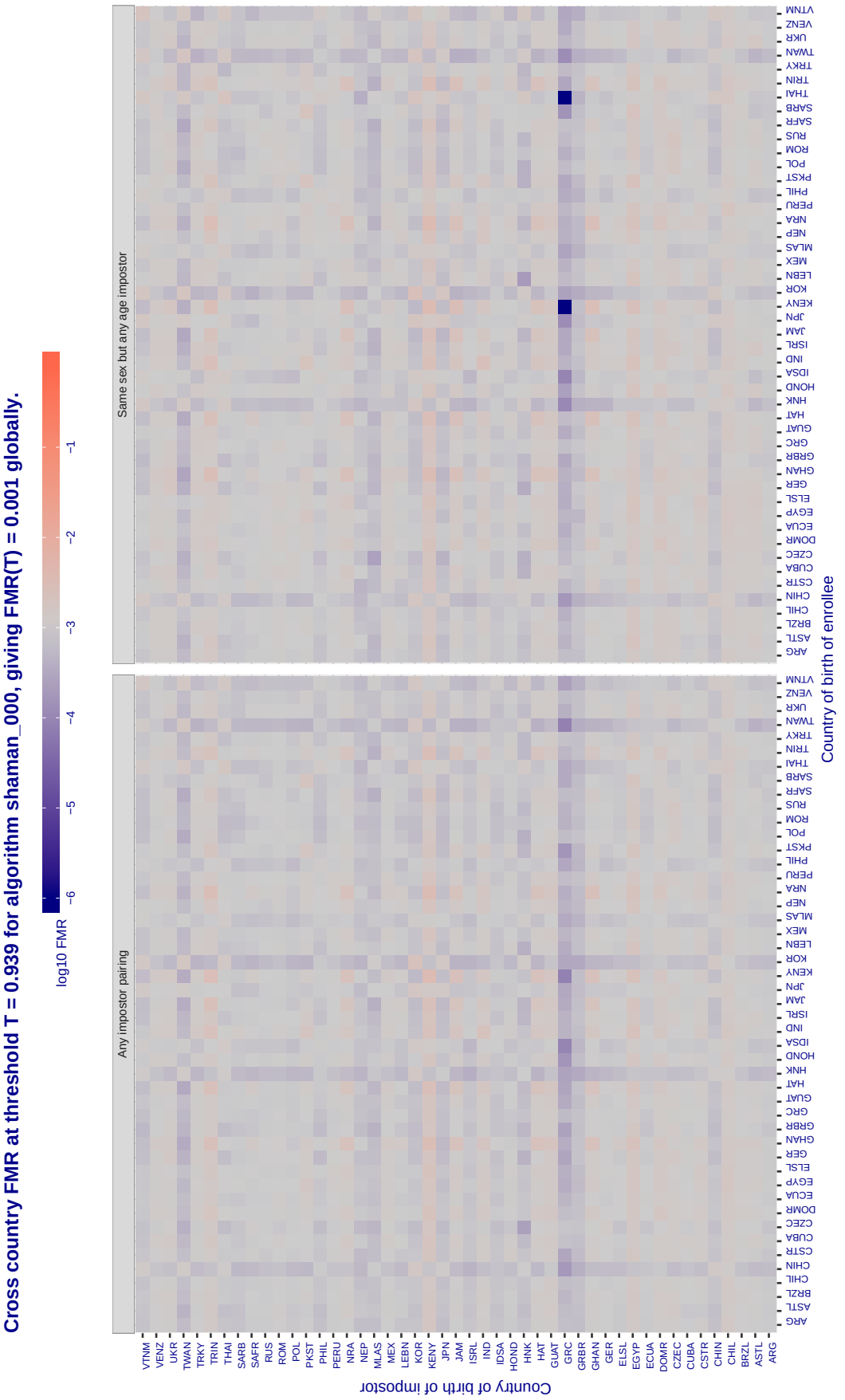


Figure 363: For algorithm shaman-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

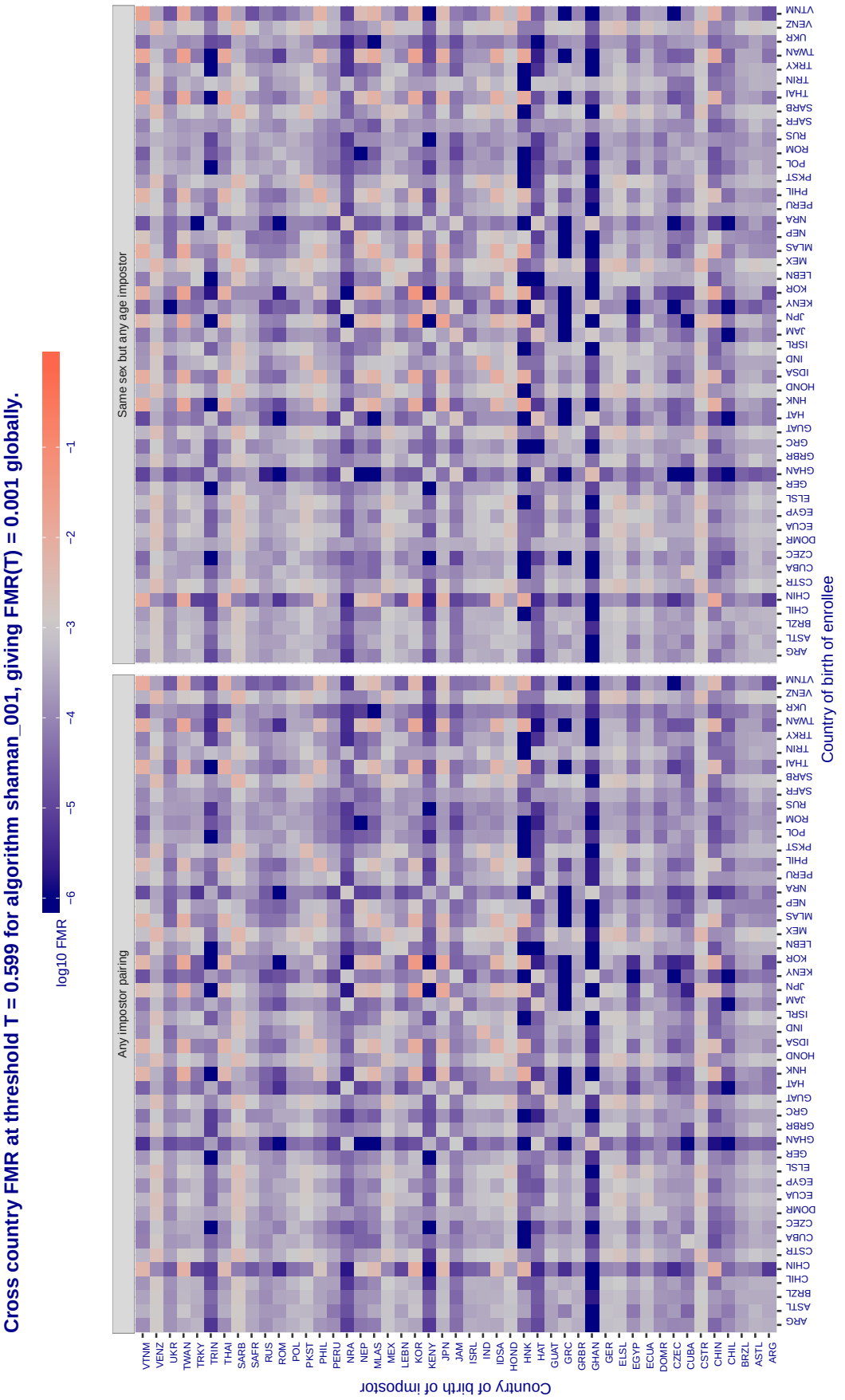


Figure 364: For algorithm shaman-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

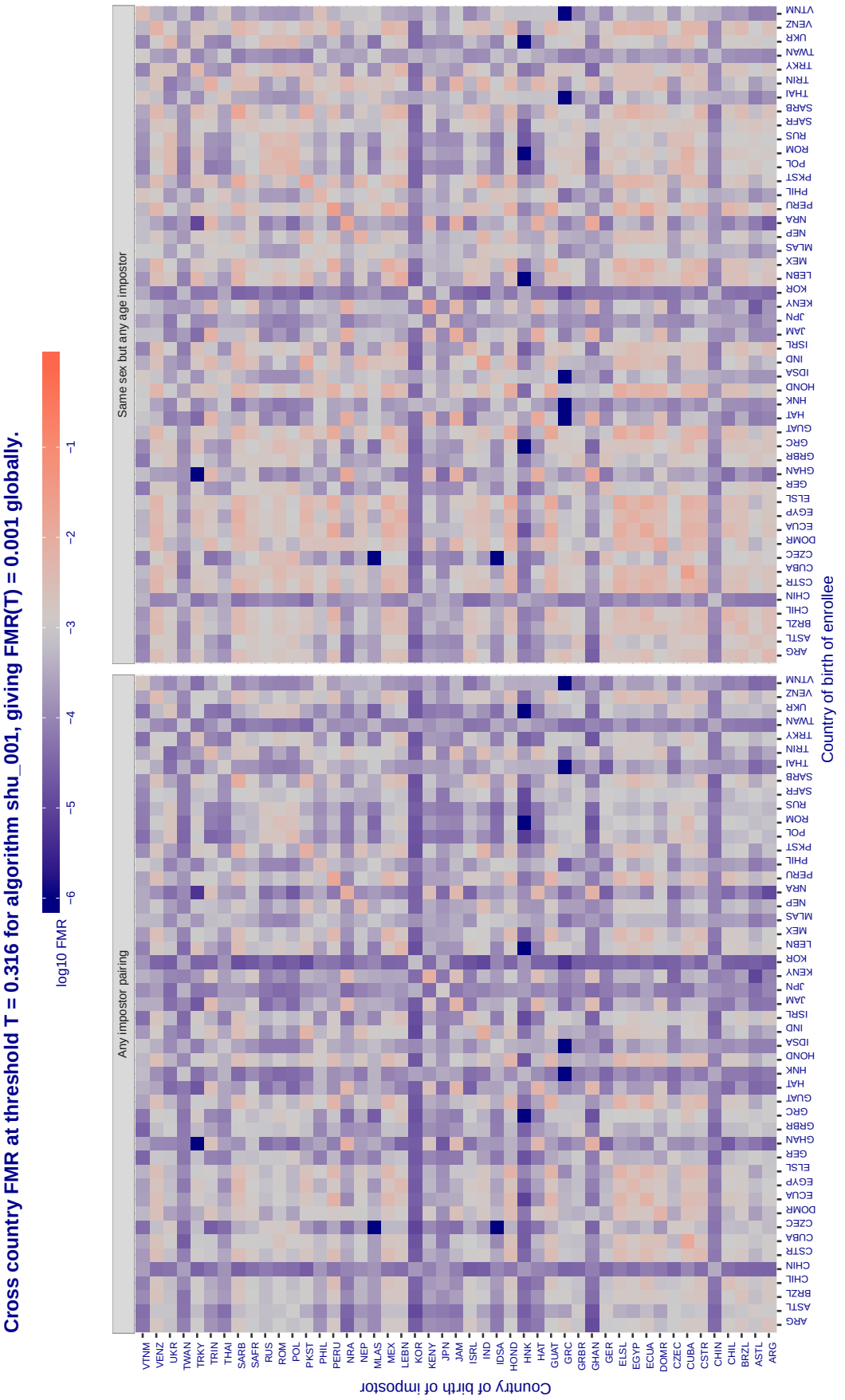


Figure 365: For algorithm shu-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

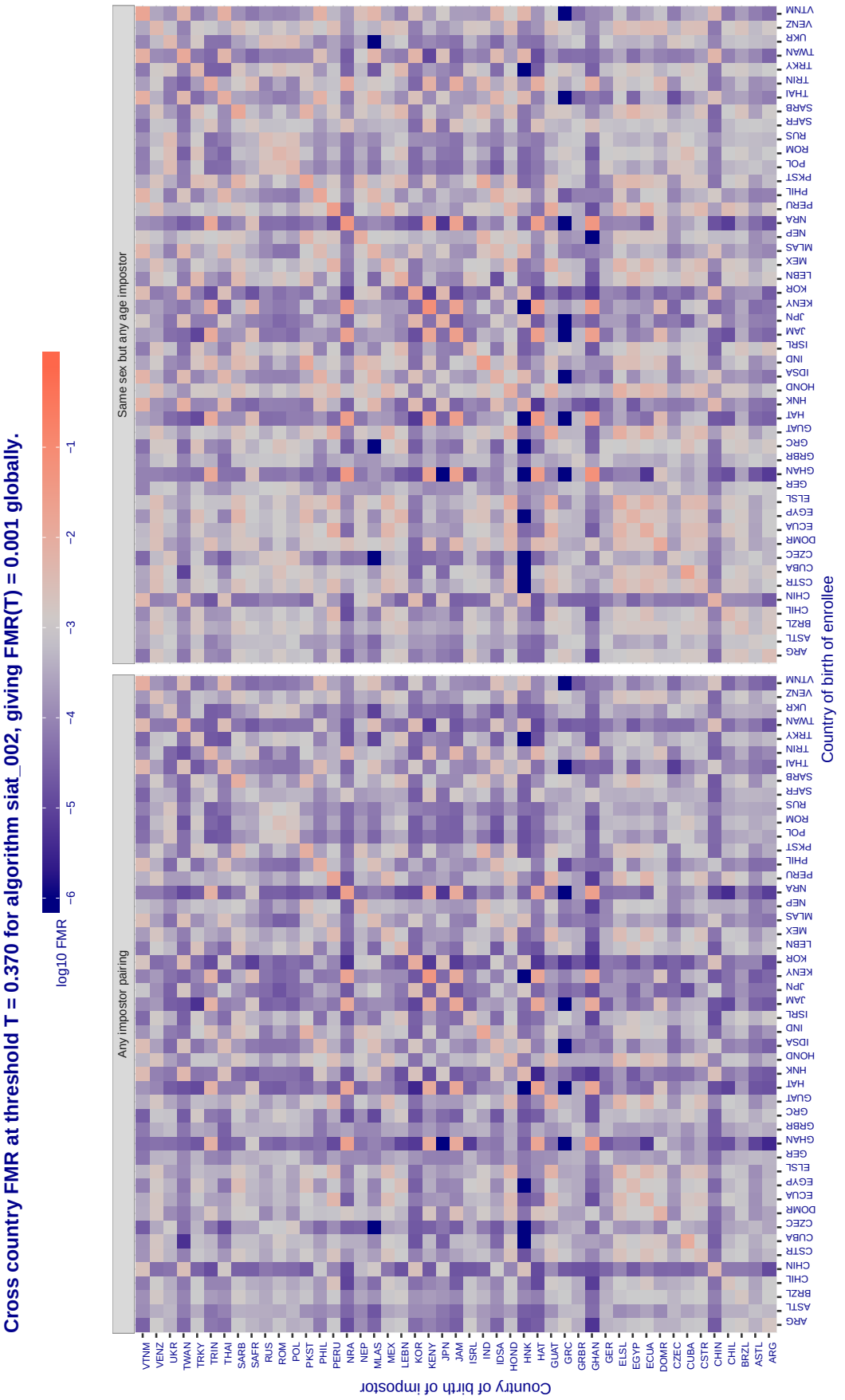


Figure 366: For algorithm siat-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

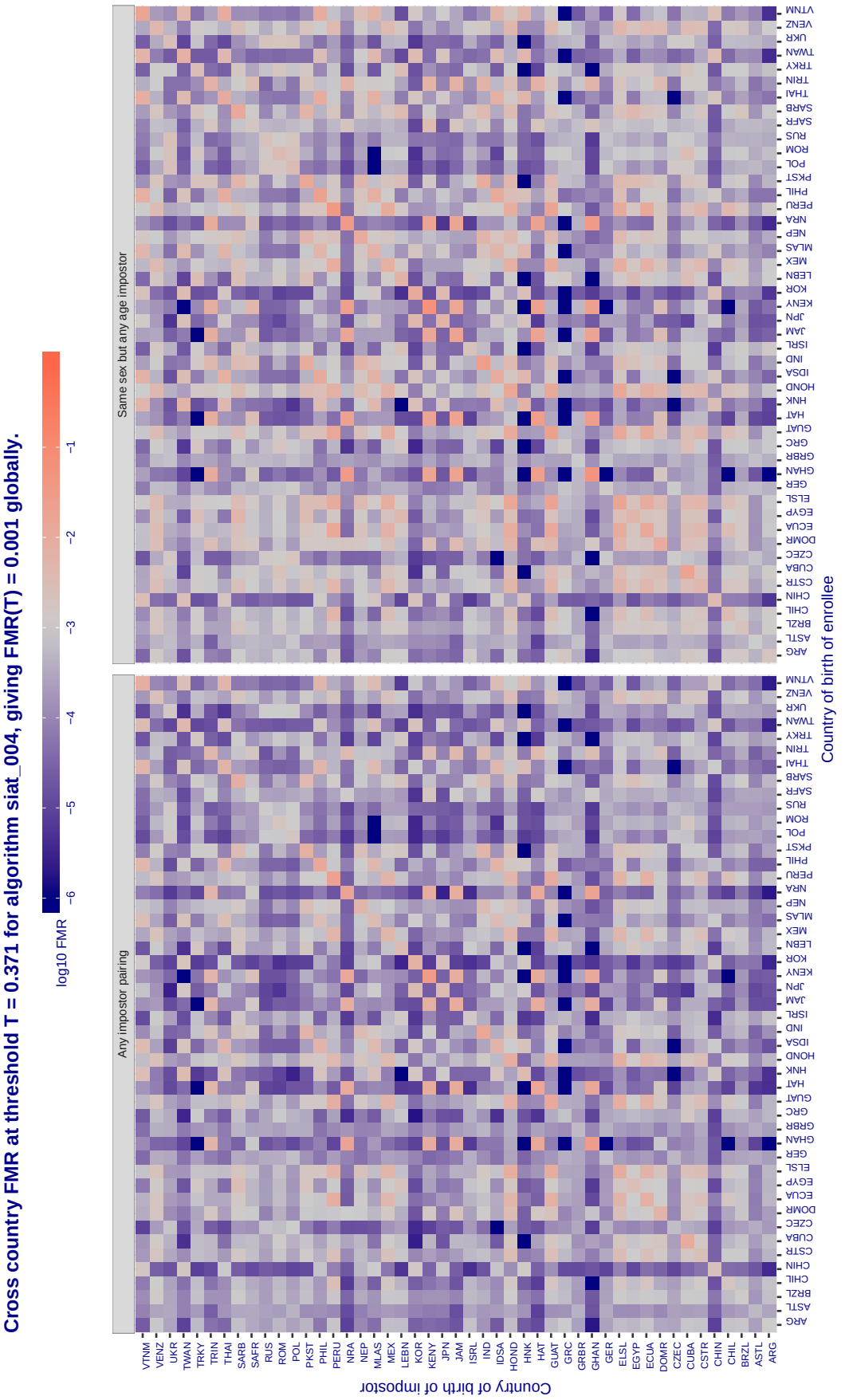


Figure 367: For algorithm siat-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

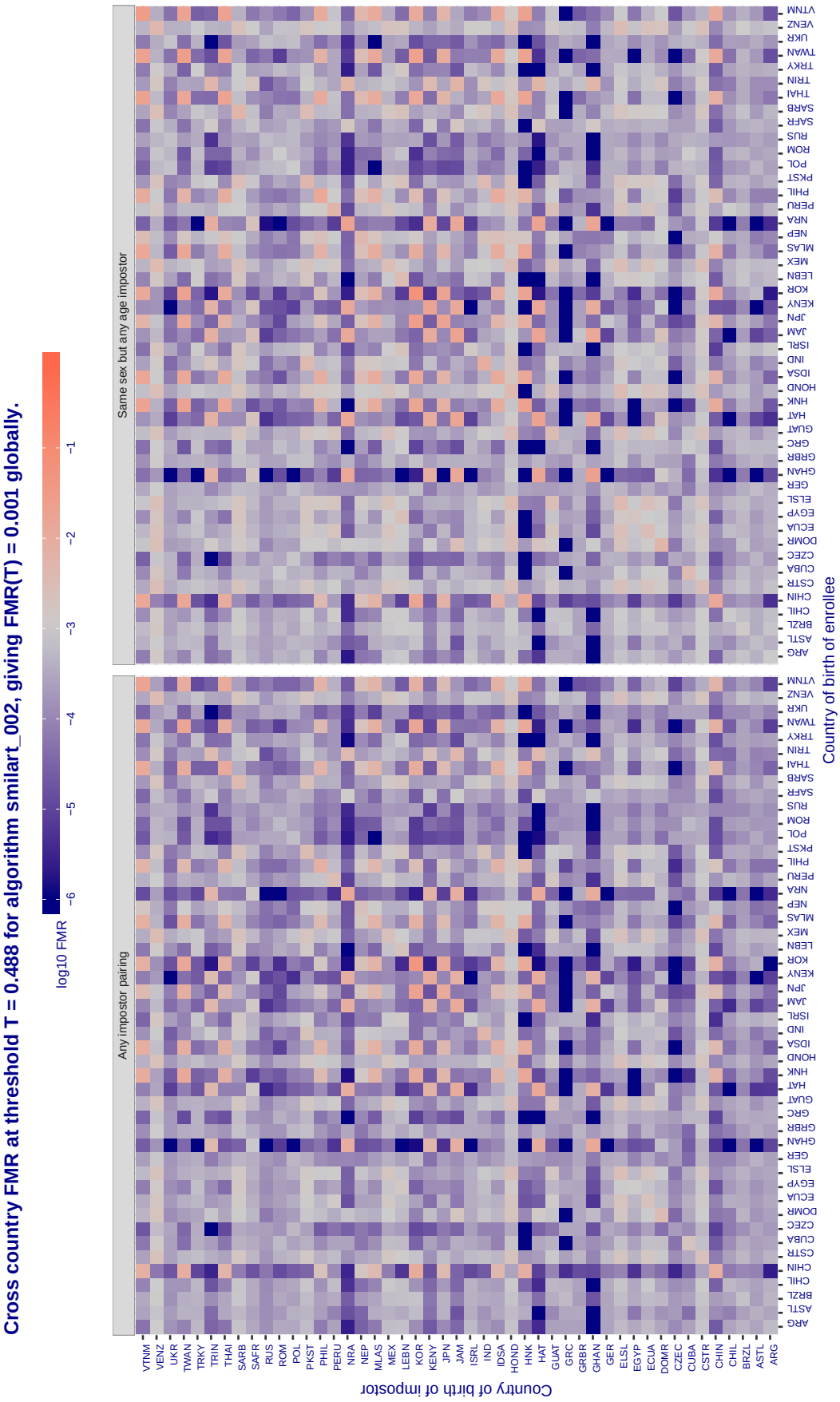


Figure 368: For algorithm smilart-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

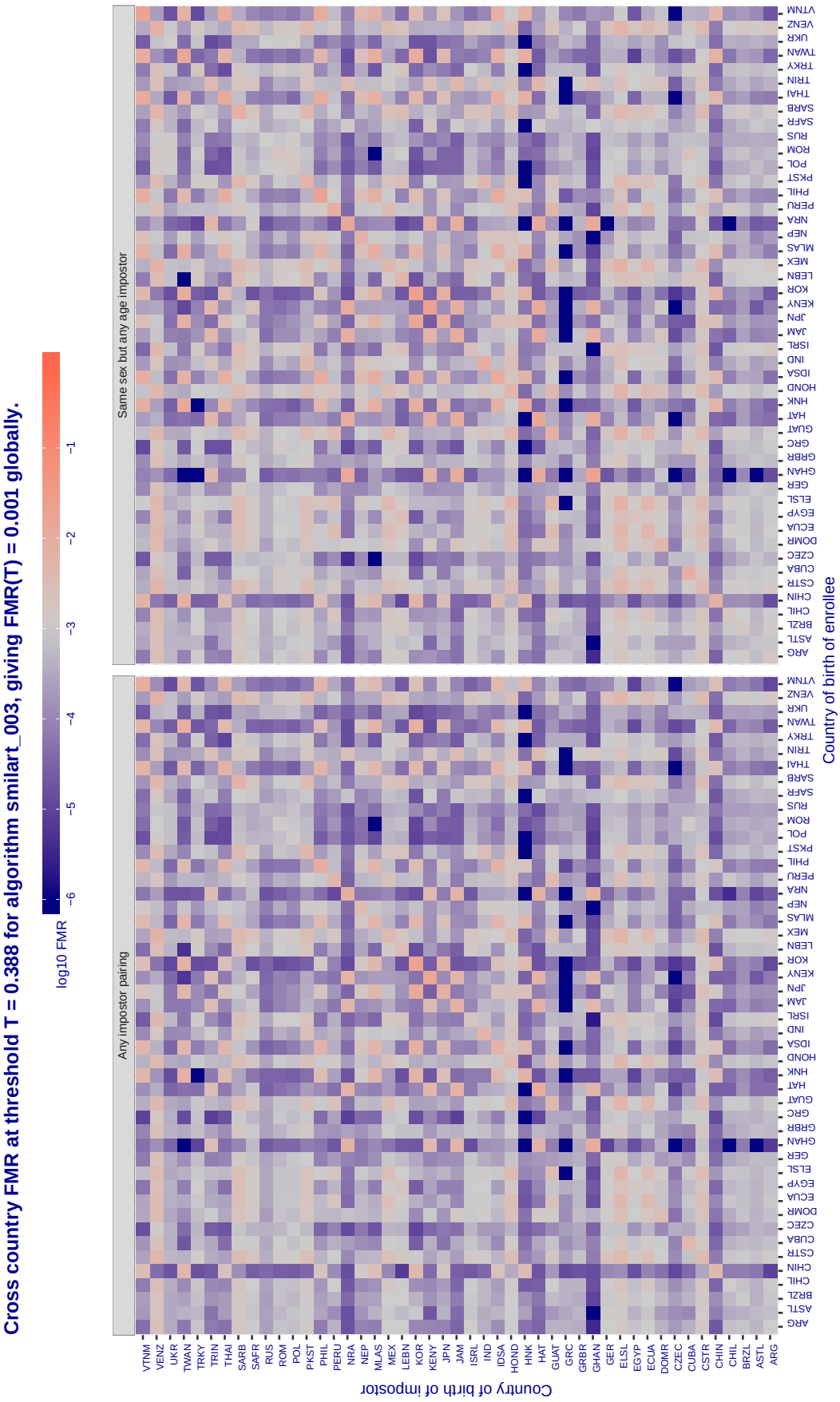


Figure 369: For algorithm smilart-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

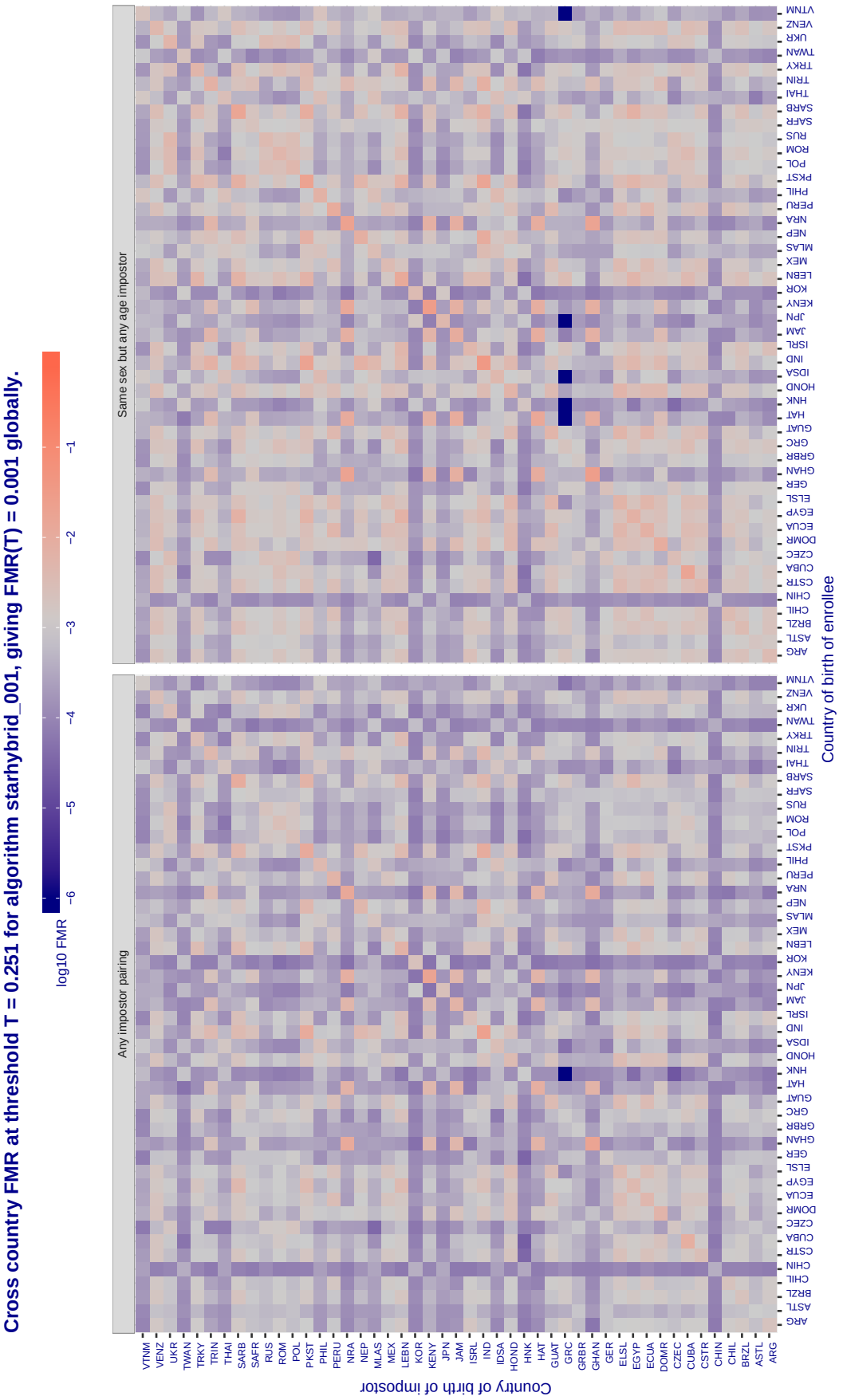


Figure 370: For algorithm starhybrid-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

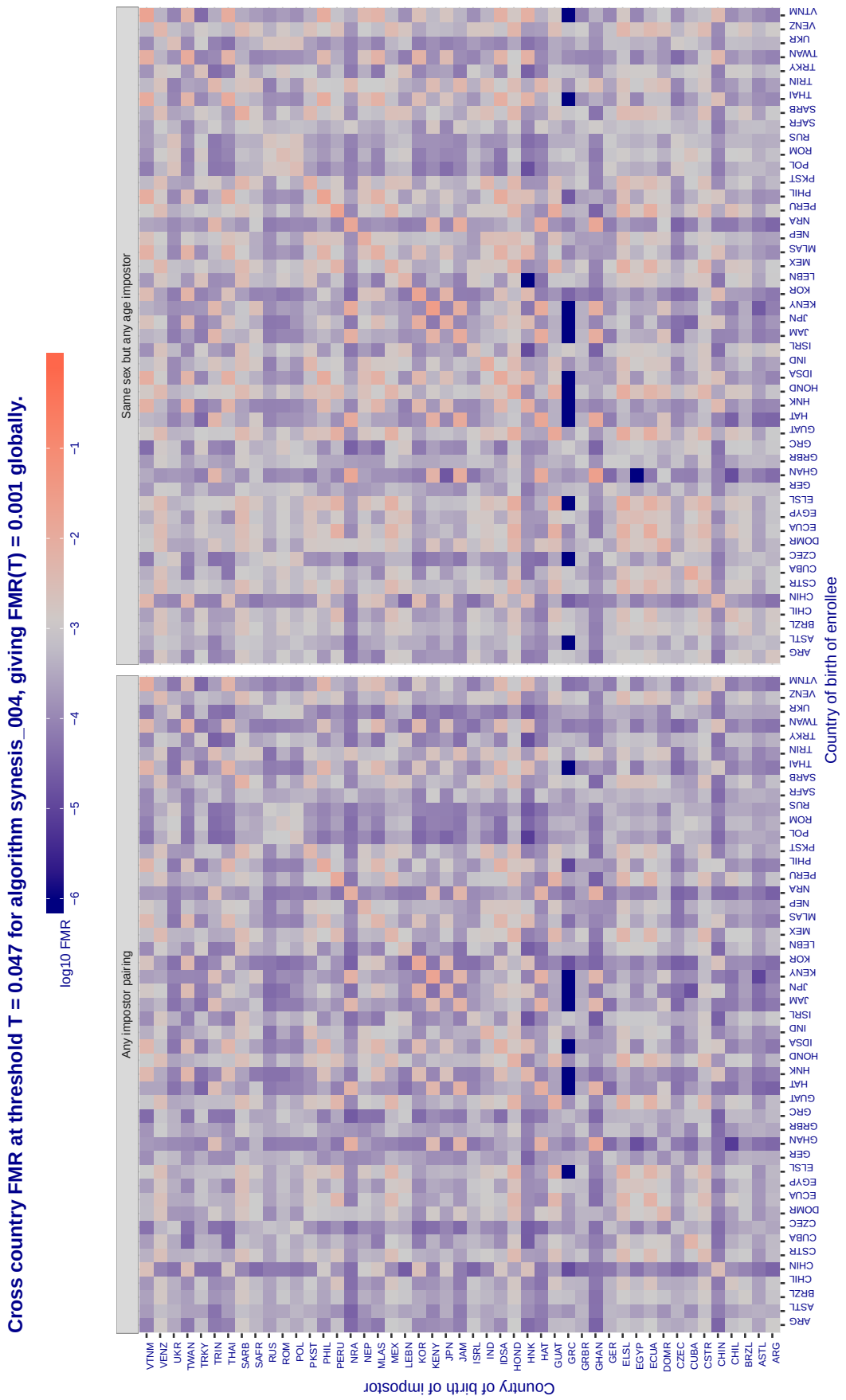


Figure 371: For algorithm synesis-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

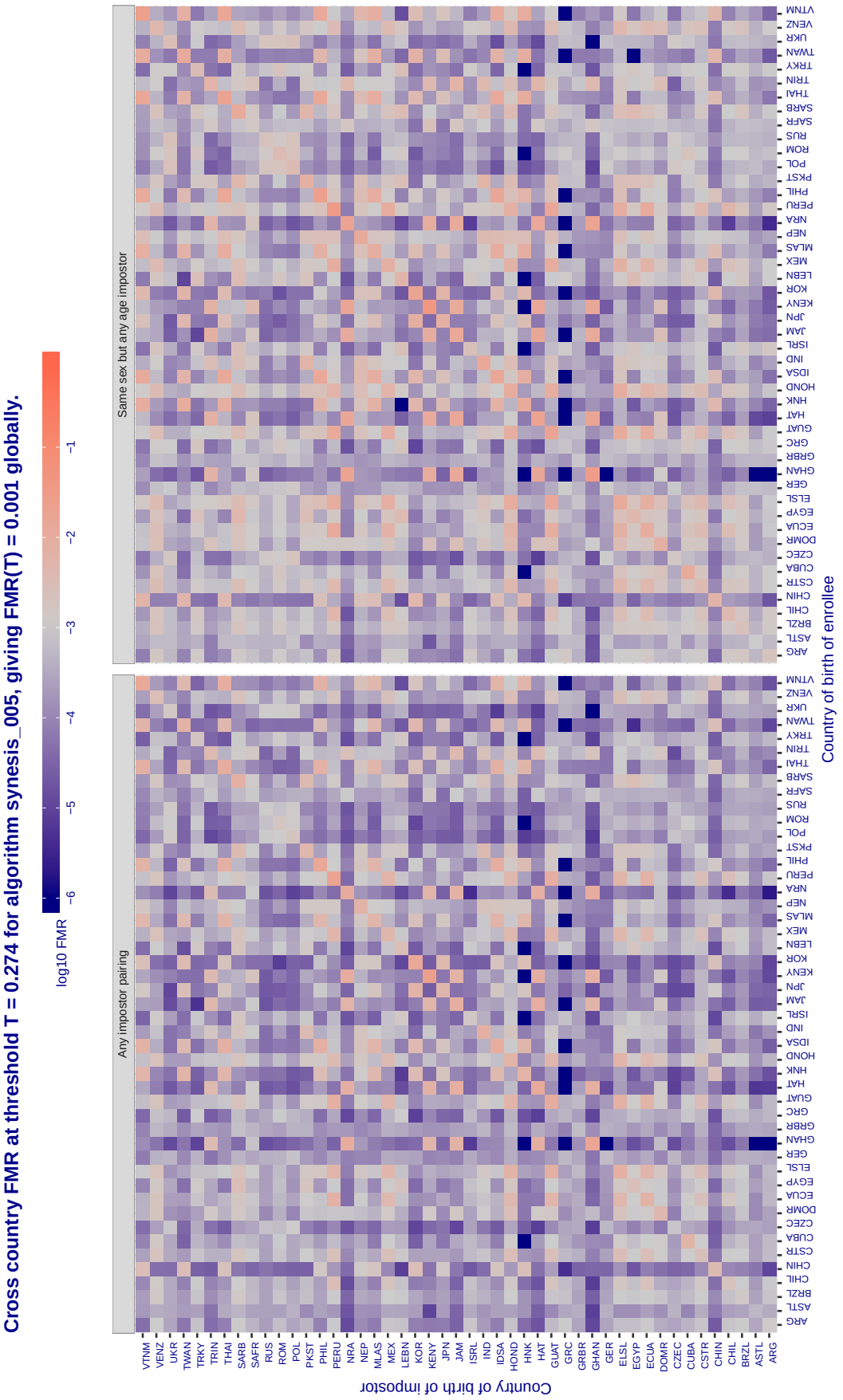


Figure 372: For algorithm synesis-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

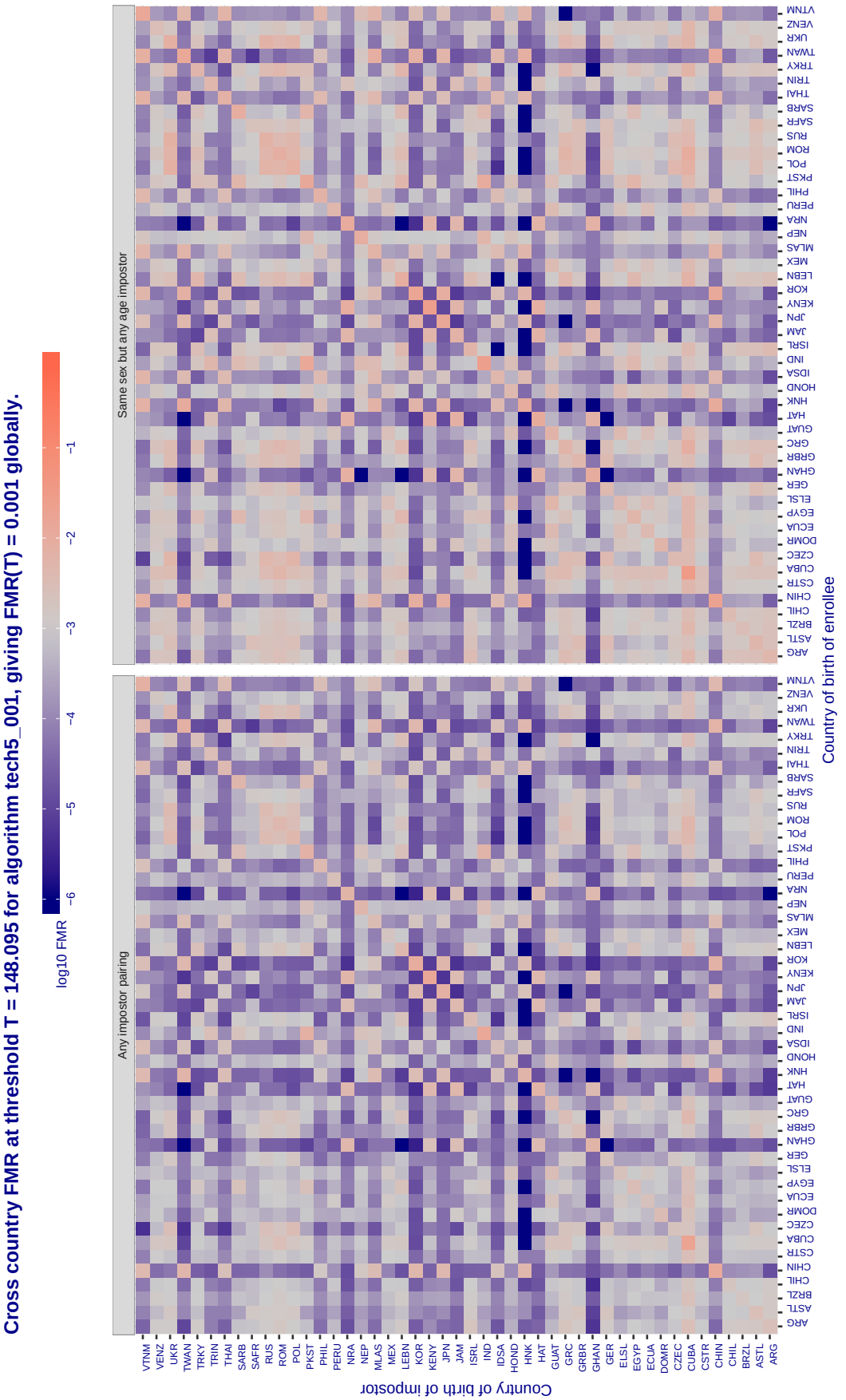


Figure 373: For algorithm tech5-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

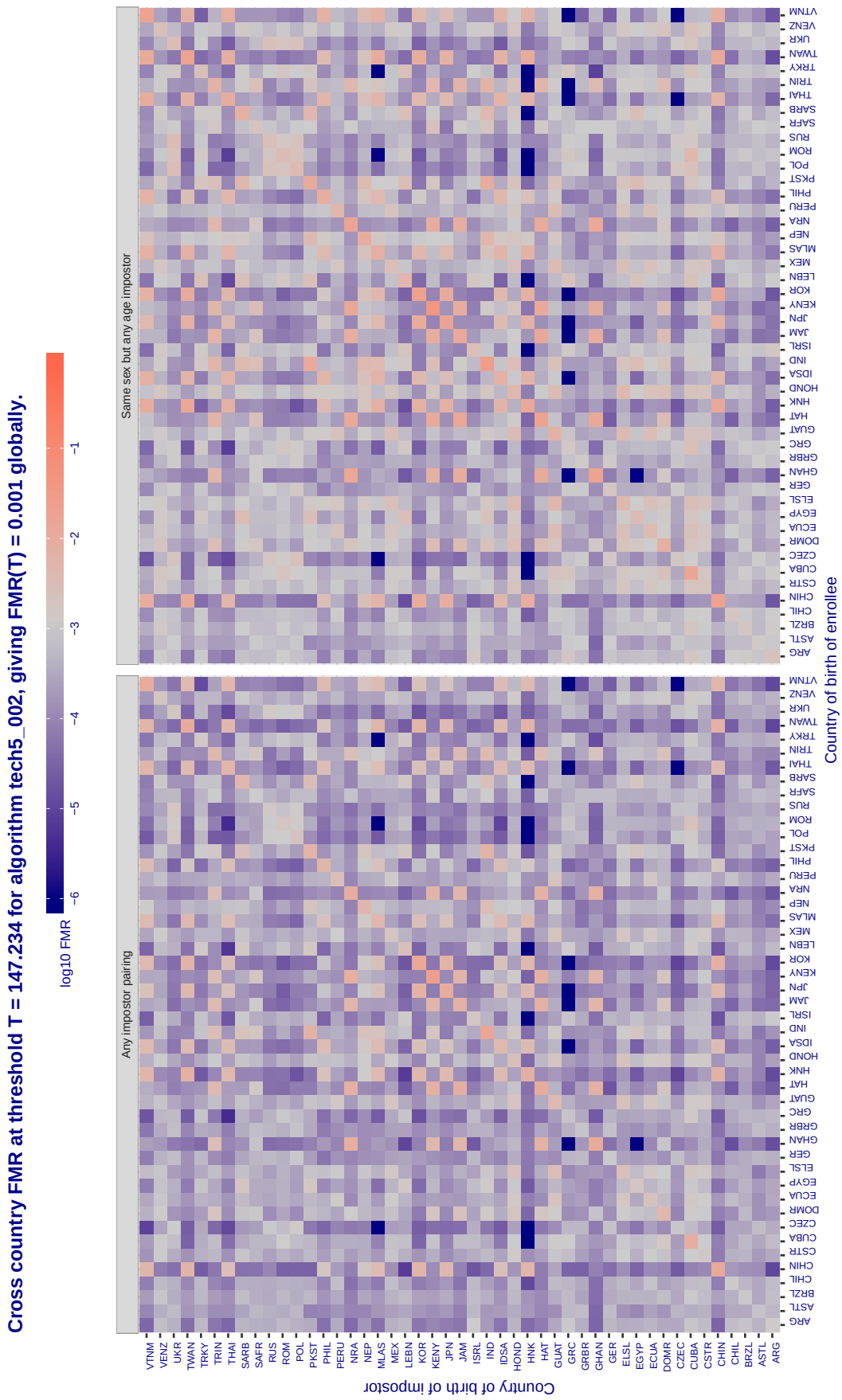


Figure 374: For algorithm tech5-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

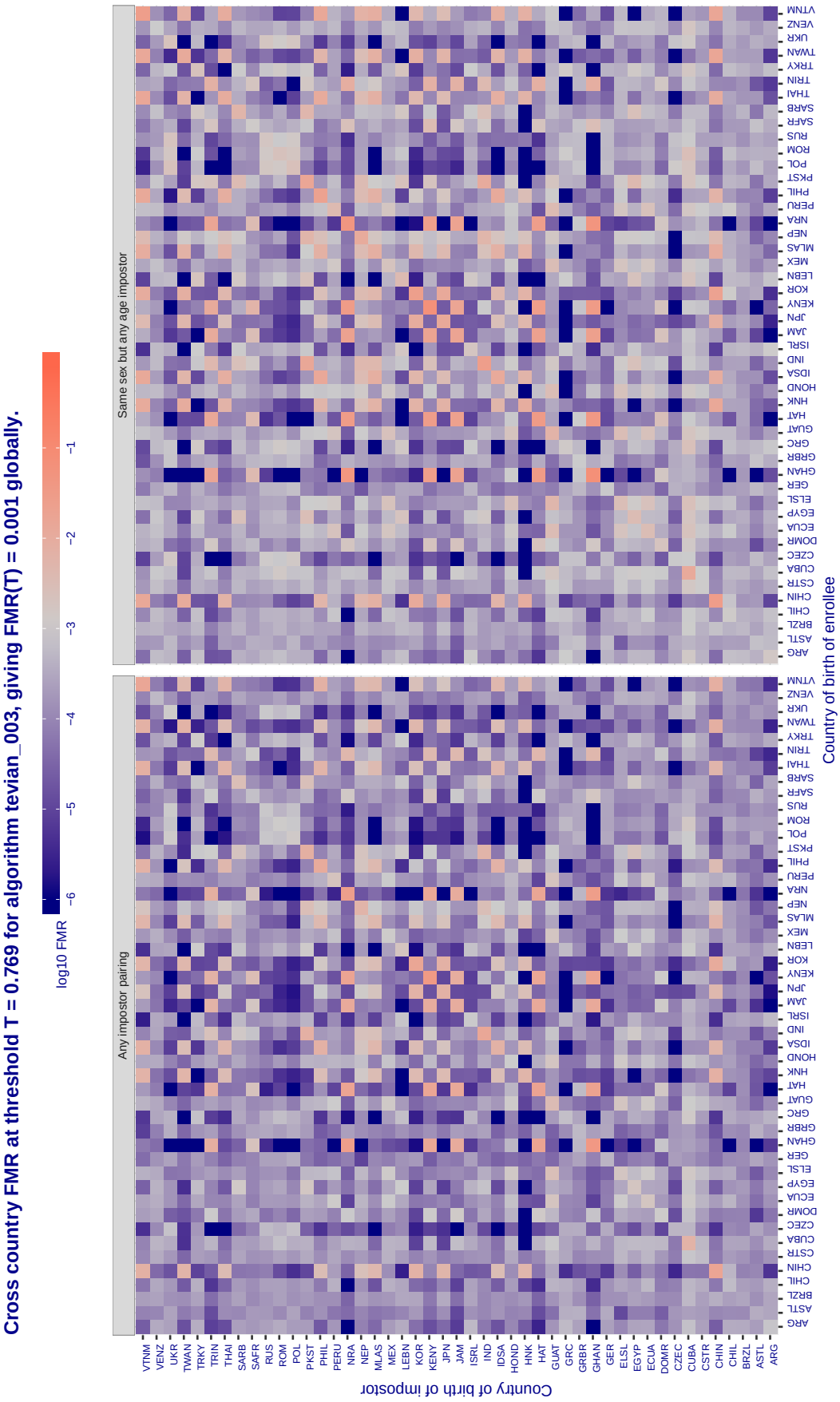


Figure 375: For algorithm tevian-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

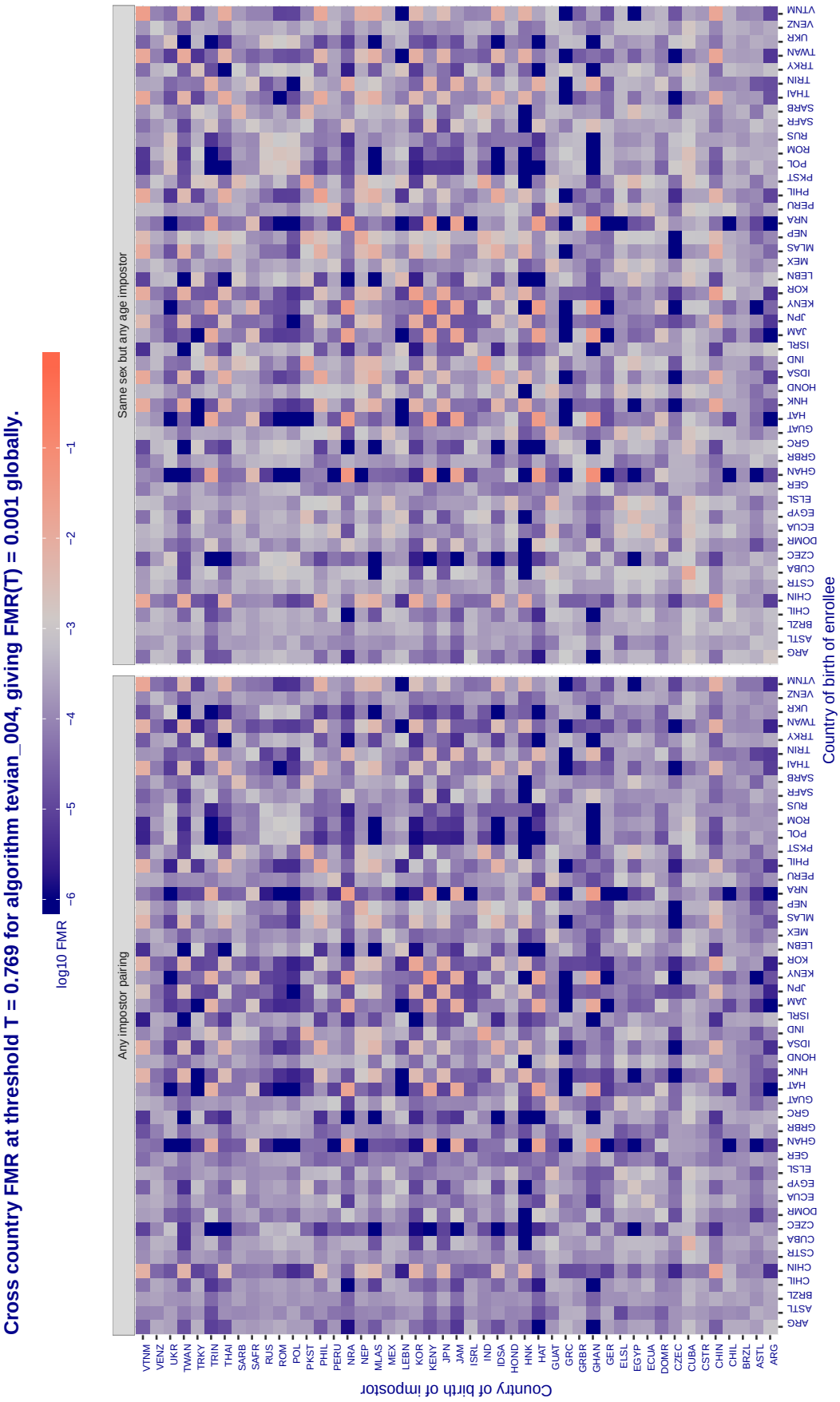


Figure 376: For algorithm tevian-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

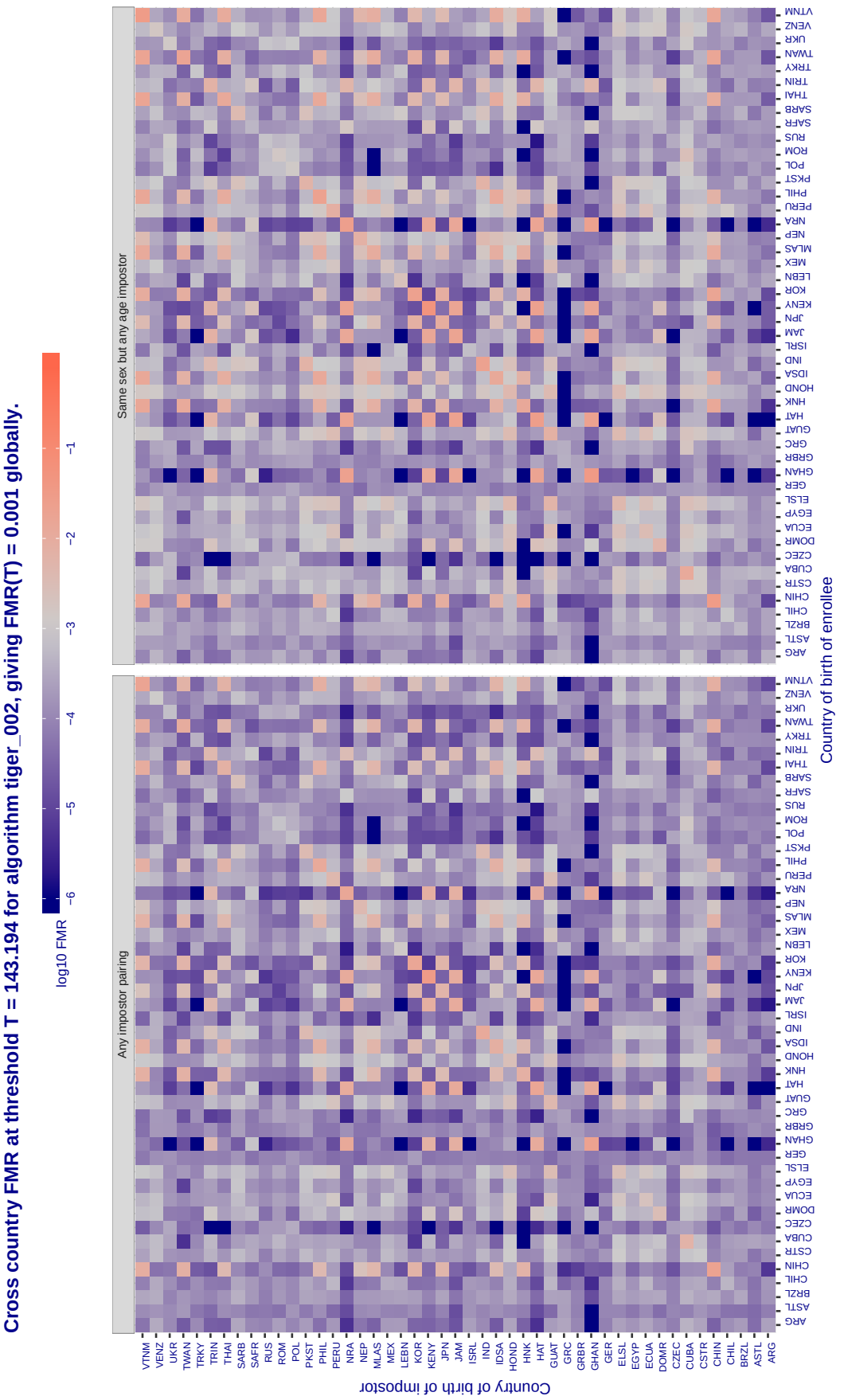


Figure 377: For algorithm tiger-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

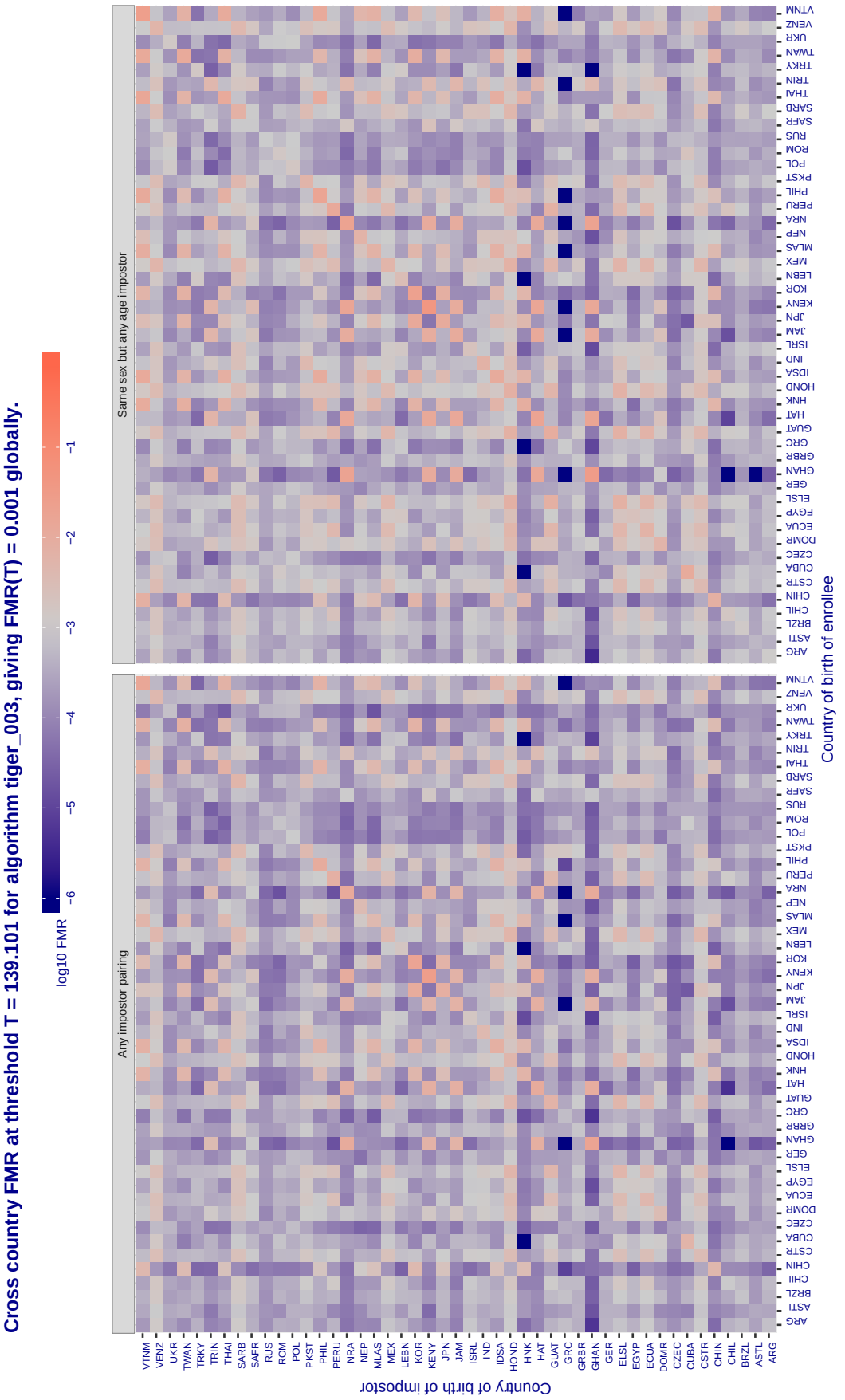


Figure 378: For algorithm tiger-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

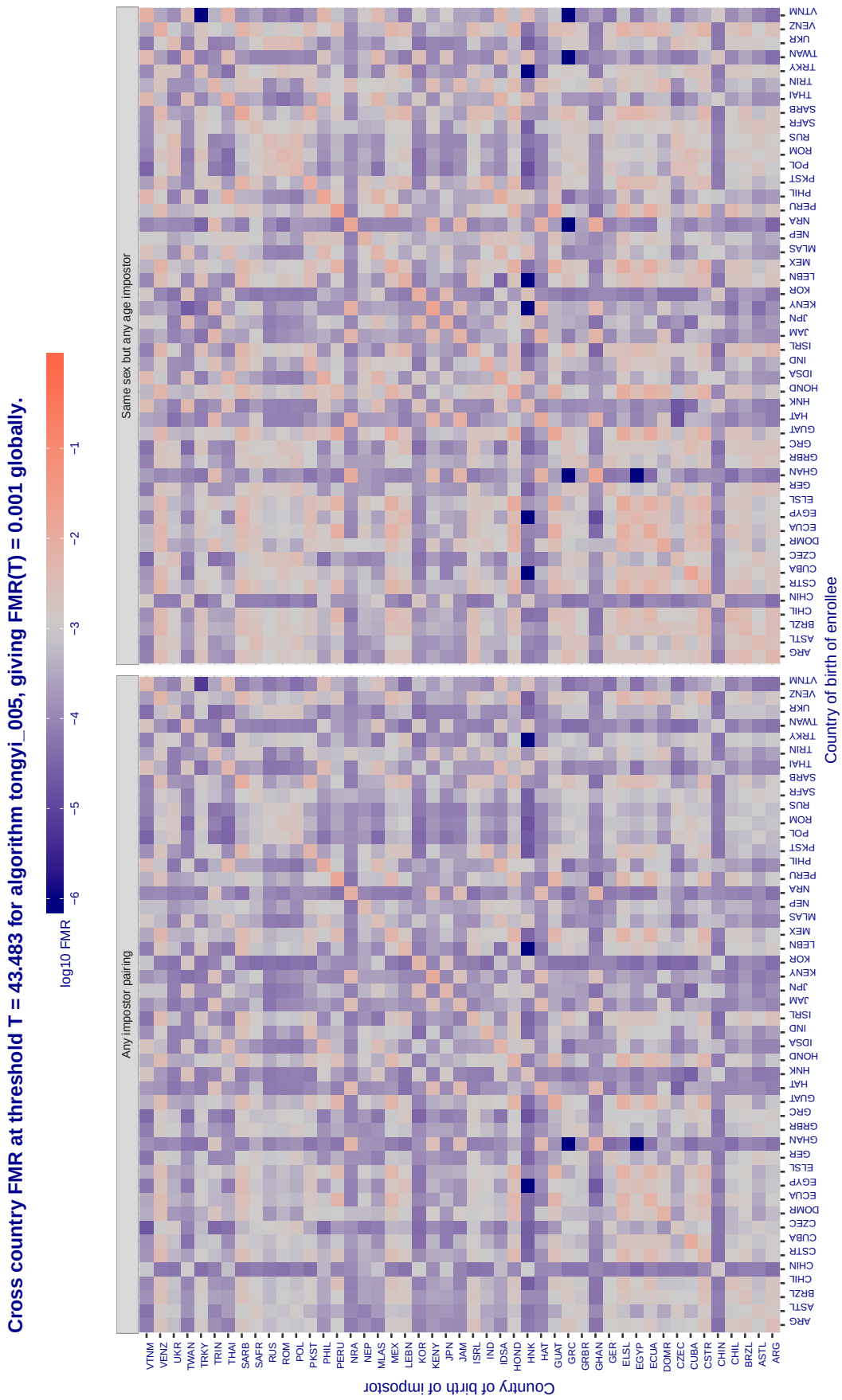


Figure 379: For algorithm tongyi-005 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

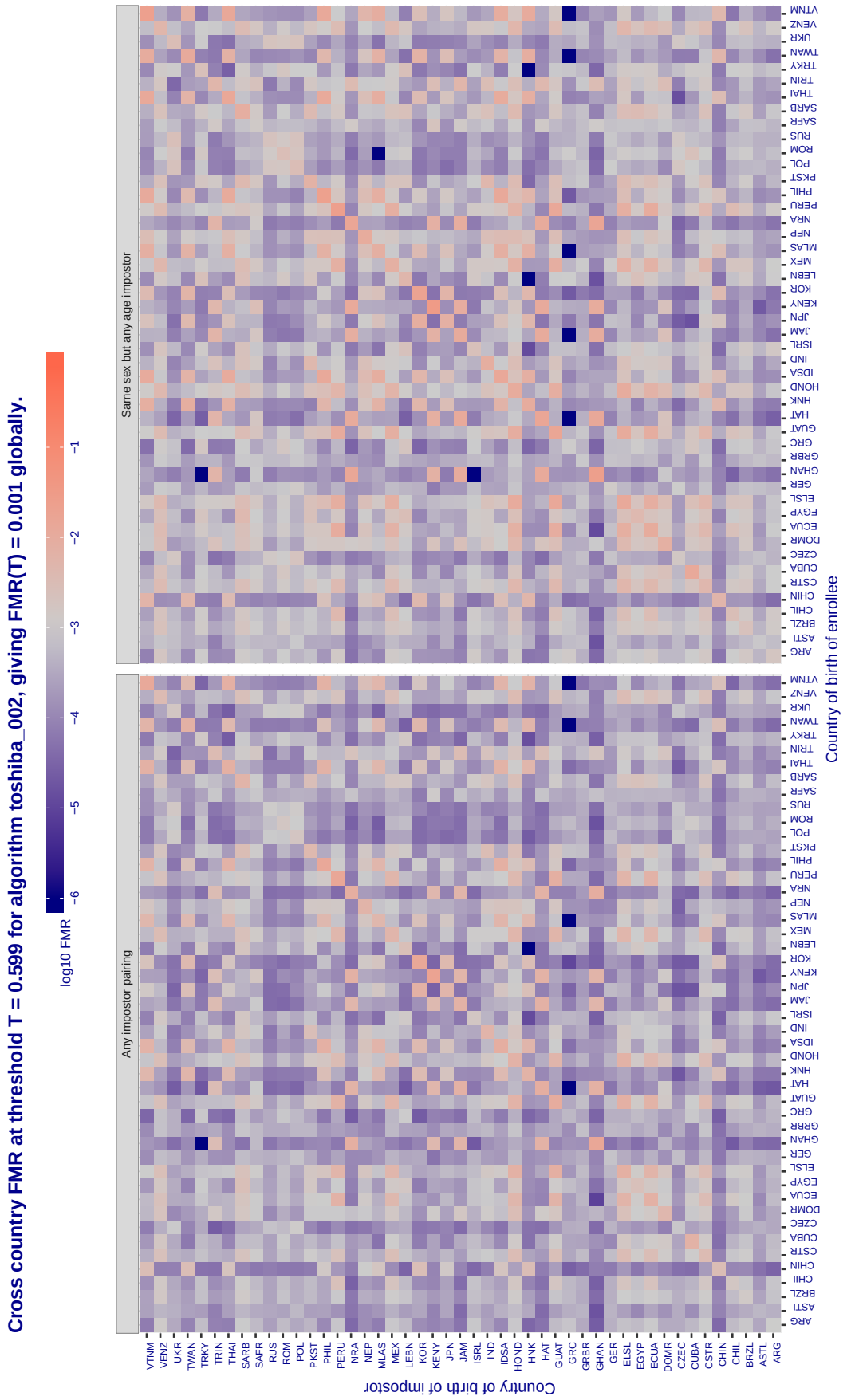


Figure 380: For algorithm toshiba-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

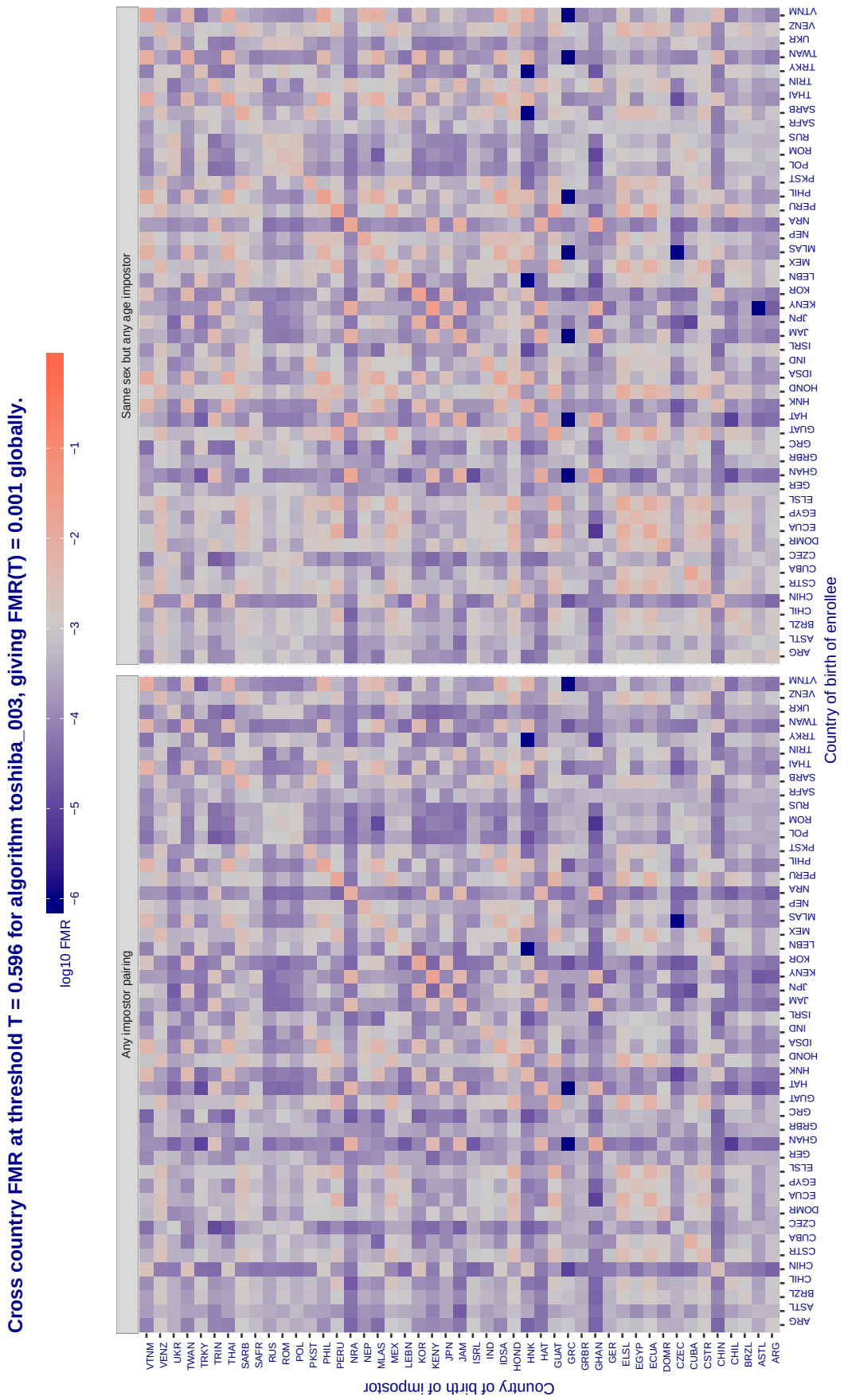


Figure 381: For algorithm toshiba-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

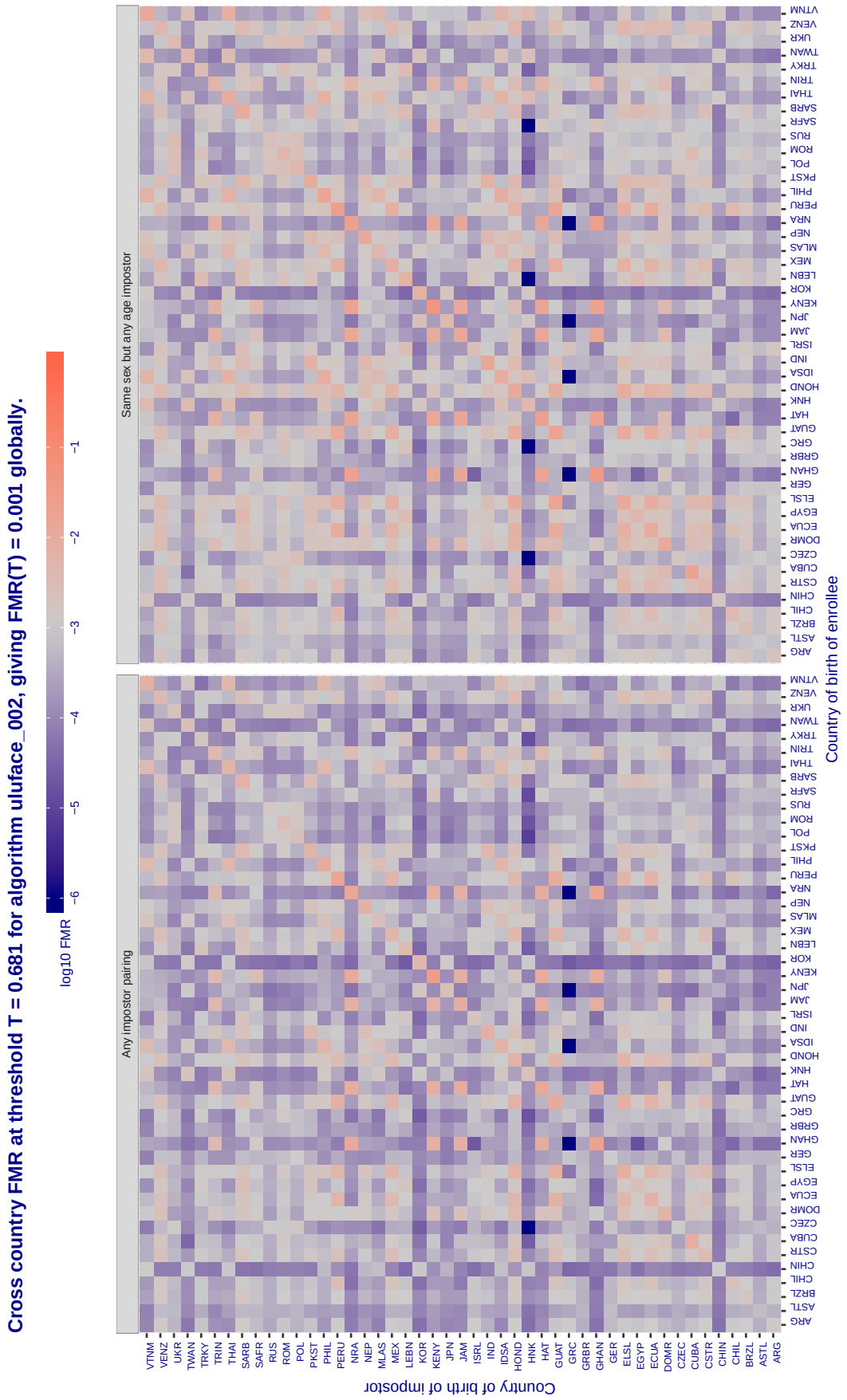


Figure 382: For algorithm uluface-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

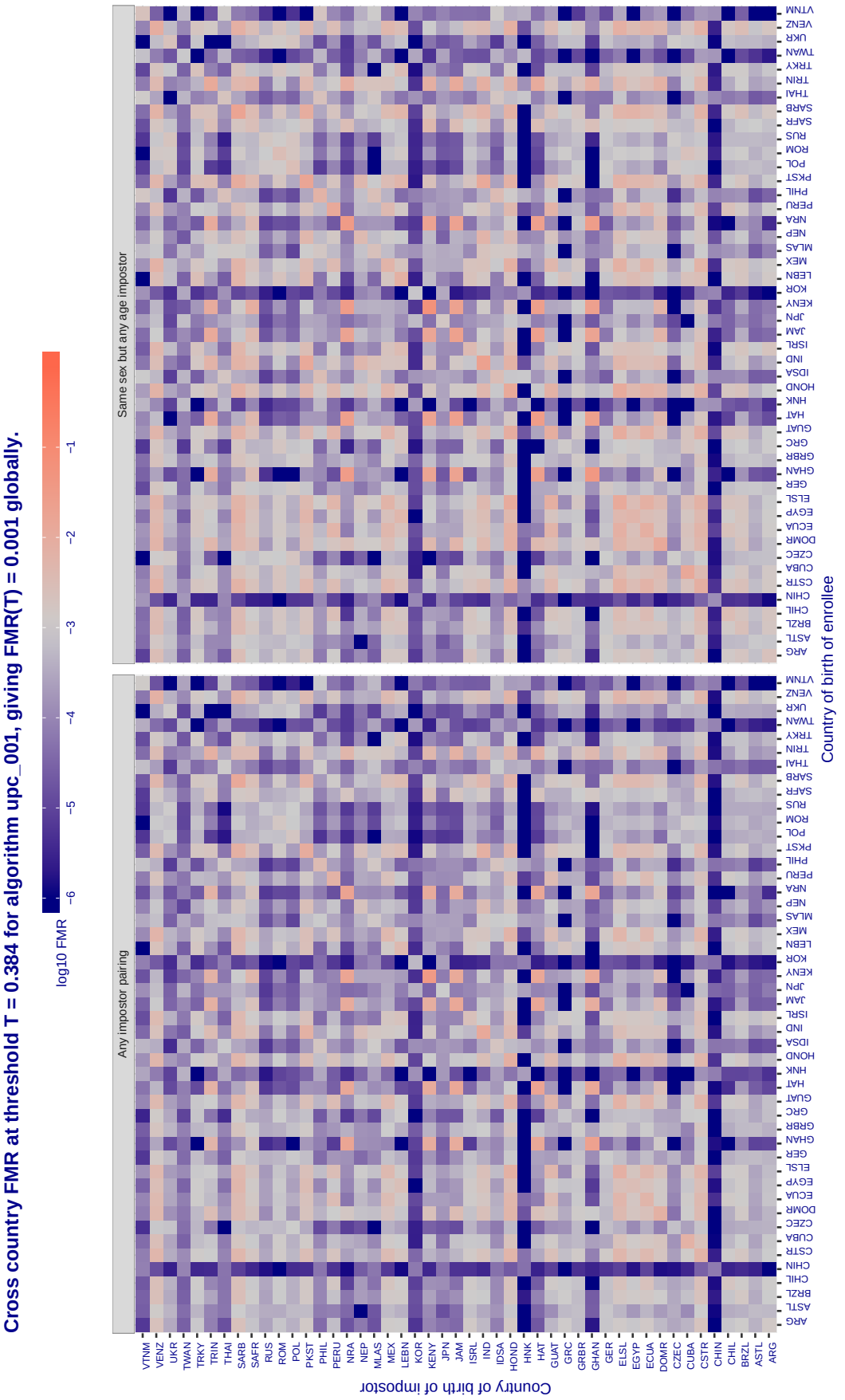


Figure 383: For algorithm upc-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

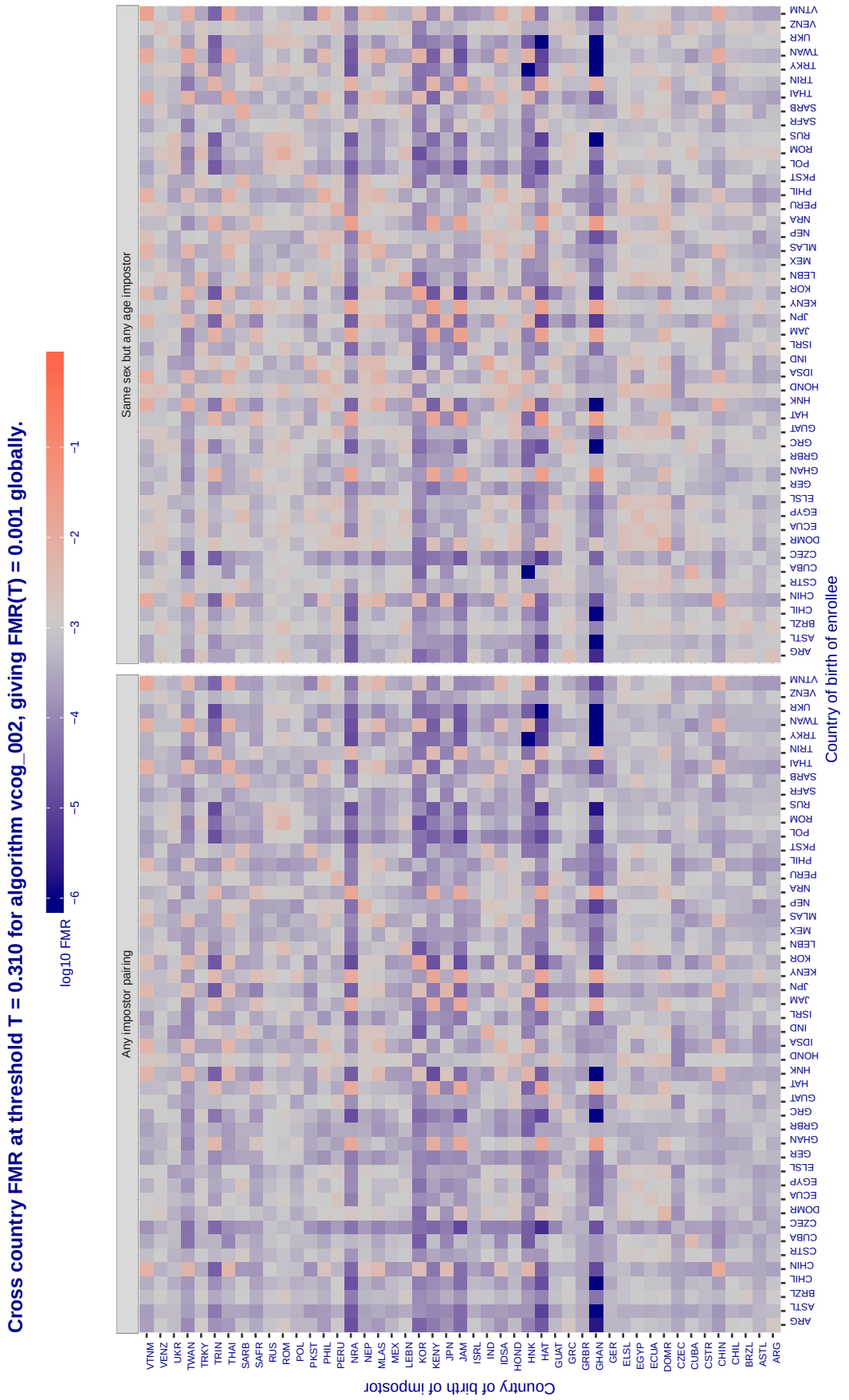


Figure 384: For algorithm vcog-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

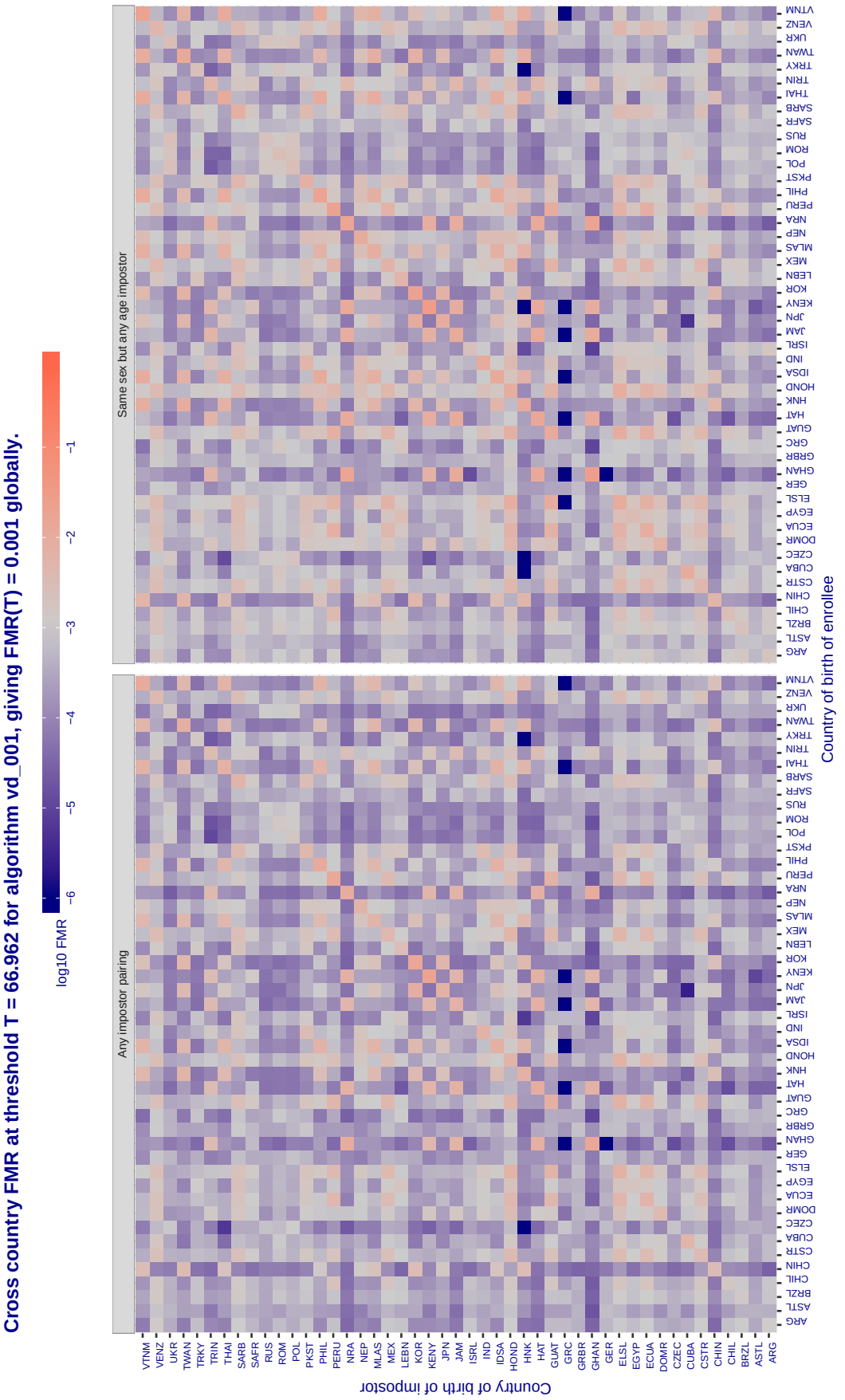


Figure 385: For algorithm vd-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

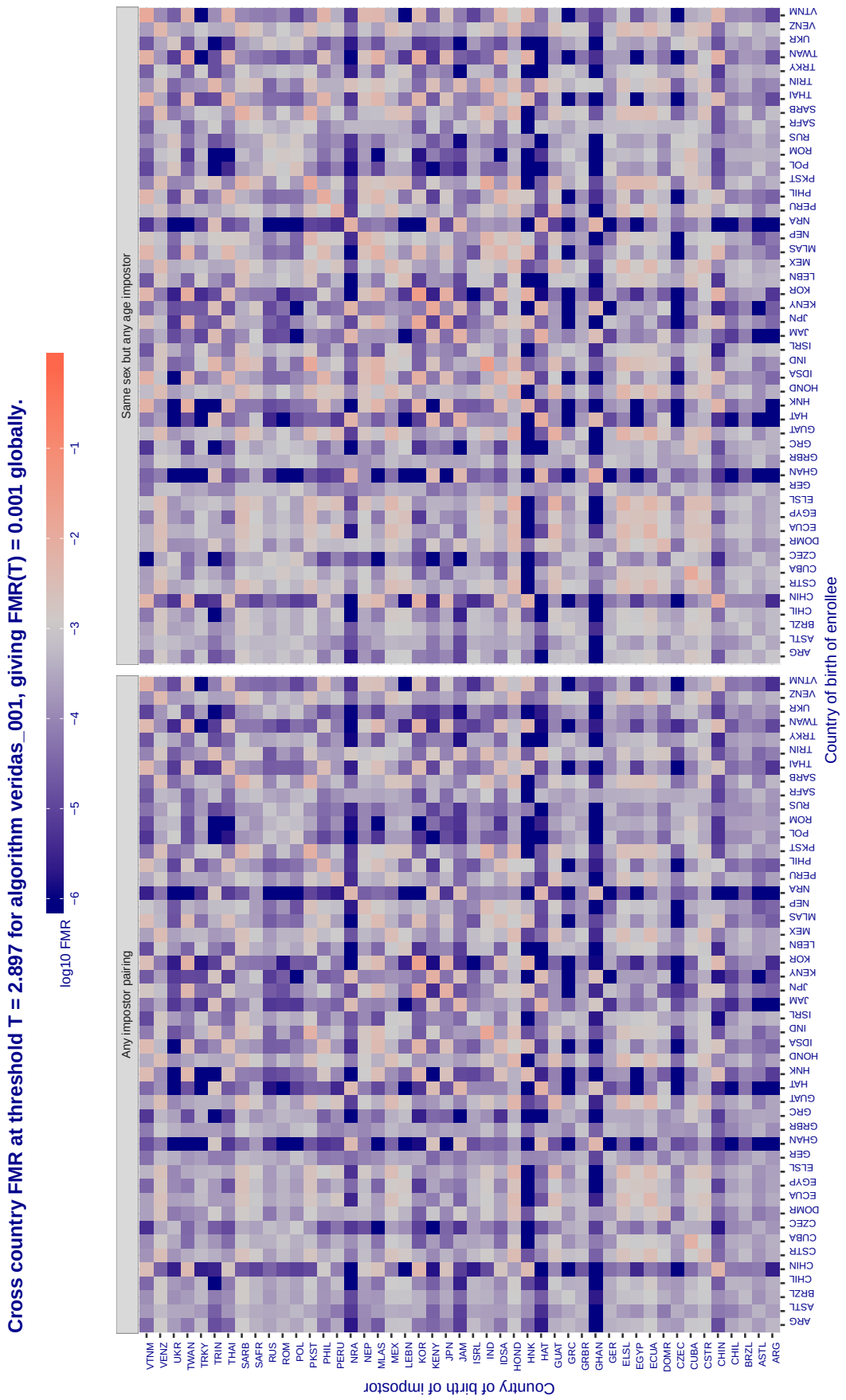


Figure 386: For algorithm veridas-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

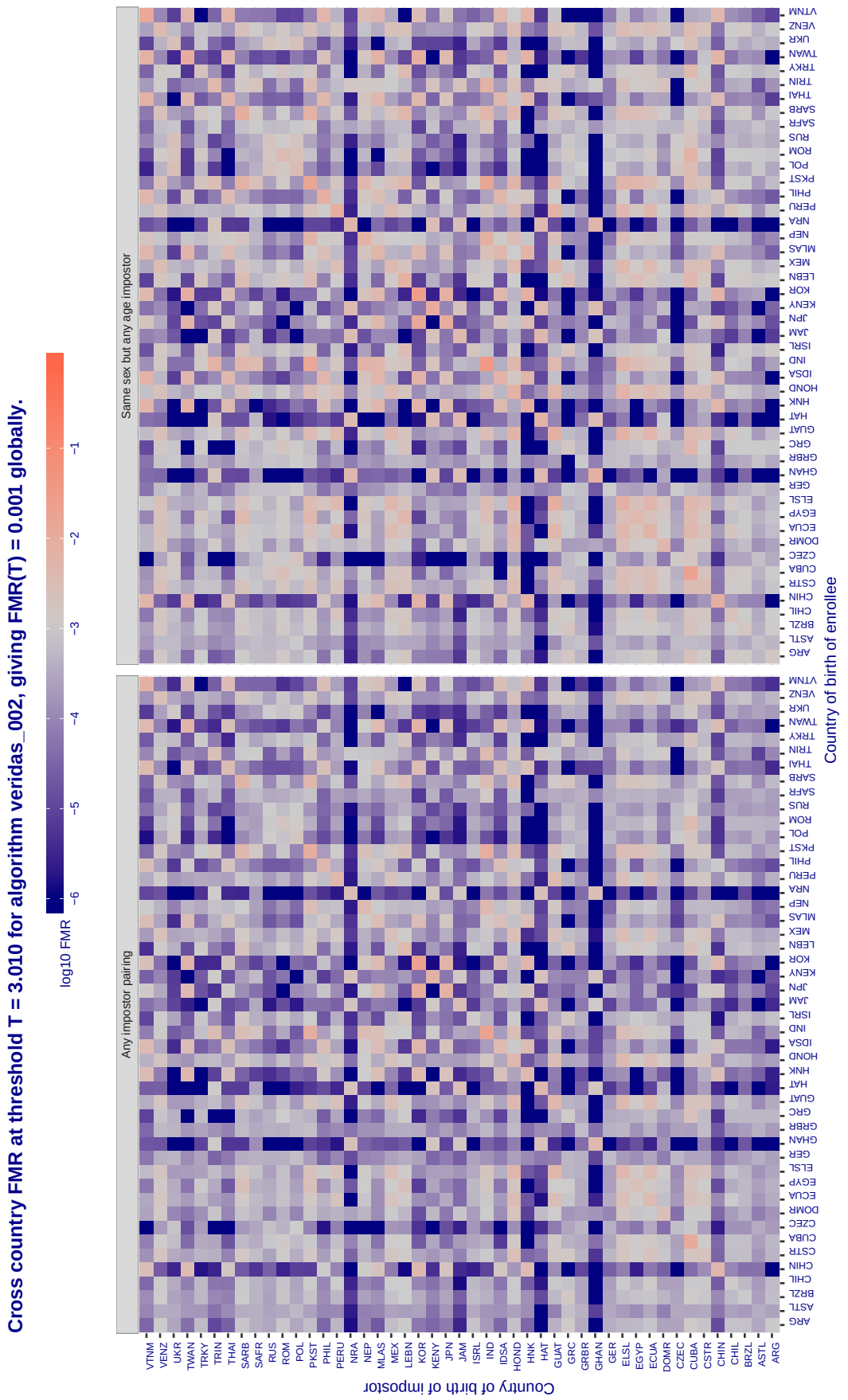


Figure 387: For algorithm veridas-002 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

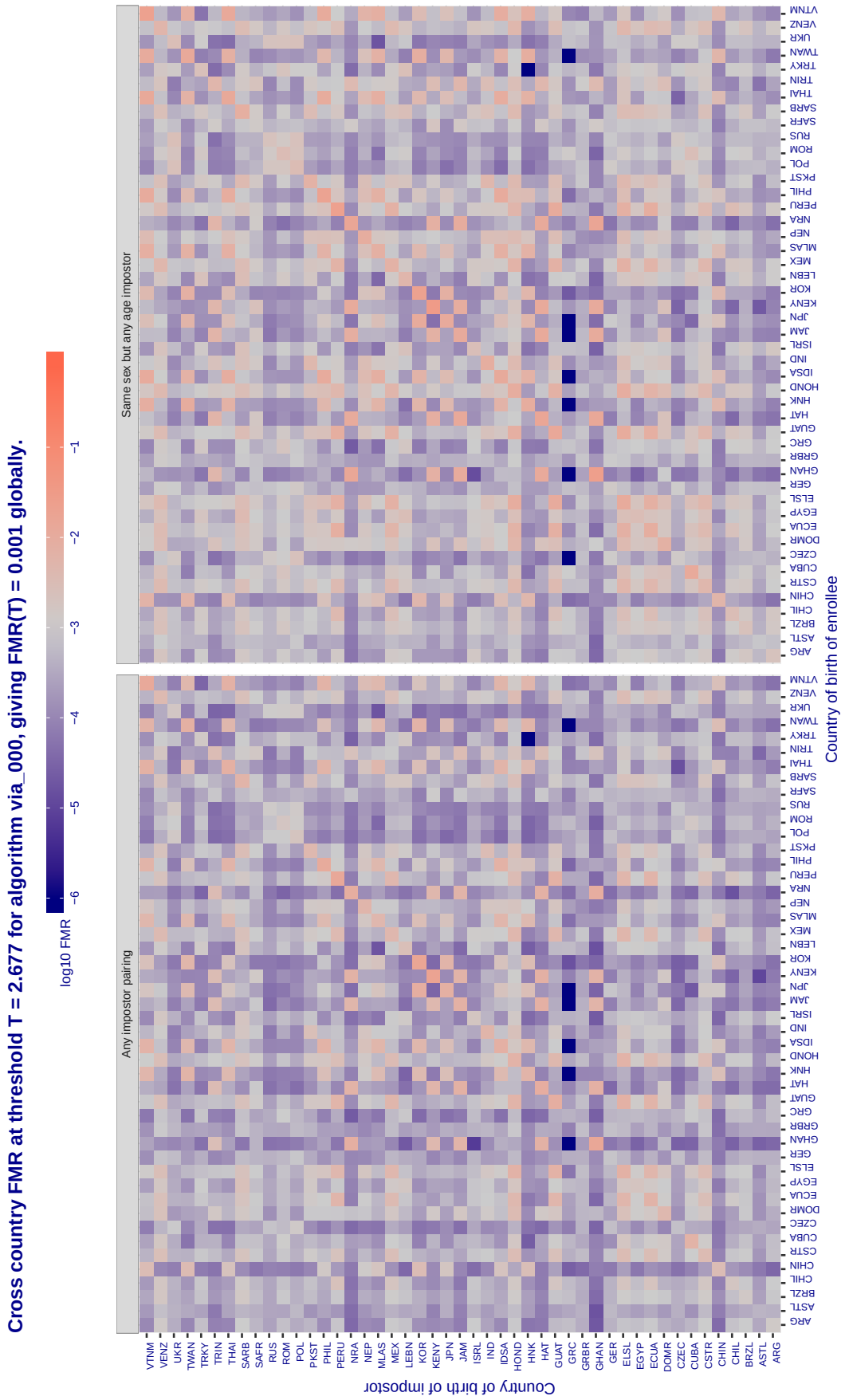


Figure 388: For algorithm via-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

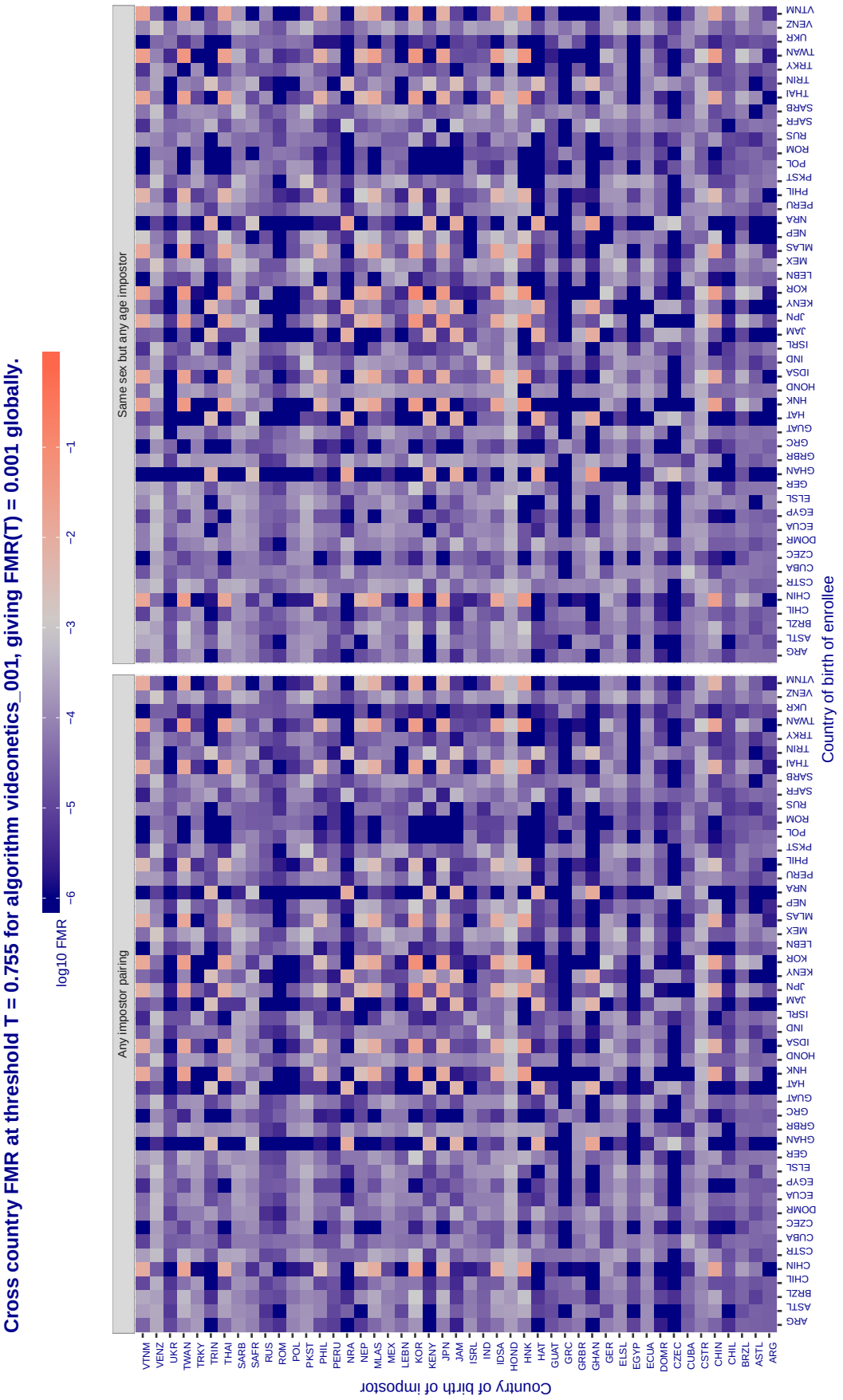


Figure 389: For algorithm videonetics-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

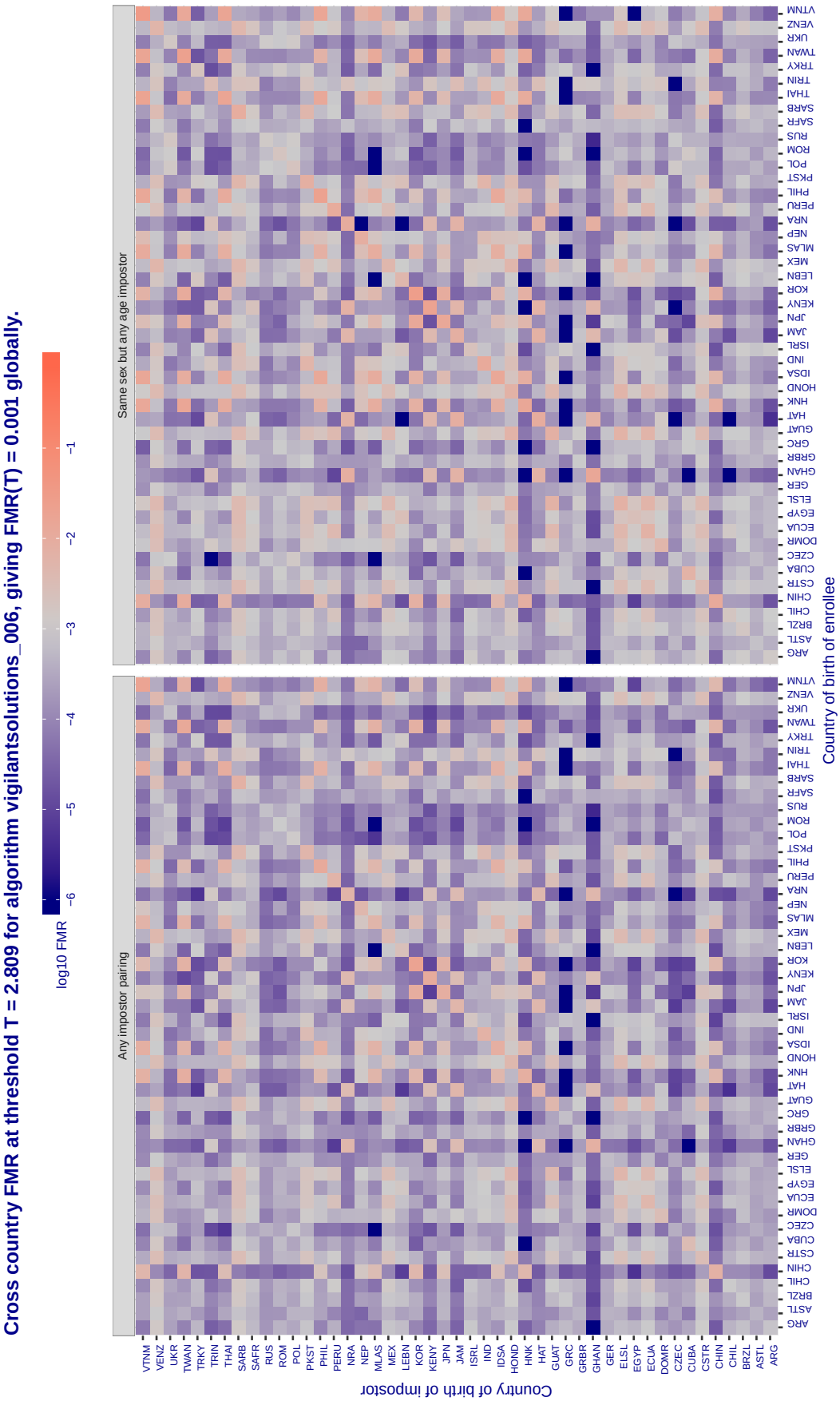


Figure 390: For algorithm vigilantsolutions-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

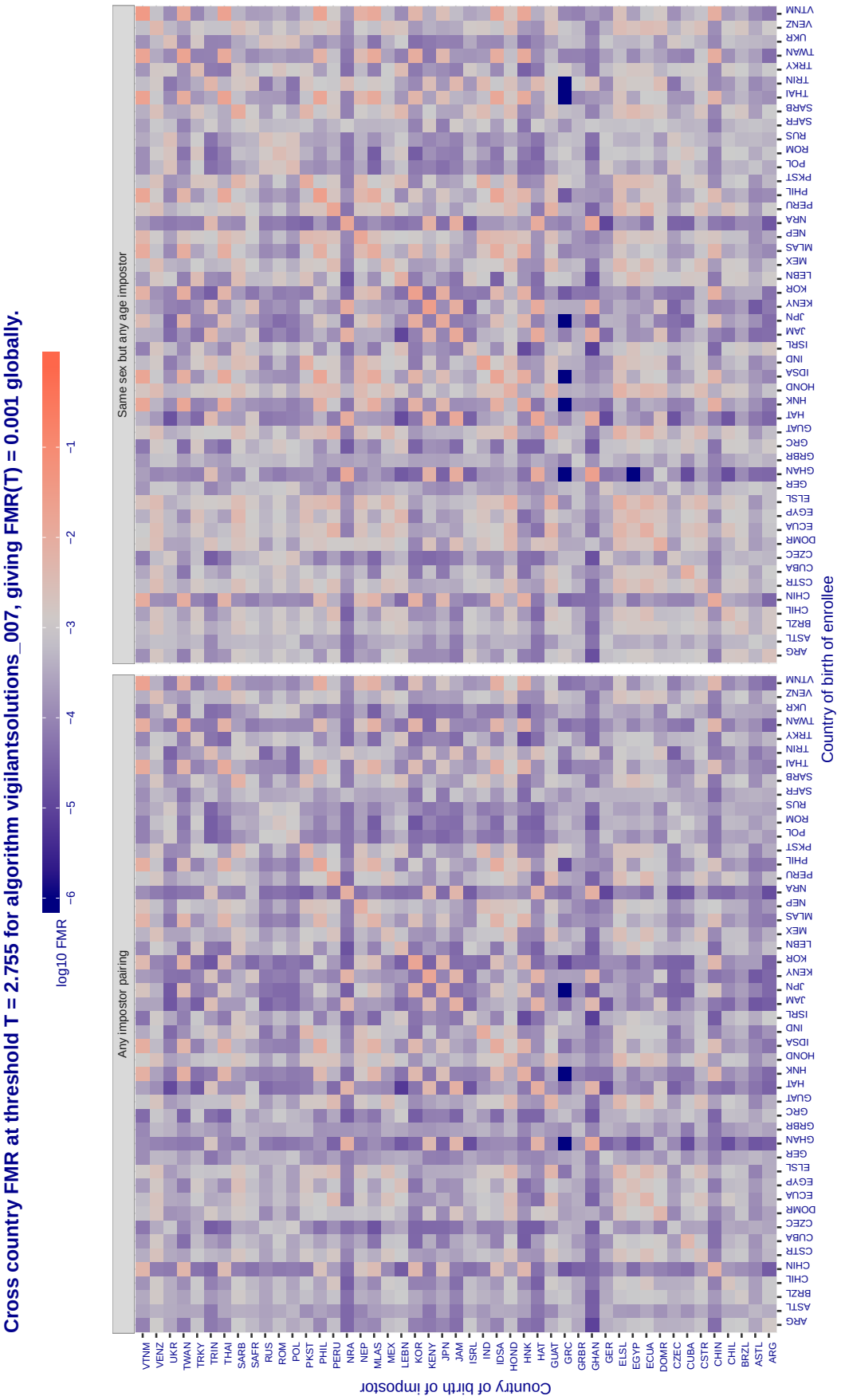


Figure 391: For algorithm vigilantsolutions-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

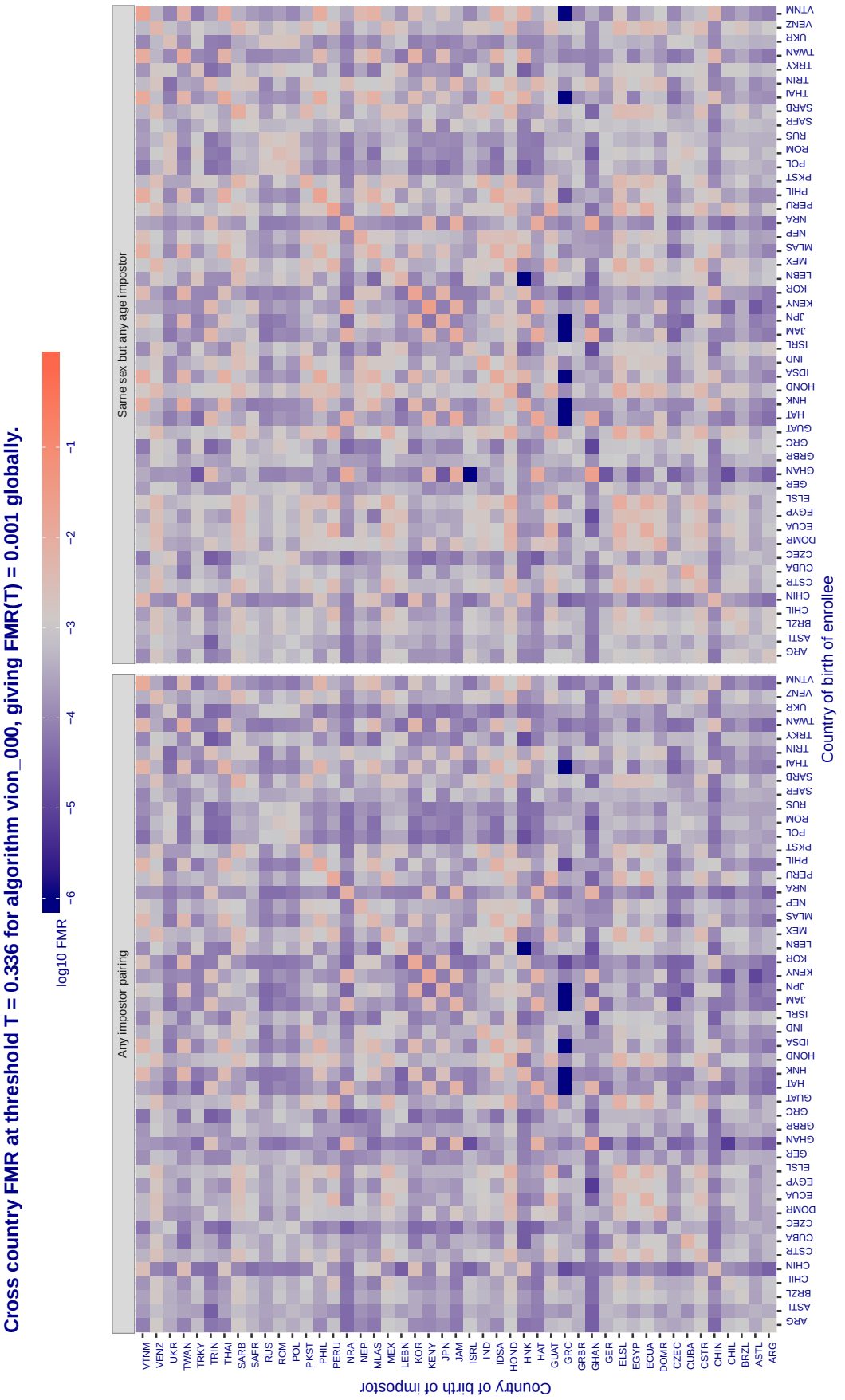


Figure 392: For algorithm vion-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

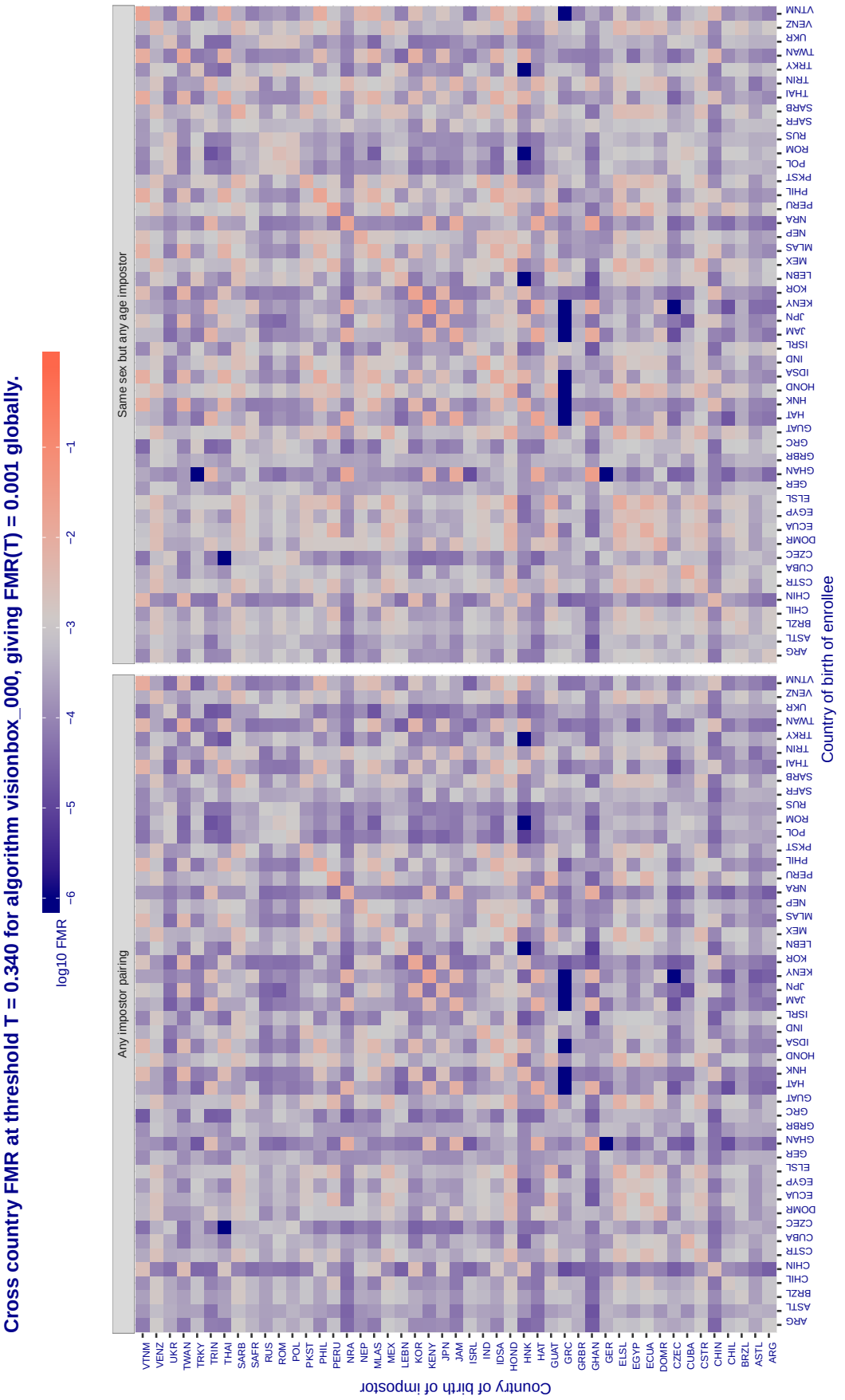


Figure 393: For algorithm visionbox-000 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

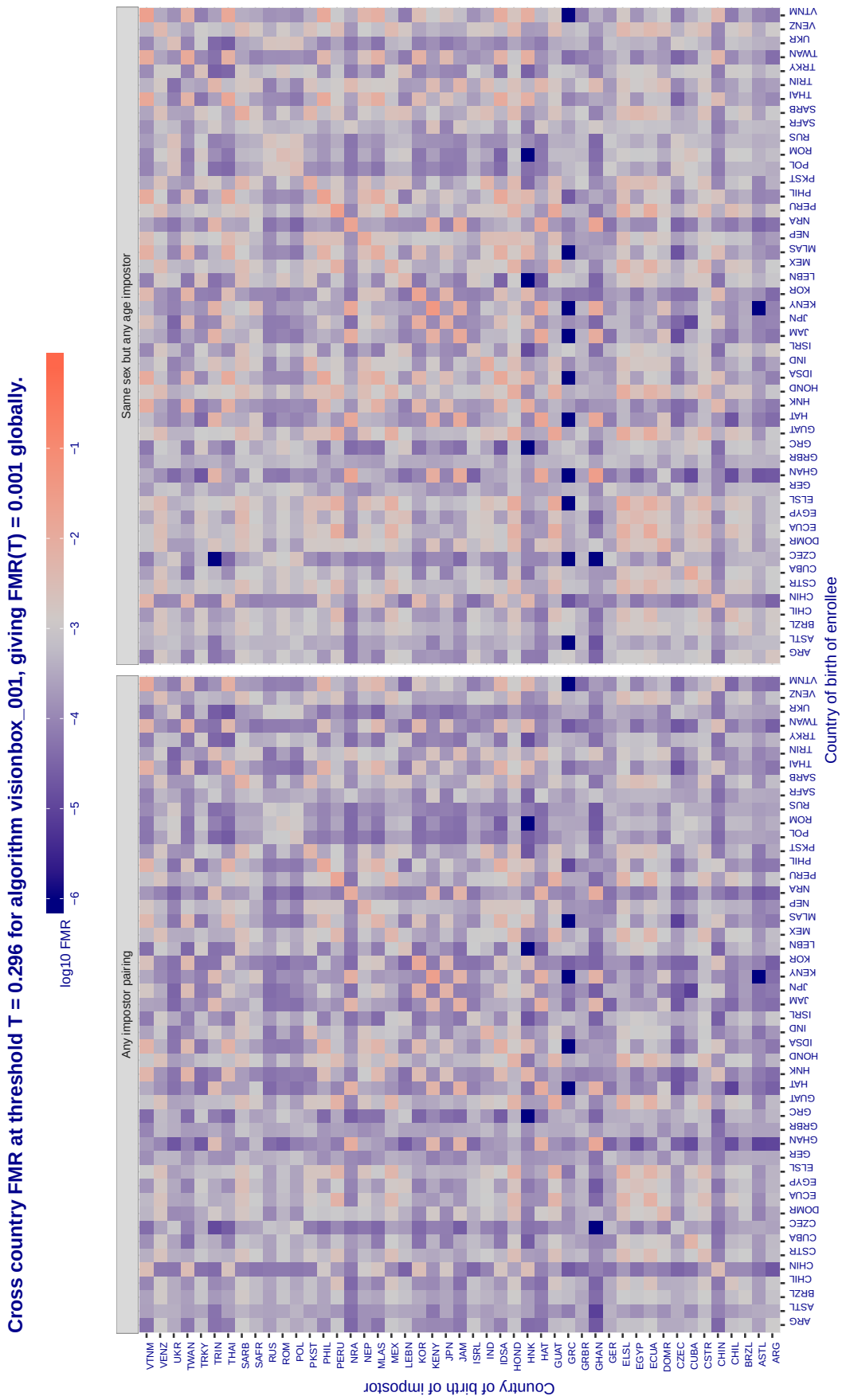


Figure 394: For algorithm visionbox-001 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

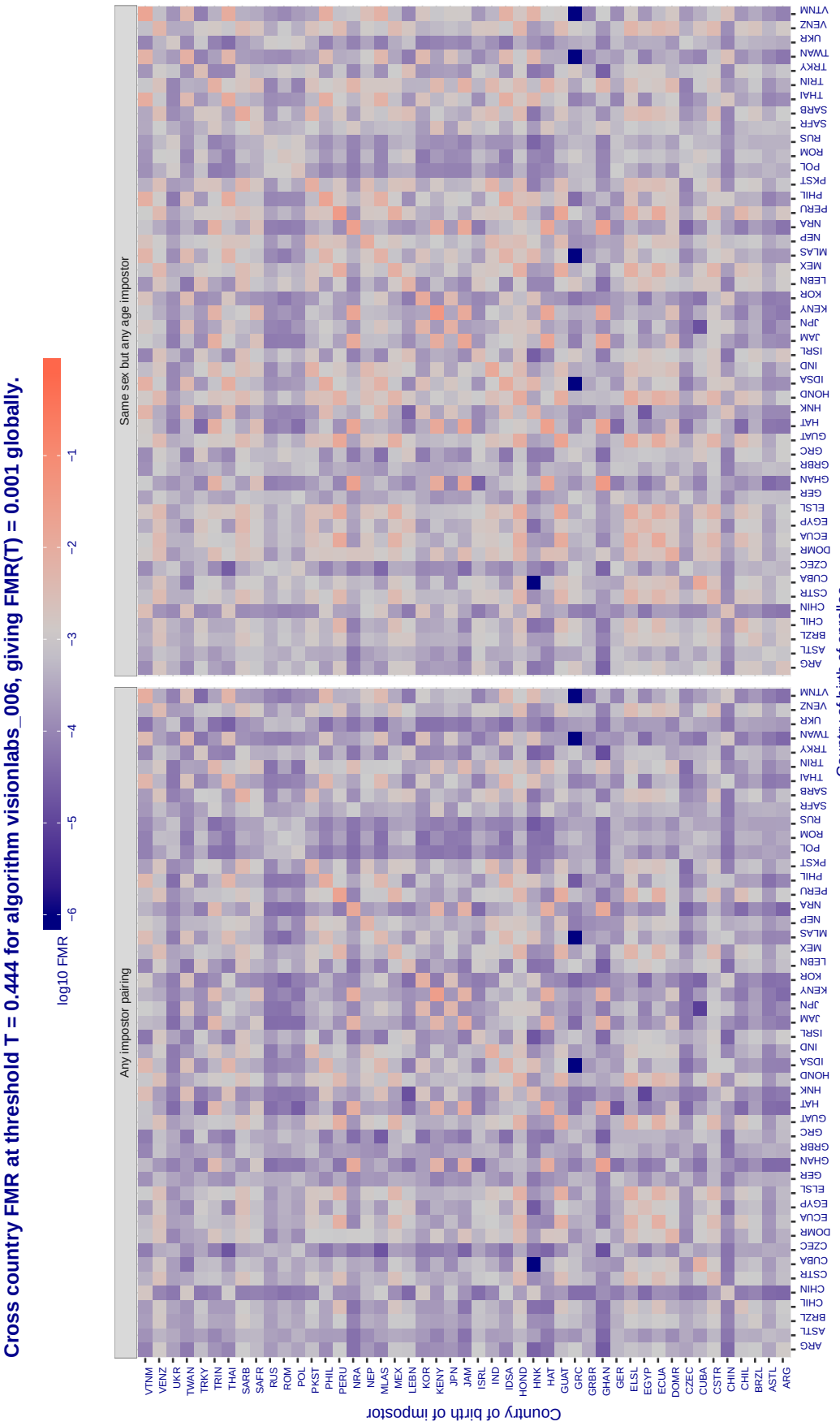


Figure 395: For algorithm visionlabs-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

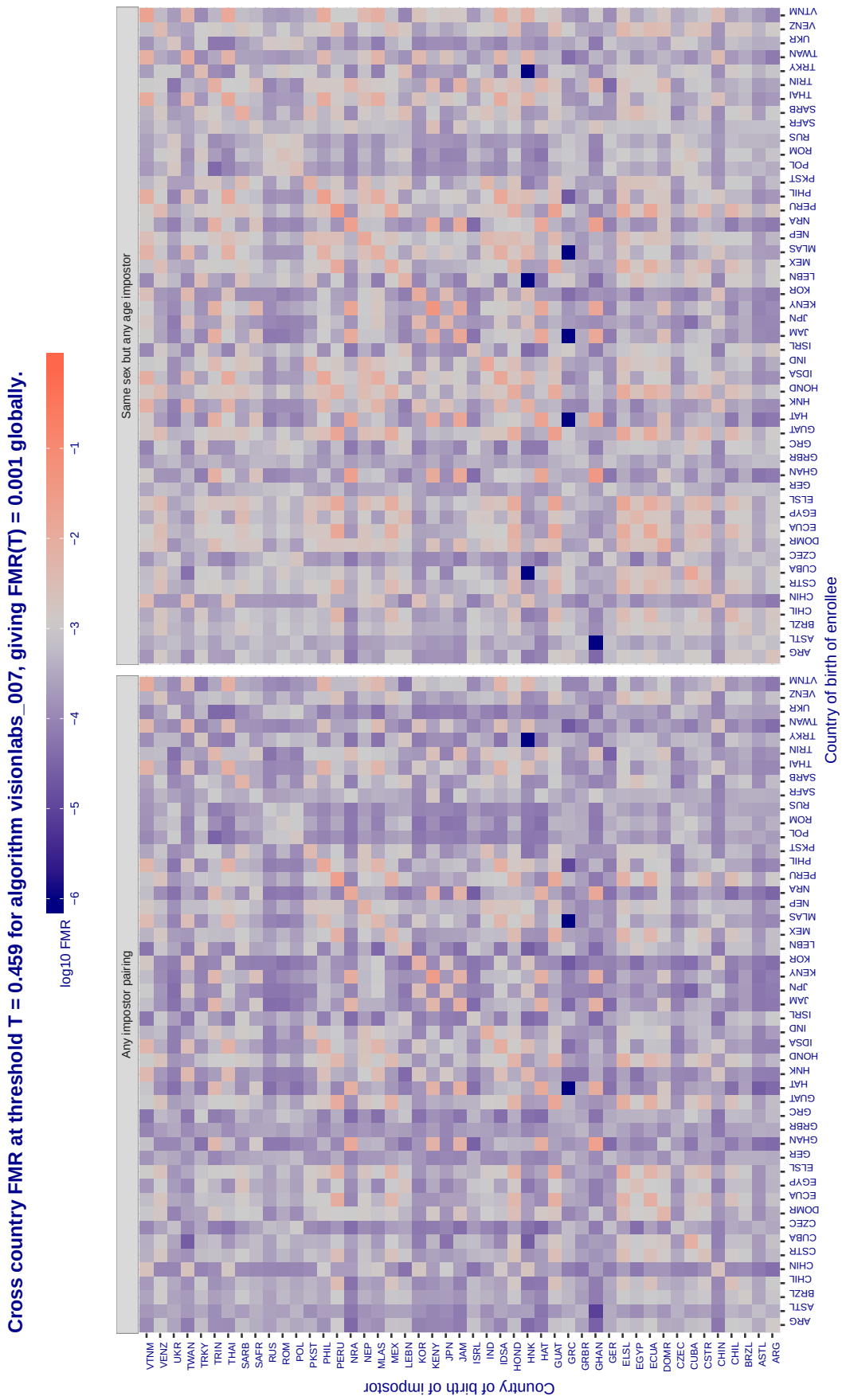


Figure 396: For algorithm visionlabs-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

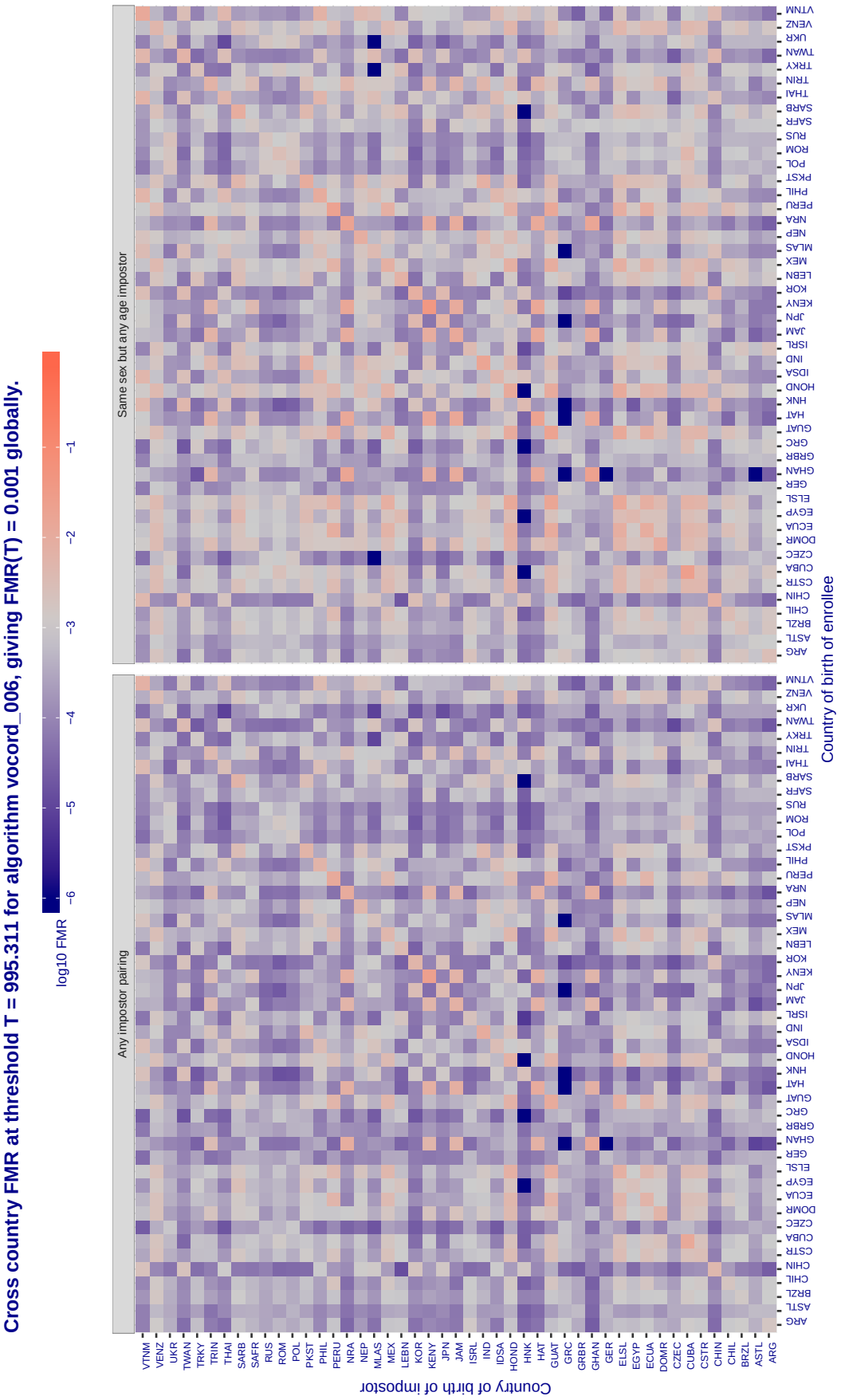


Figure 397: For algorithm vocord-006 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

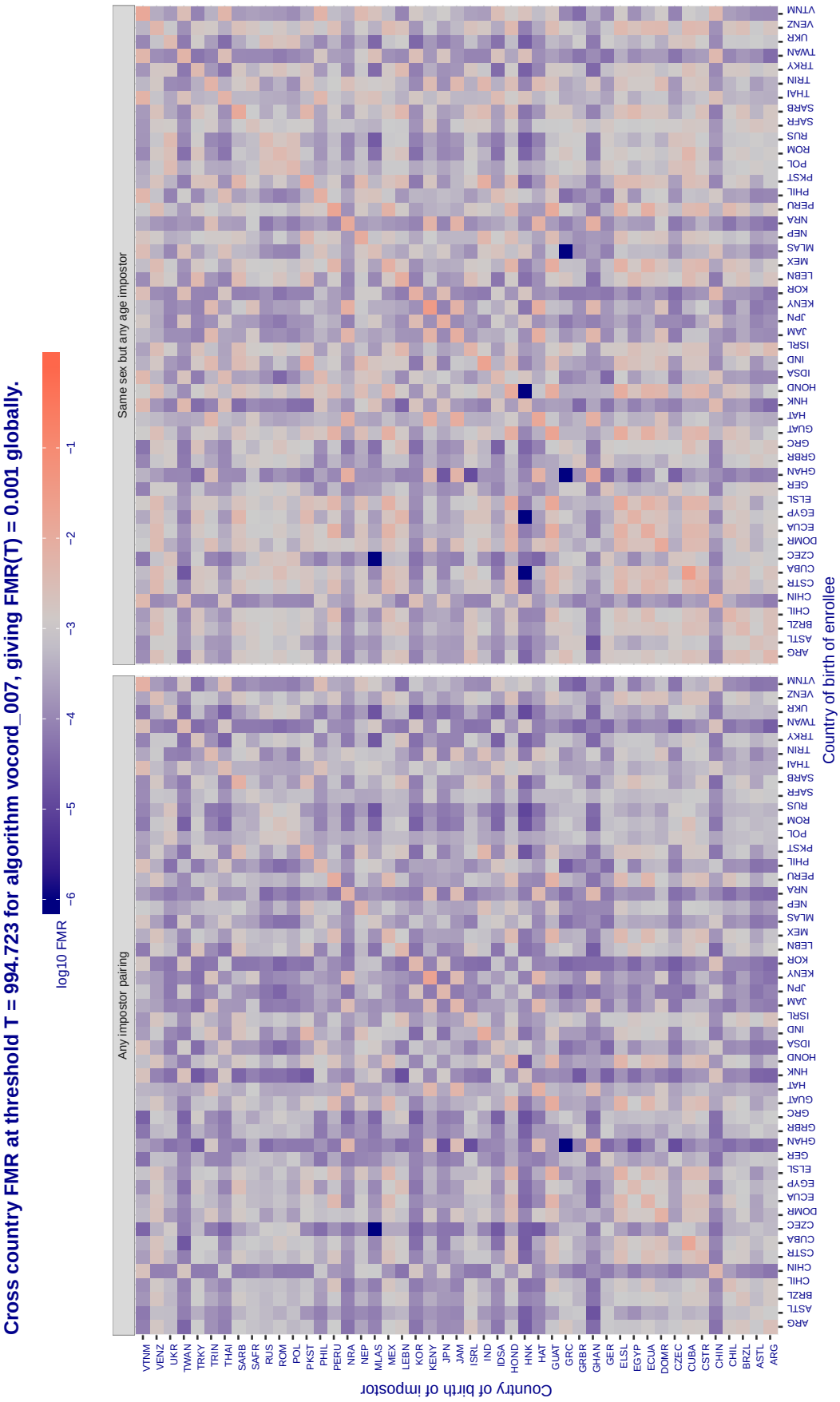


Figure 398: For algorithm vocord-007 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

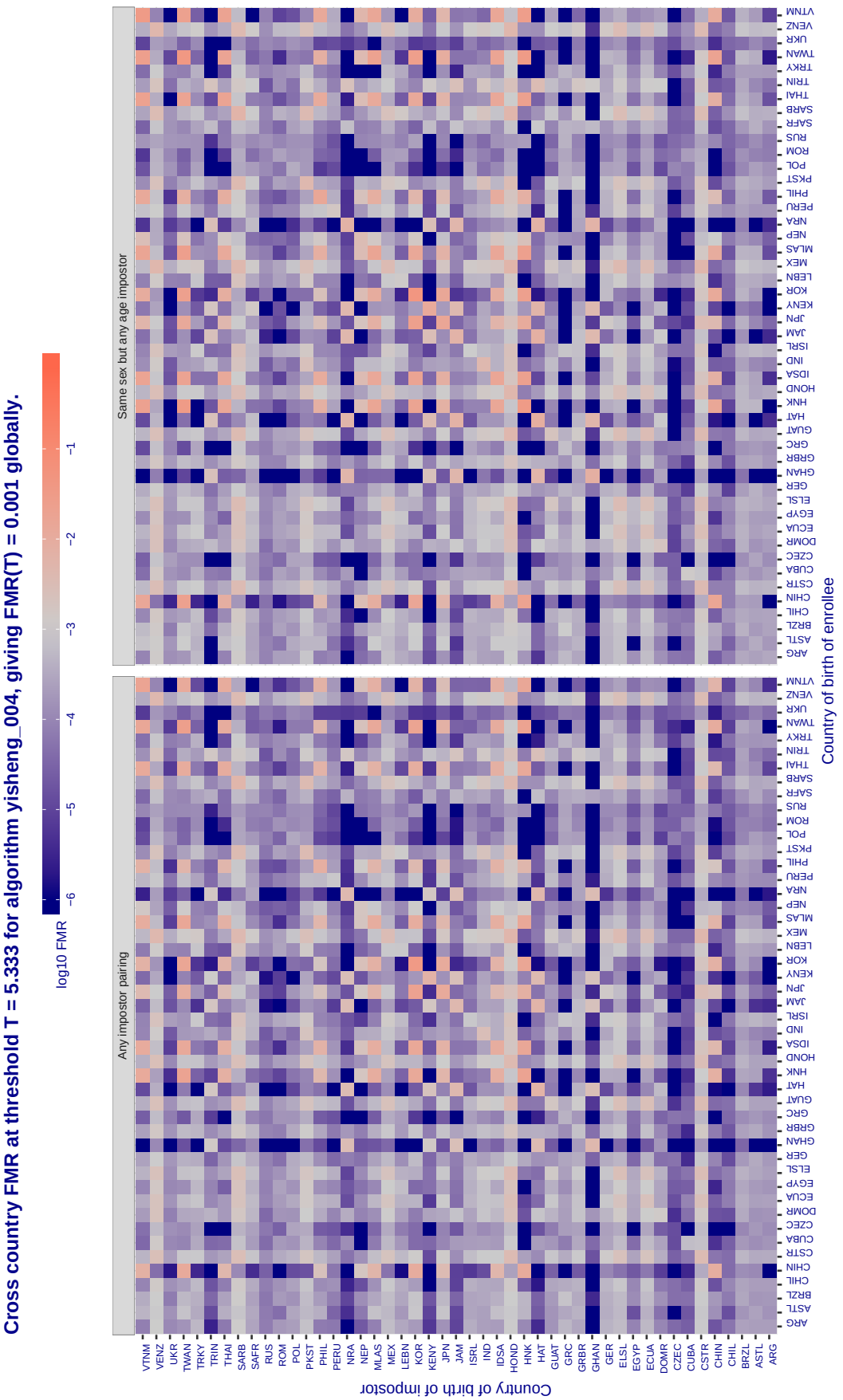


Figure 399: For algorithm yisheng-004 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

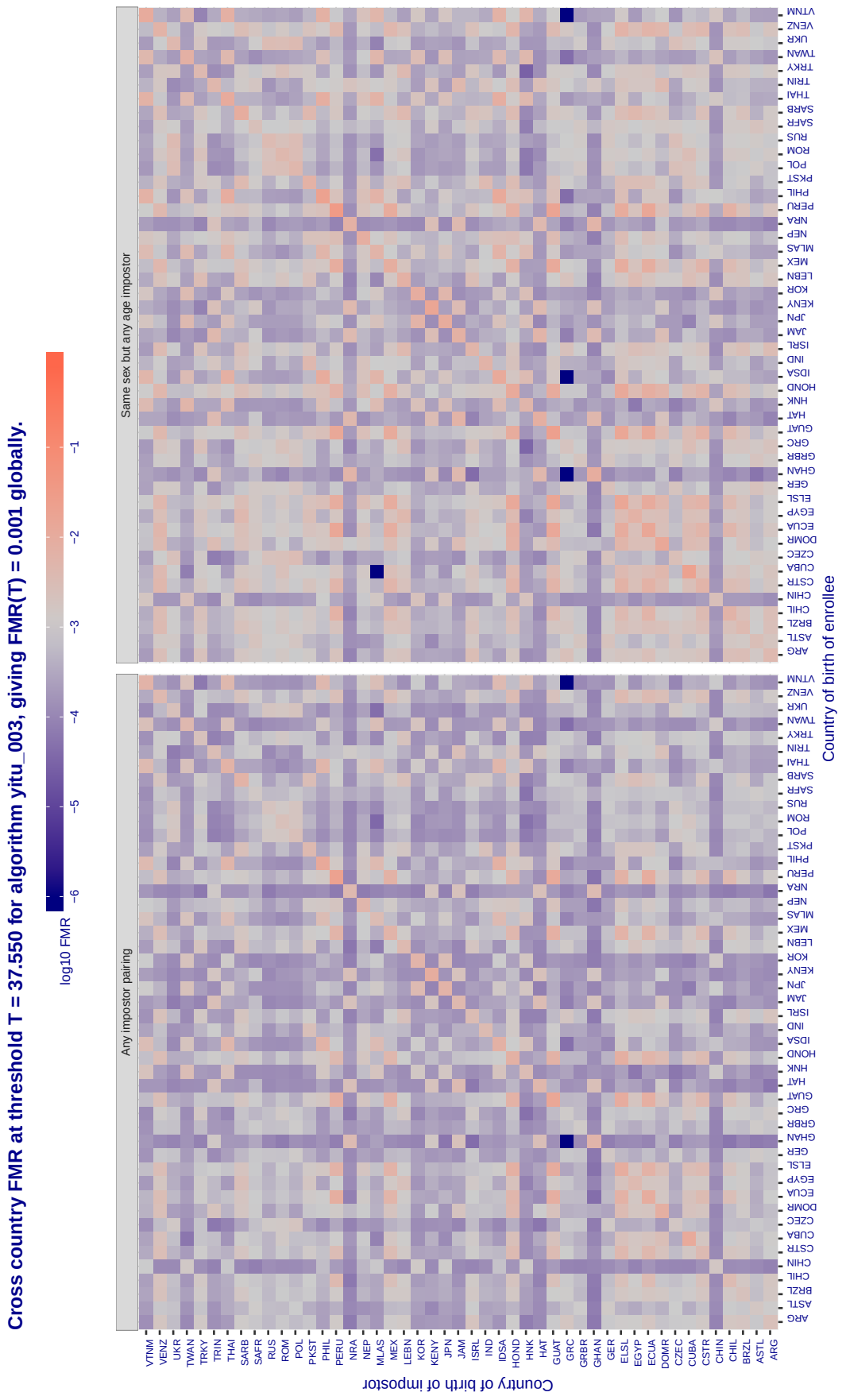


Figure 400: For algorithm yitu-003 operating on visa images, the heatmap shows false match rates observed over impostor comparisons of faces from different individuals who were born in the given country pair. False matches are counted against a recognition threshold fixed globally to give the target FMR in the plot title, computed over all on the order of 10^{10} impostor comparisons. If text appears in each box it give the same quantity as that coded by the color. Grey indicates FMR is at the intended FMR target level. Light red colors present a security vulnerability to, for example, a passport gate. Each +1 increase in log10 FMR corresponds to a factor of 10 increase in FMR. The matrix is not quite symmetric because images in the enrollment and verification sets are different.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

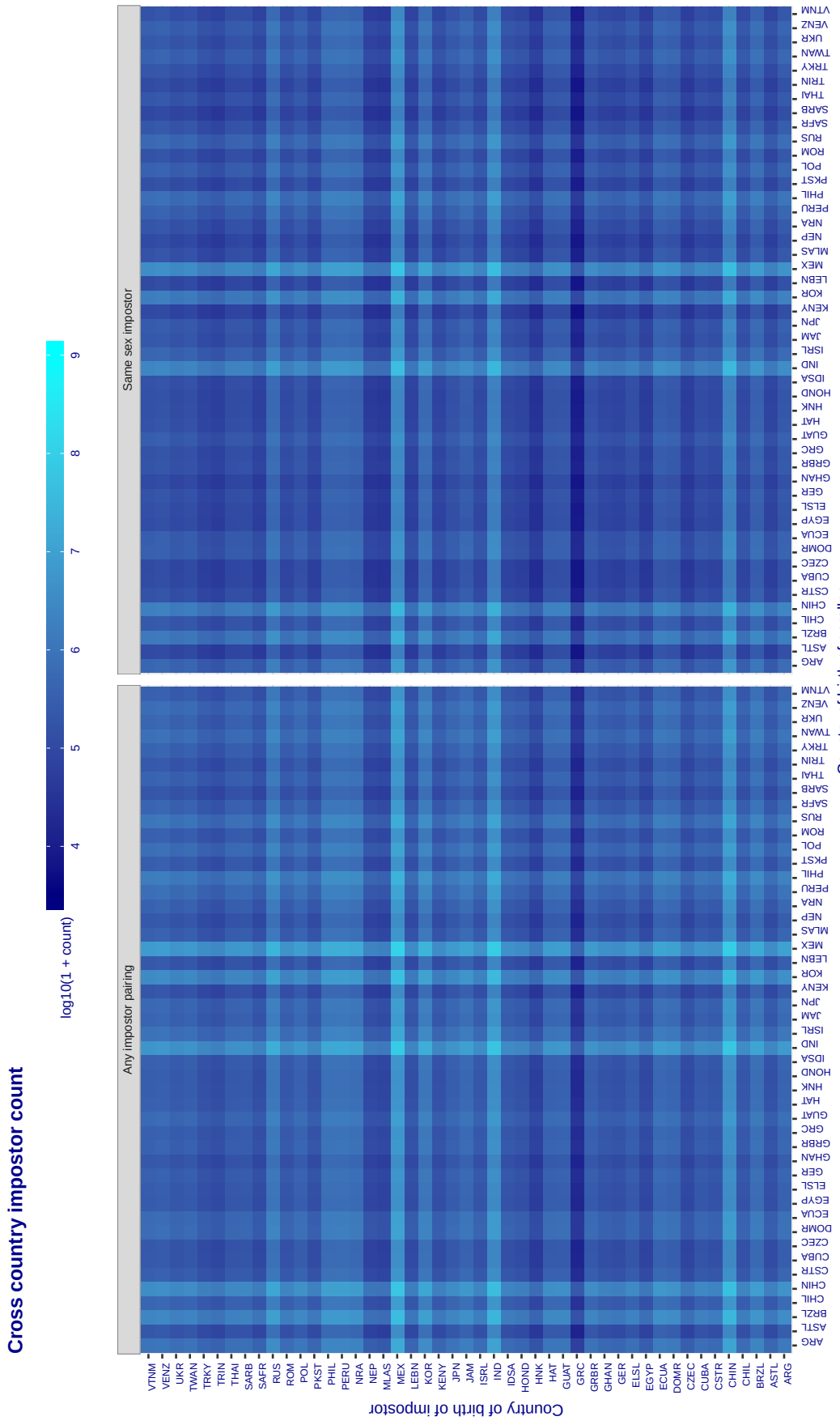


Figure 401: For visa images, the heatmap shows the count of impostor comparisons of faces from different individuals who were born in the given country pair.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

3.6.2 Effect of age on impostors

Background: This section shows the effect of age on the impostor distribution. The ideal behaviour is that the age of the enrollee and the impostor would not affect impostor scores. This would support FMR stability over sub-populations.

Goals:

- ▷ To show the effect of relative ages of the impostor and enrollee on false match rates.
- ▷ To determine whether some algorithms have better impostor distribution stability.

Methods:

- ▷ Define 14 age group bins, spanning 0 to over 100 years old.
- ▷ Compute FMR over all impostor comparisons for which the subjects in the enrollee and impostor images have ages in two bins.
- ▷ Compute FMR over all impostor comparisons for which the subjects are additionally of the same sex, and born in the same geographic region.

Results:

The notable aspects are:

- ▷ Diagonal dominance: Impostors are more likely to be matched against their same age group.
- ▷ Same sex and same region impostors are more successful. On the diagonal, an impostor is more likely to succeed by posing as someone of the same sex. If $\Delta \log_{10}$ FMR $= 0.2$, then same-sex same-region FMR exceeds the all-pairs FMR by factor of $10^{0.2} = 1.6$.
- ▷ Young children impostors give elevated FMR against young children. Older adult impostor give elevated FMR against older adults. These effects are quite large, for example if $\Delta \log_{10}$ FMR $= 1.0$ larger than a 32 year old, then these groups have higher FMR by a factor of $10^1 = 10$. This would imply an FMR above 0.01 for a nominal (global) FMR = 0.001.
- ▷ Algorithms vary.
- ▷ We computed the same quantities for a global FMR = 0.0001. The effects are similar.

Note the calculations in this section include impostors paired across all countries of birth.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

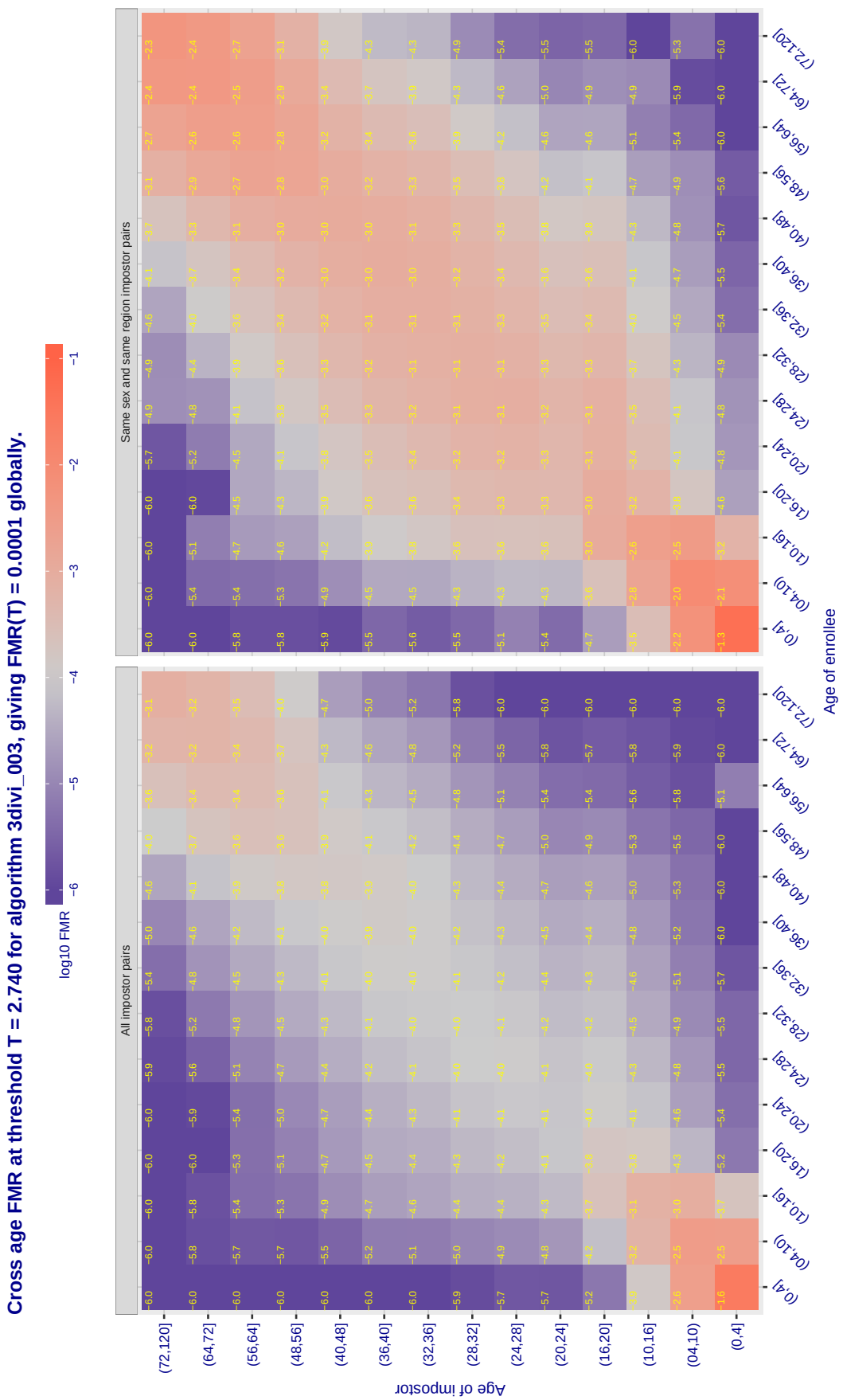


Figure 402: For algorithm 3divi-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

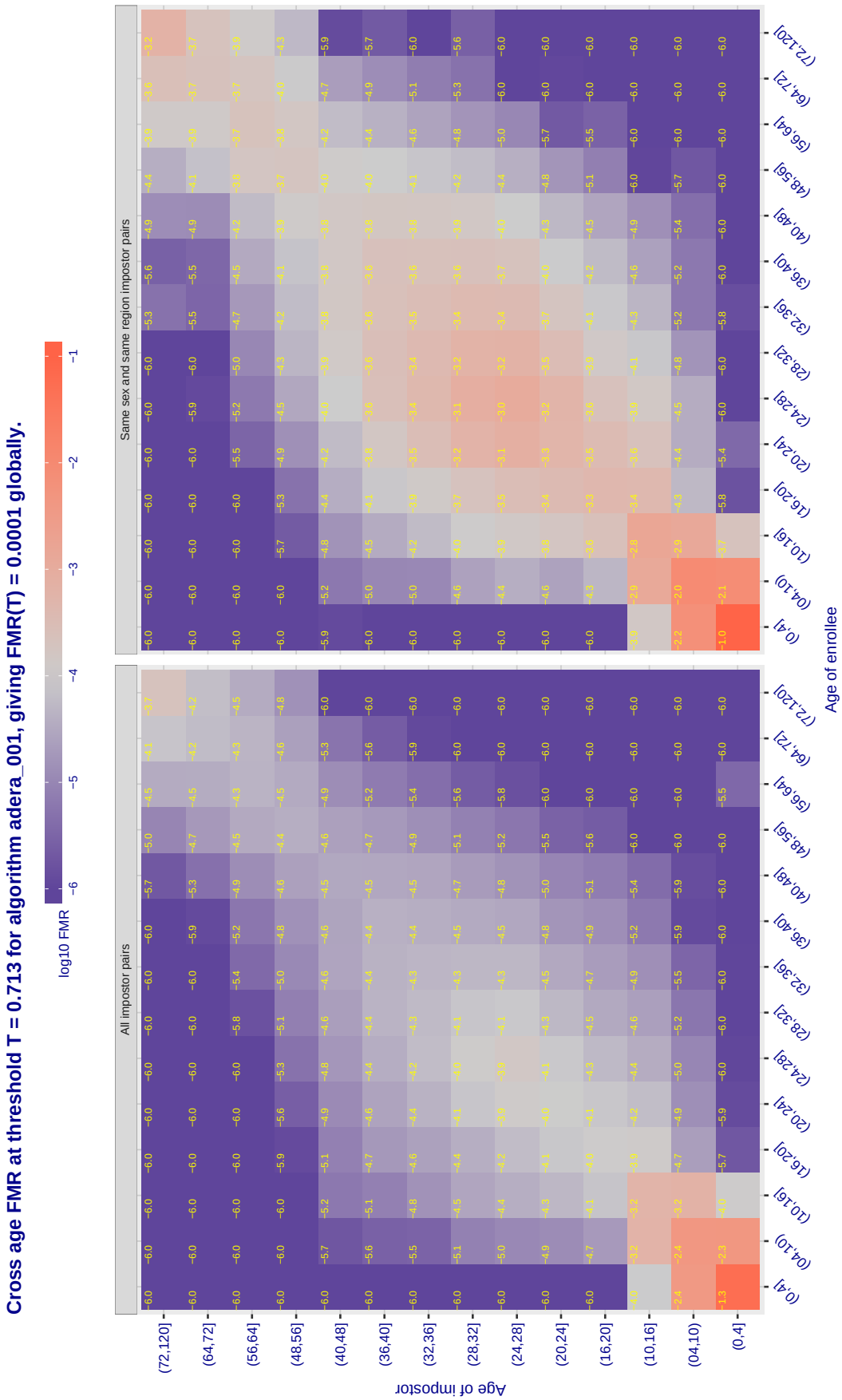


Figure 403: For algorithm adera-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

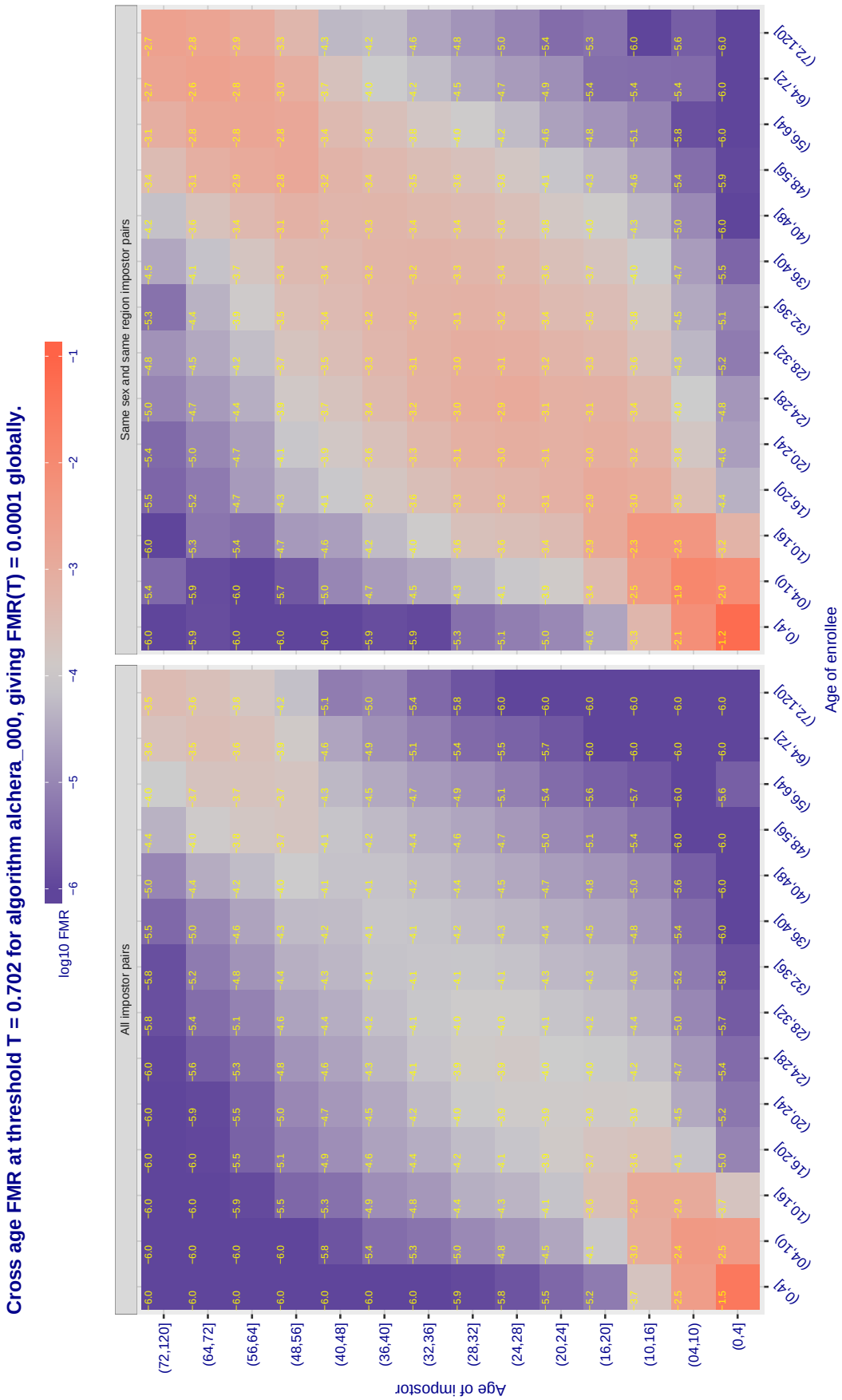


Figure 404: For algorithm alchera-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

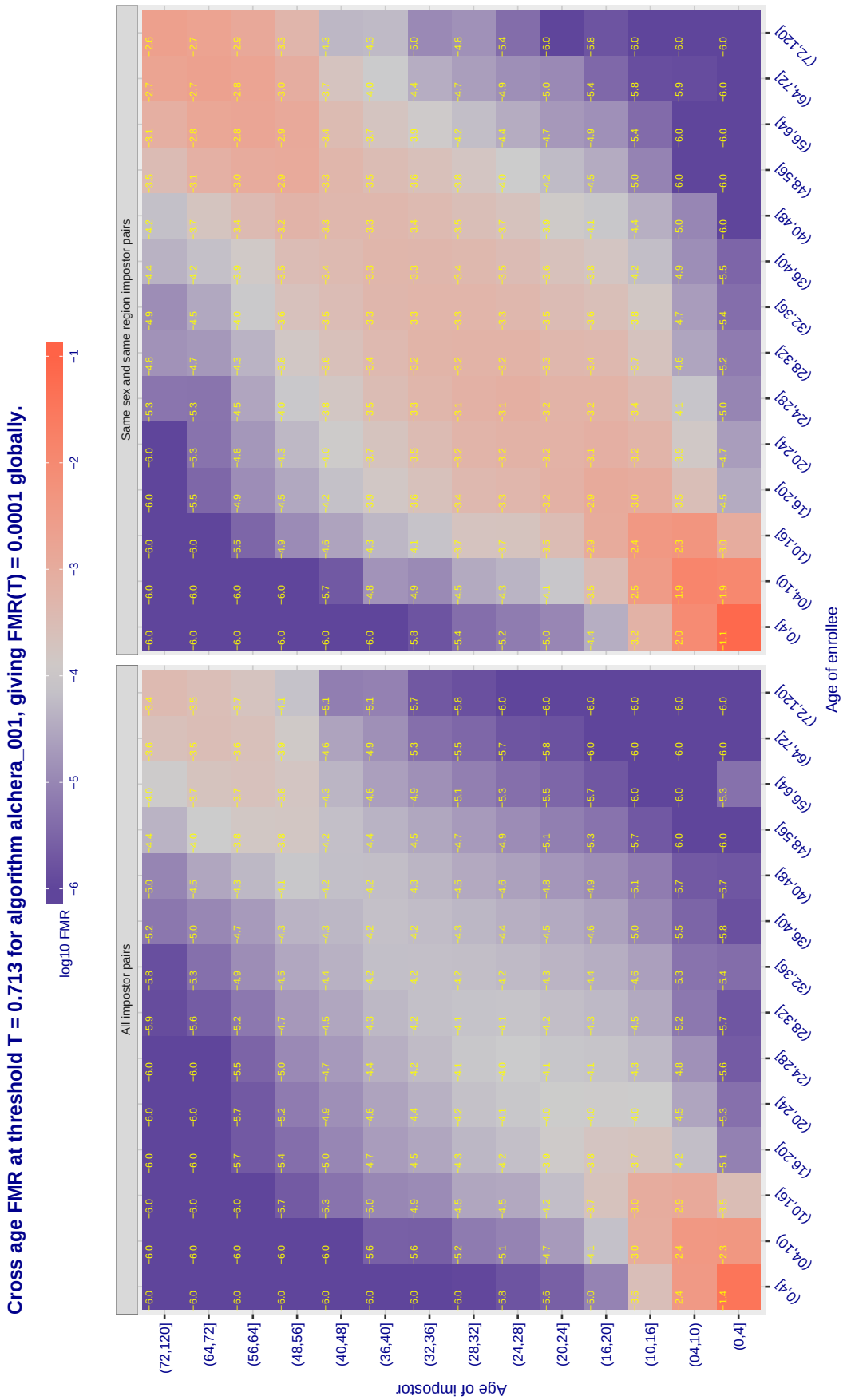


Figure 405: For algorithm alchera-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

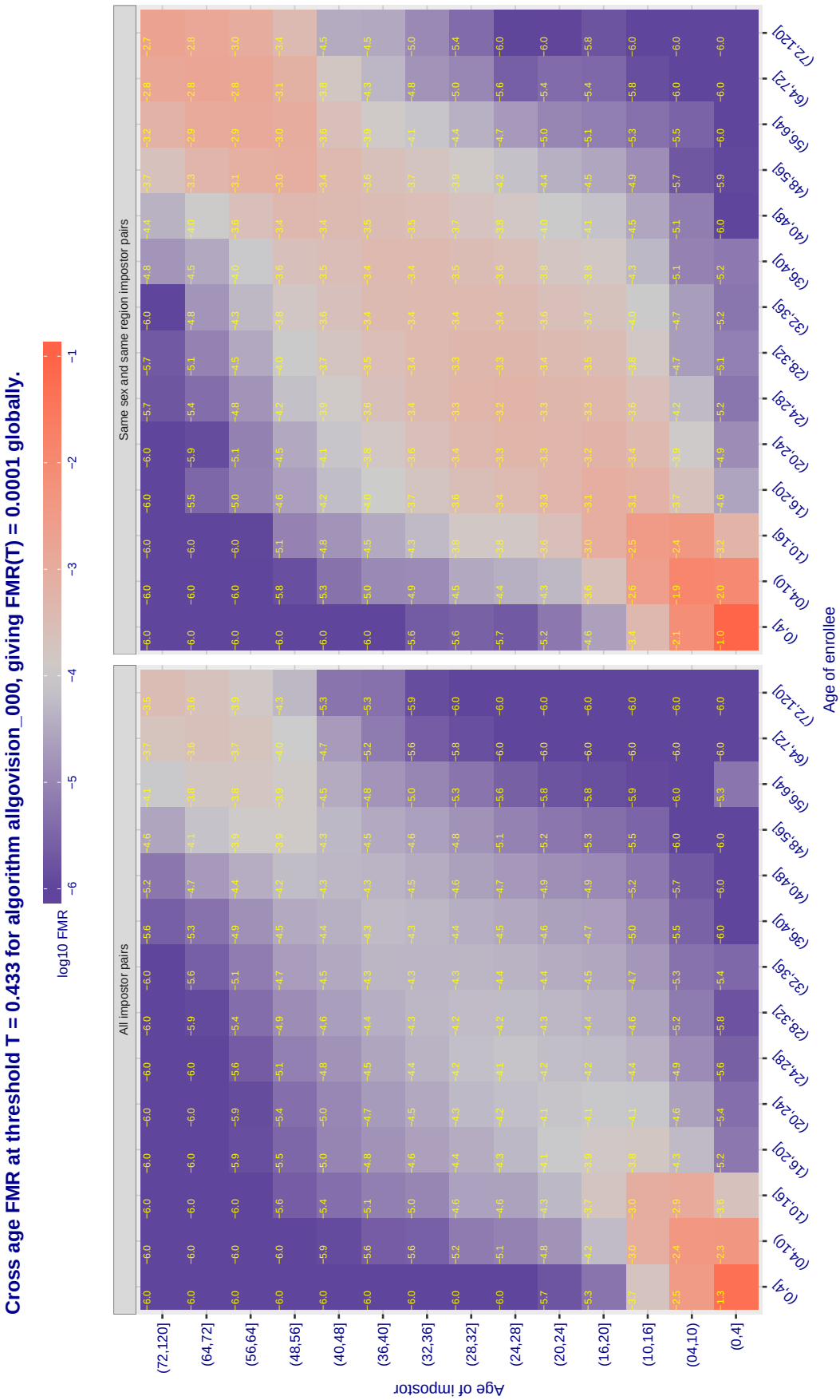


Figure 406: For algorithm allgovision-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

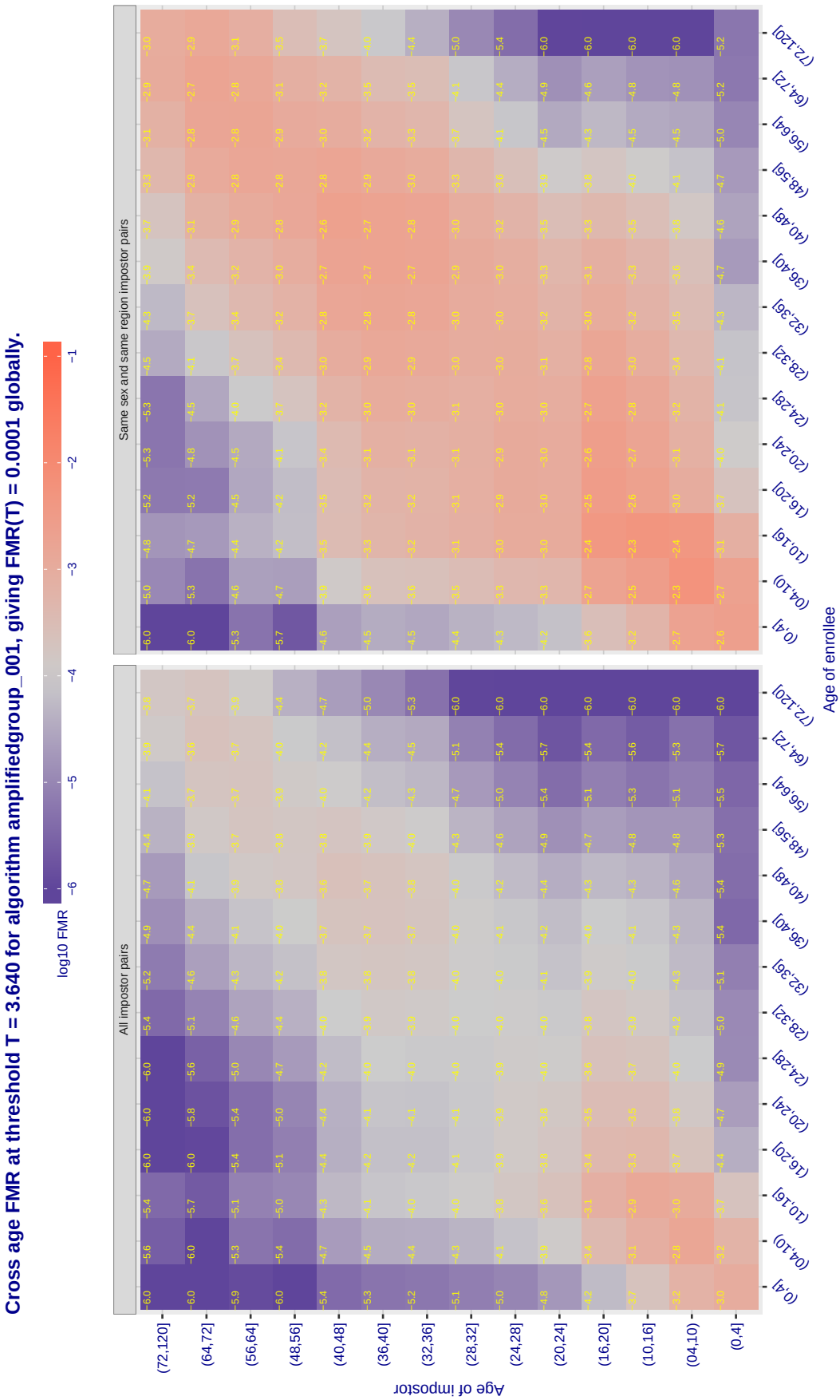


Figure 407: For algorithm amplifiedgroup-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

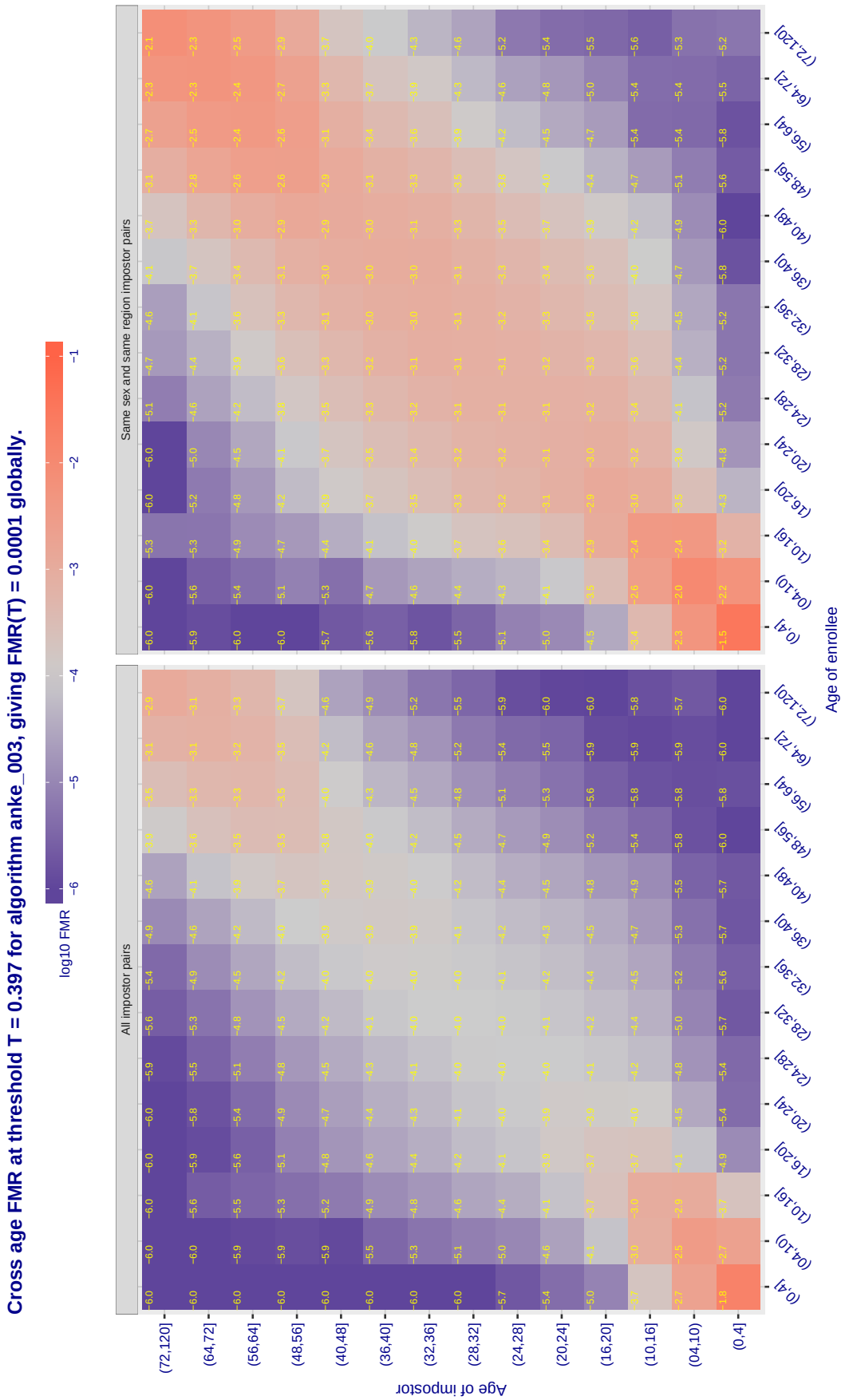


Figure 408: For algorithm anke-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

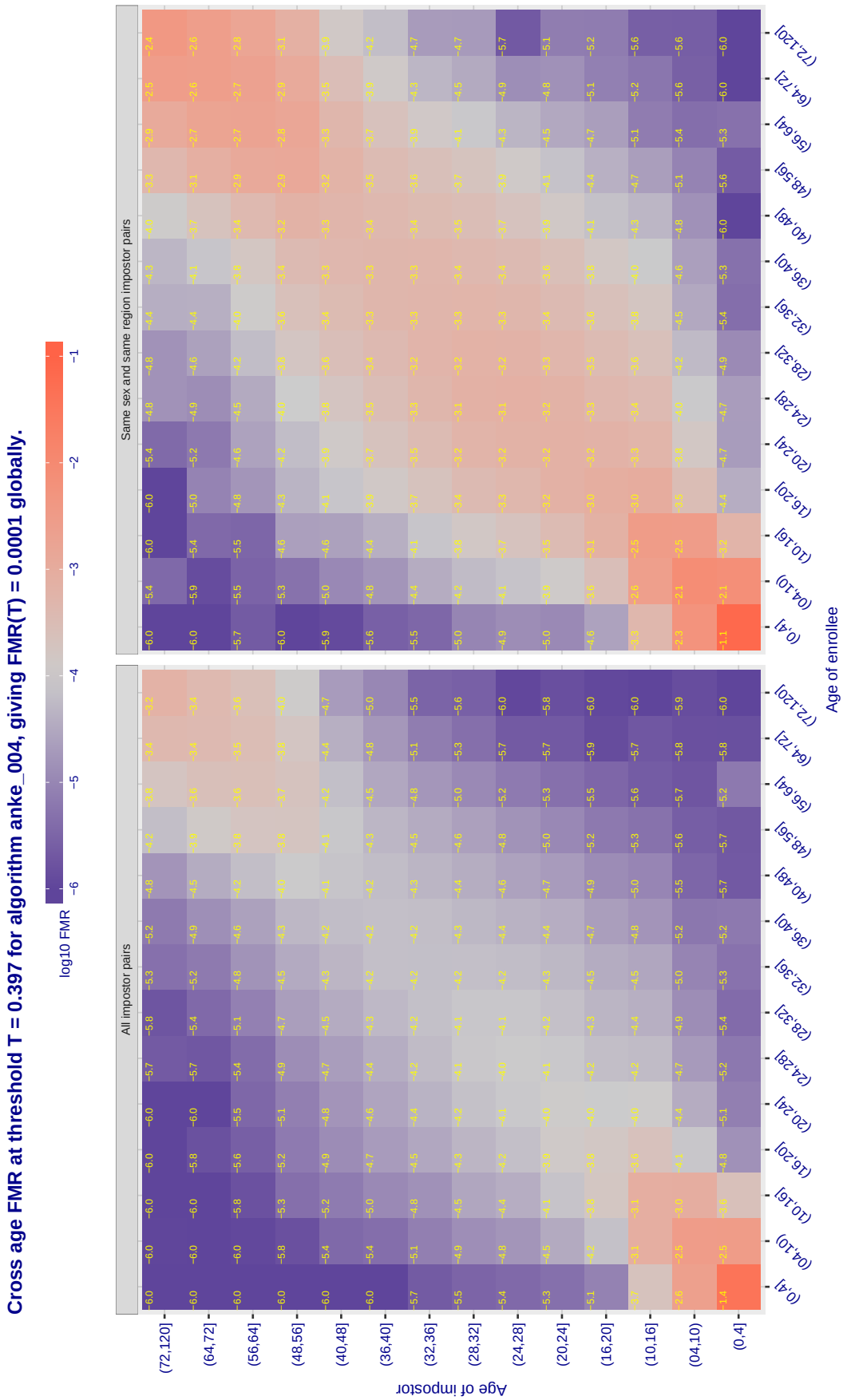


Figure 409: For algorithm anke-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

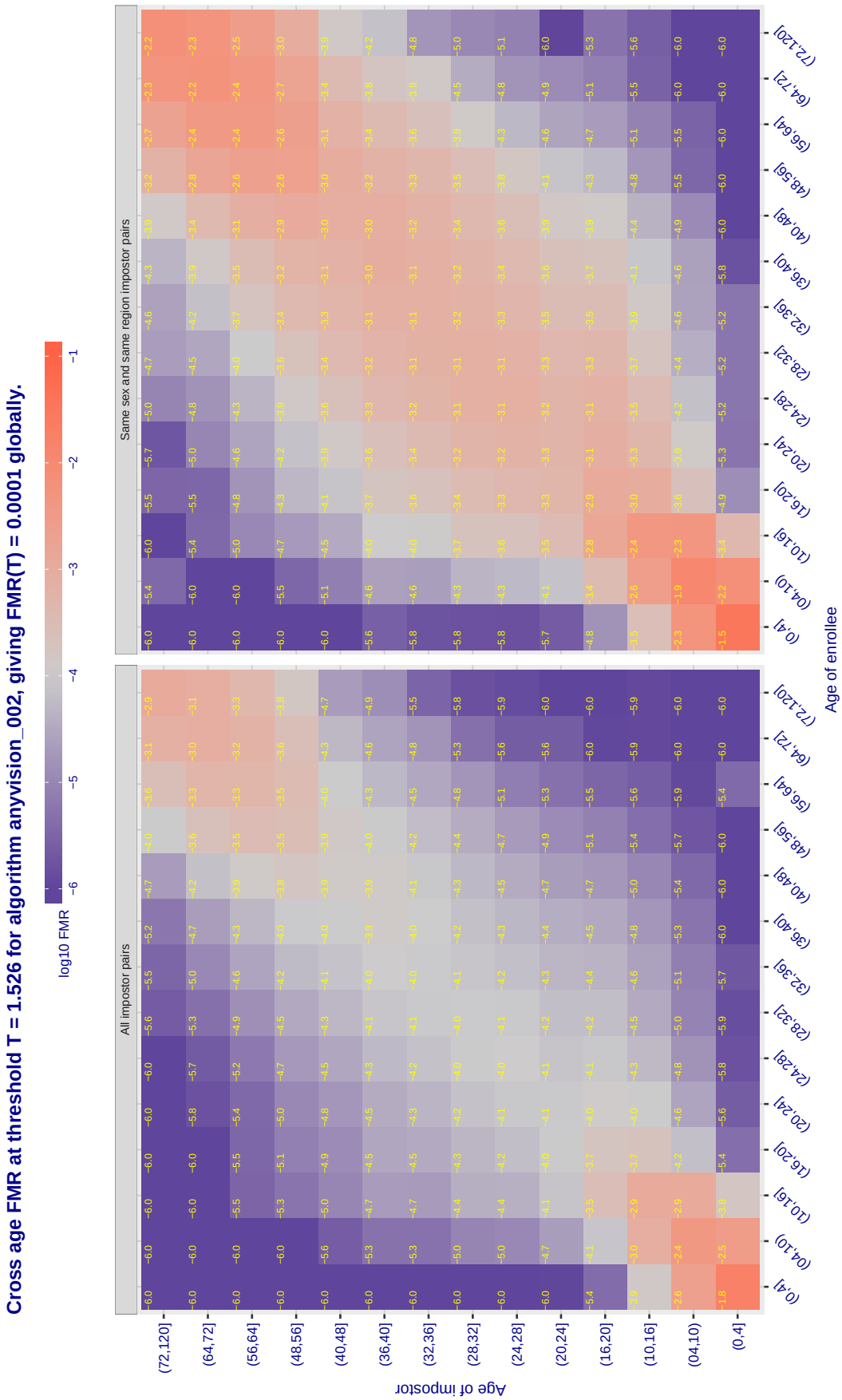


Figure 410: For algorithm anyvision-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

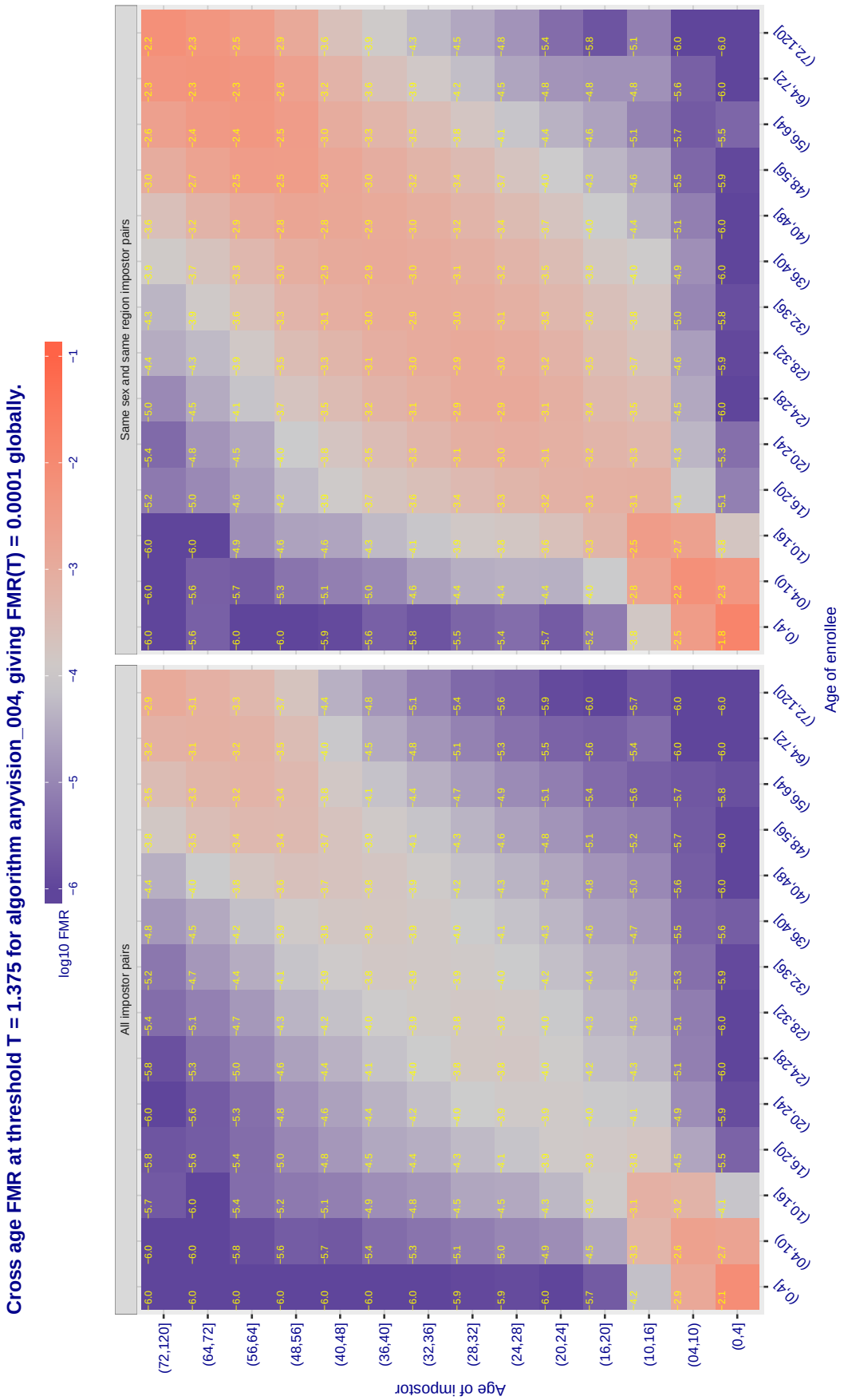


Figure 411: For algorithm anyvision-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

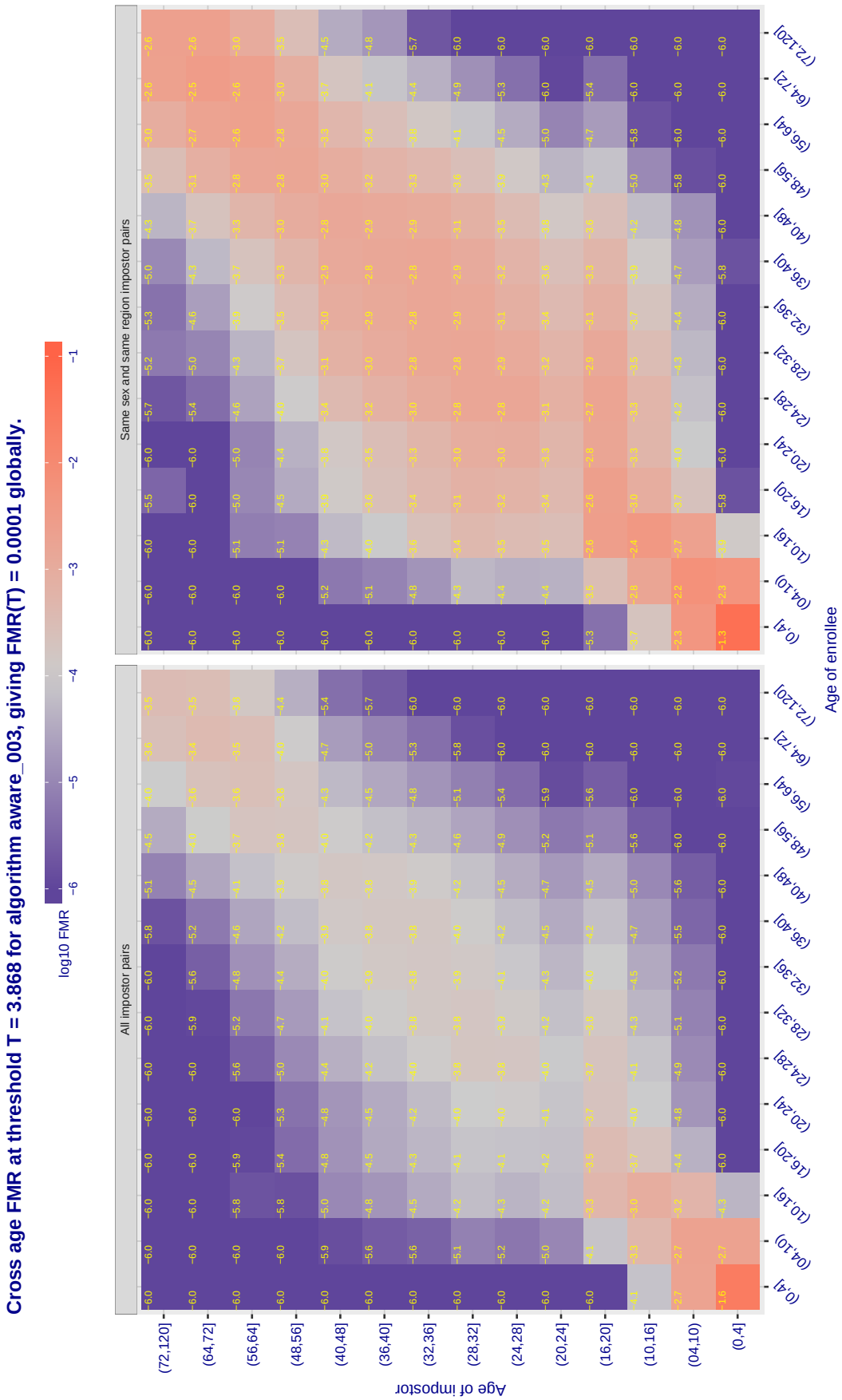


Figure 412: For algorithm aware-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

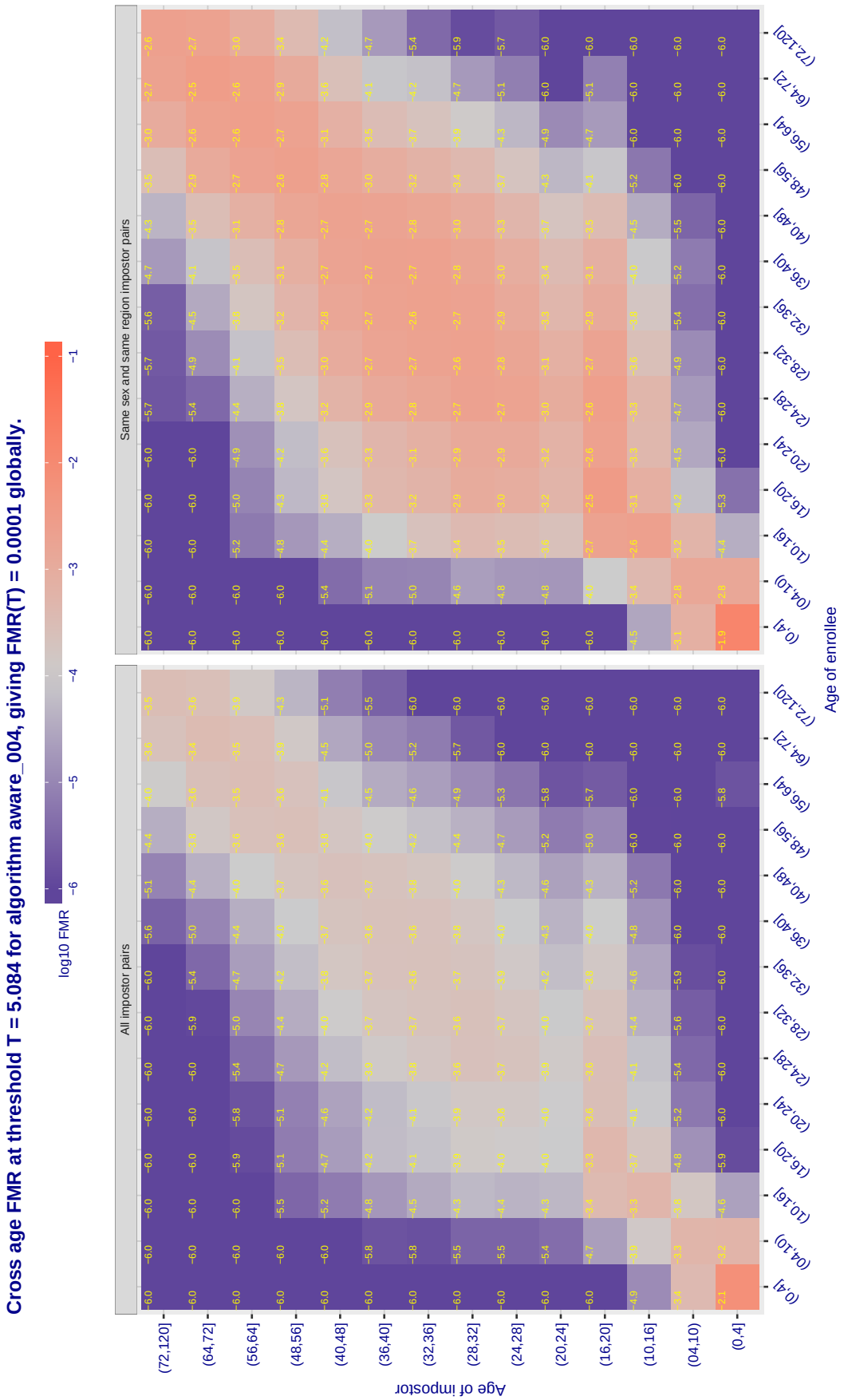


Figure 413: For algorithm aware-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

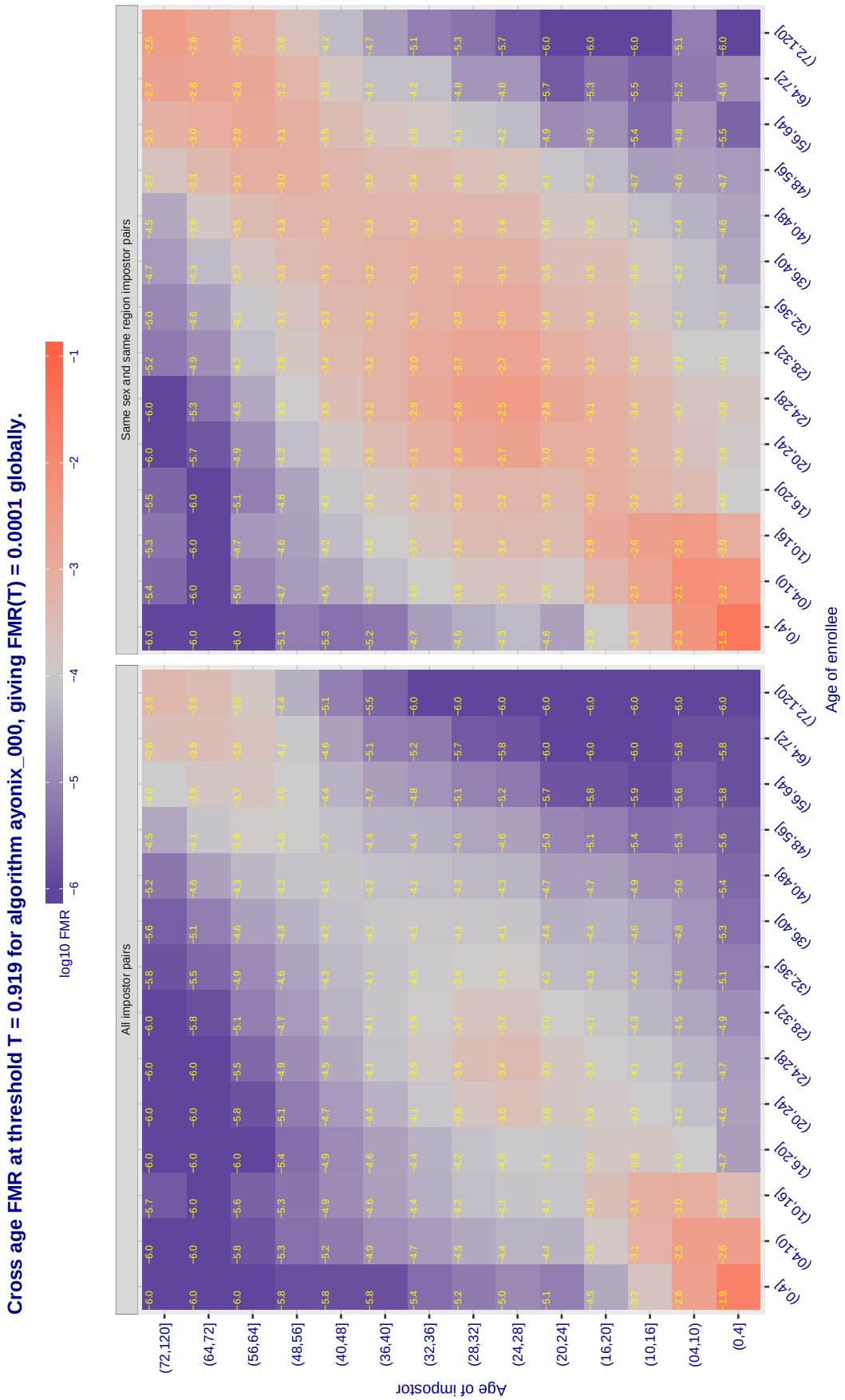


Figure 414: For algorithm ayonix-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

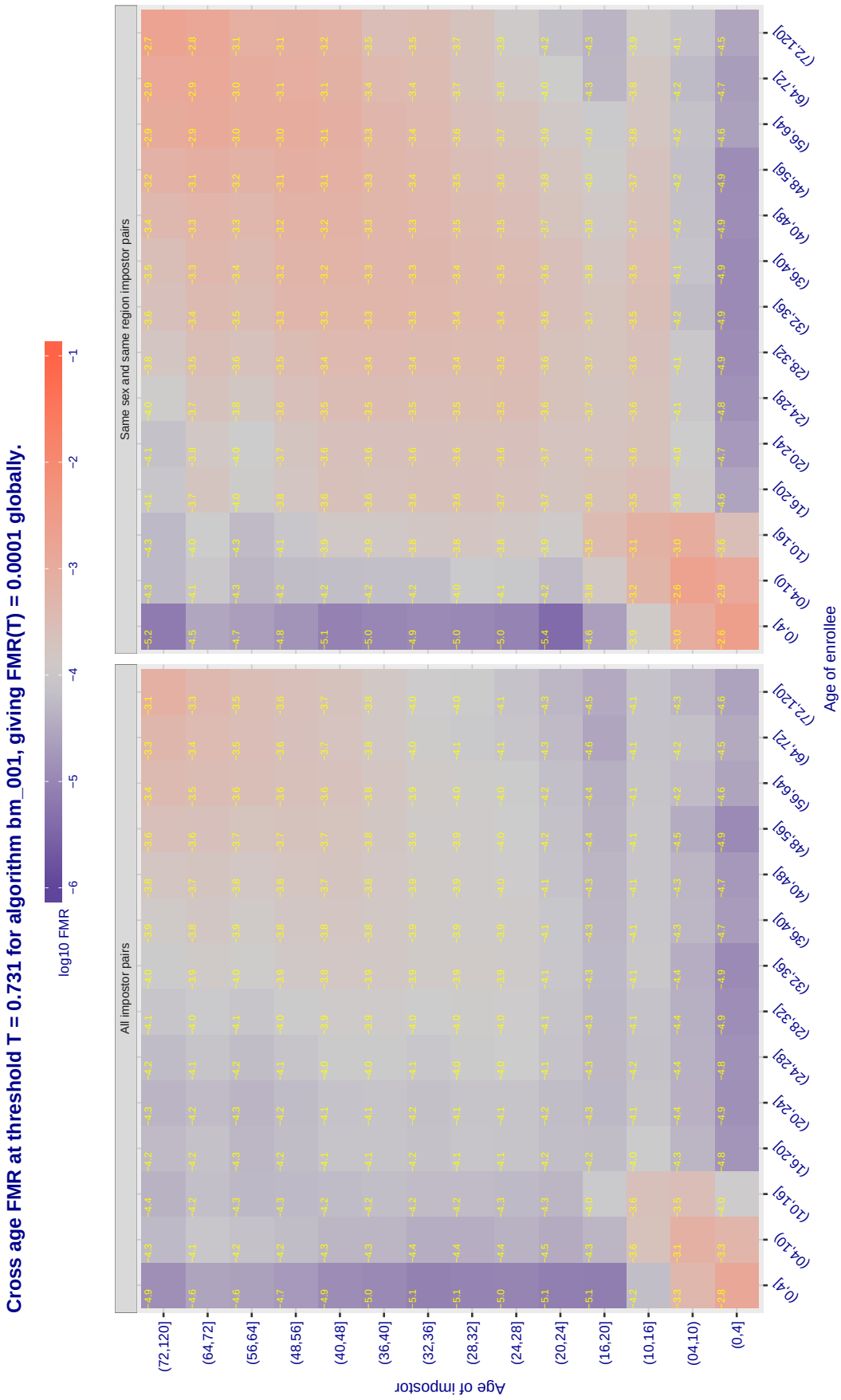


Figure 415: For algorithm bm-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

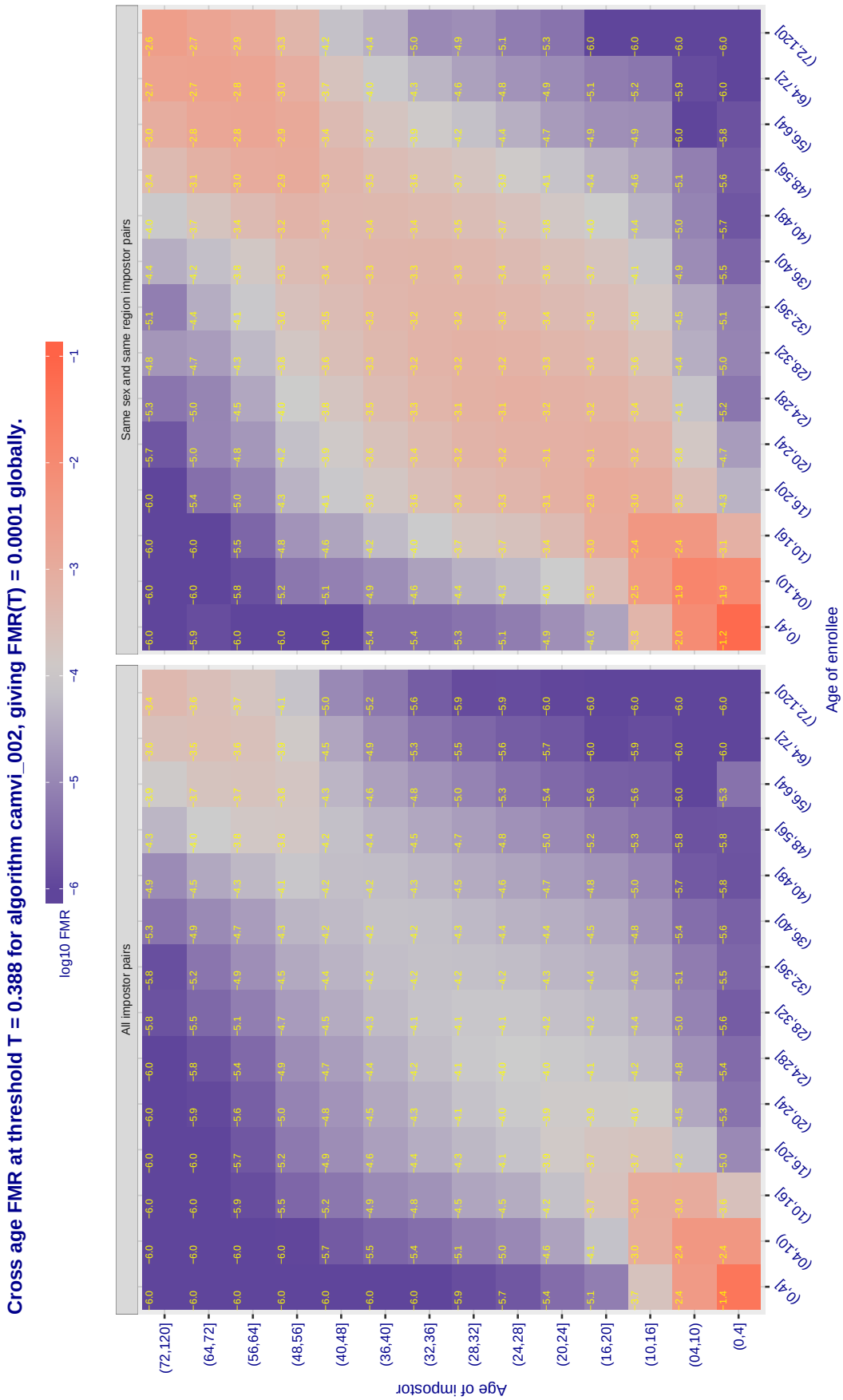


Figure 416: For algorithm camvi-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

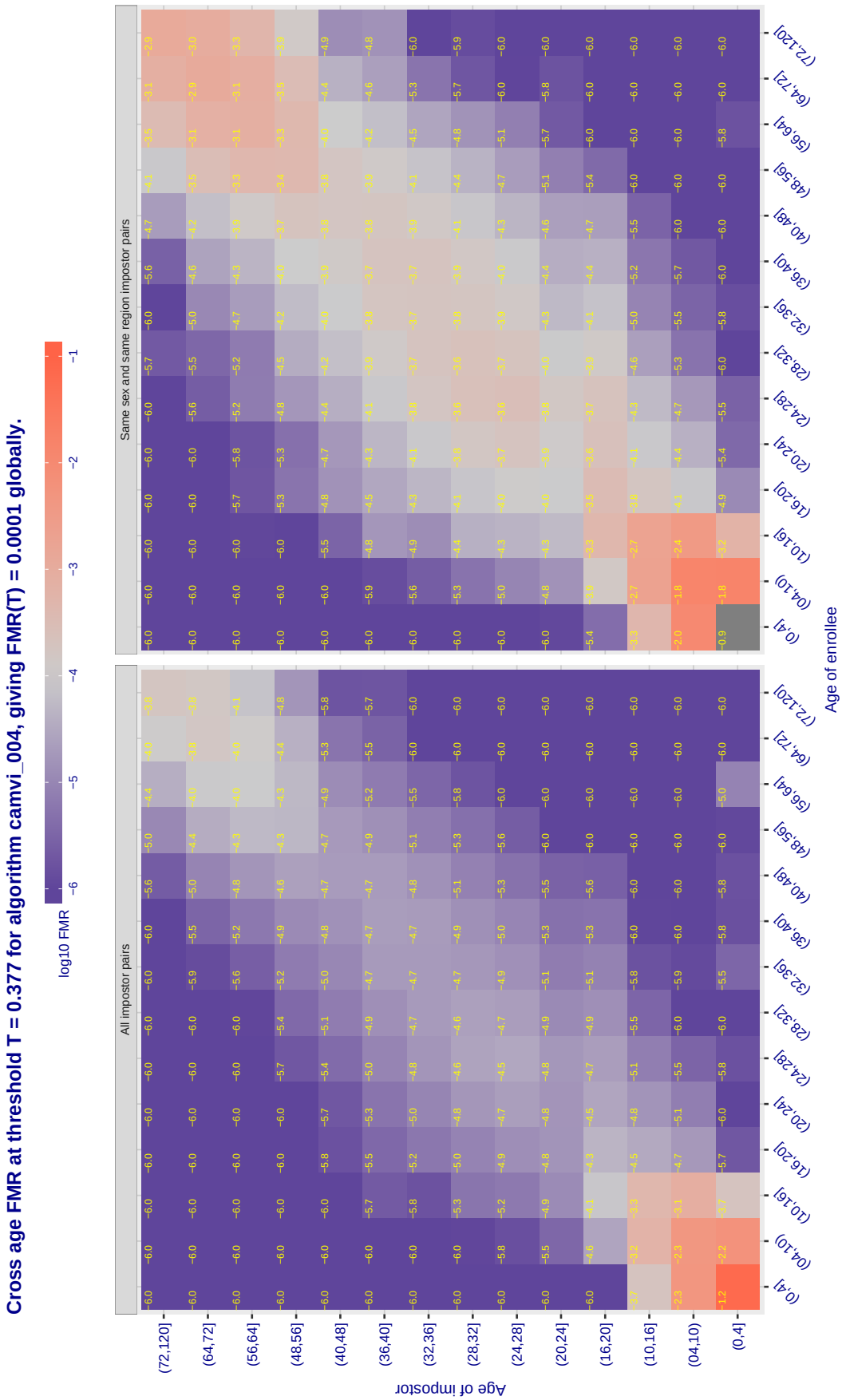


Figure 417: For algorithm camvi-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

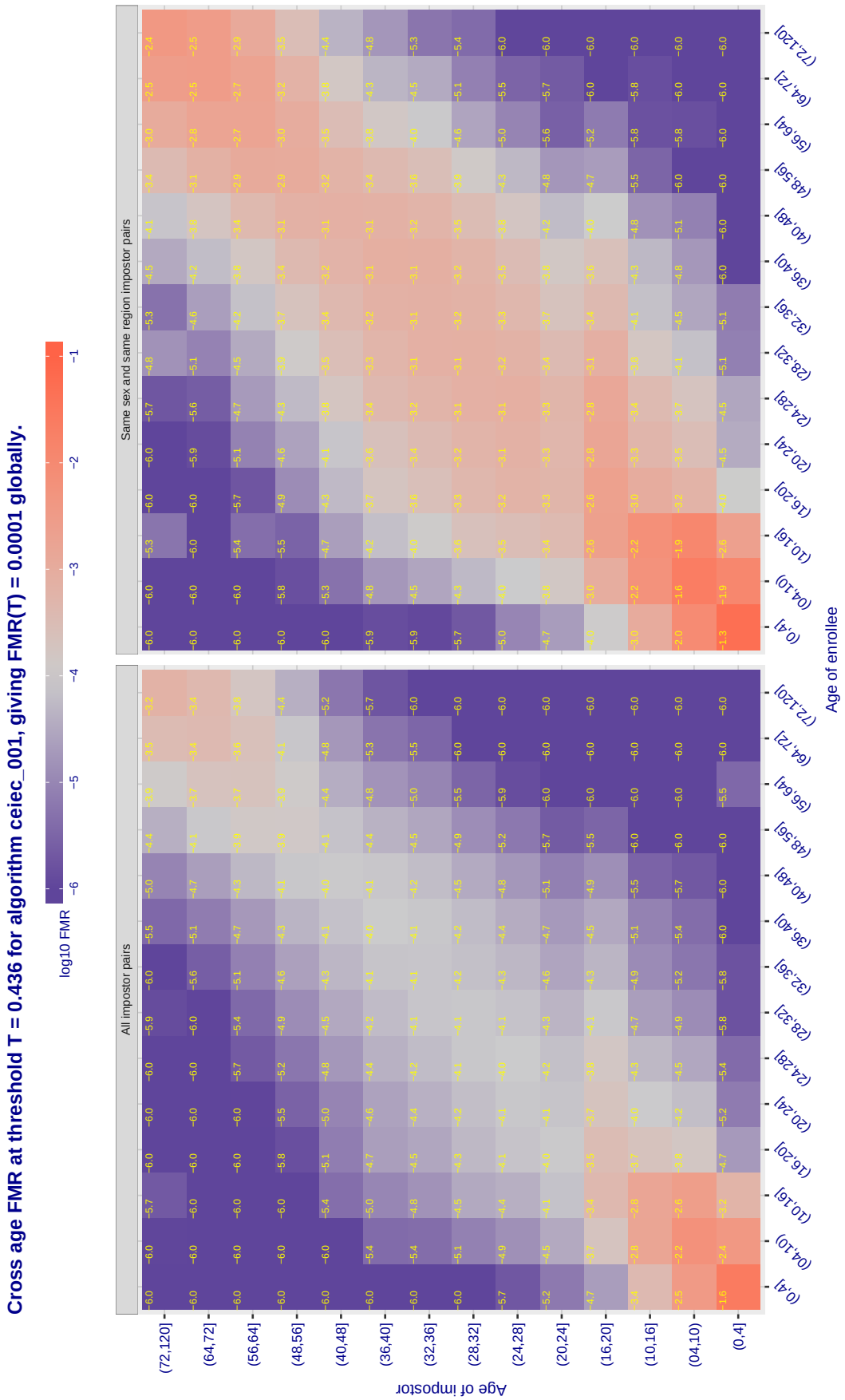


Figure 418: For algorithm ceiec-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

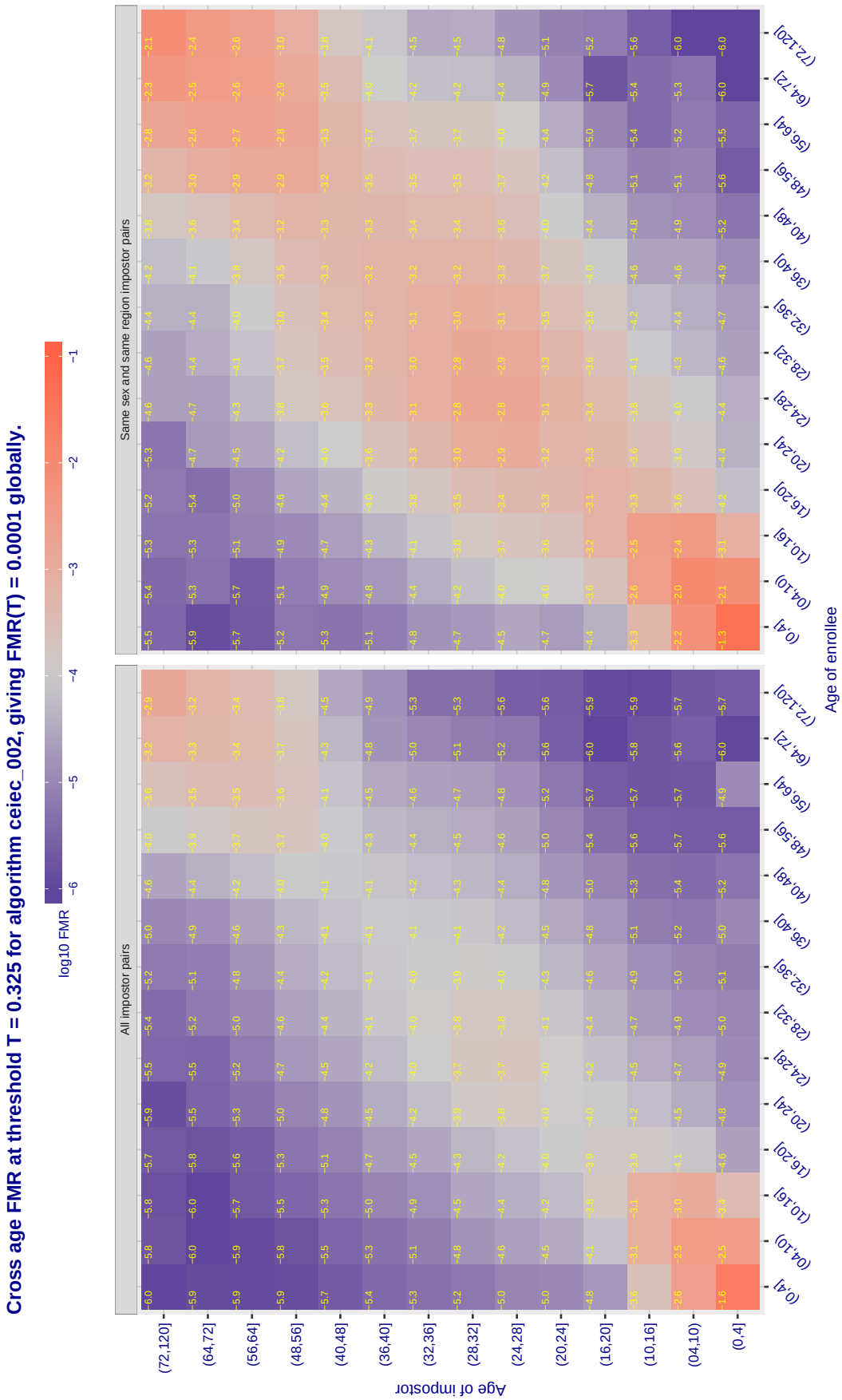


Figure 419: For algorithm ceiec-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

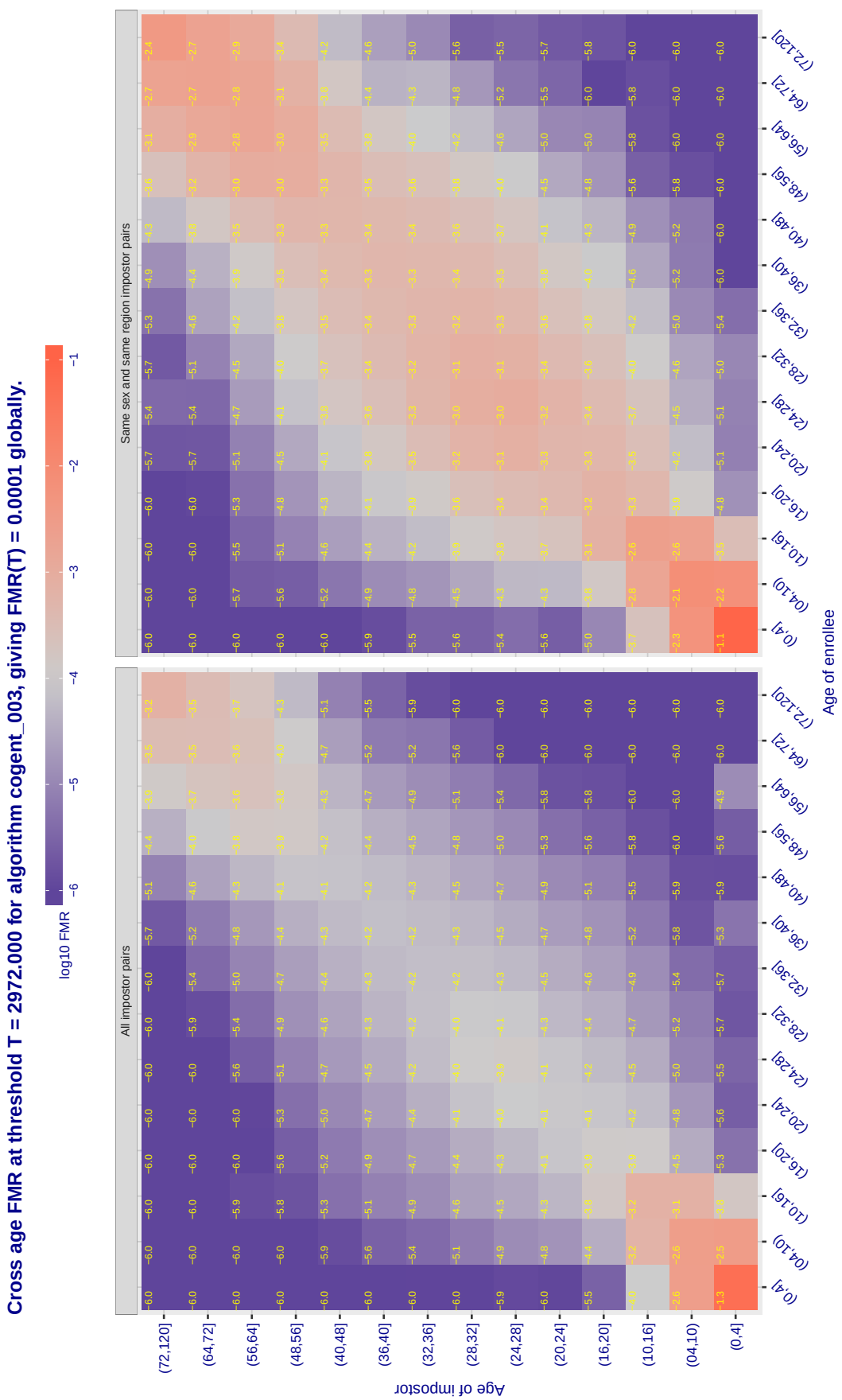


Figure 420: For algorithm cogent-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

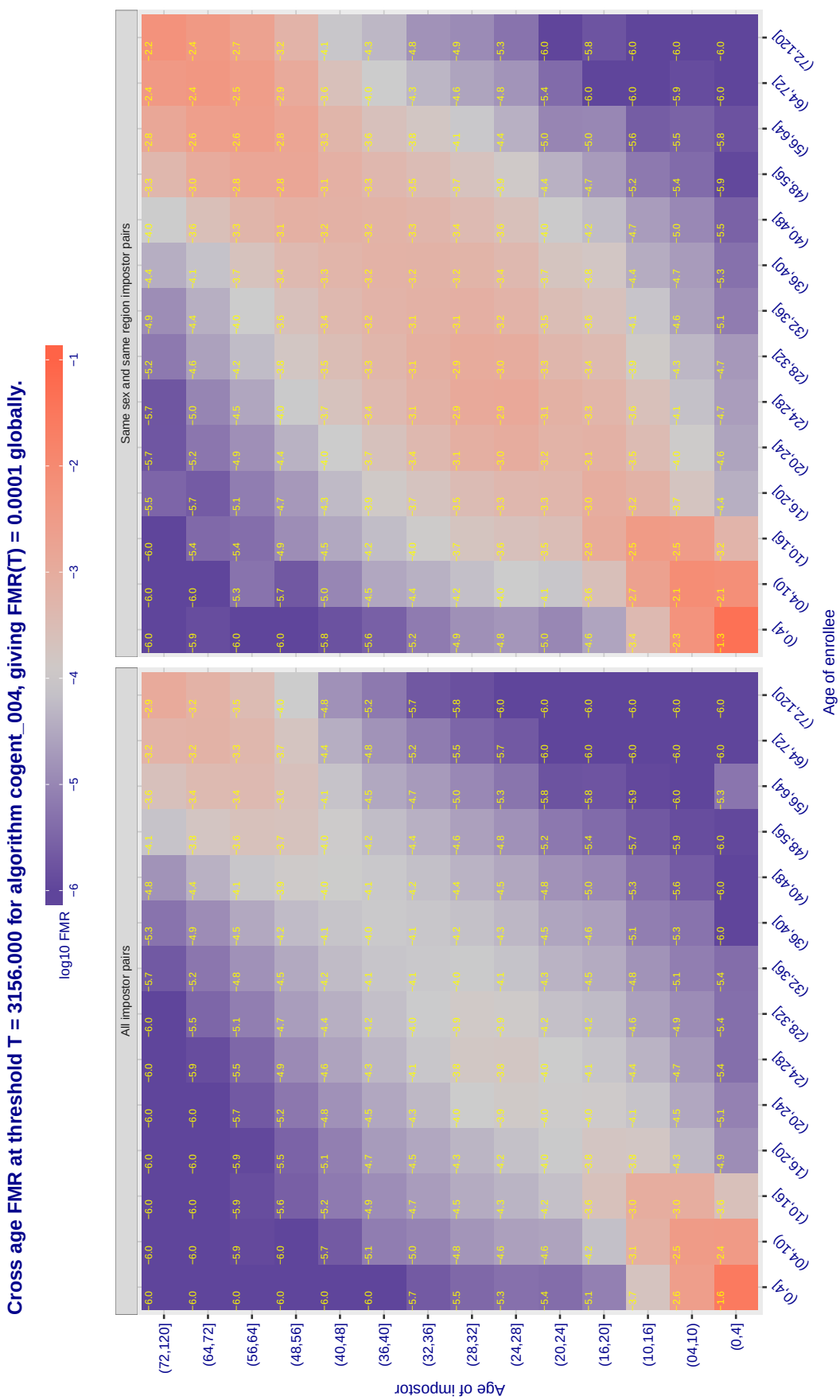


Figure 421: For algorithm cogent-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

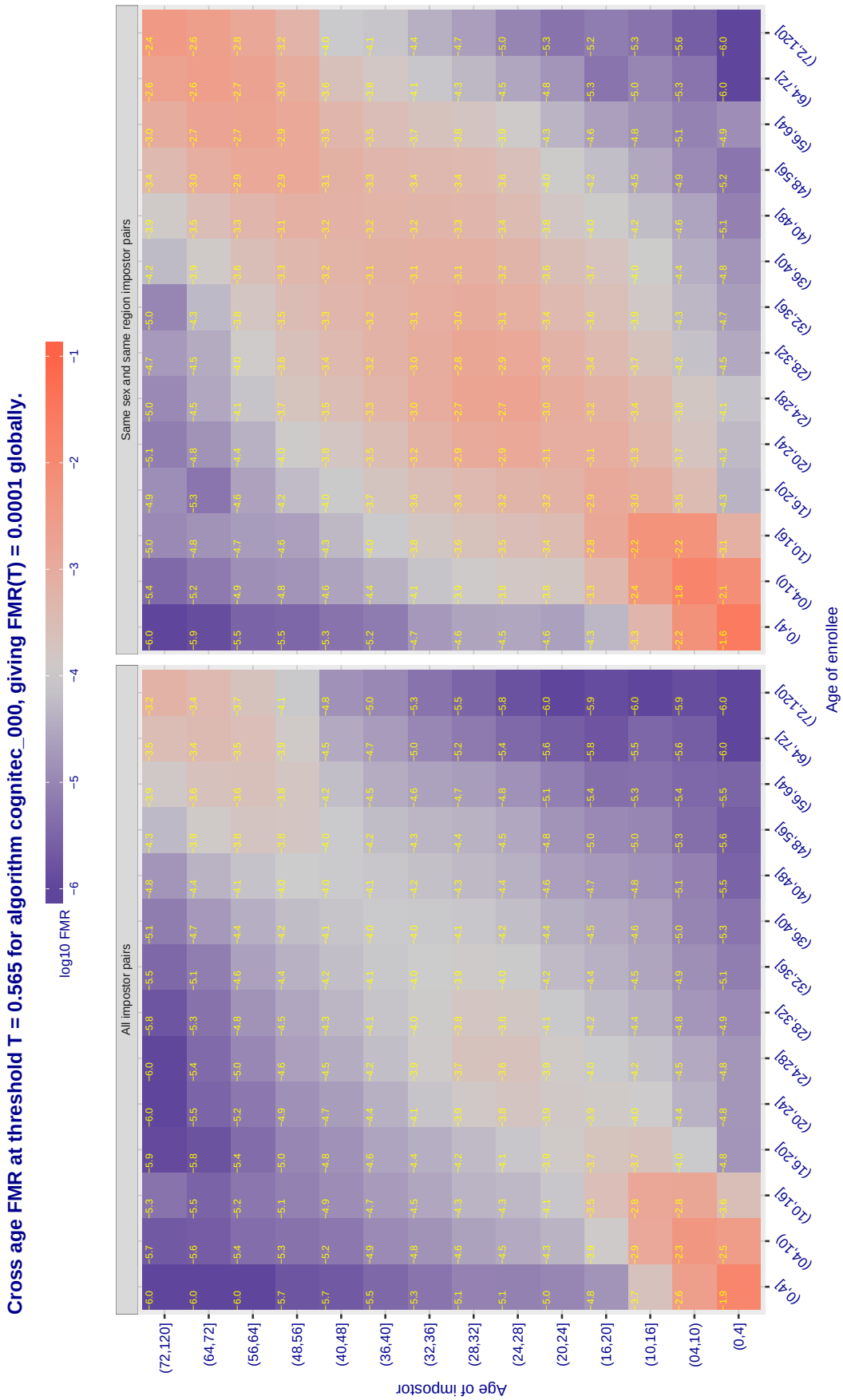


Figure 422: For algorithm cognitec-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

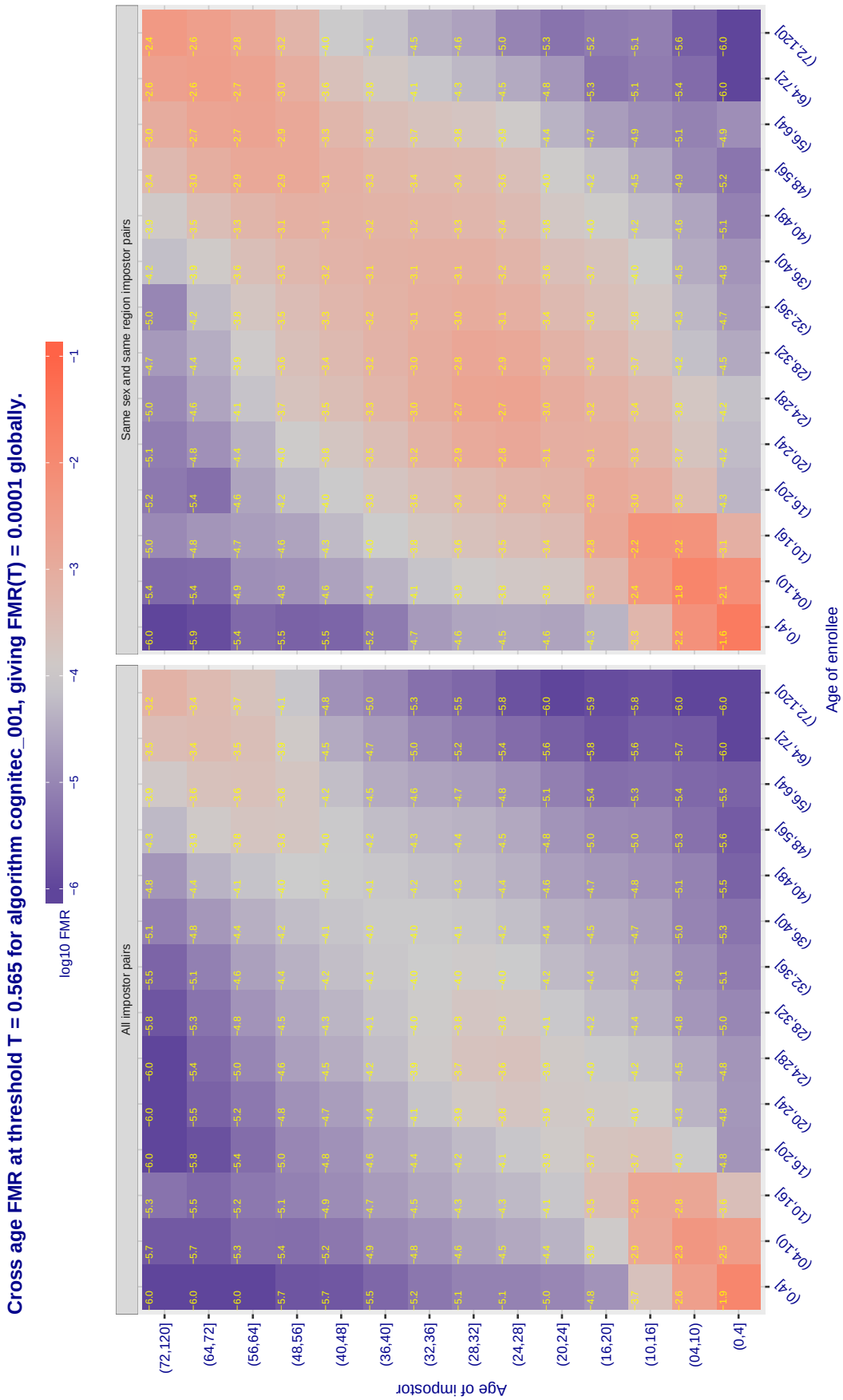


Figure 423: For algorithm cognitec-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

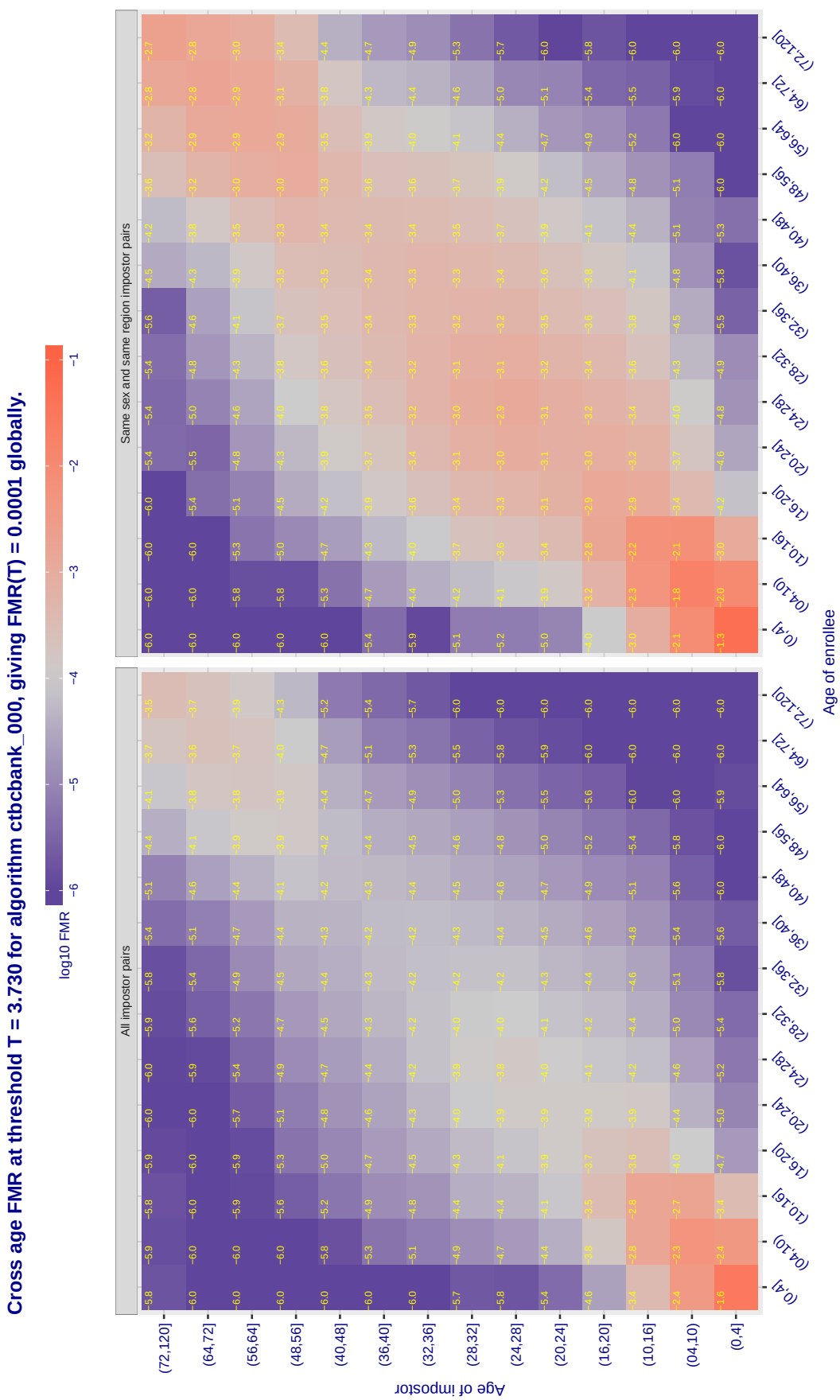


Figure 424: For algorithm ctbcbank-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

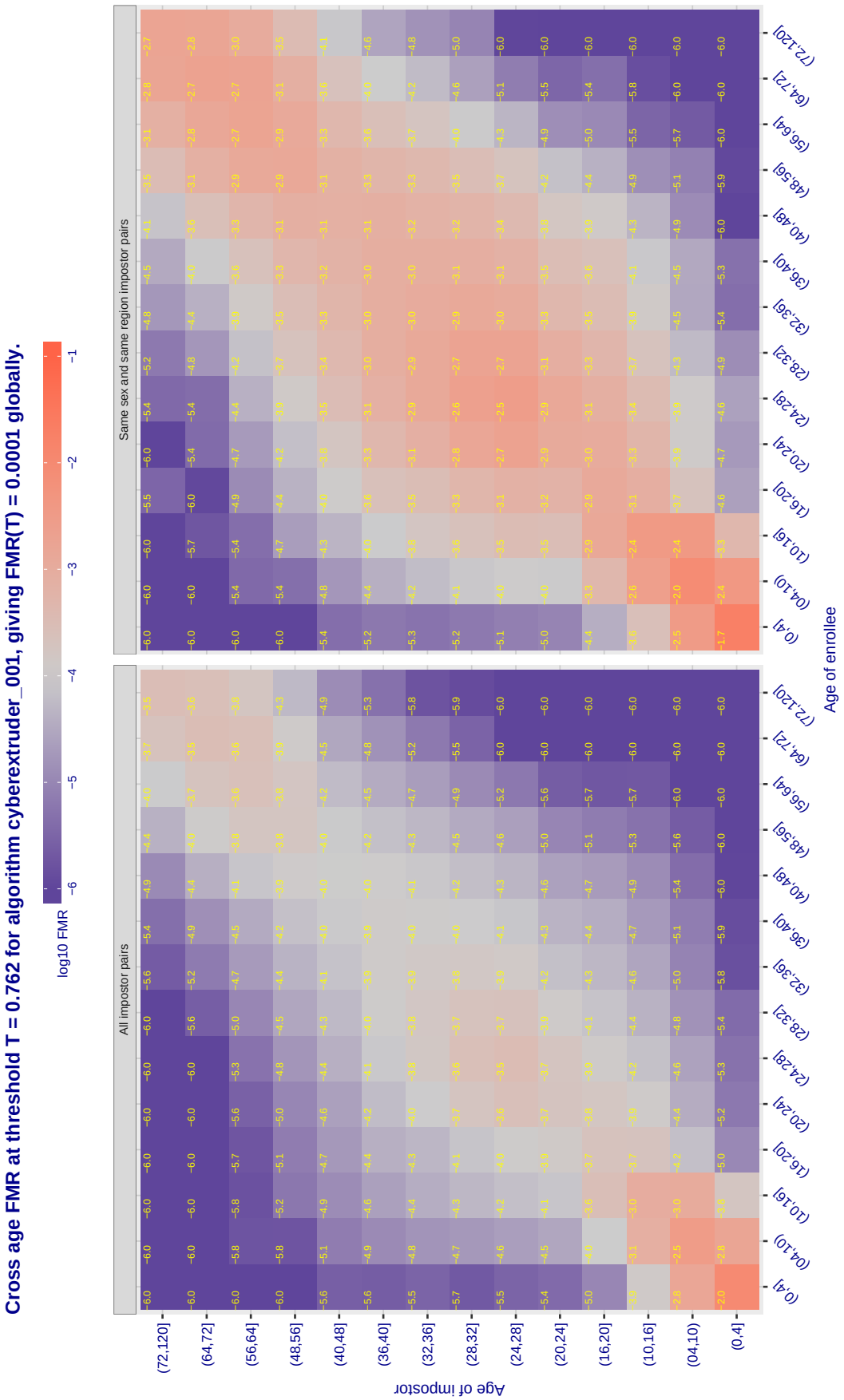


Figure 425: For algorithm cyberextruder-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

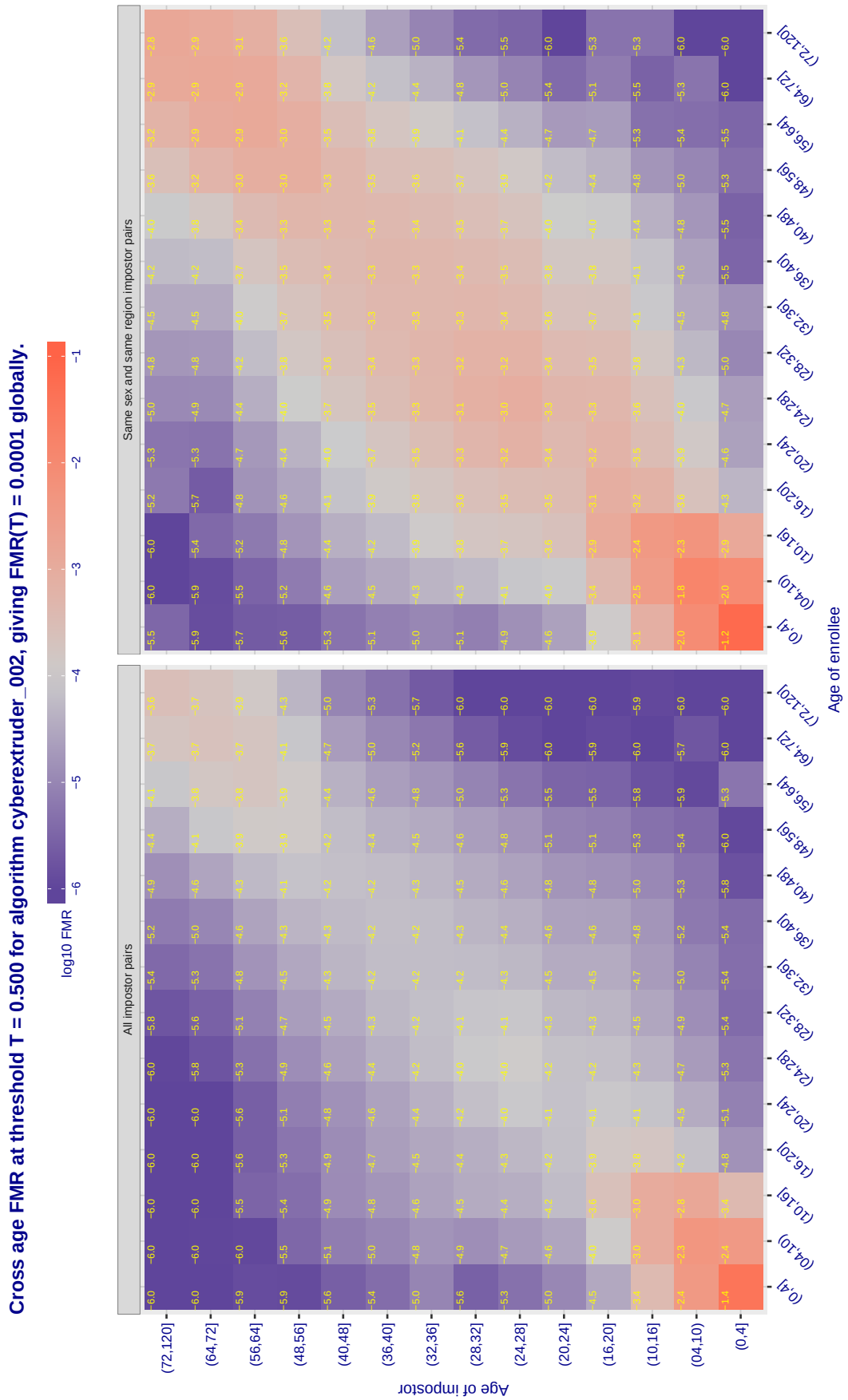


Figure 426: For algorithm cyberextruder-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

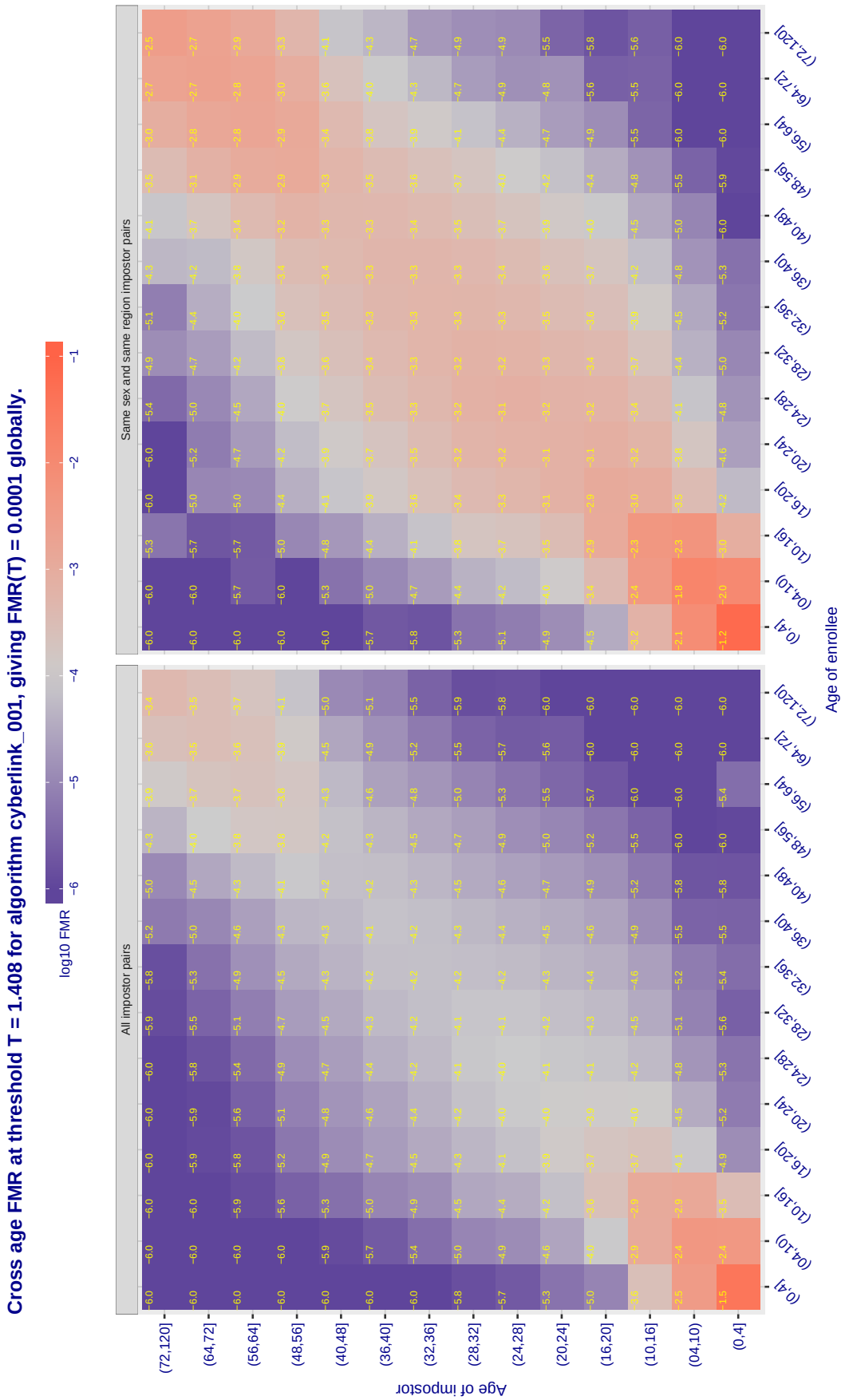


Figure 427: For algorithm cyberlink-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

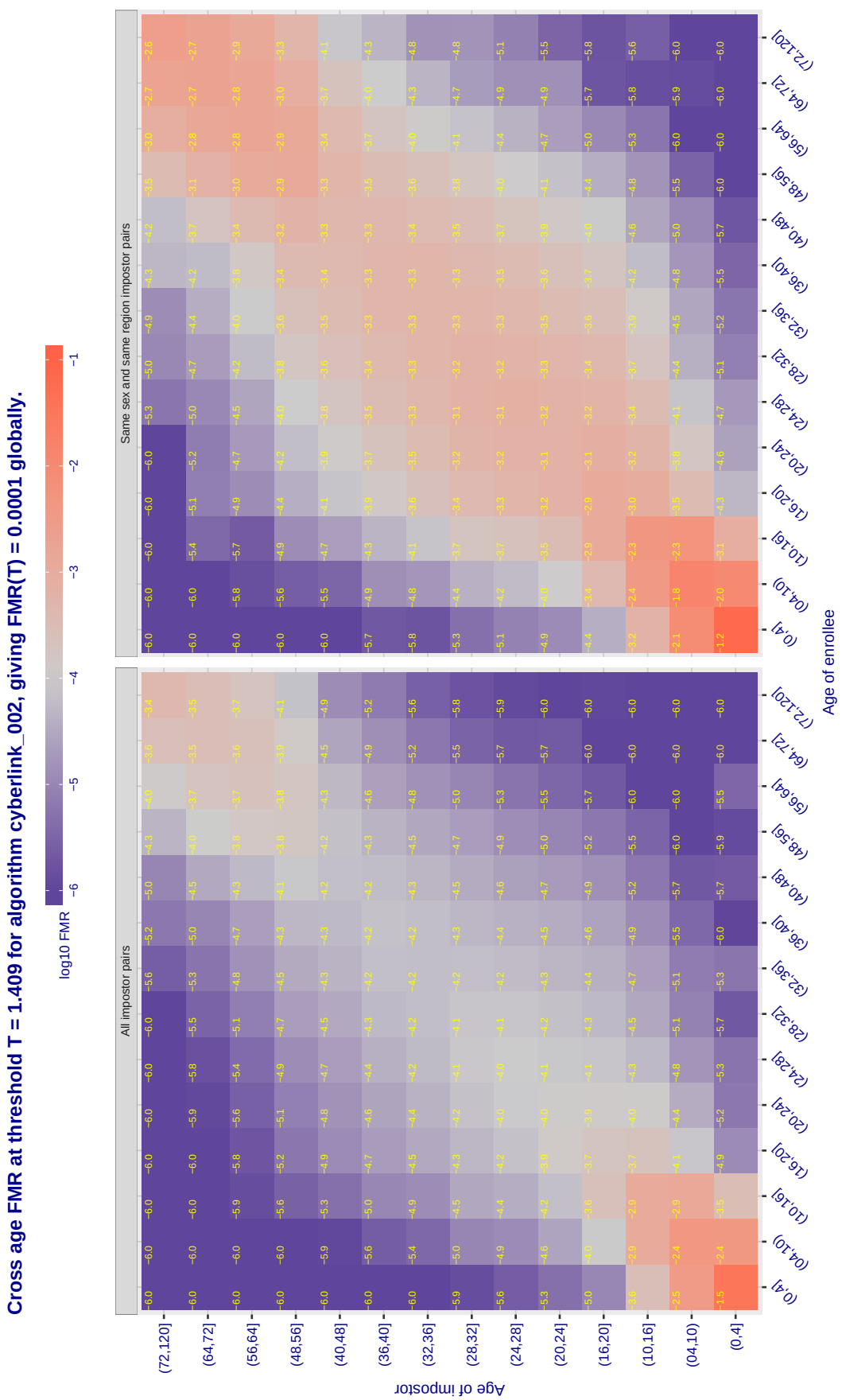


Figure 428: For algorithm cyberlink-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

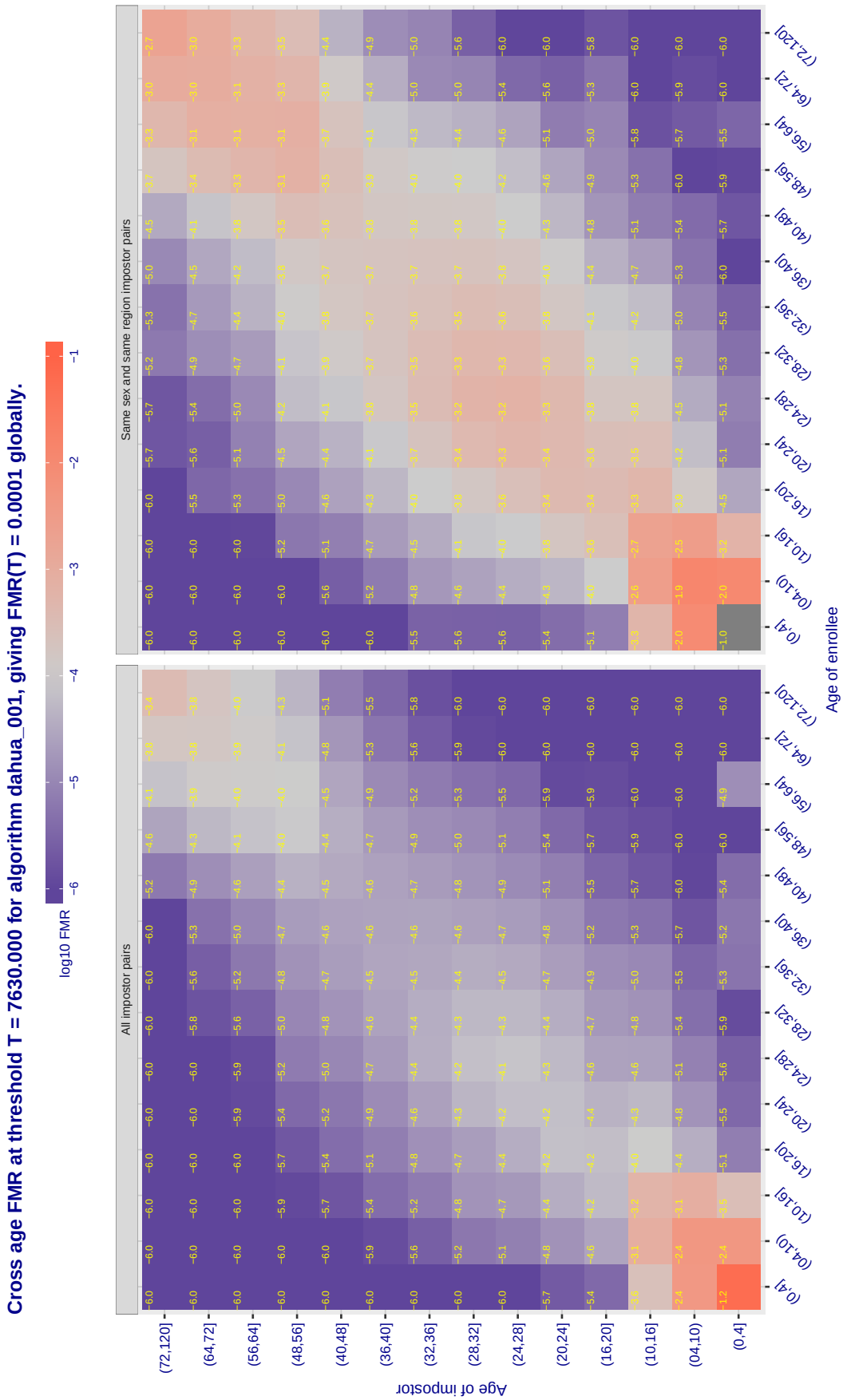


Figure 429: For algorithm dahua-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

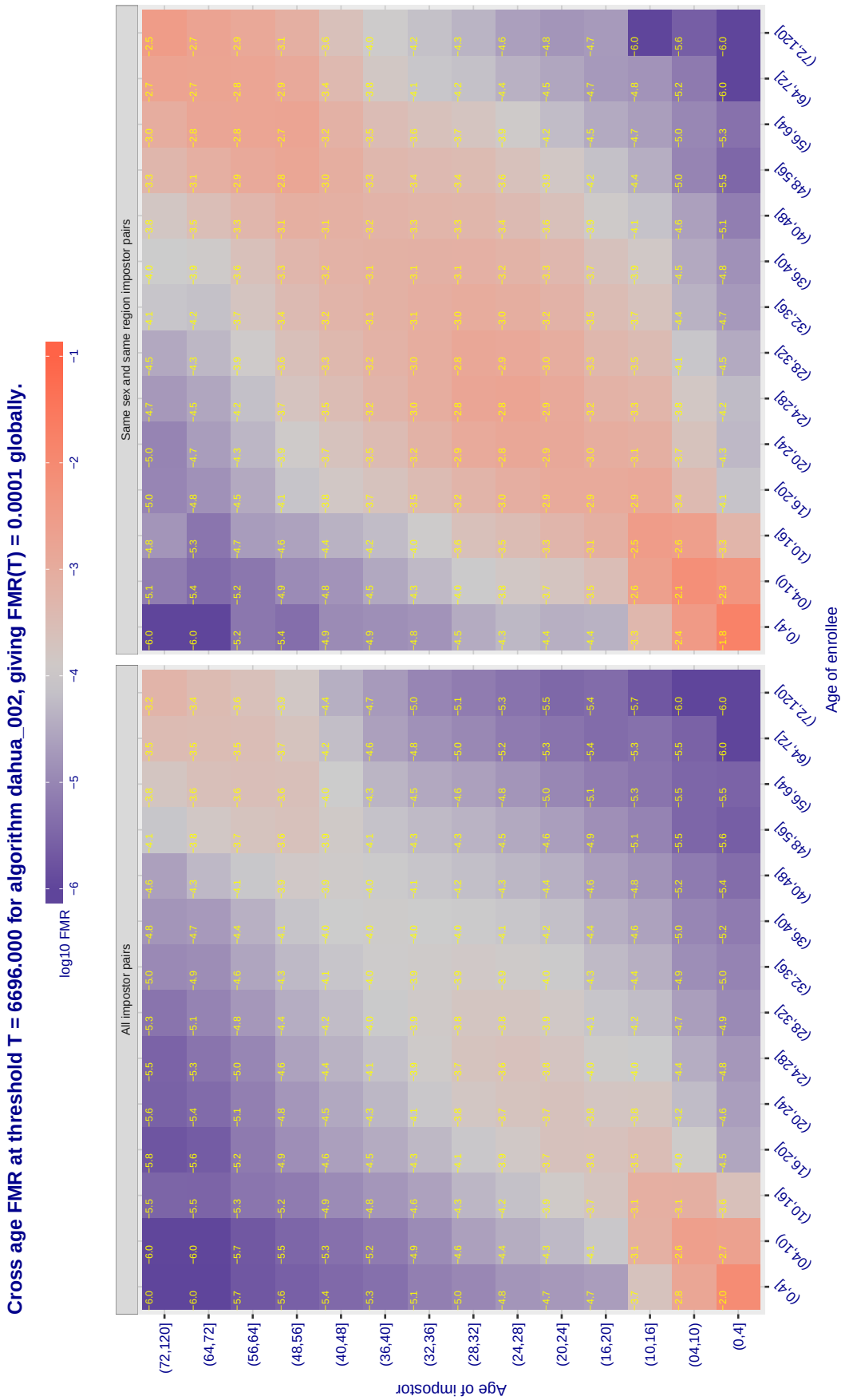


Figure 430: For algorithm dahua-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

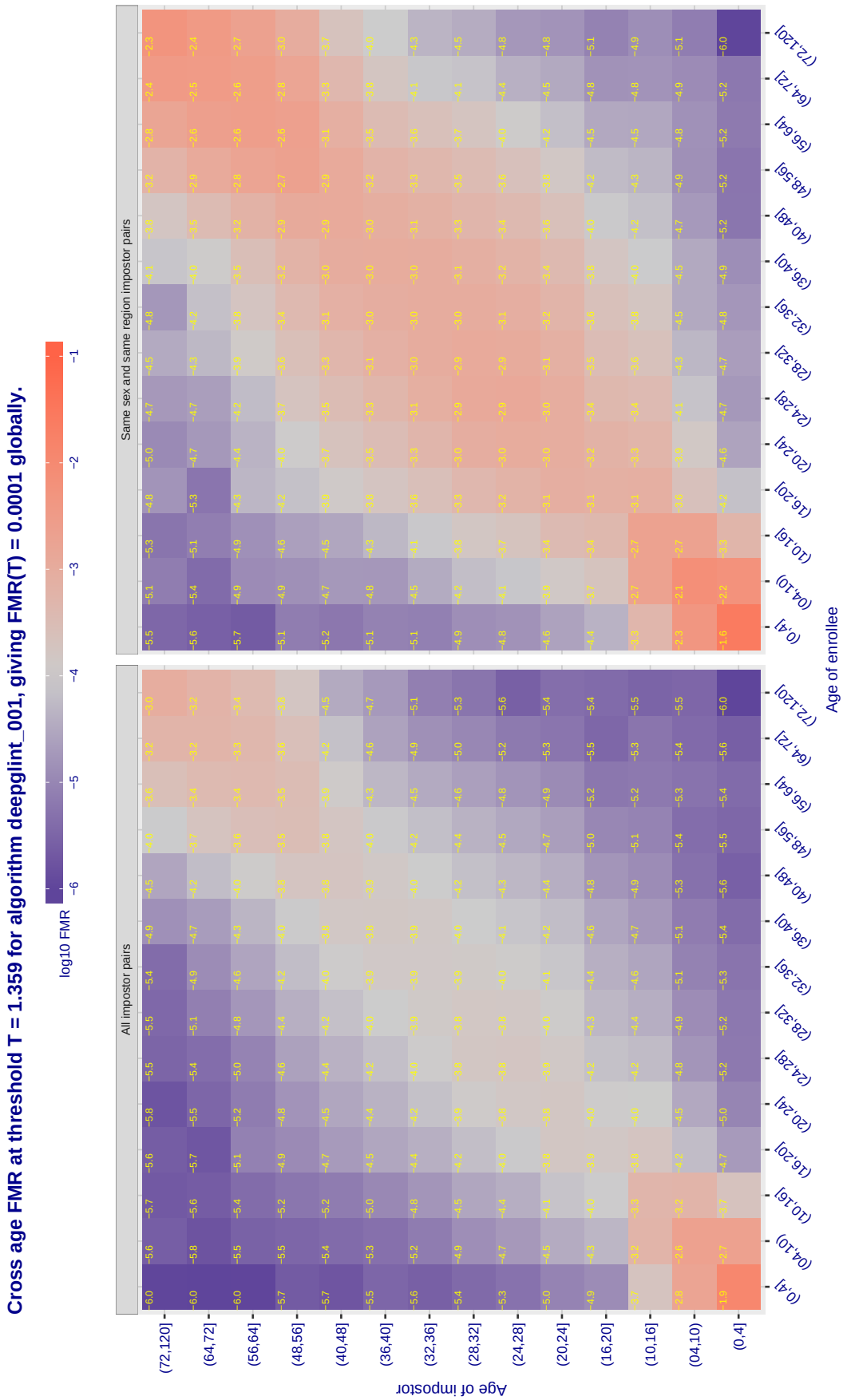


Figure 431: For algorithm deepglint-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

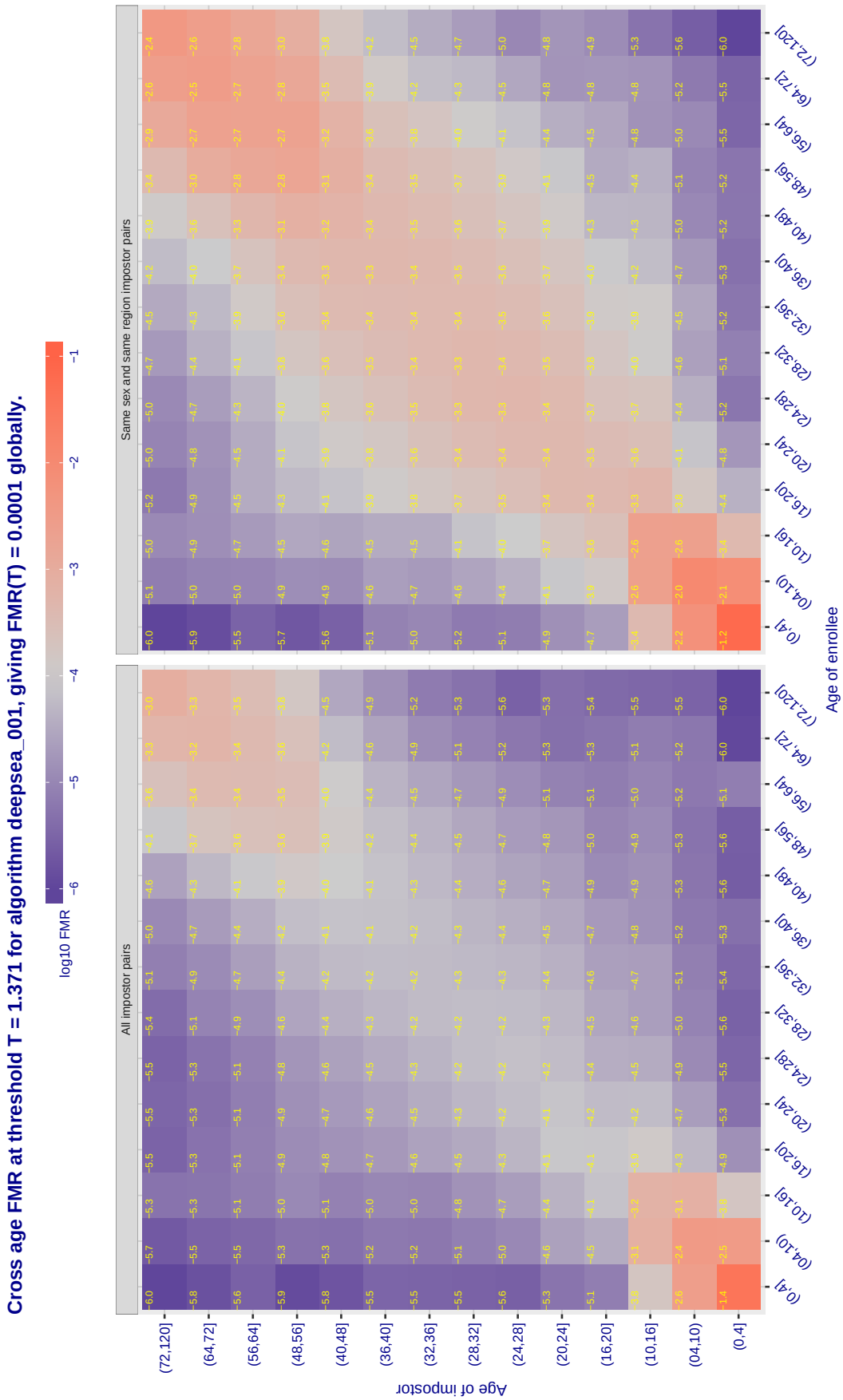


Figure 432: For algorithm deepsea-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

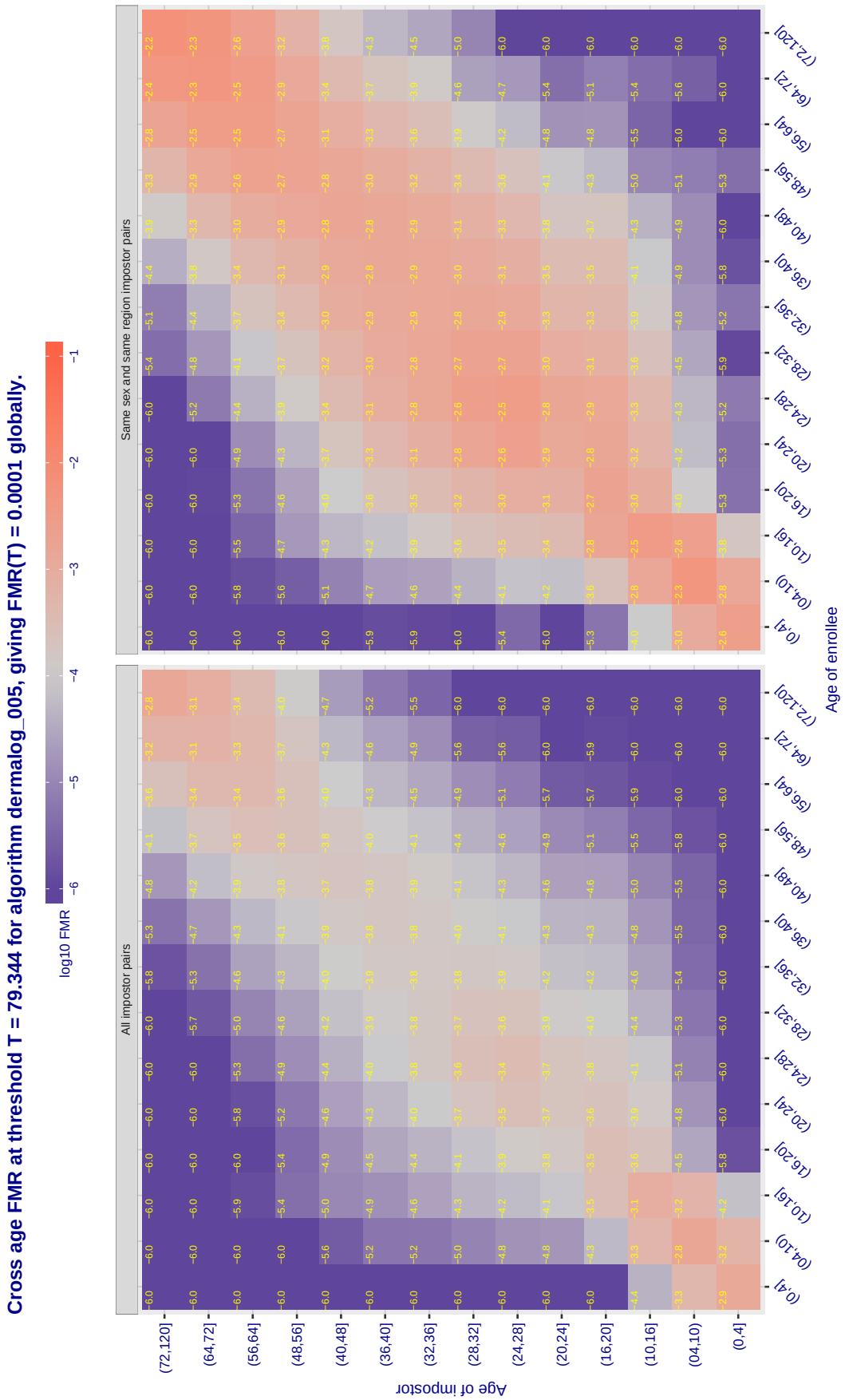


Figure 433: For algorithm dermalog-005 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

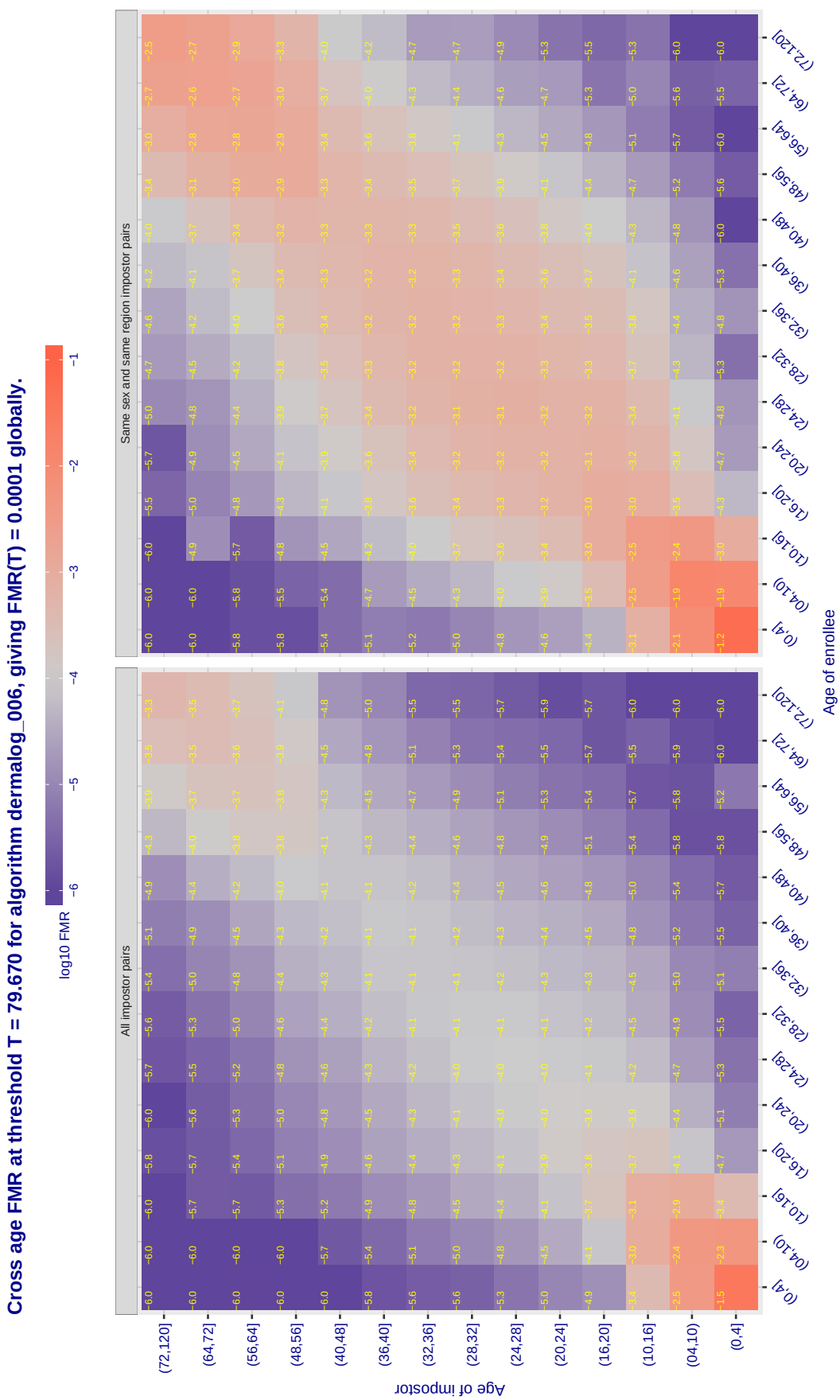


Figure 434: For algorithm dermalog-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

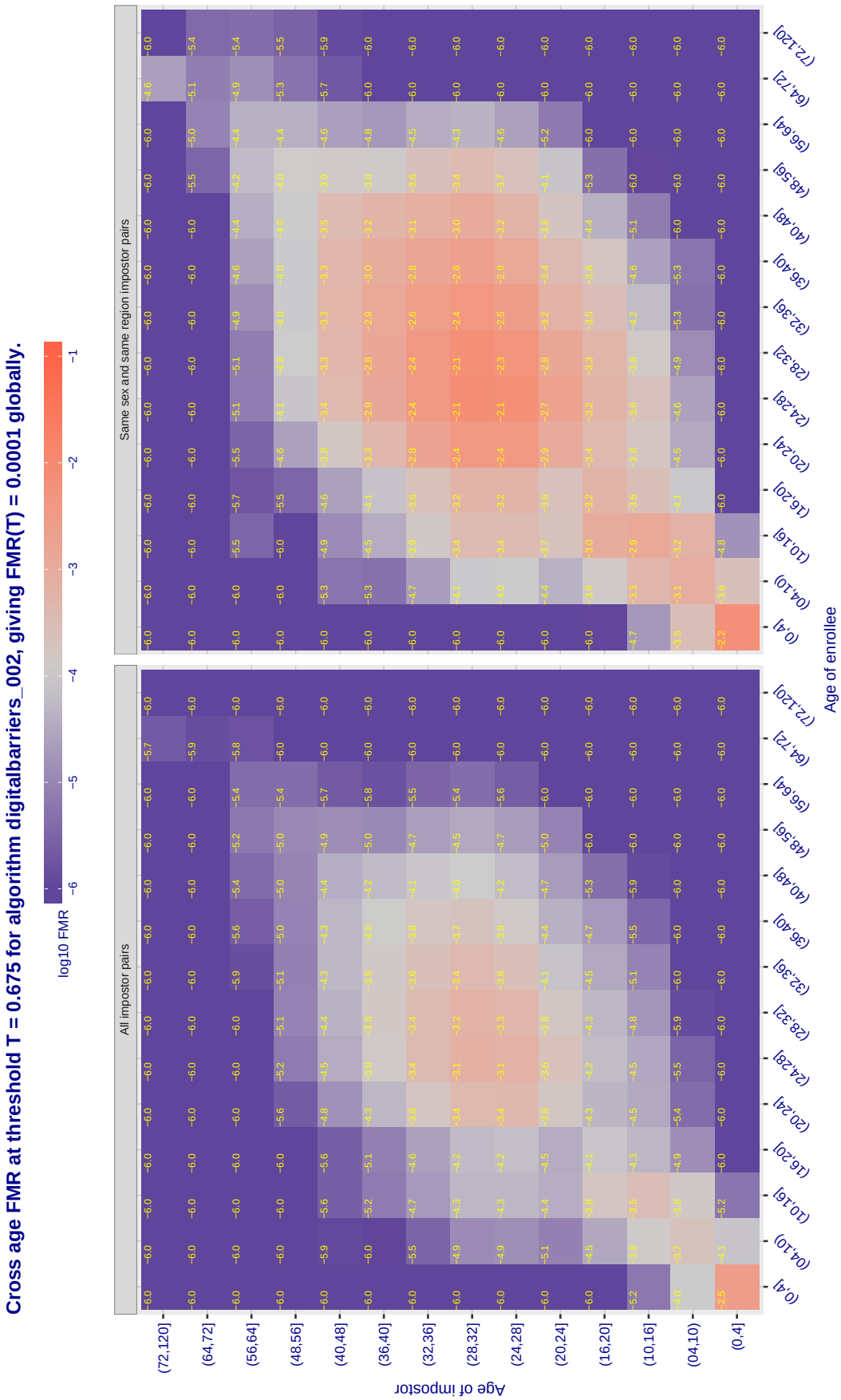


Figure 435: For algorithm digitalbarriers-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

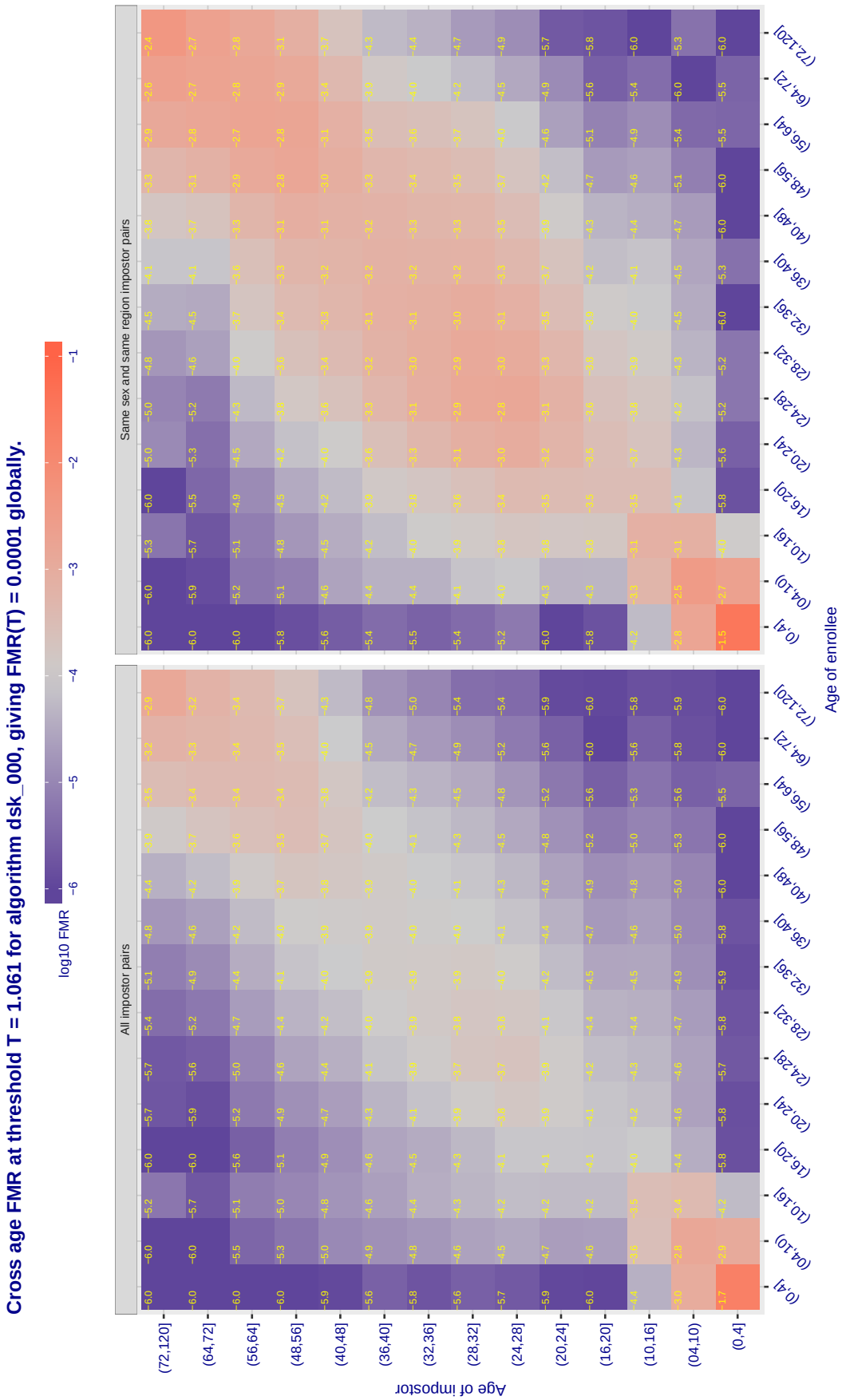


Figure 436: For algorithm dsk-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

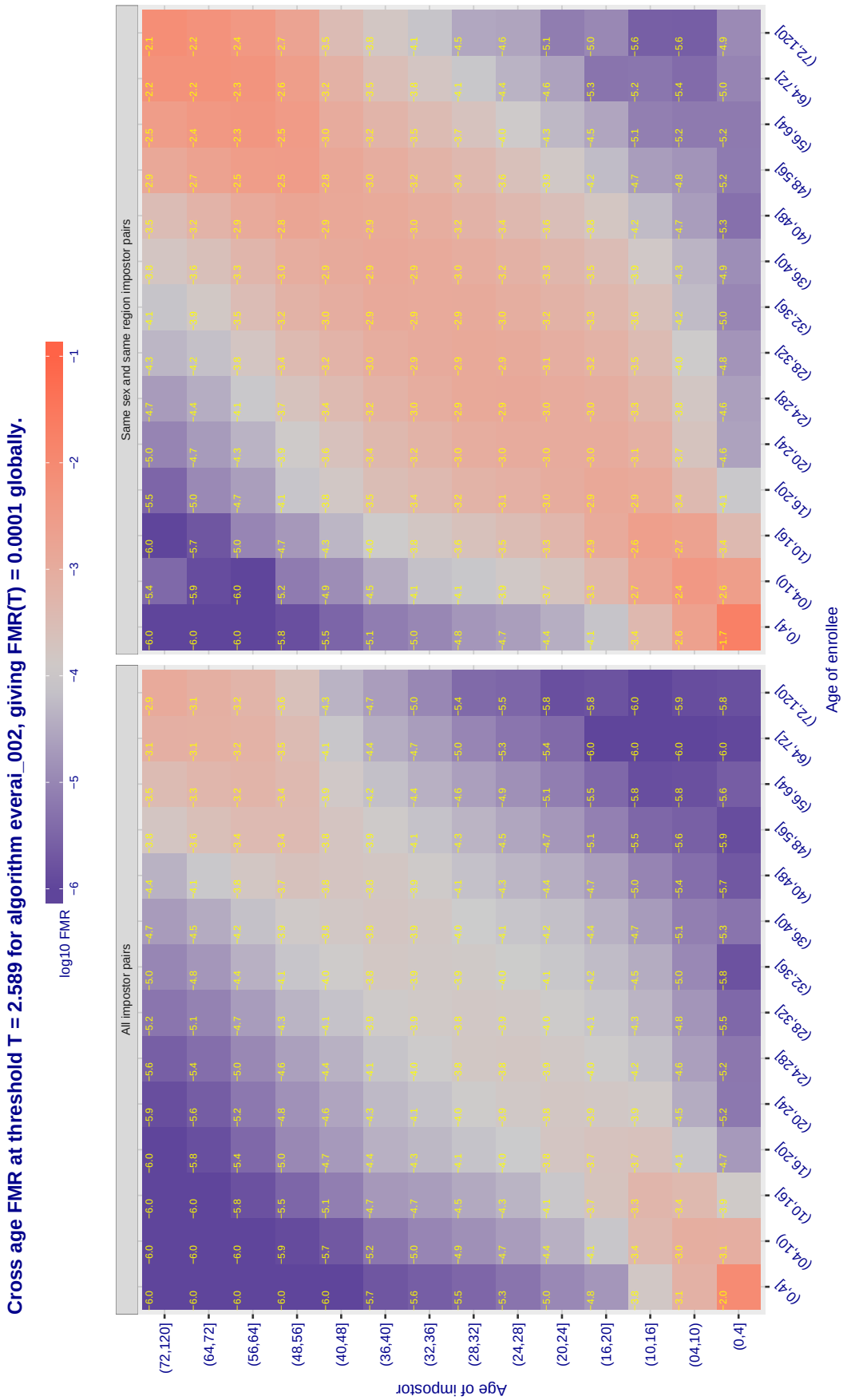


Figure 437: For algorithm everai-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

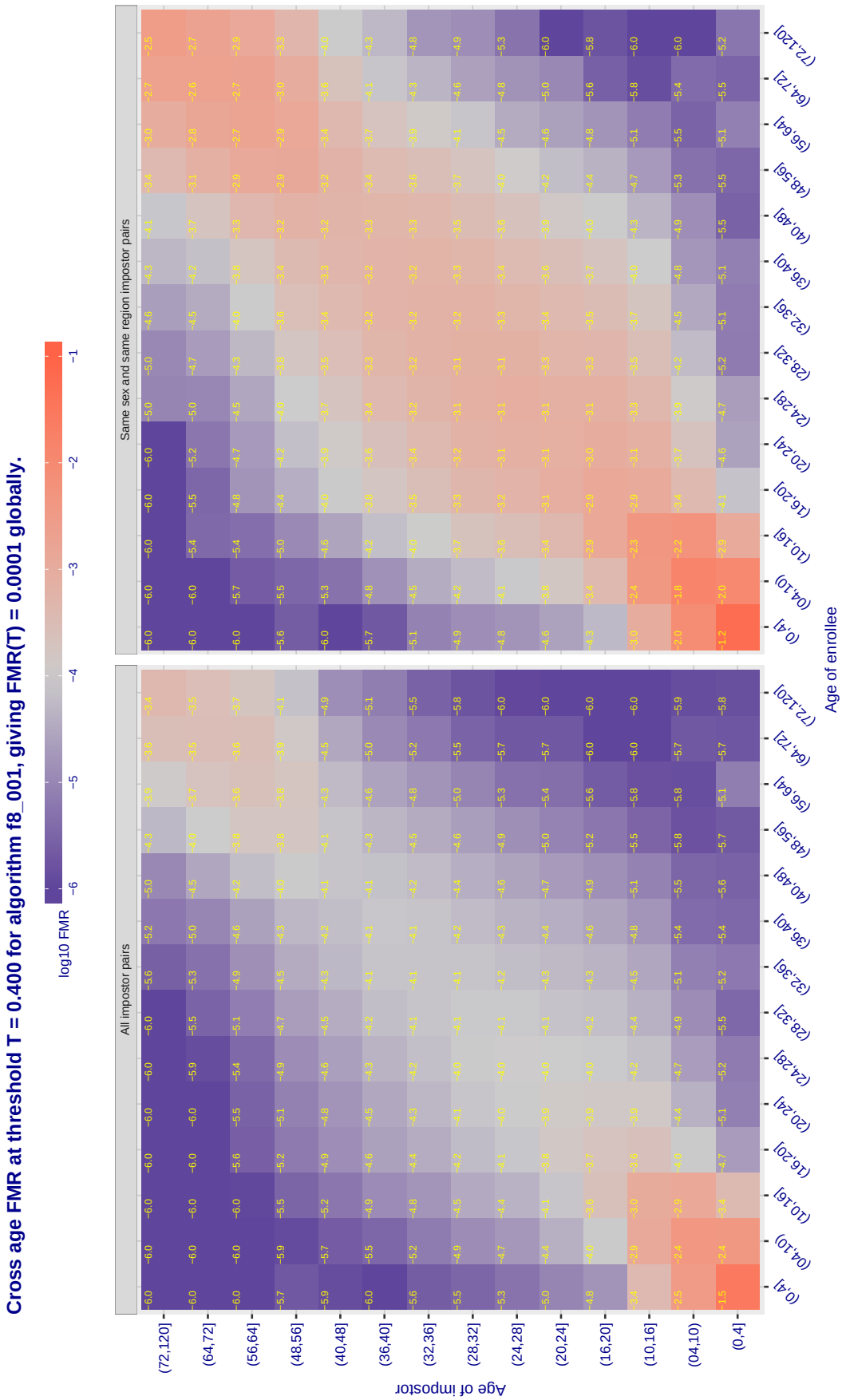


Figure 438: For algorithm f8-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

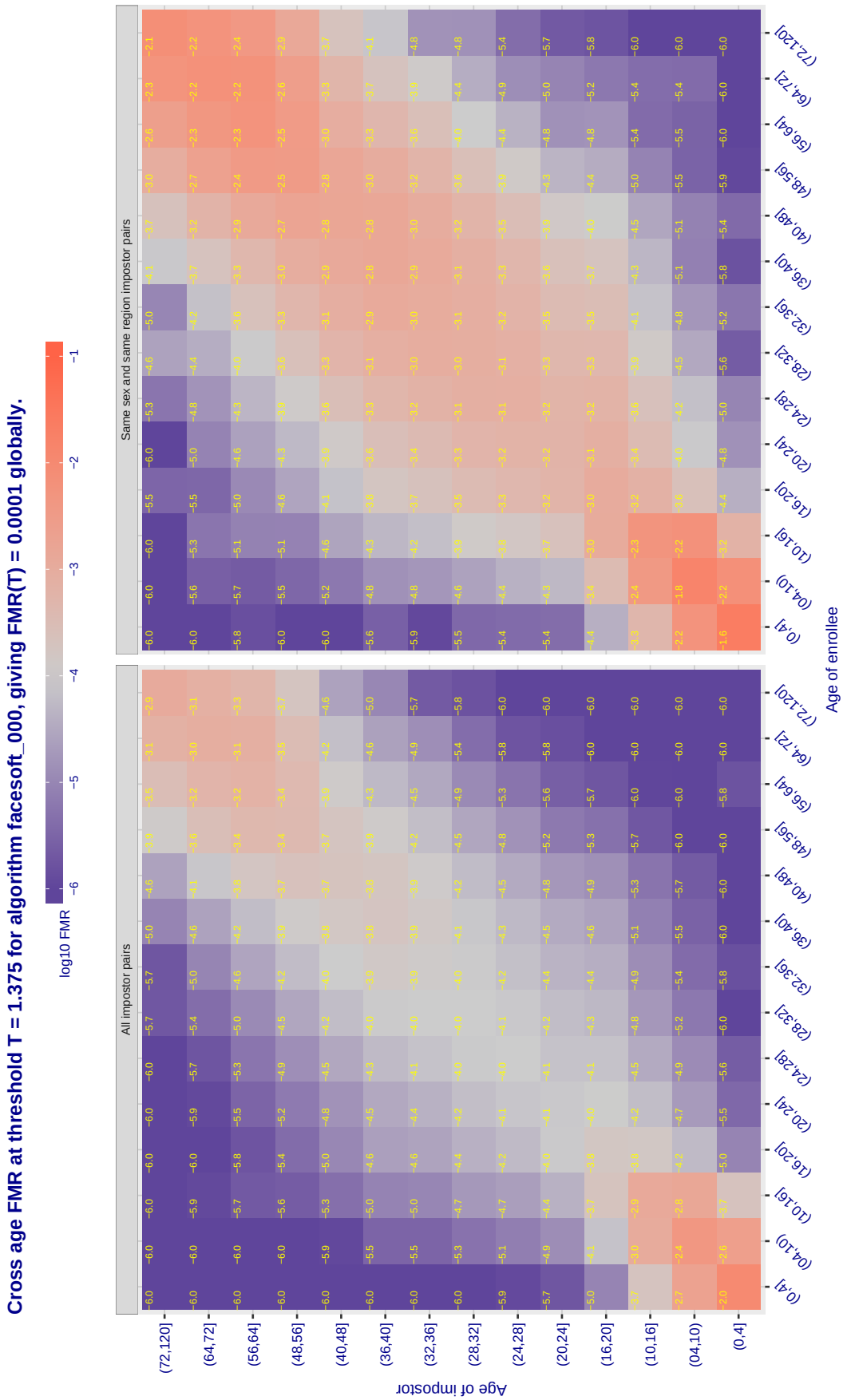


Figure 439: For algorithm facesoft-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

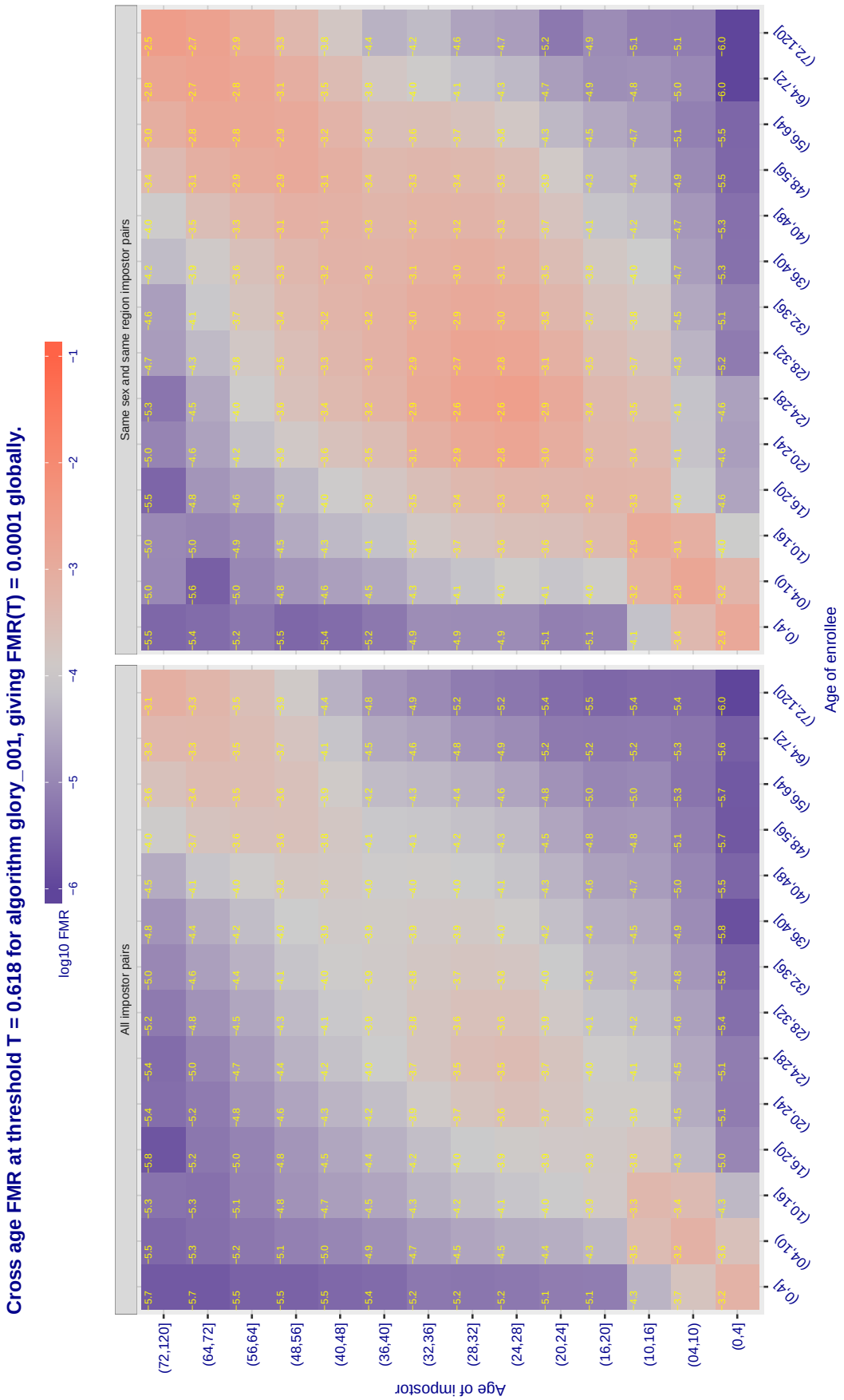


Figure 440: For algorithm glory-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

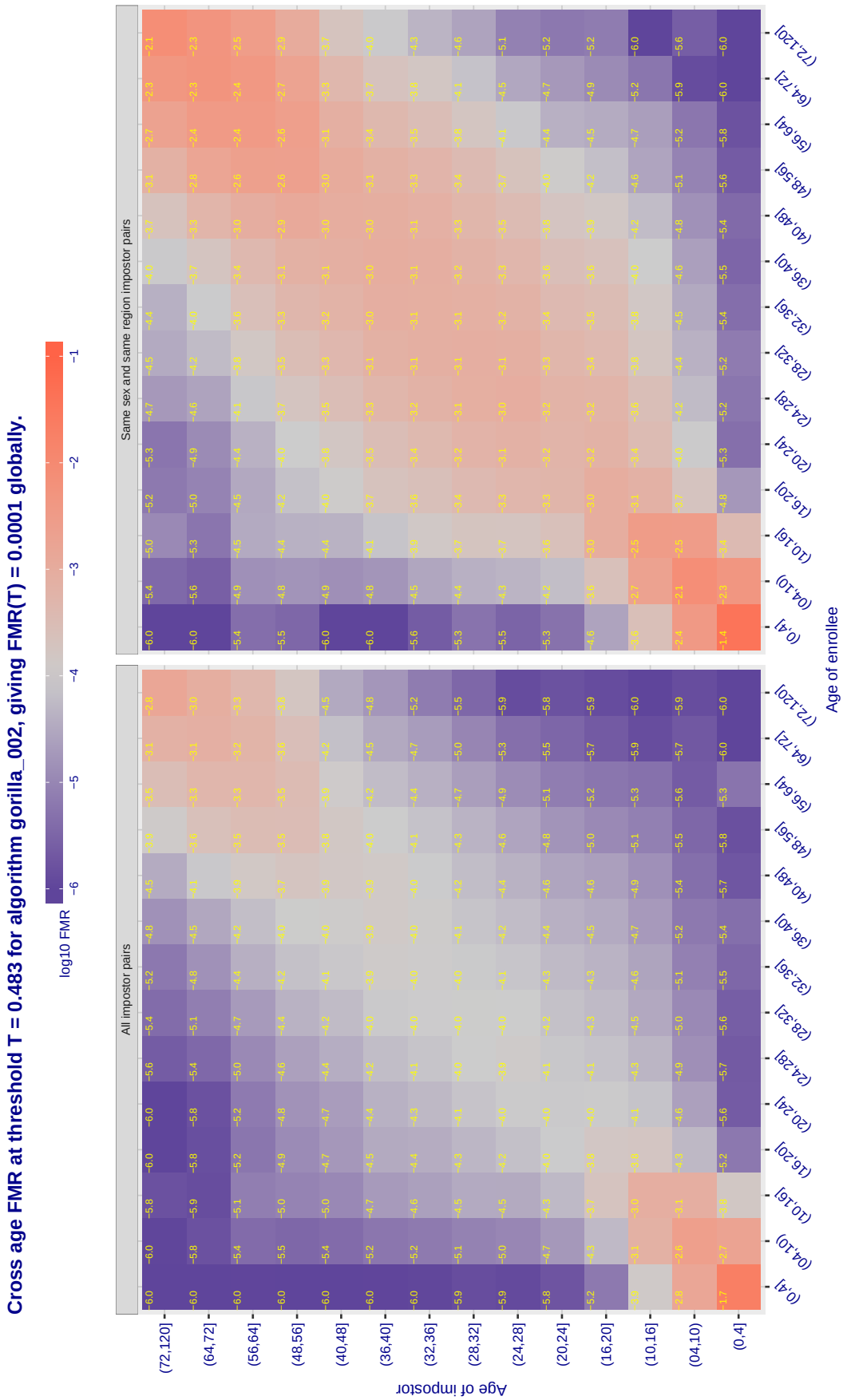


Figure 441: For algorithm gorilla-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

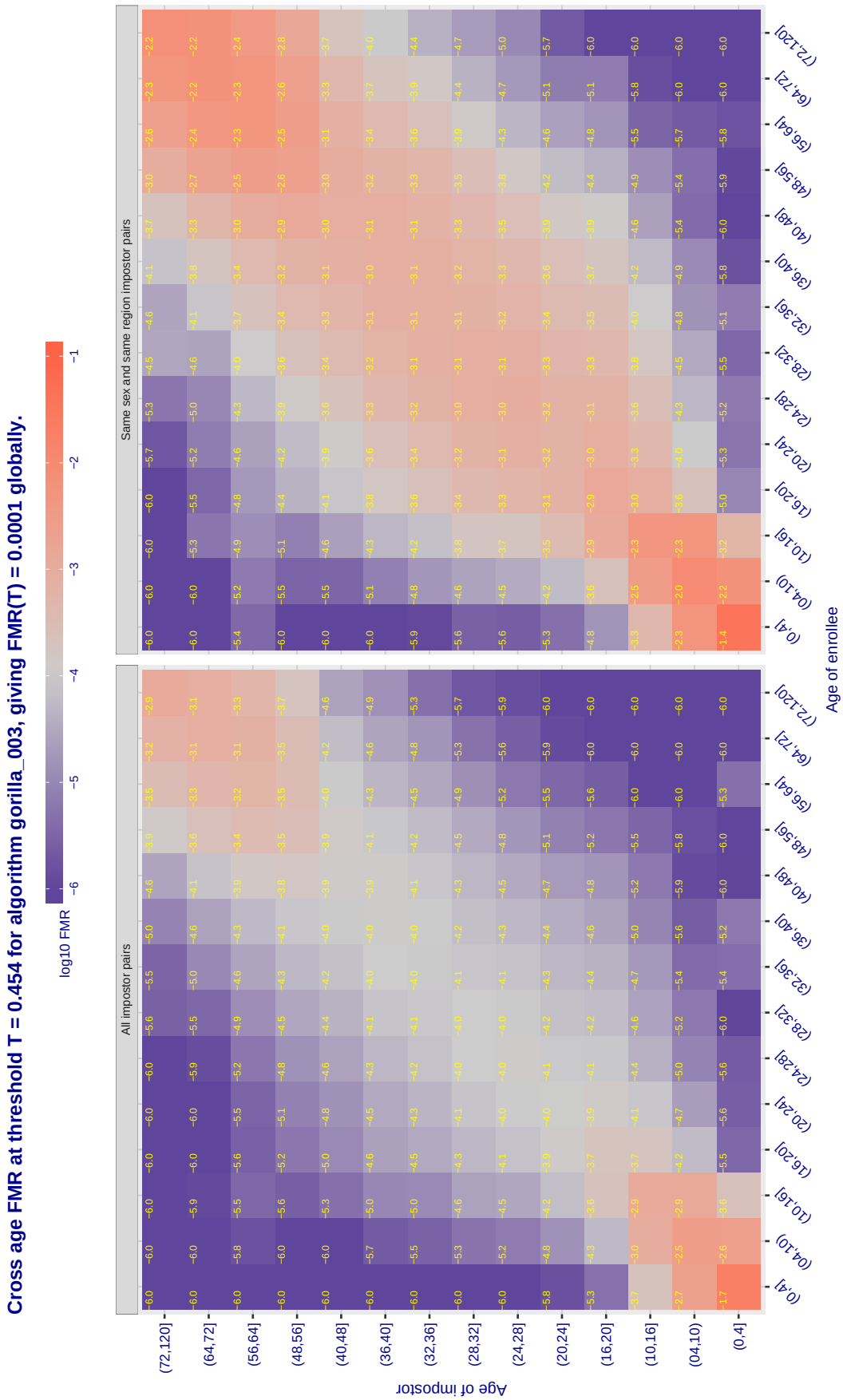


Figure 442: For algorithm gorilla-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

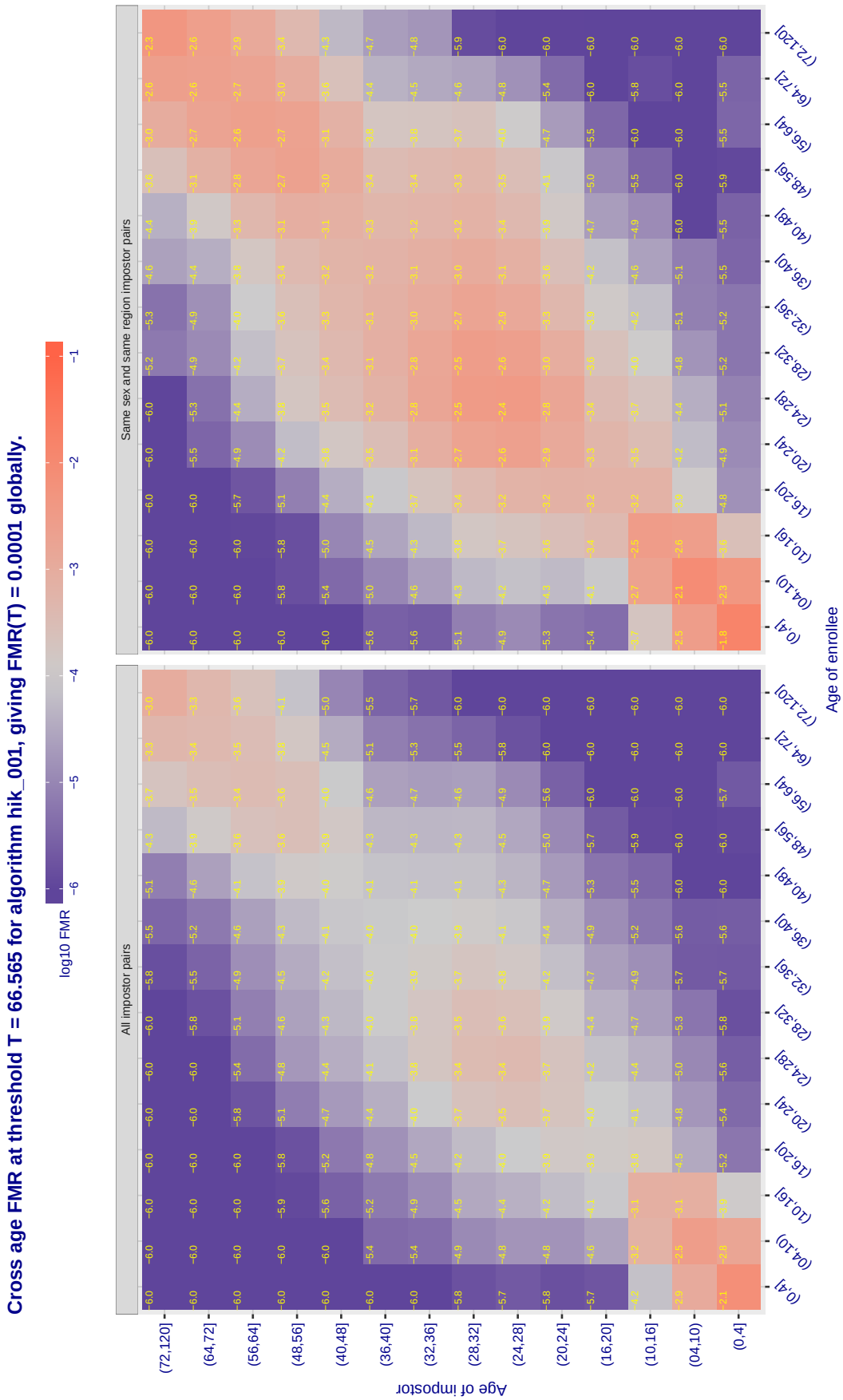


Figure 443: For algorithm hik-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

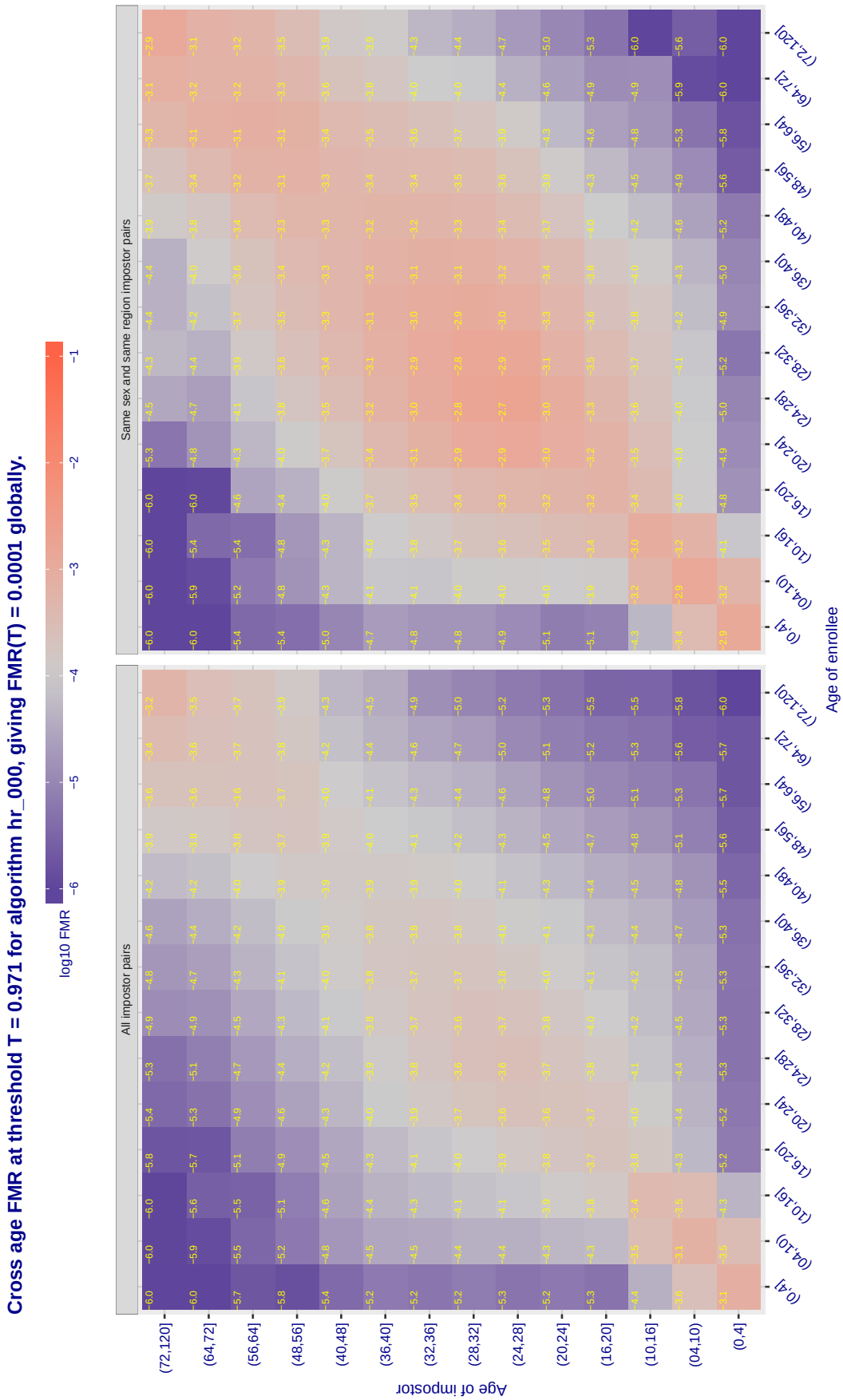


Figure 444: For algorithm hr-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

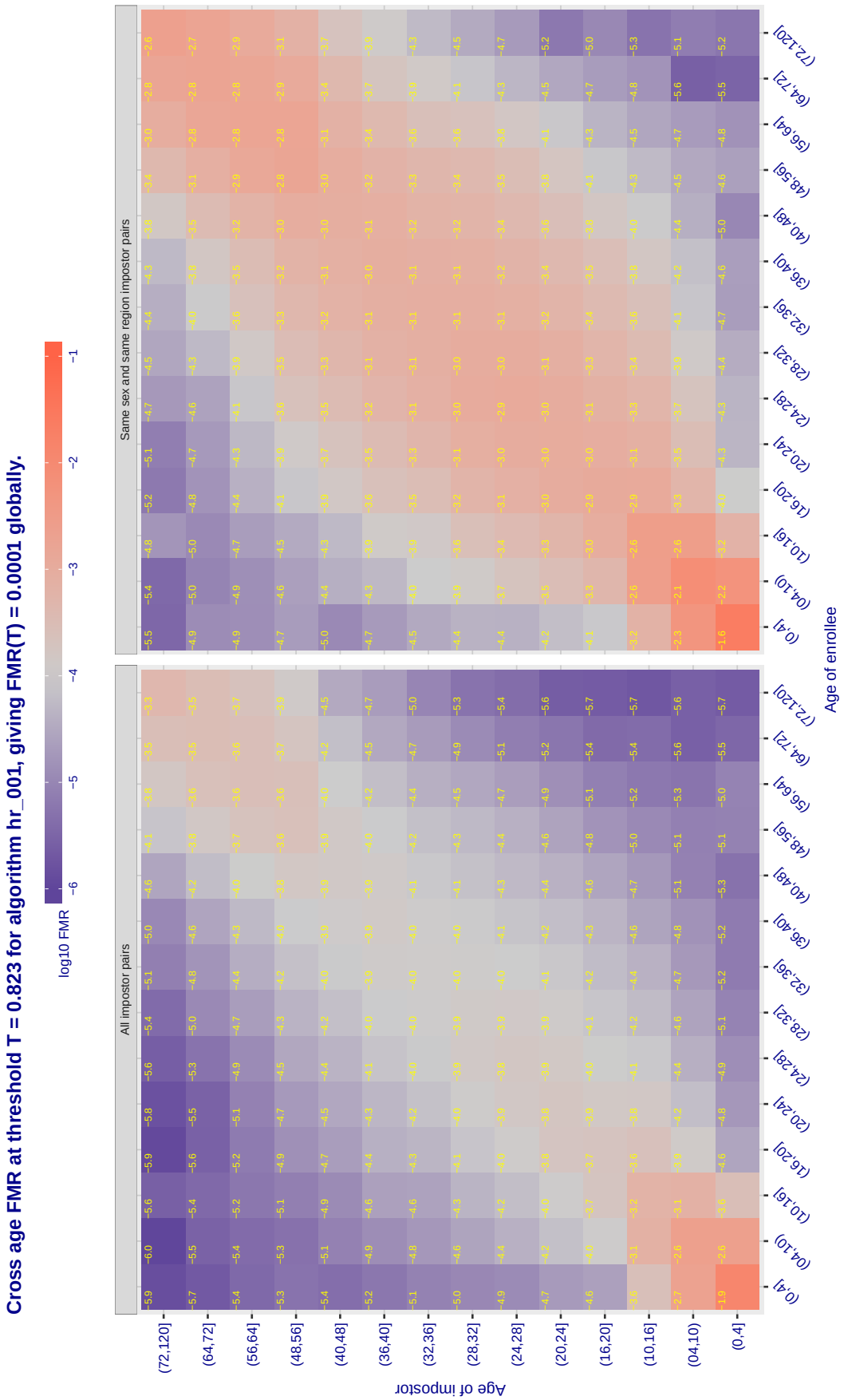


Figure 445: For algorithm hr-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

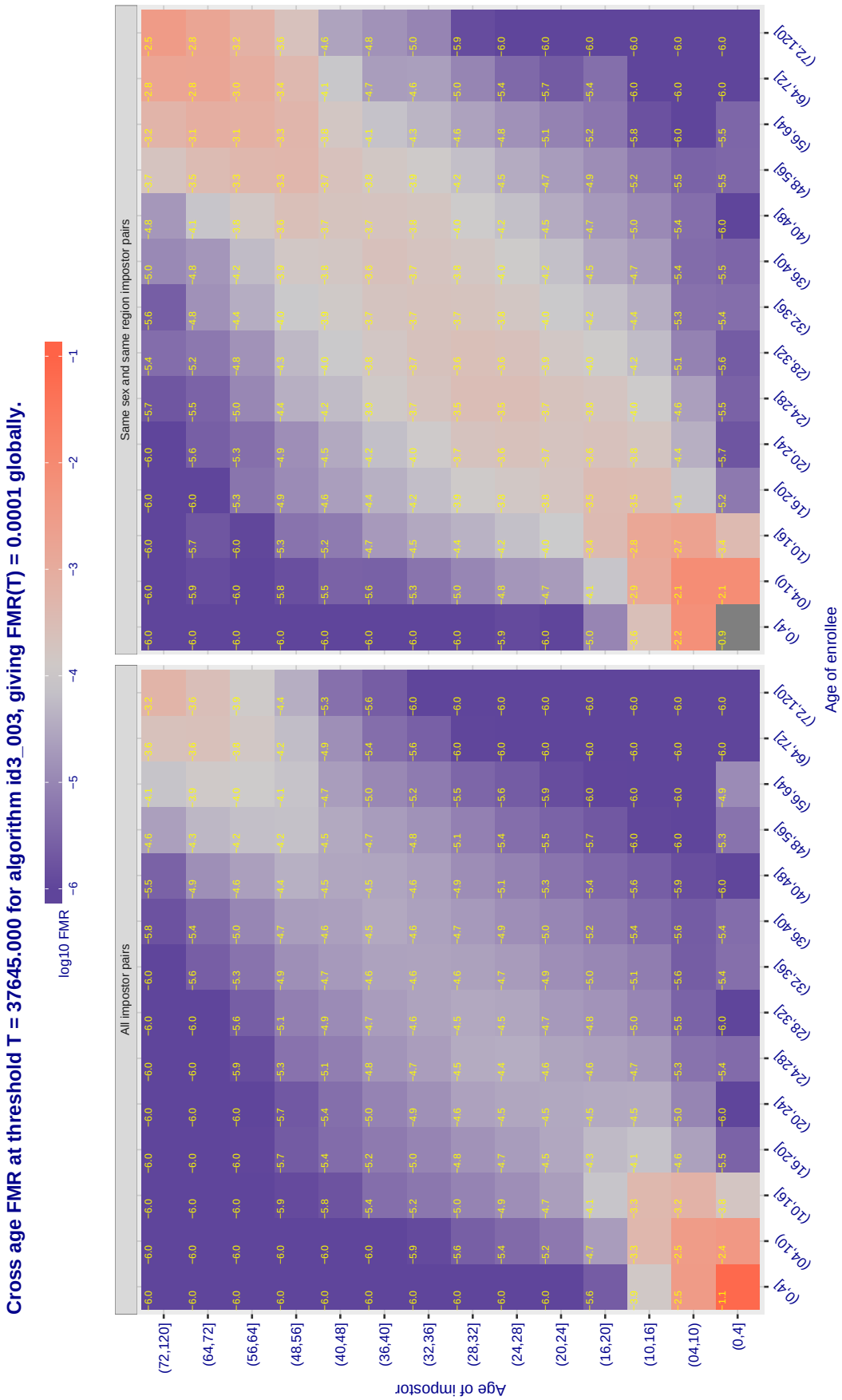


Figure 446: For algorithm id3-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

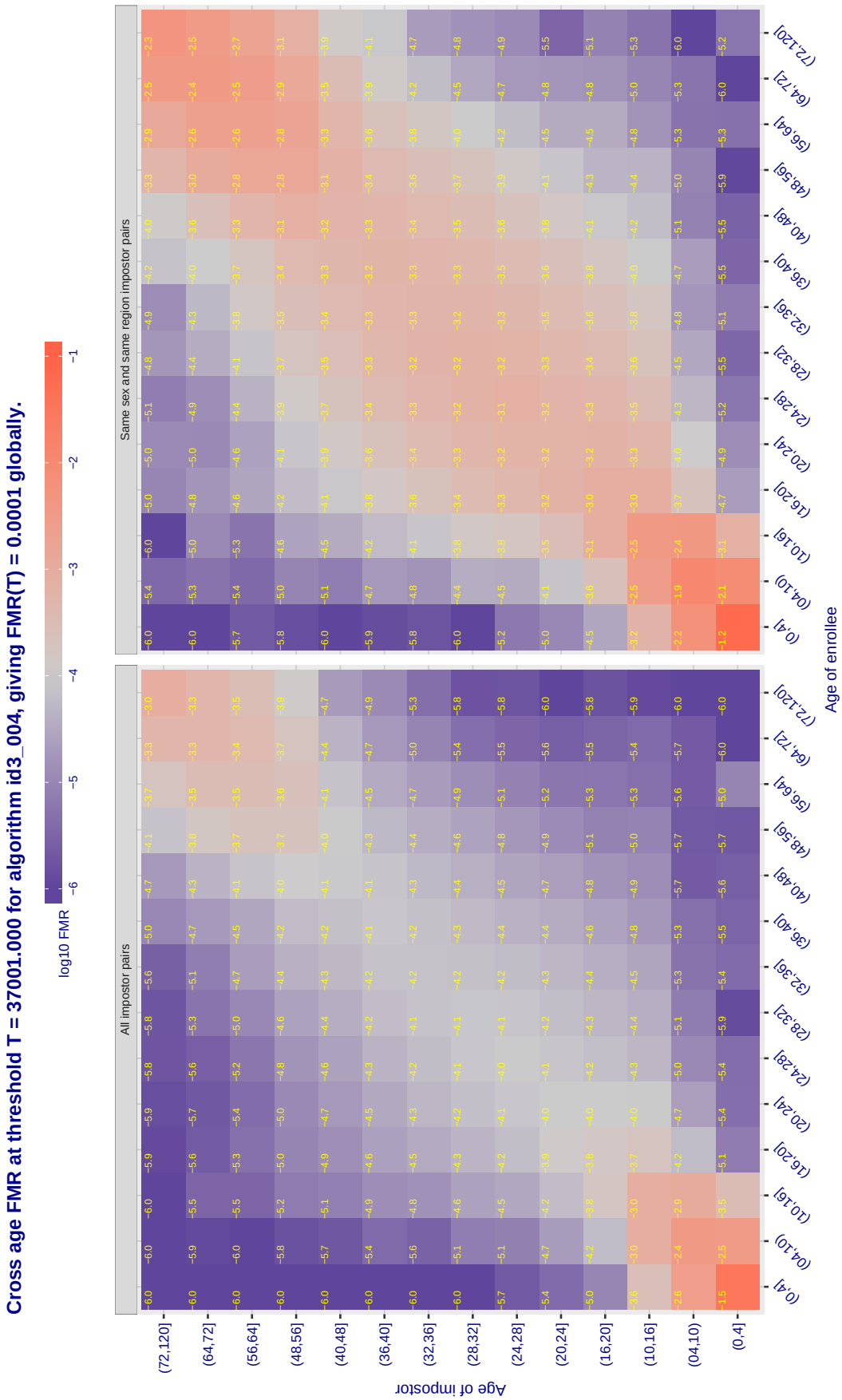


Figure 447: For algorithm id3-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

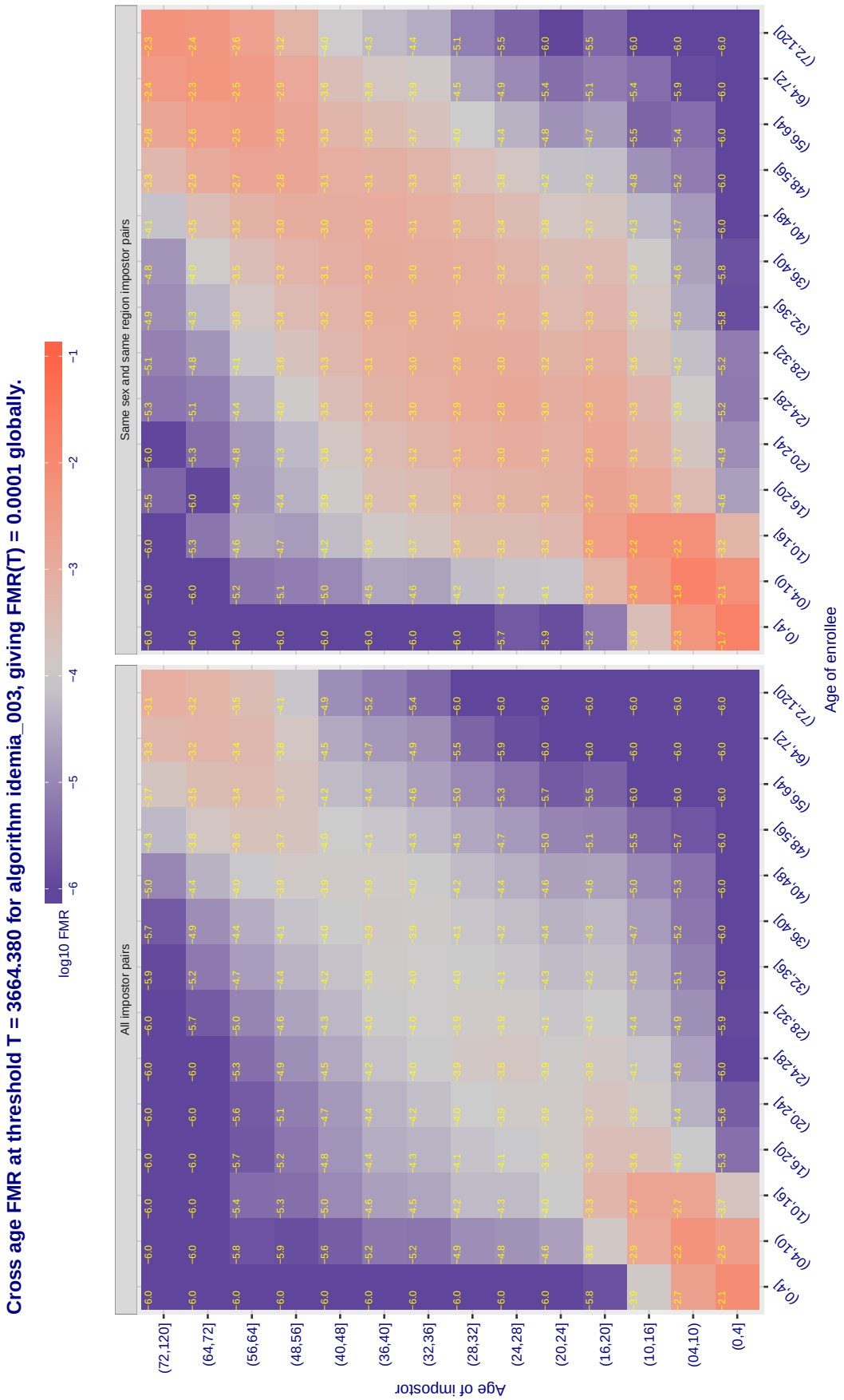


Figure 448: For algorithm idemia-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

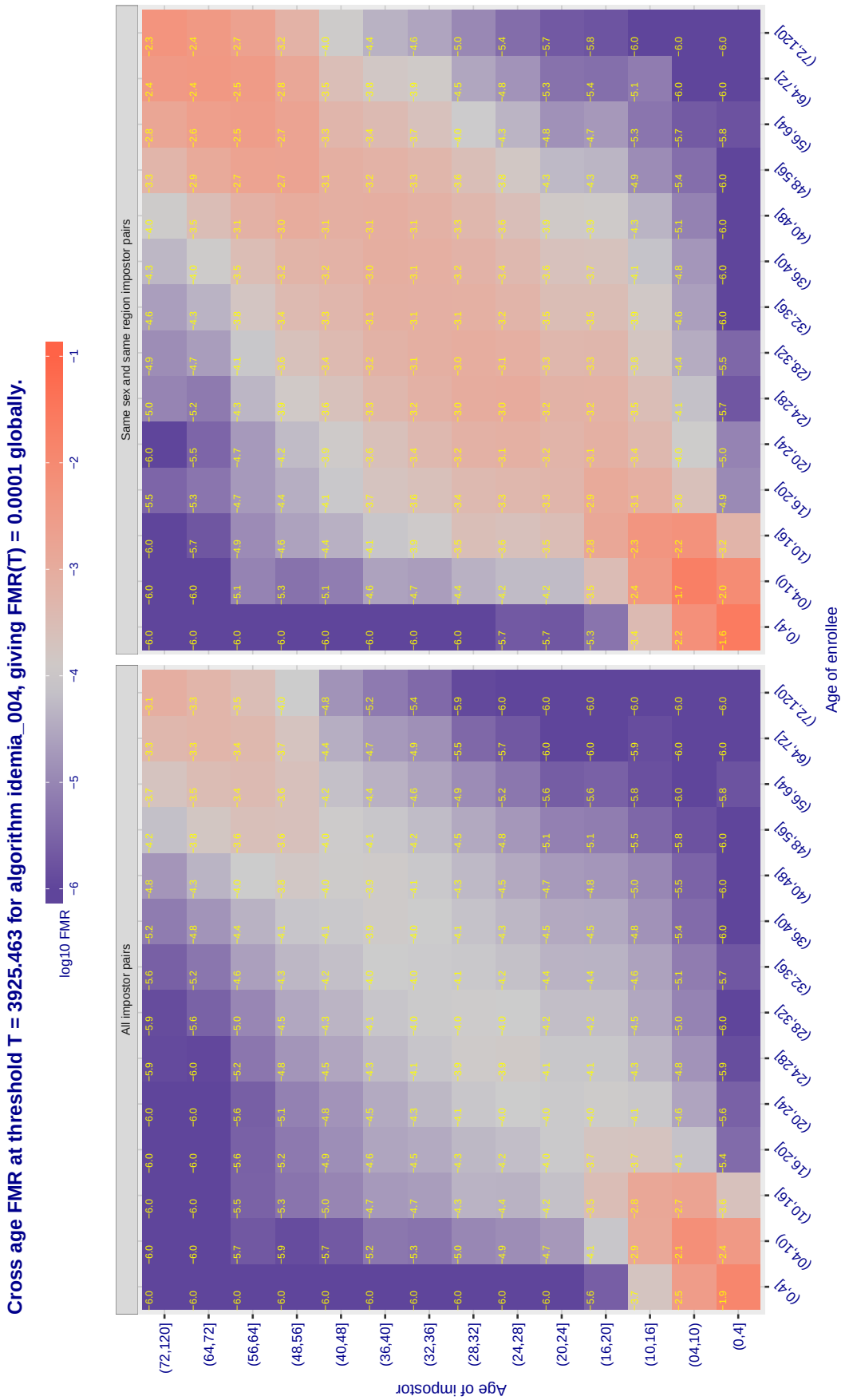


Figure 449: For algorithm idemia-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

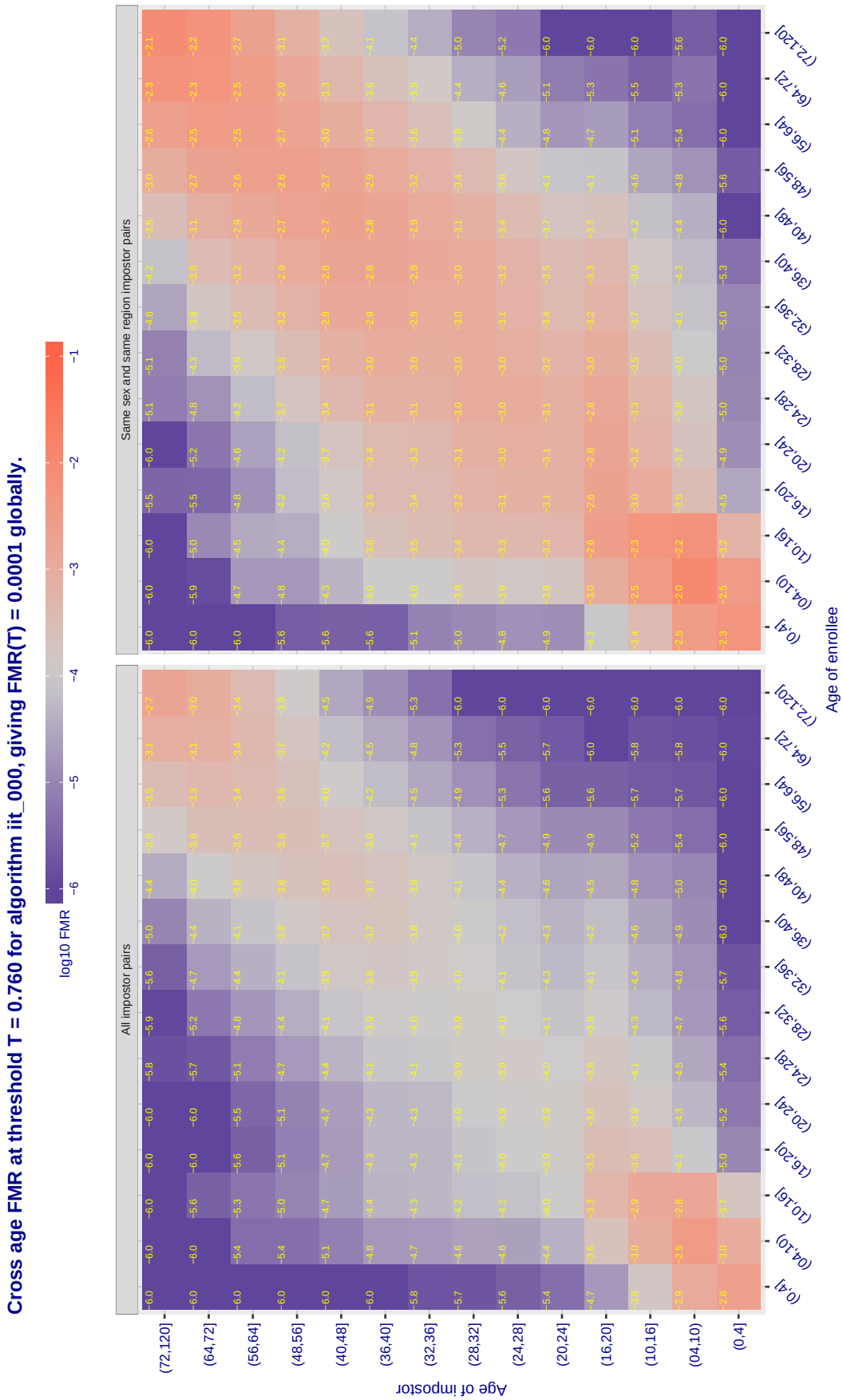


Figure 450: For algorithm iit-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

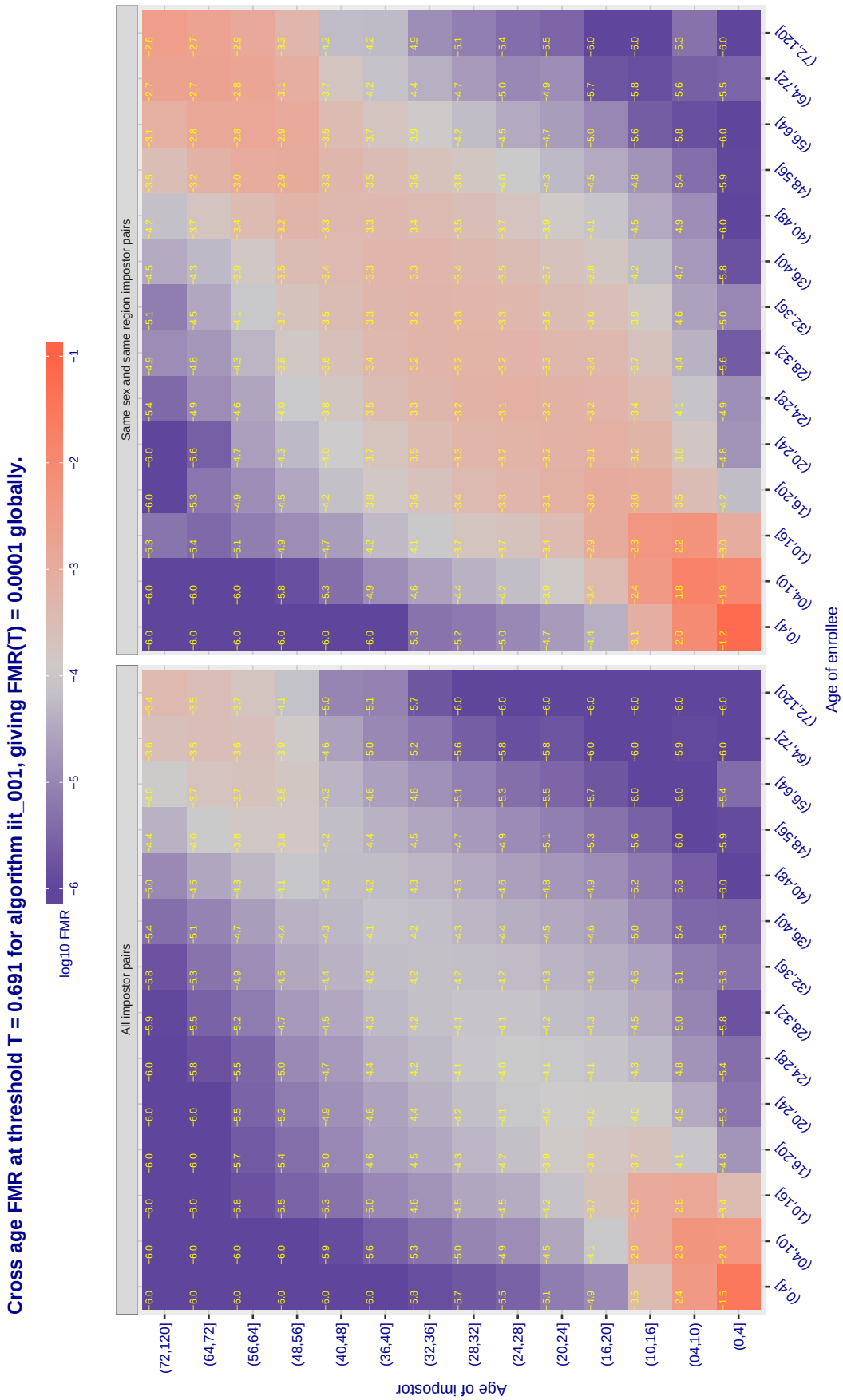


Figure 451: For algorithm iit-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

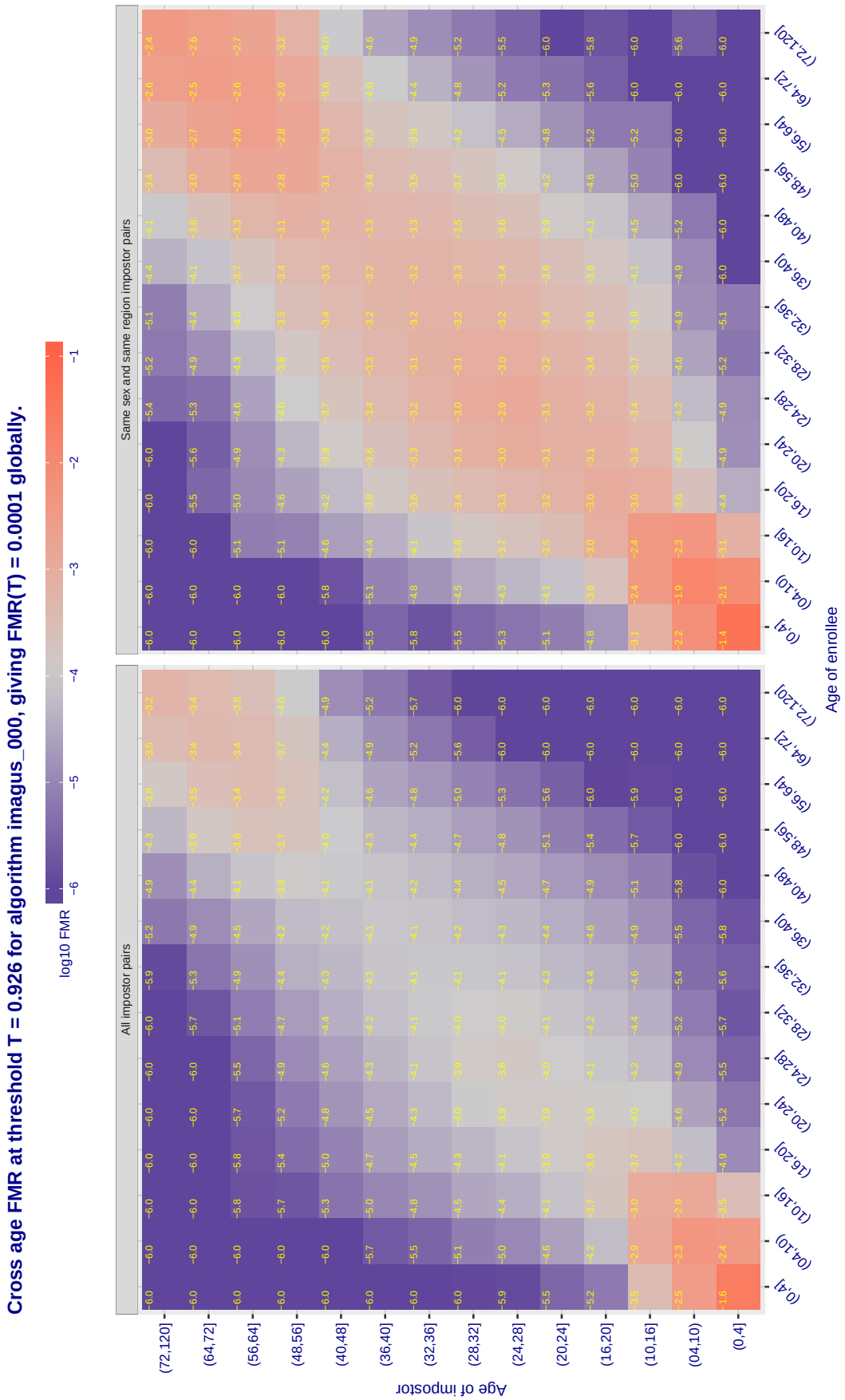


Figure 452: For algorithm imagus-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

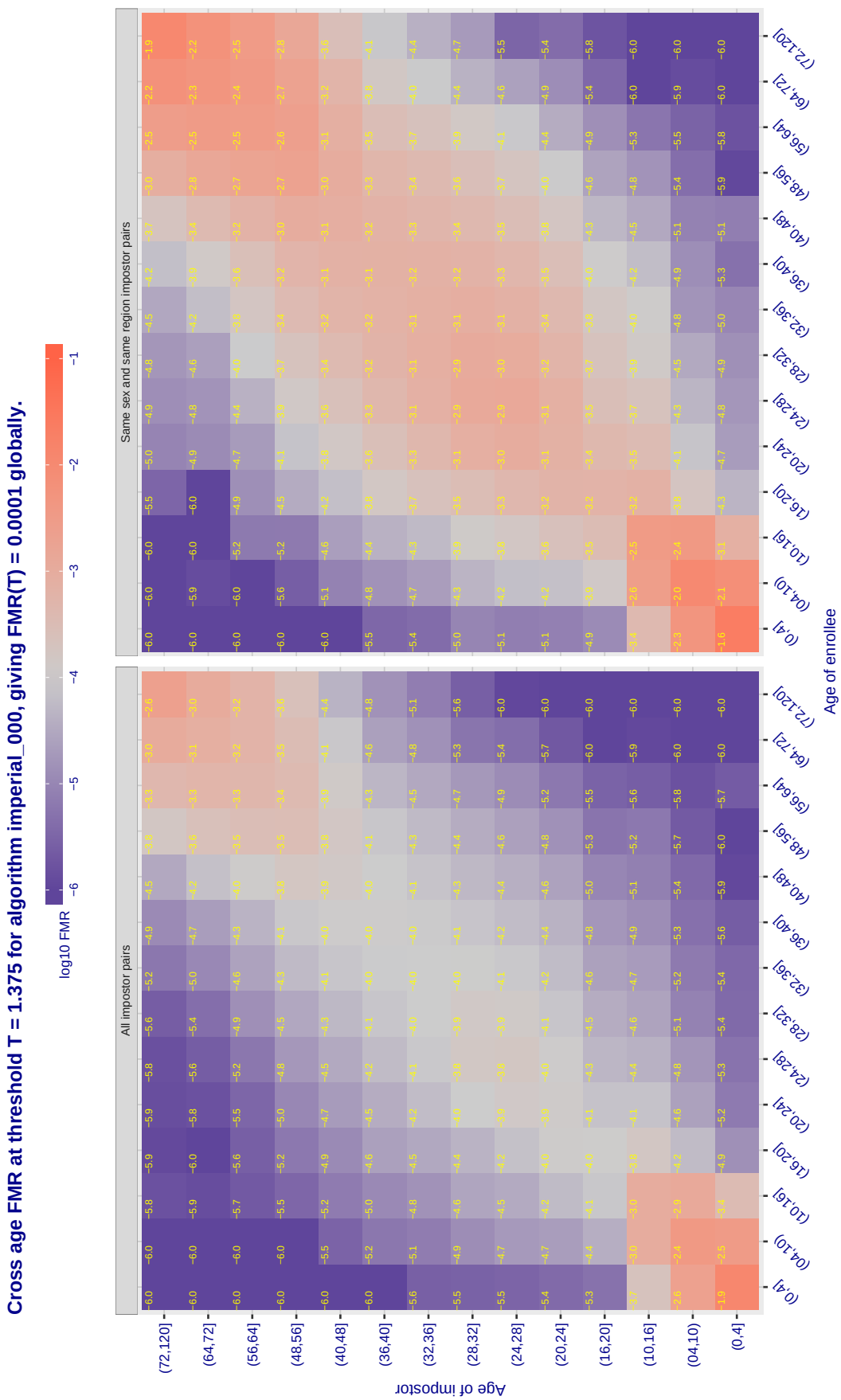


Figure 453: For algorithm imperial-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

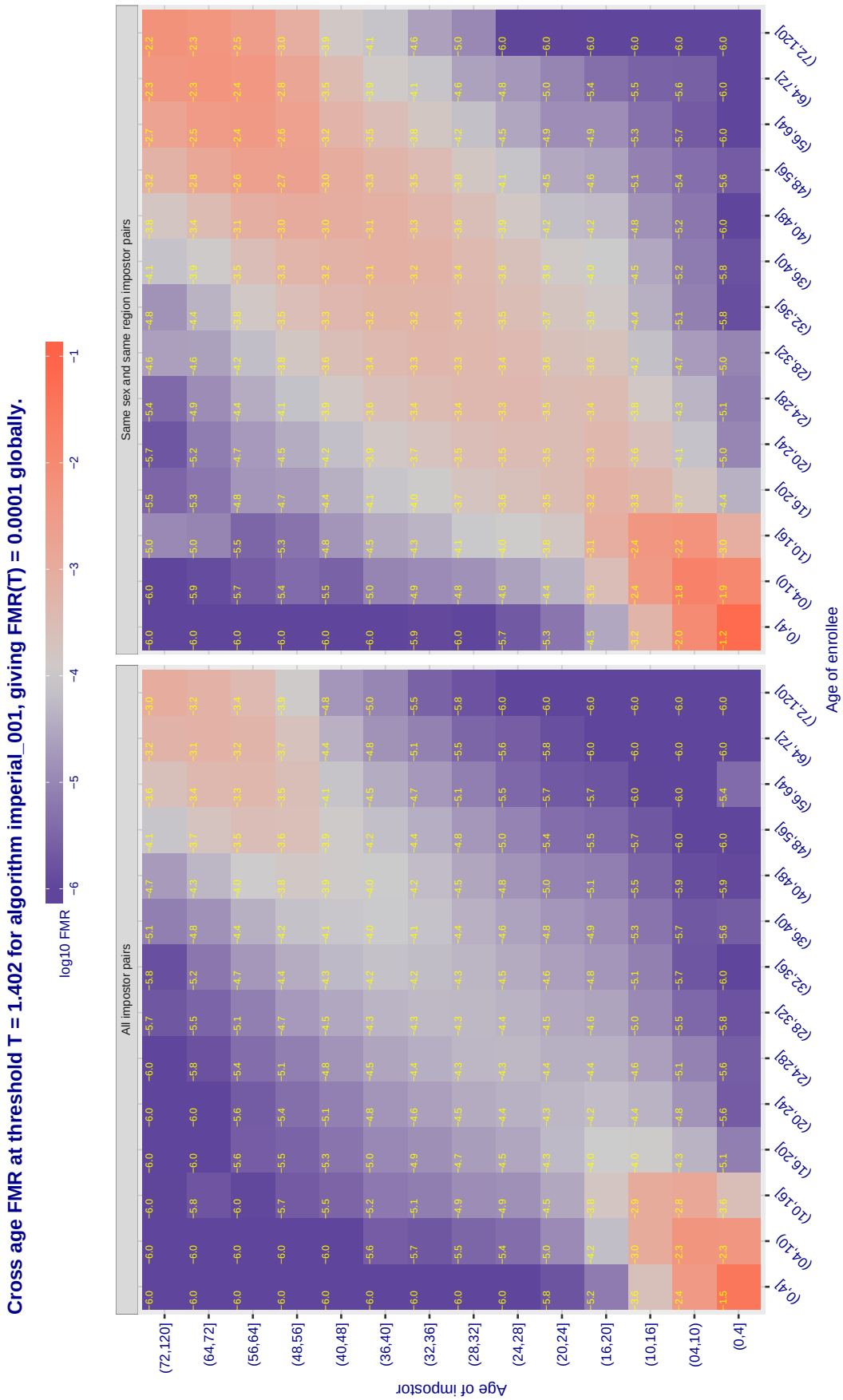


Figure 454: For algorithm imperial-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

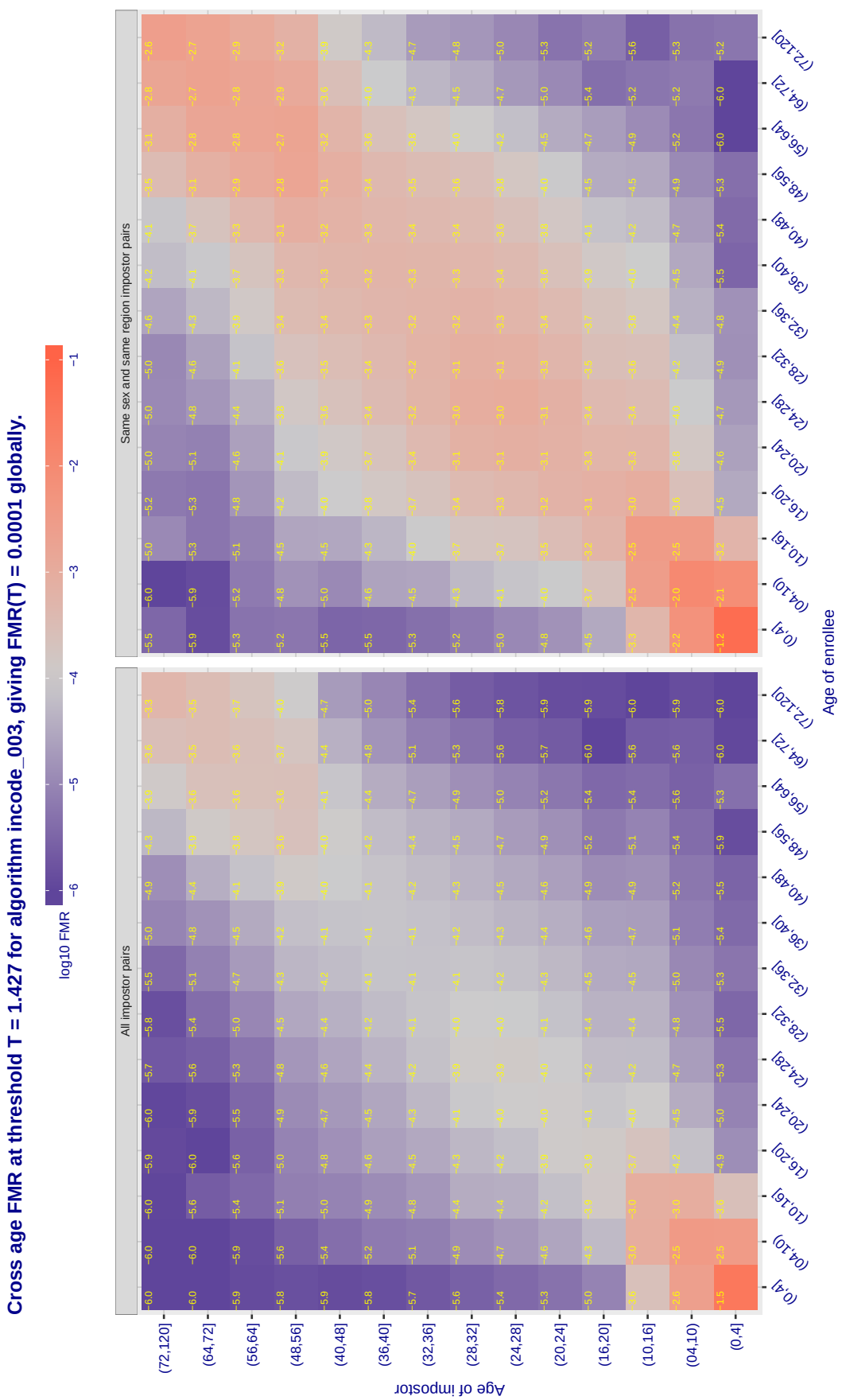


Figure 455: For algorithm incode-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

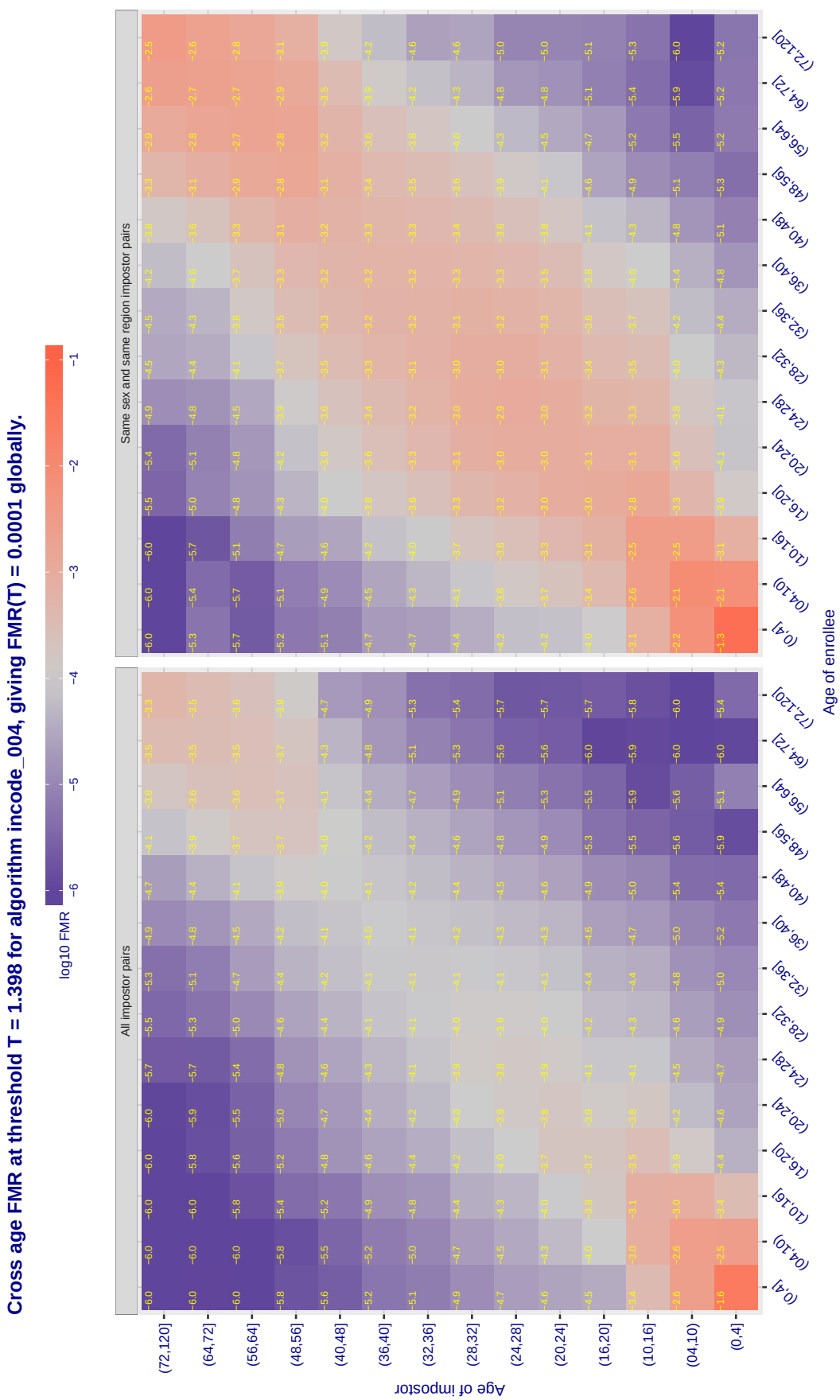


Figure 456: For algorithm incode-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

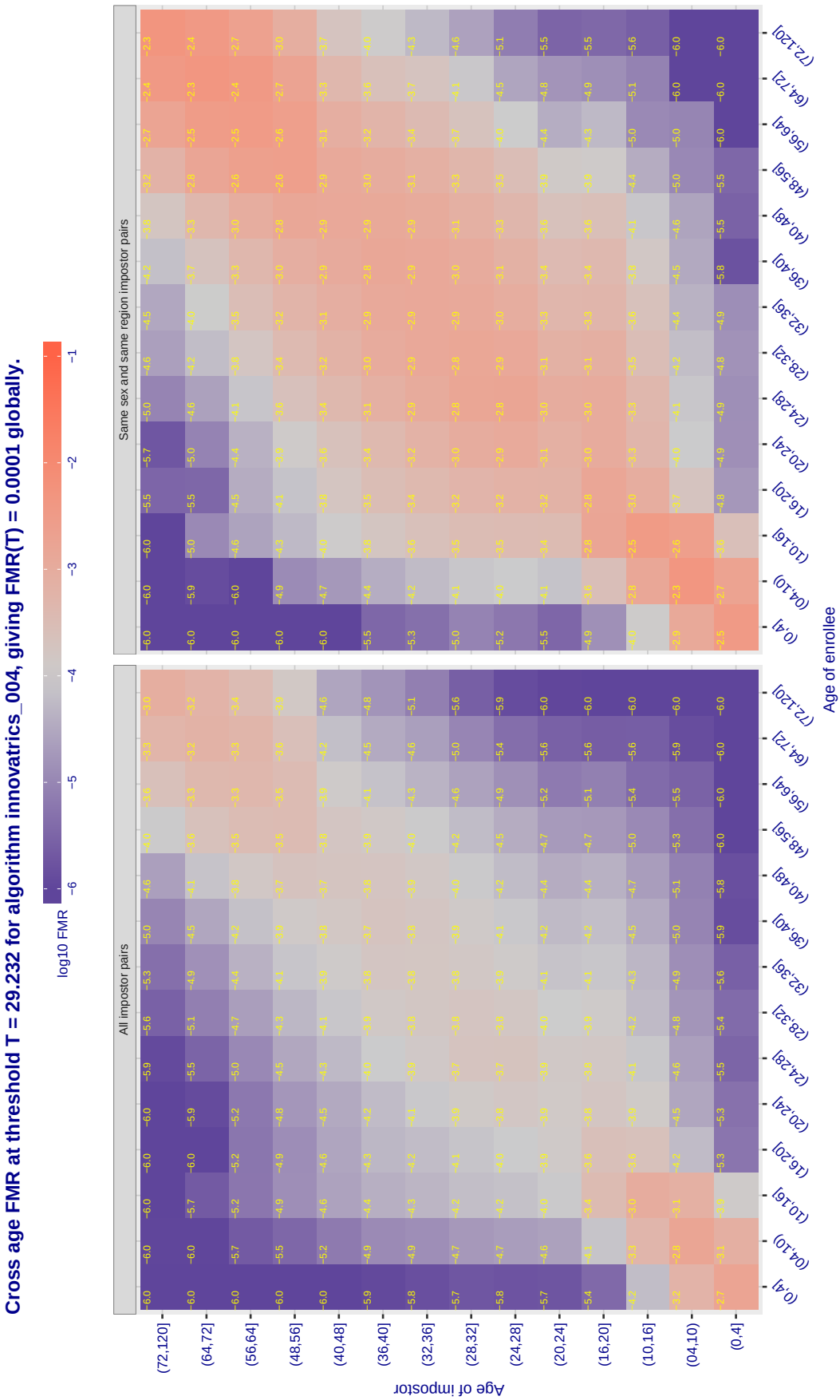


Figure 457: For algorithm innovatrics-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

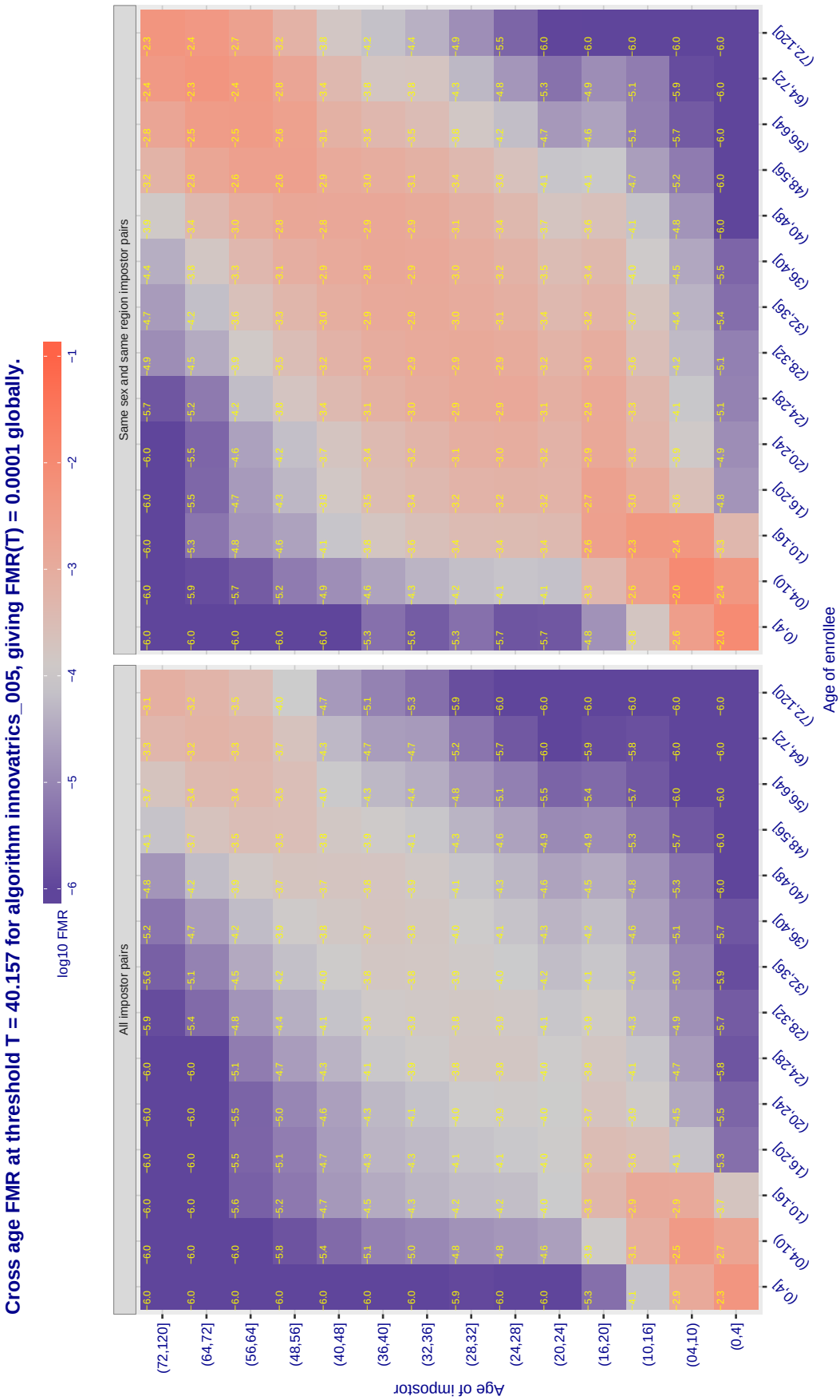


Figure 458: For algorithm innovatrics-005 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

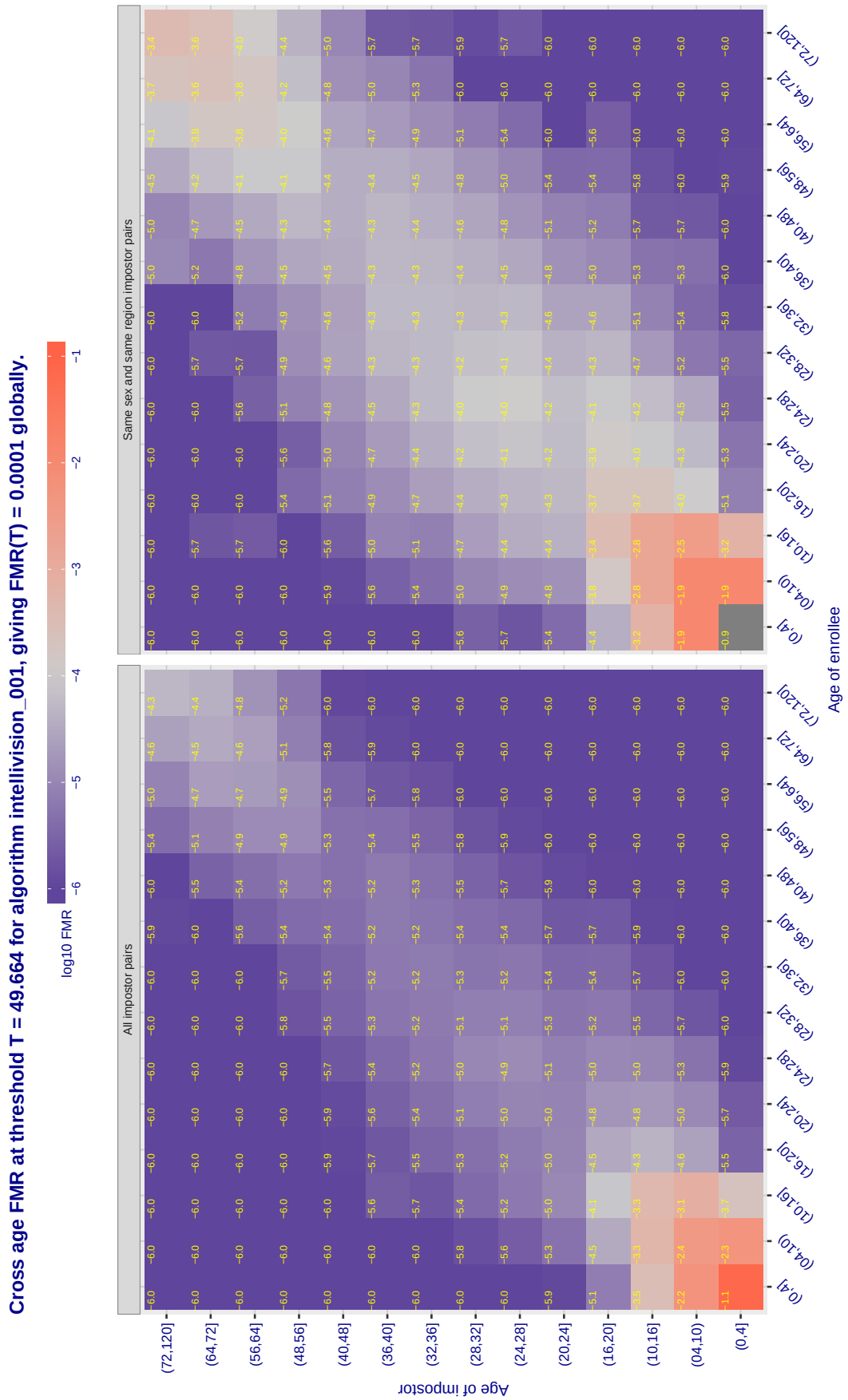


Figure 459: For algorithm intellivision-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

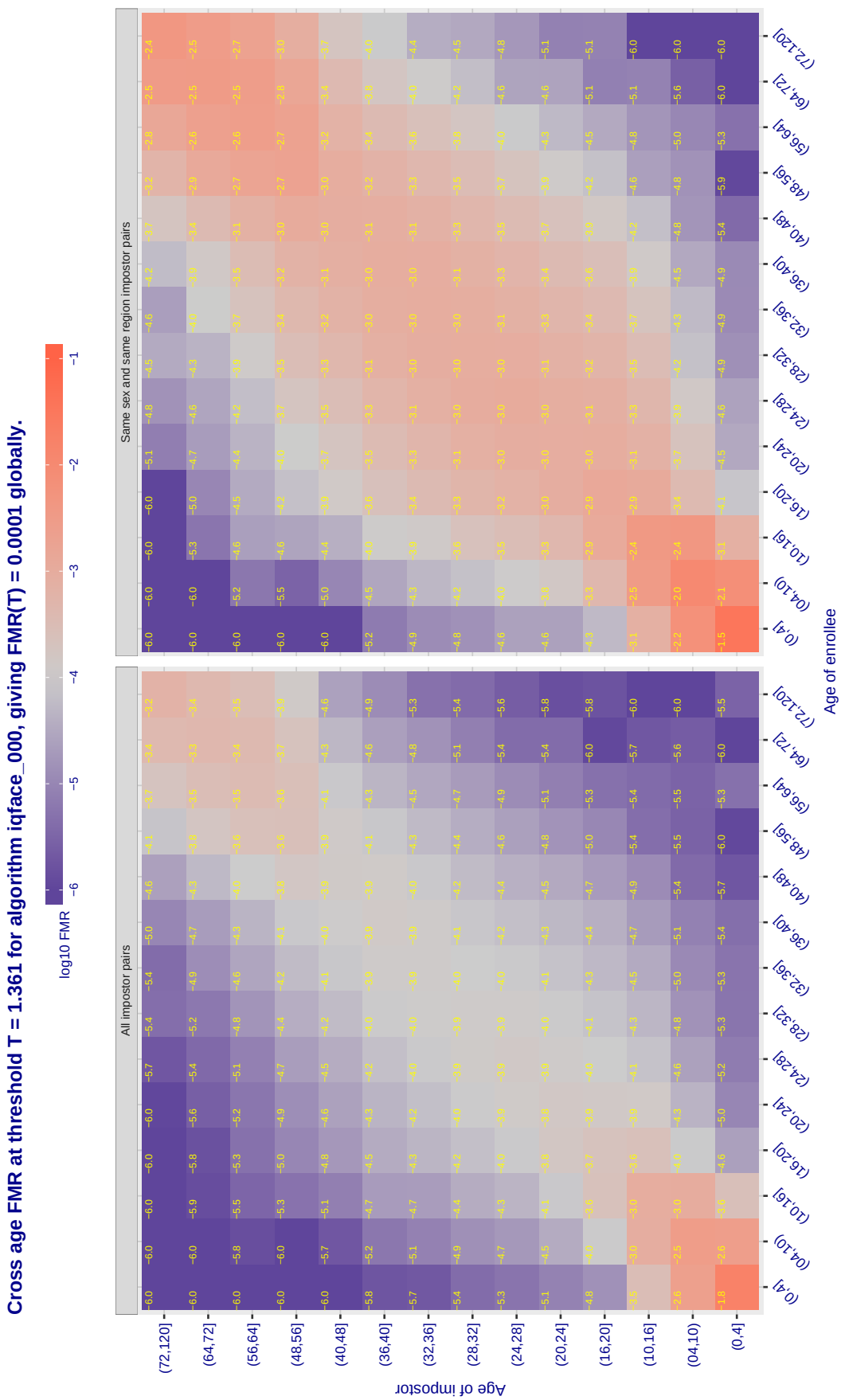


Figure 460: For algorithm iqface-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

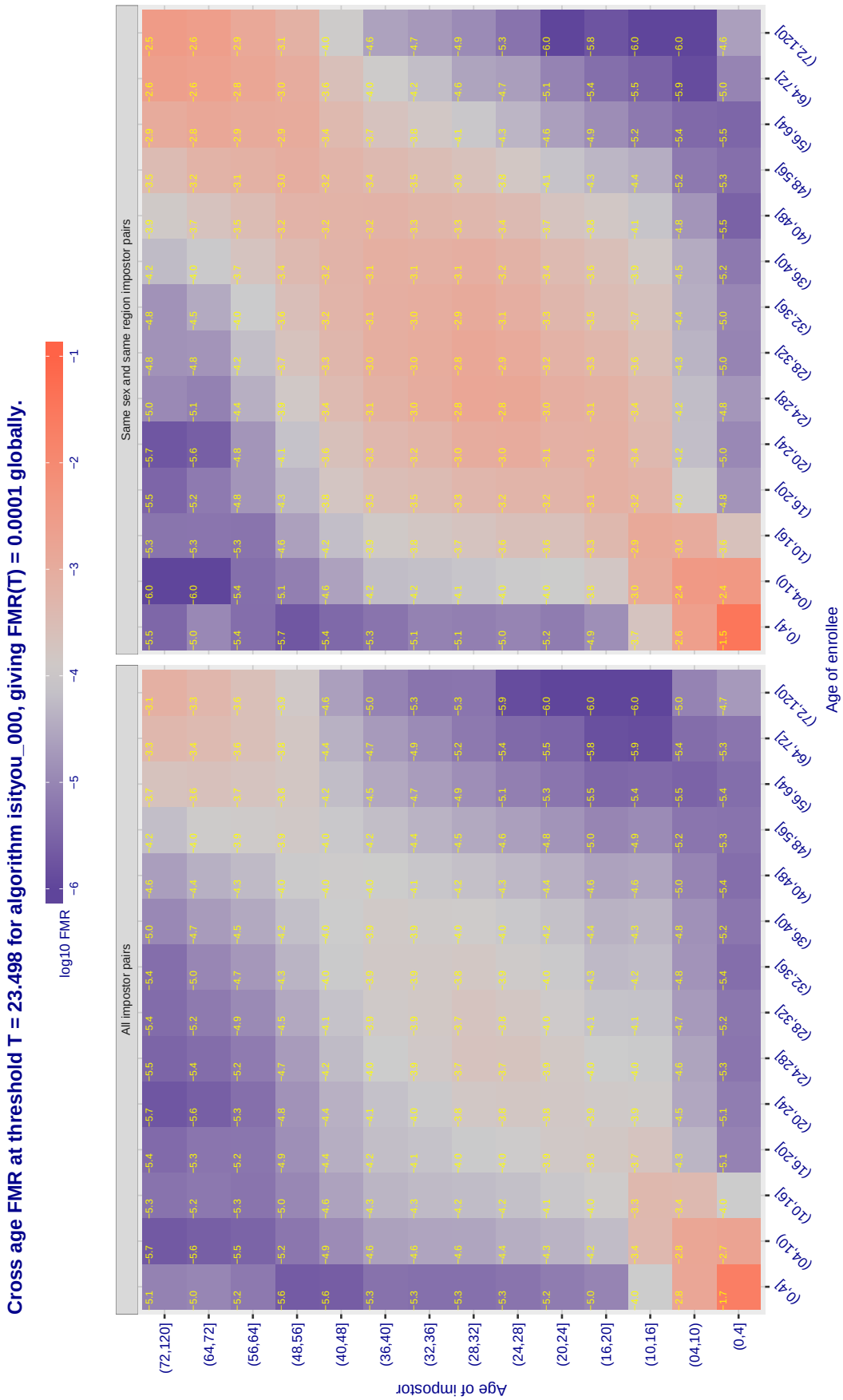


Figure 461: For algorithm isityou-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

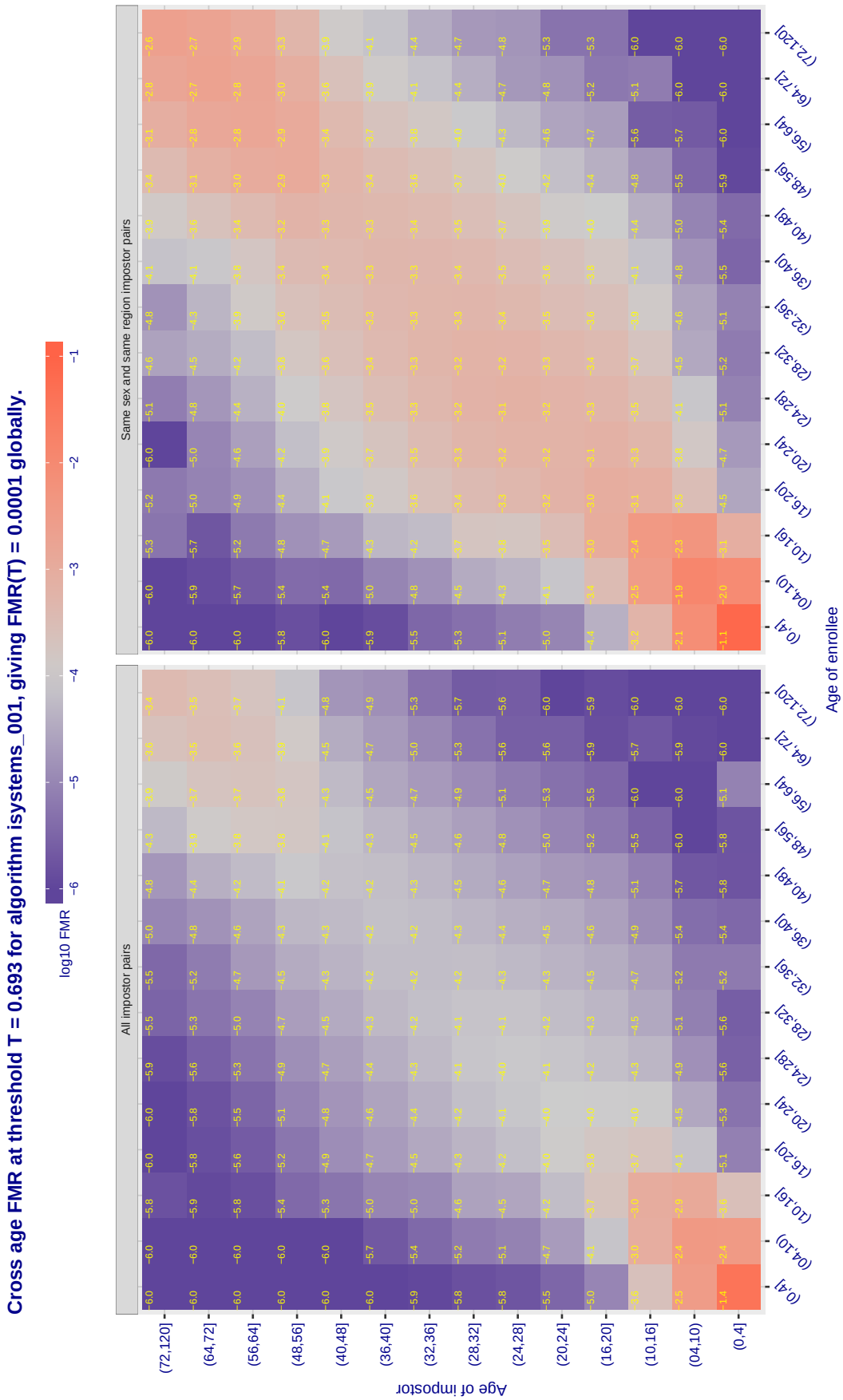


Figure 462: For algorithm isystems-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

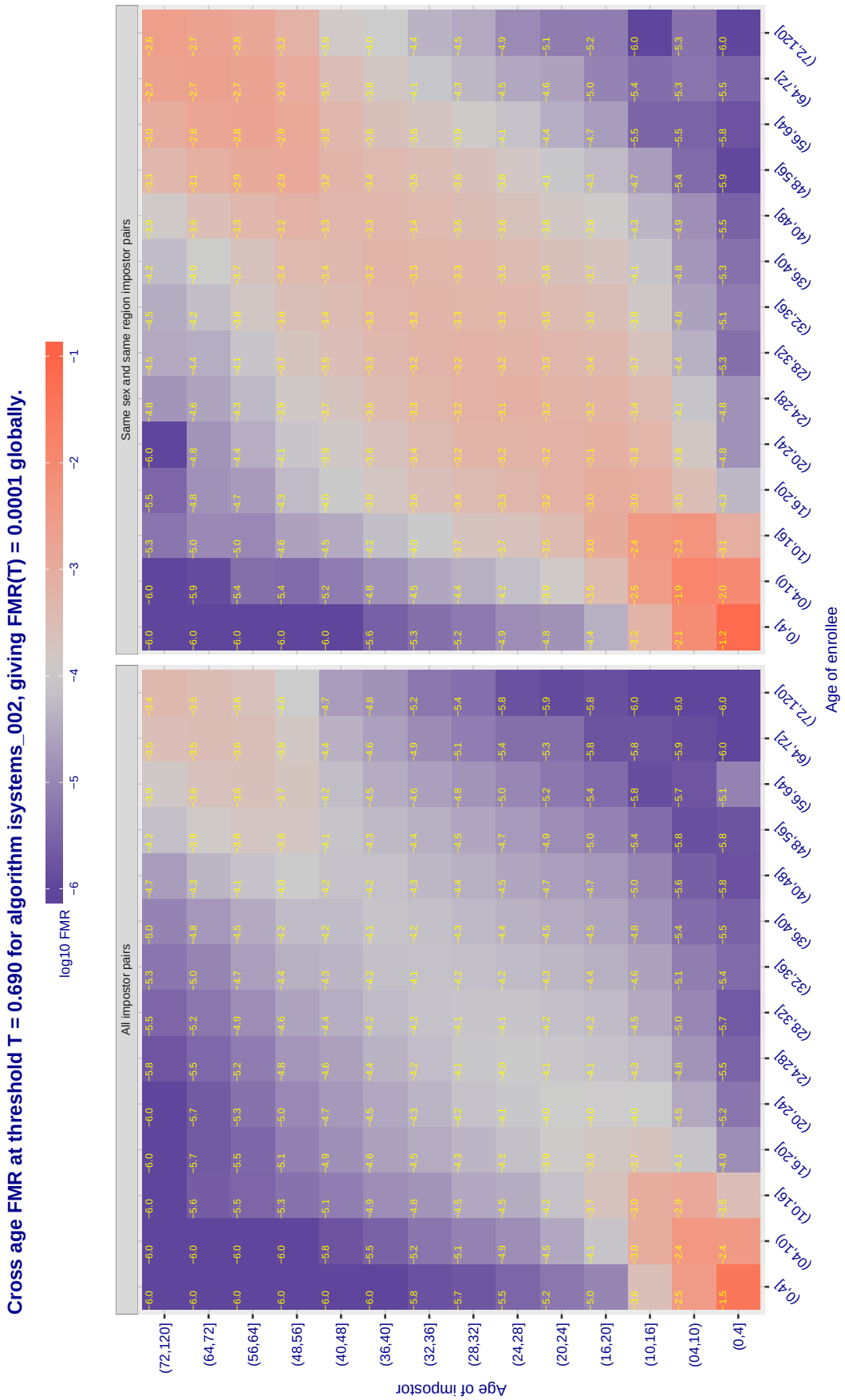


Figure 463: For algorithm isystems-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

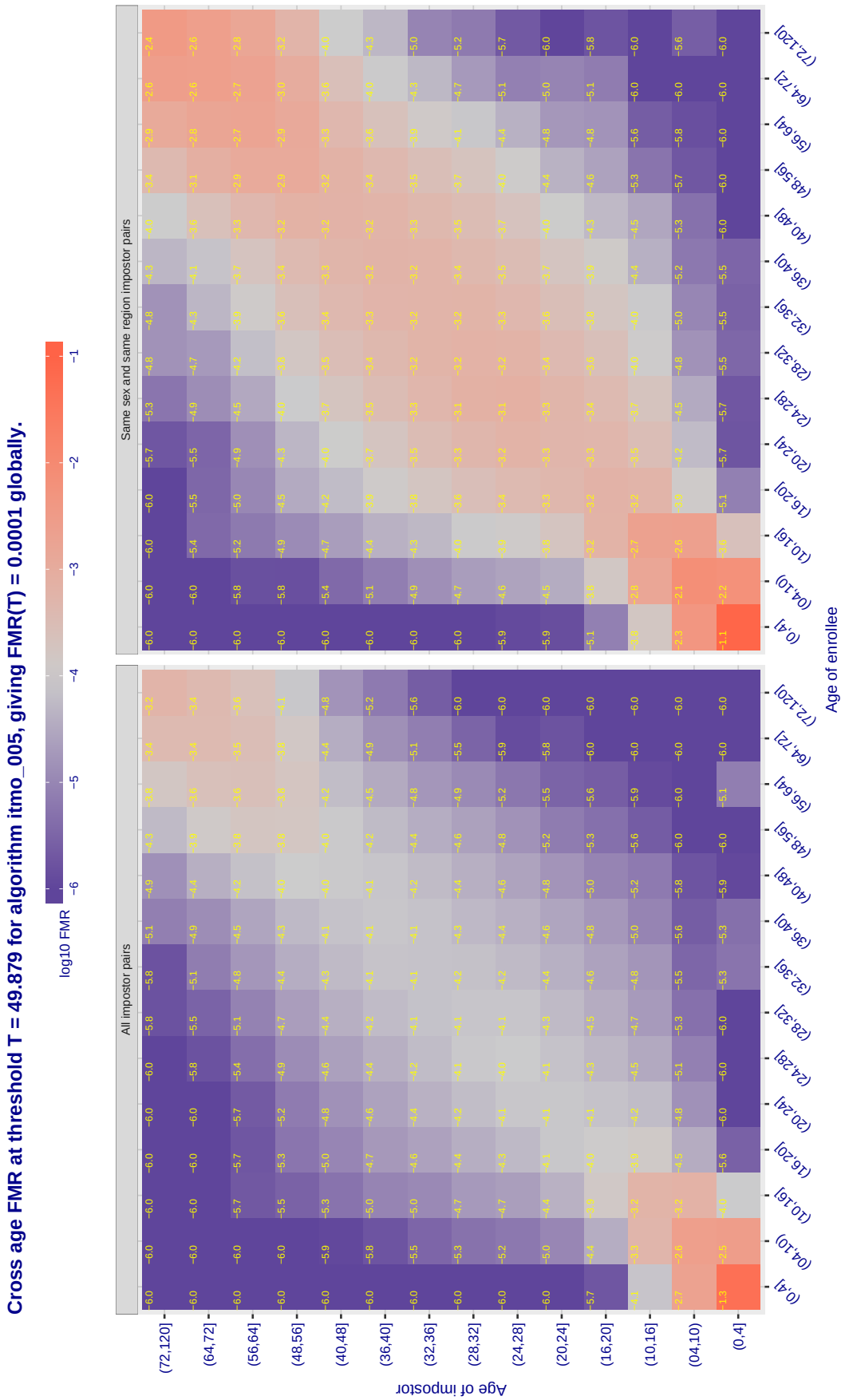


Figure 464: For algorithm itmo-005 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

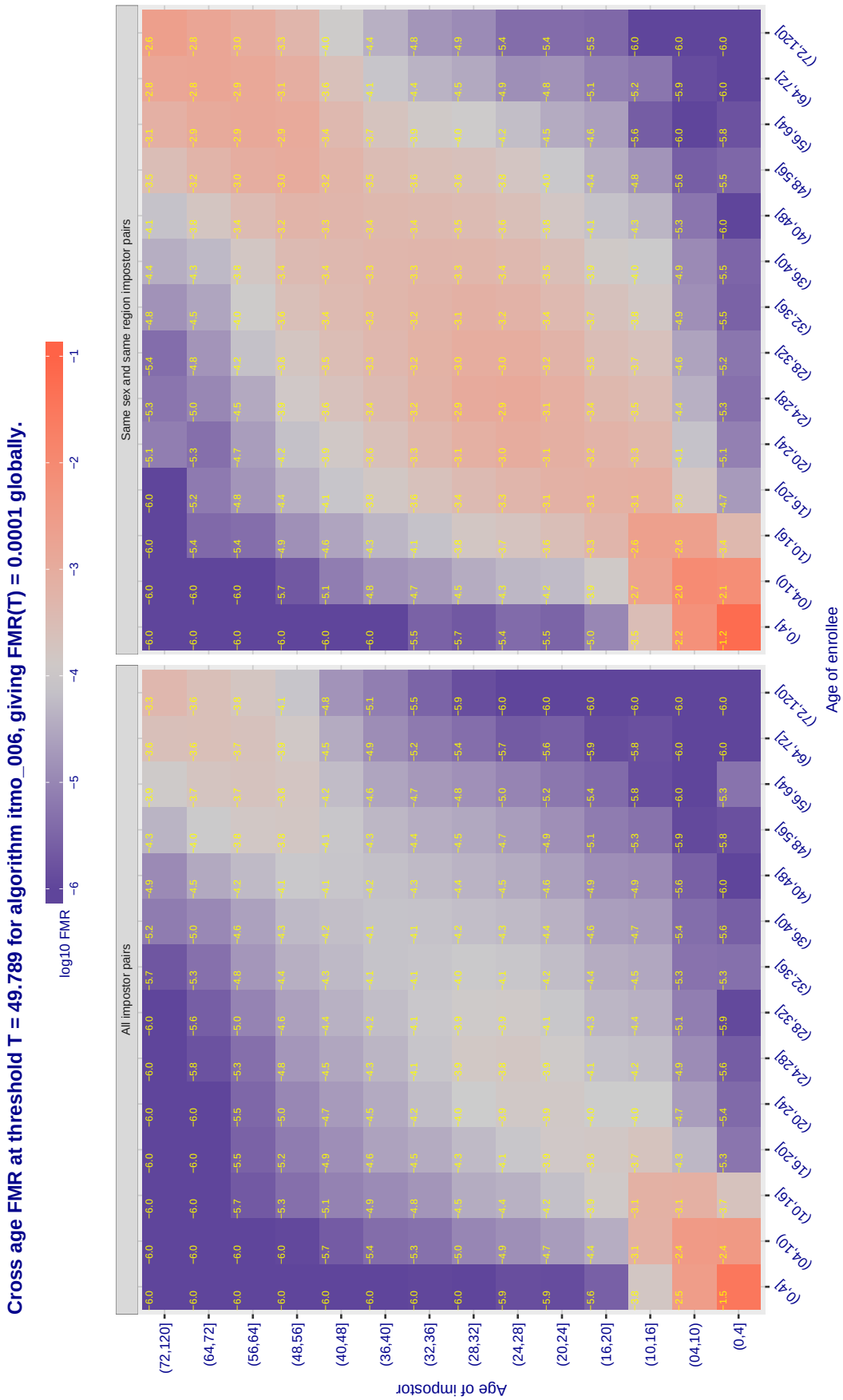


Figure 465: For algorithm itmo-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

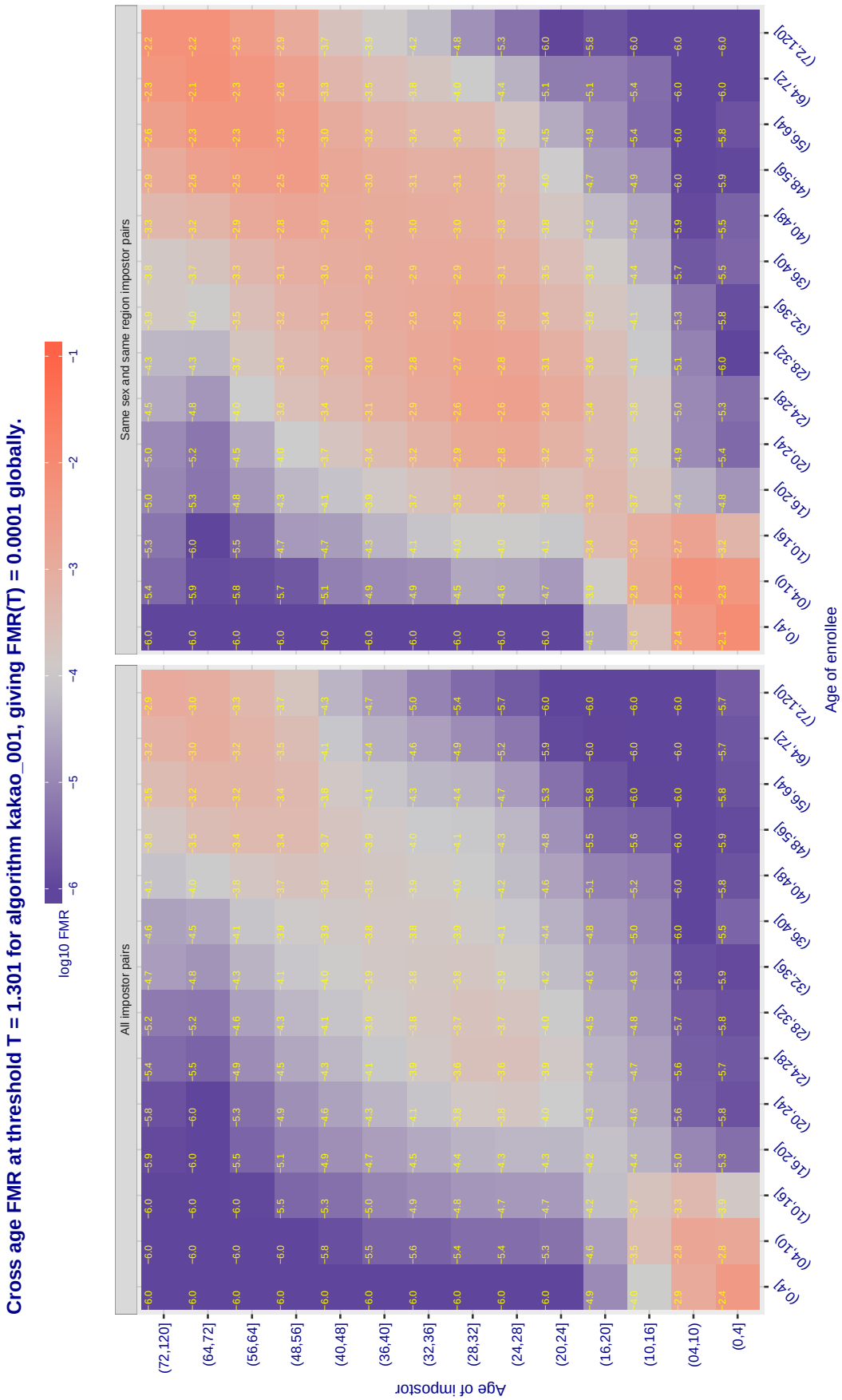


Figure 466: For algorithm kakao-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

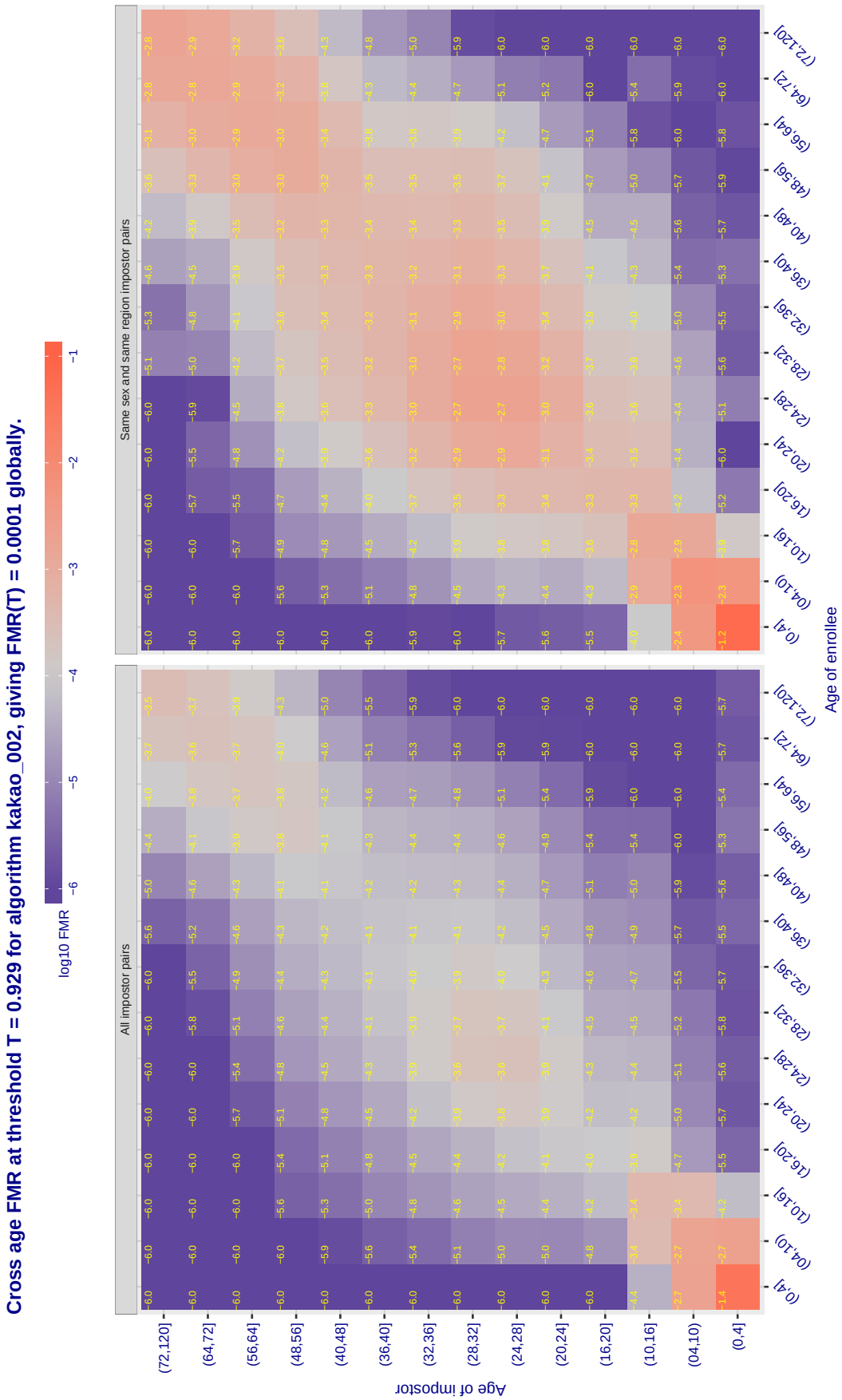


Figure 467: For algorithm kakao-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

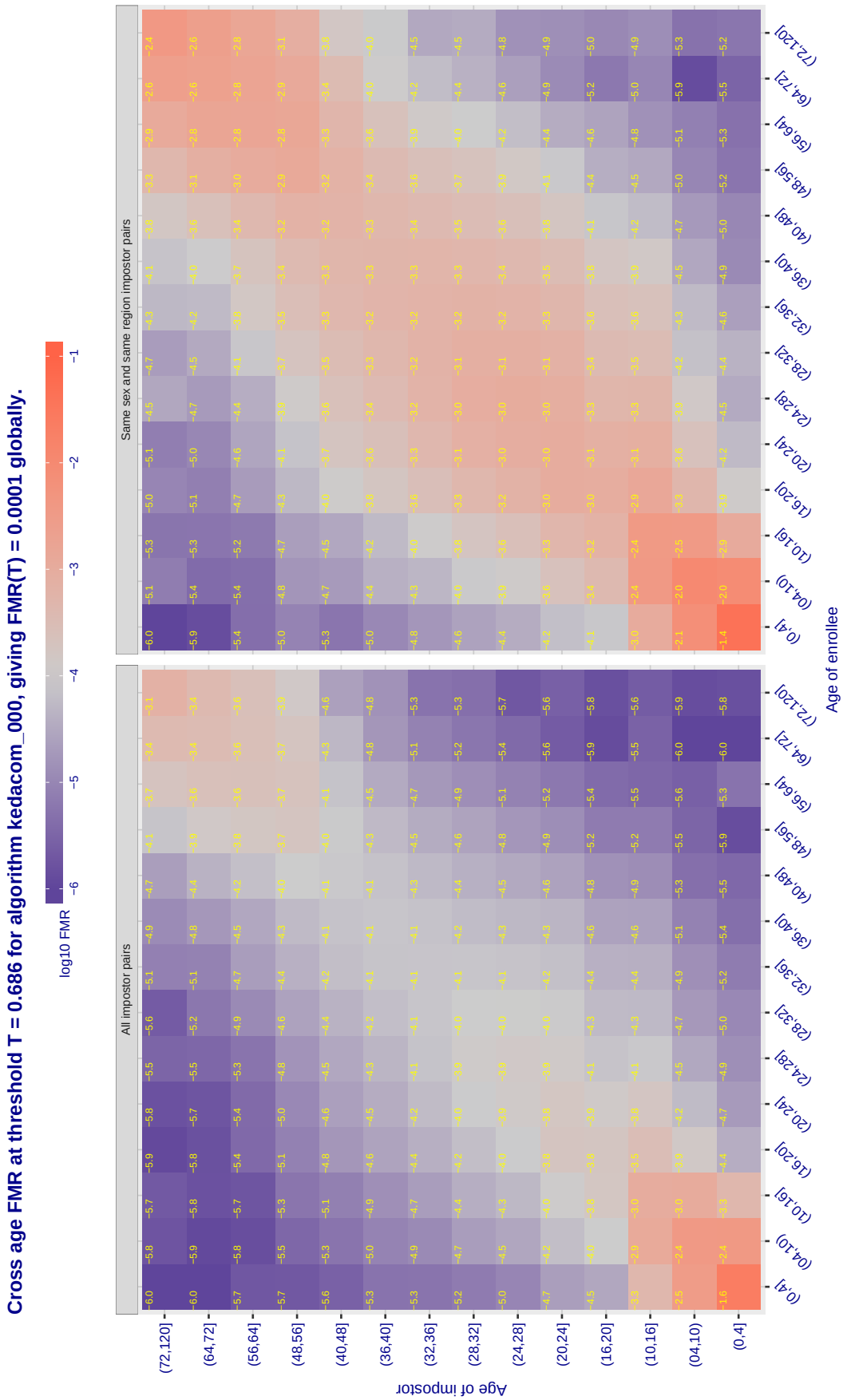


Figure 468: For algorithm kedacom-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

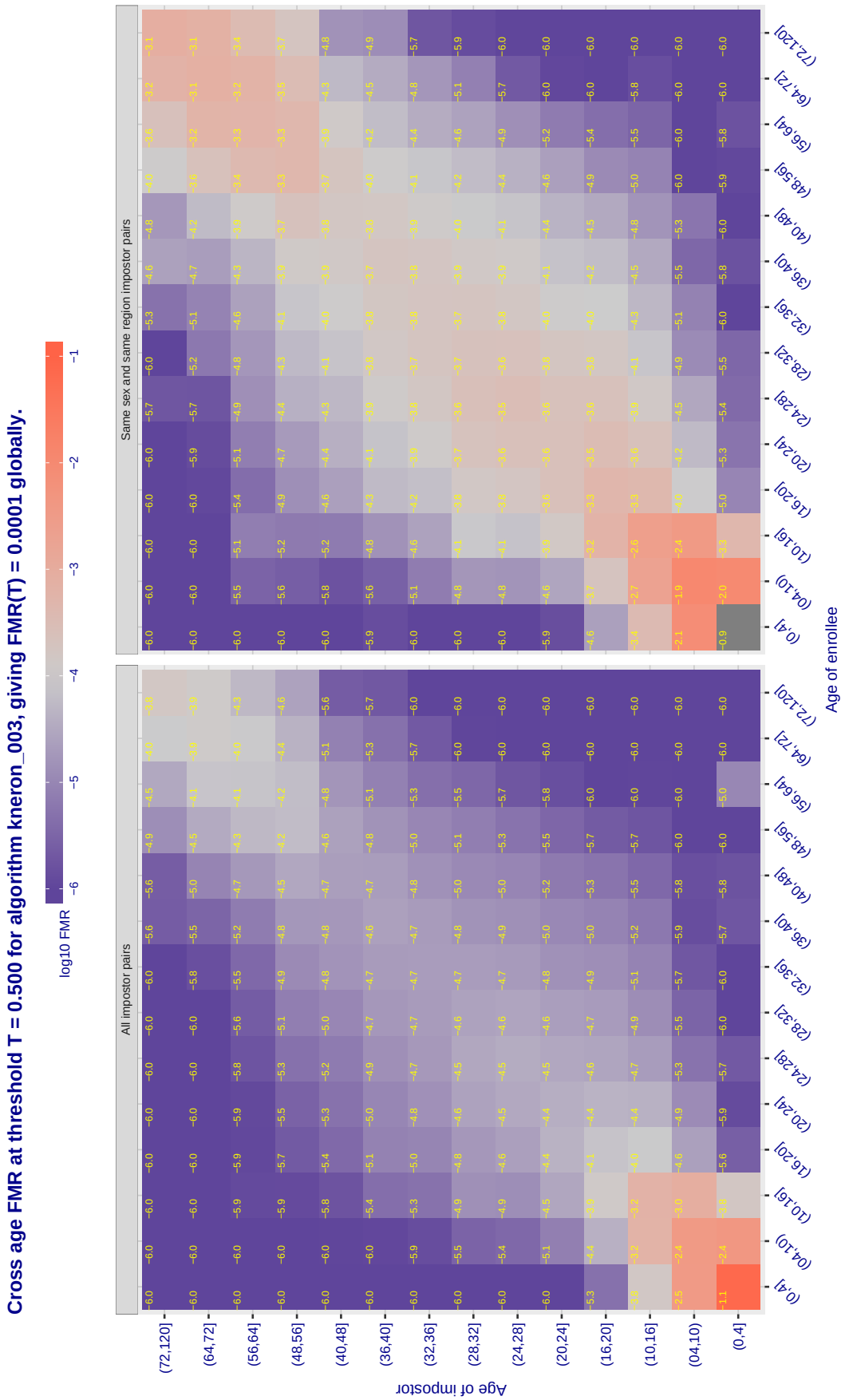


Figure 469: For algorithm kneron-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

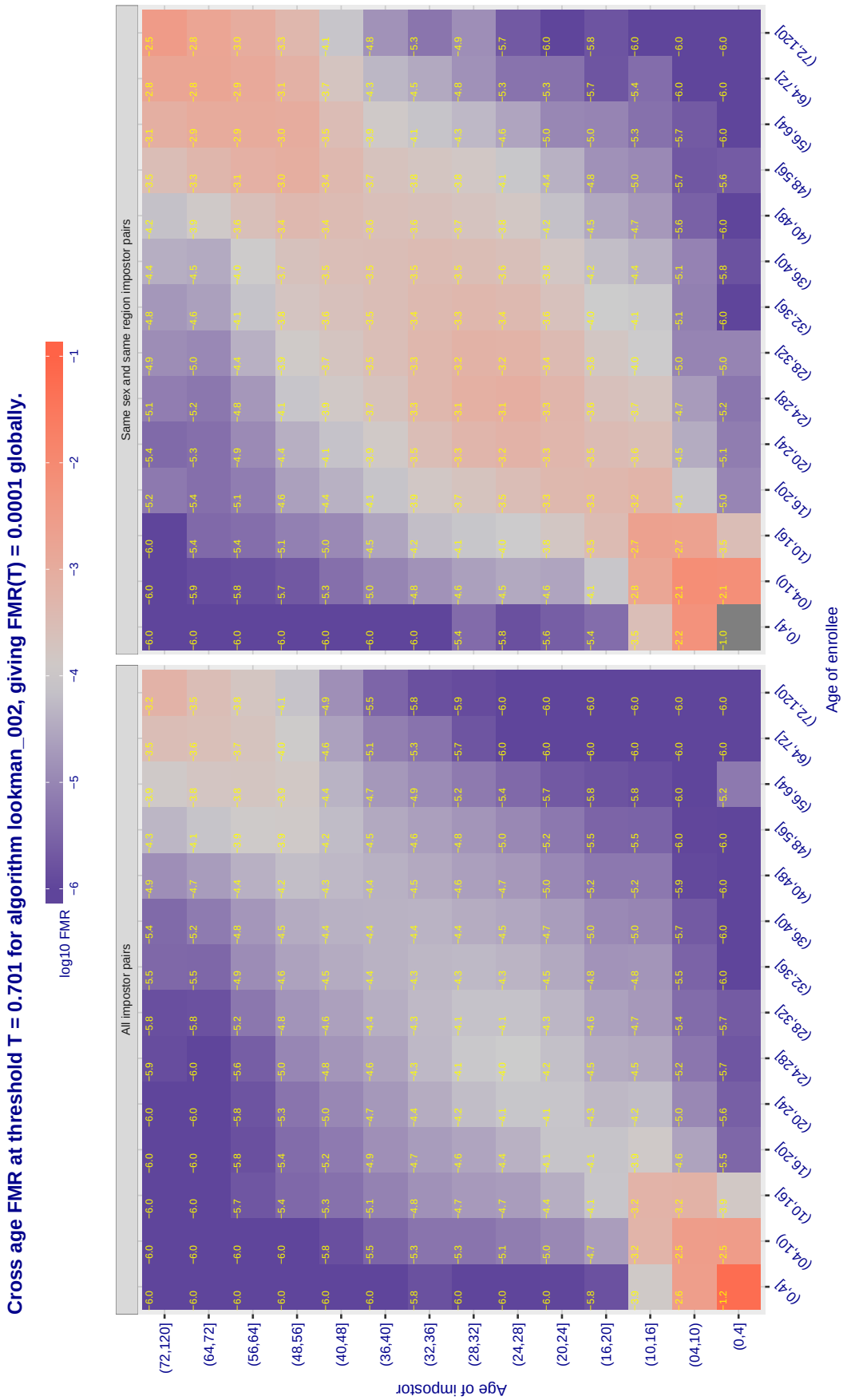


Figure 470: For algorithm lookman-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

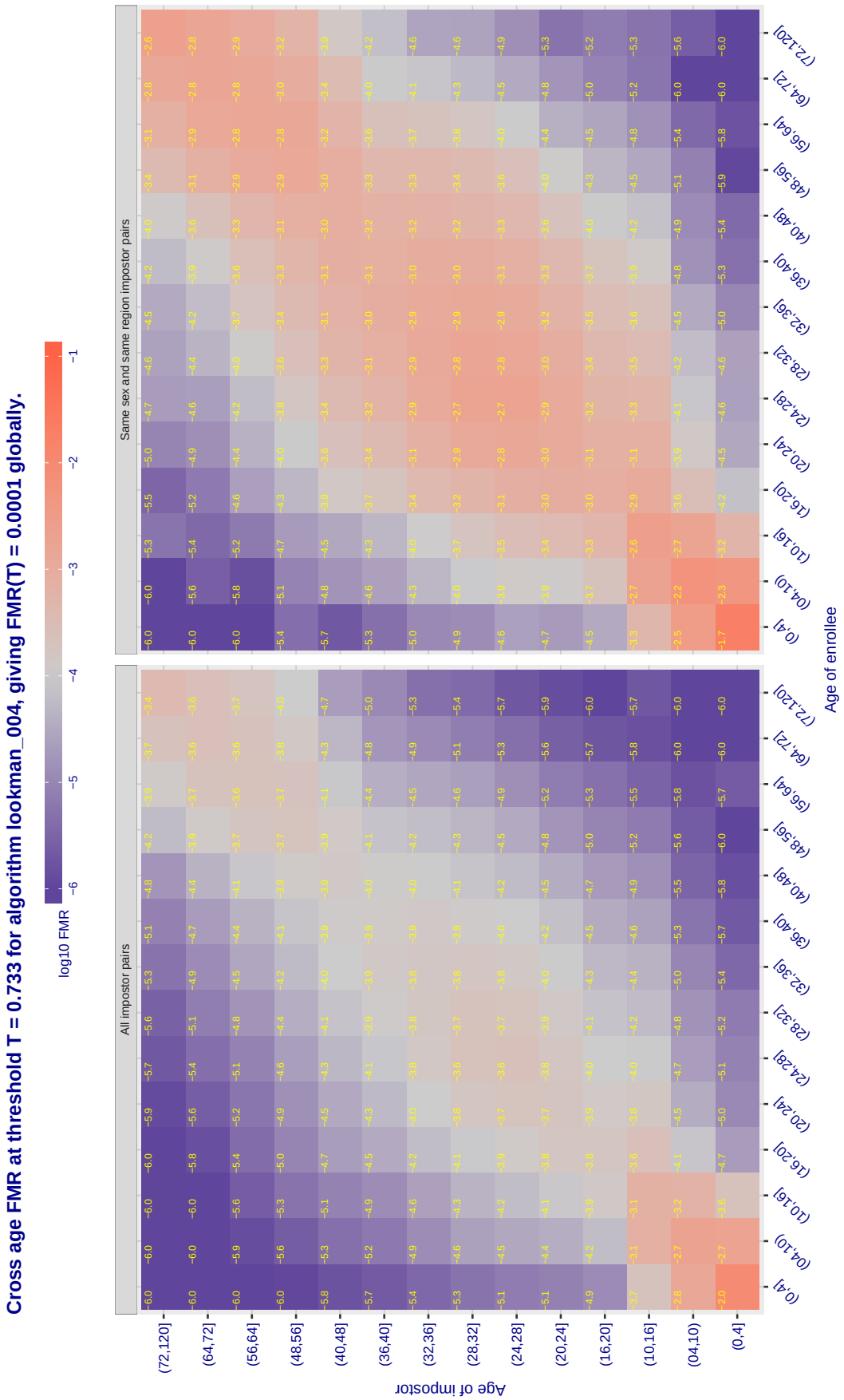


Figure 471: For algorithm lookman-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

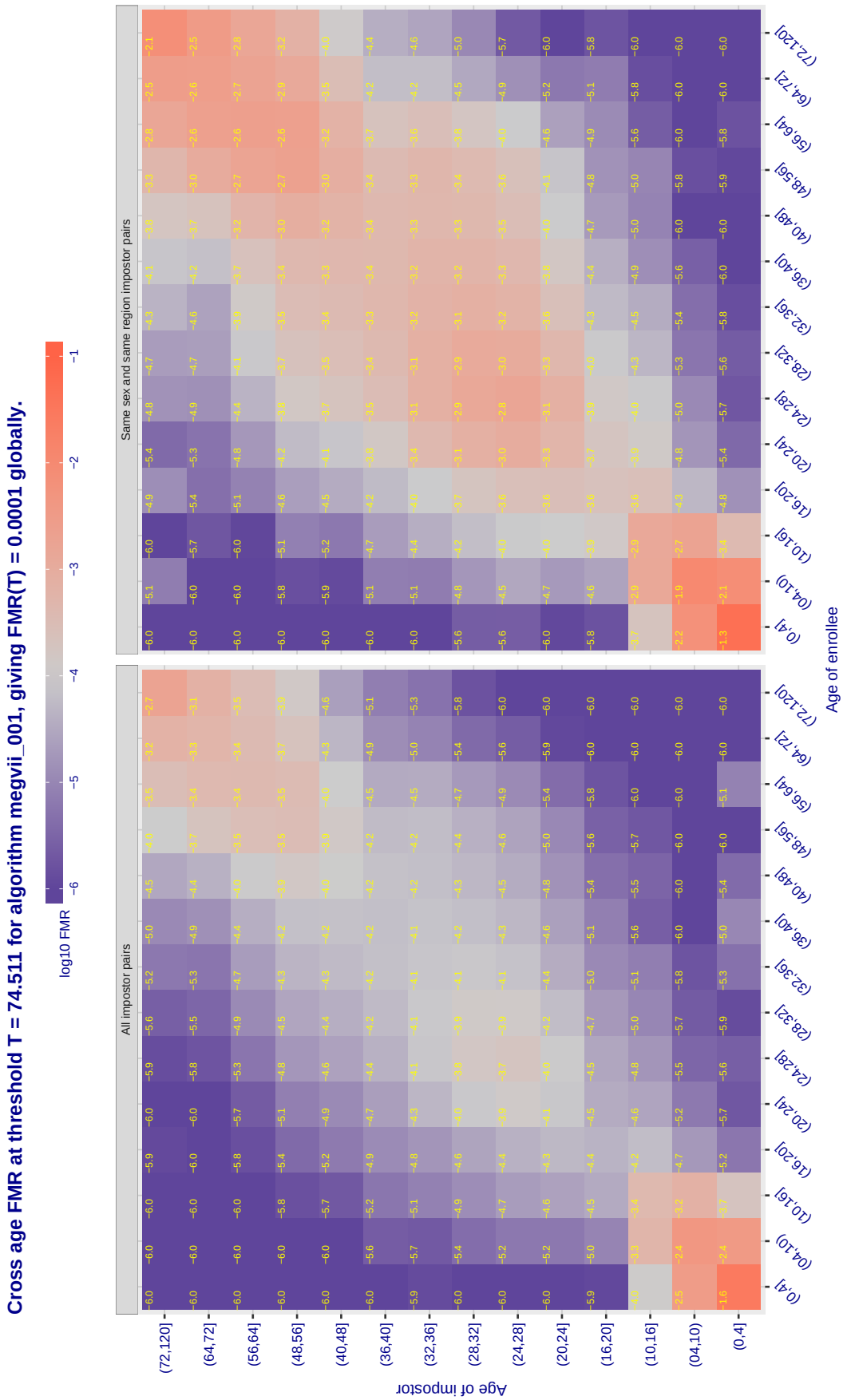


Figure 472: For algorithm megvii-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

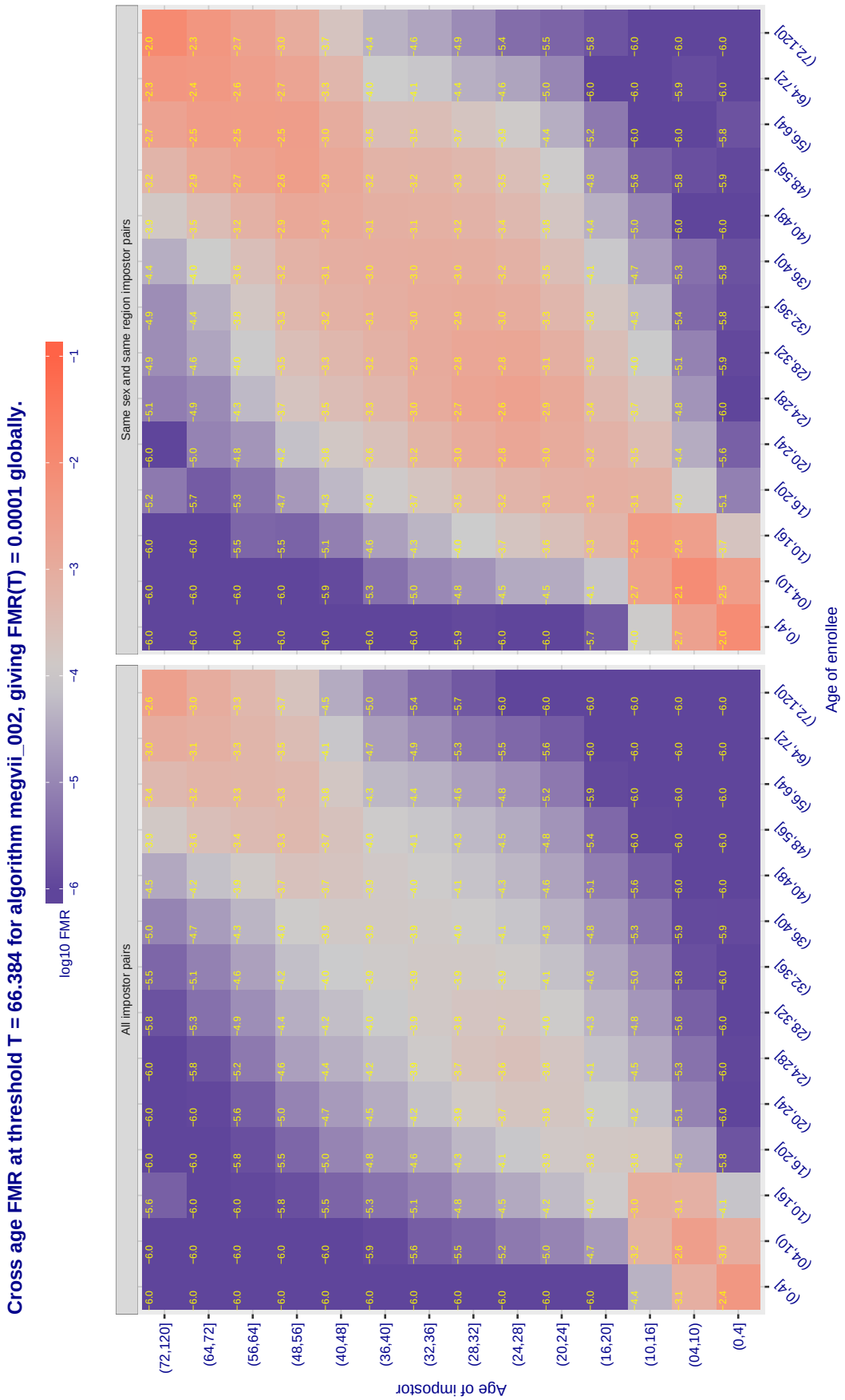


Figure 473: For algorithm megvii-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

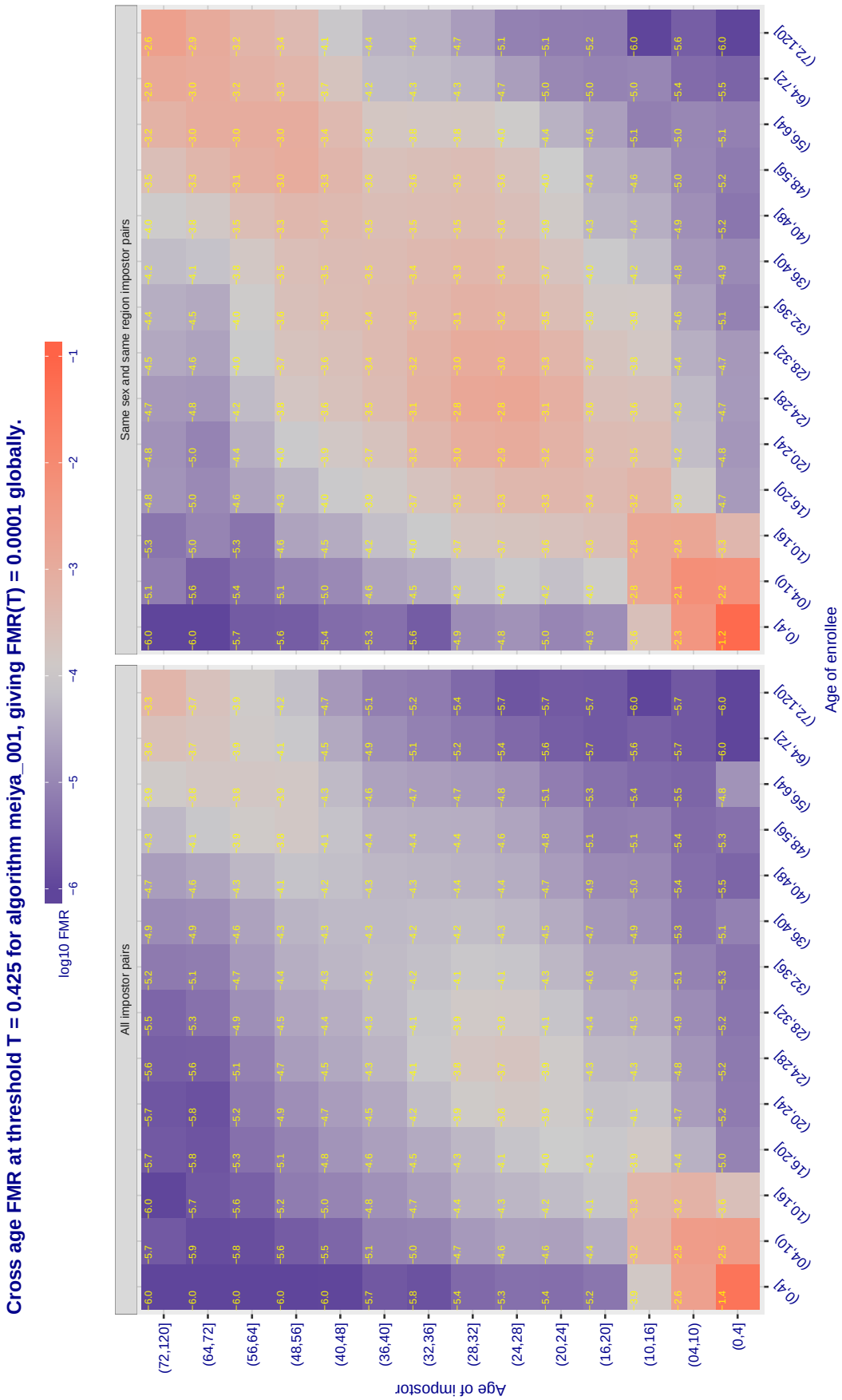


Figure 474: For algorithm meiya-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

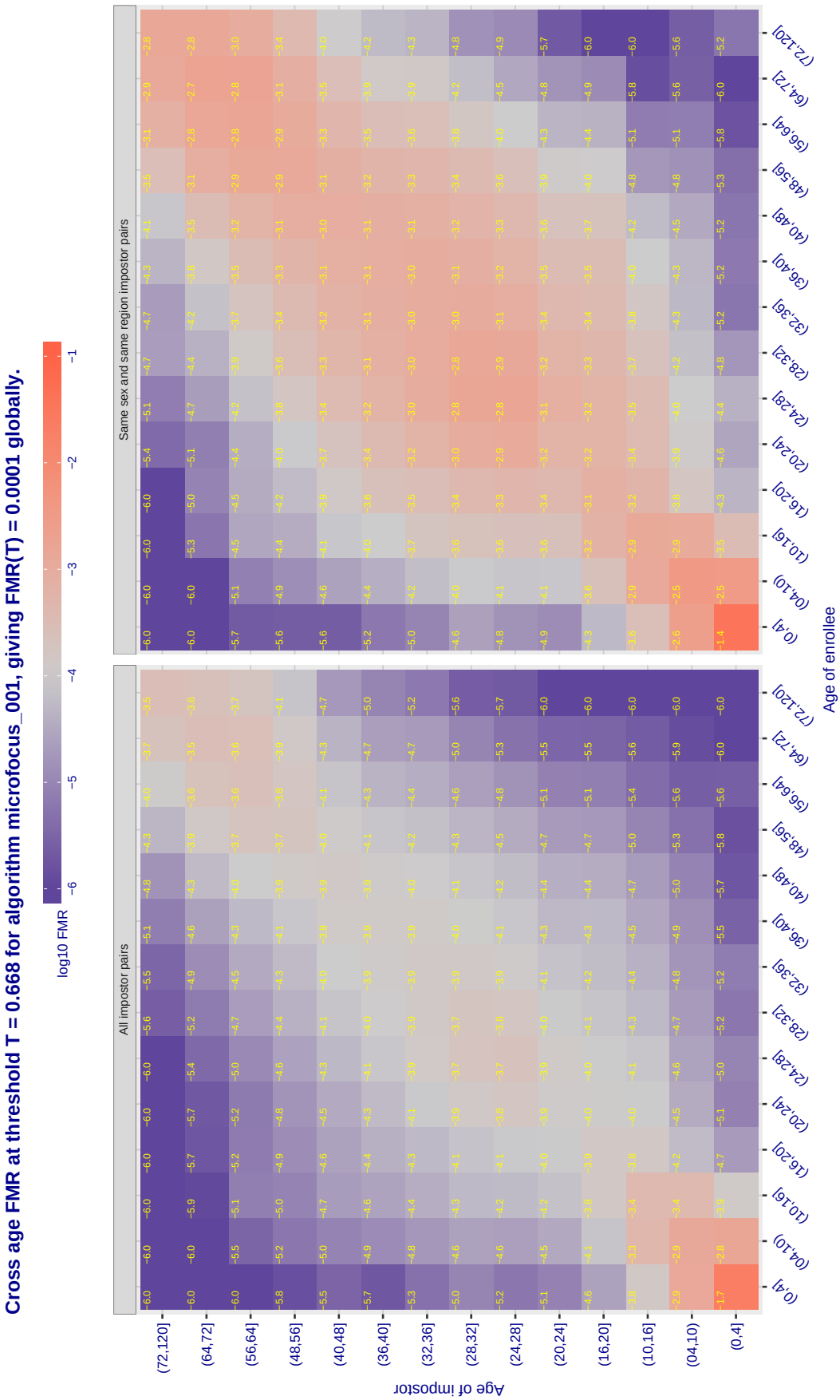


Figure 475: For algorithm microfocus-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

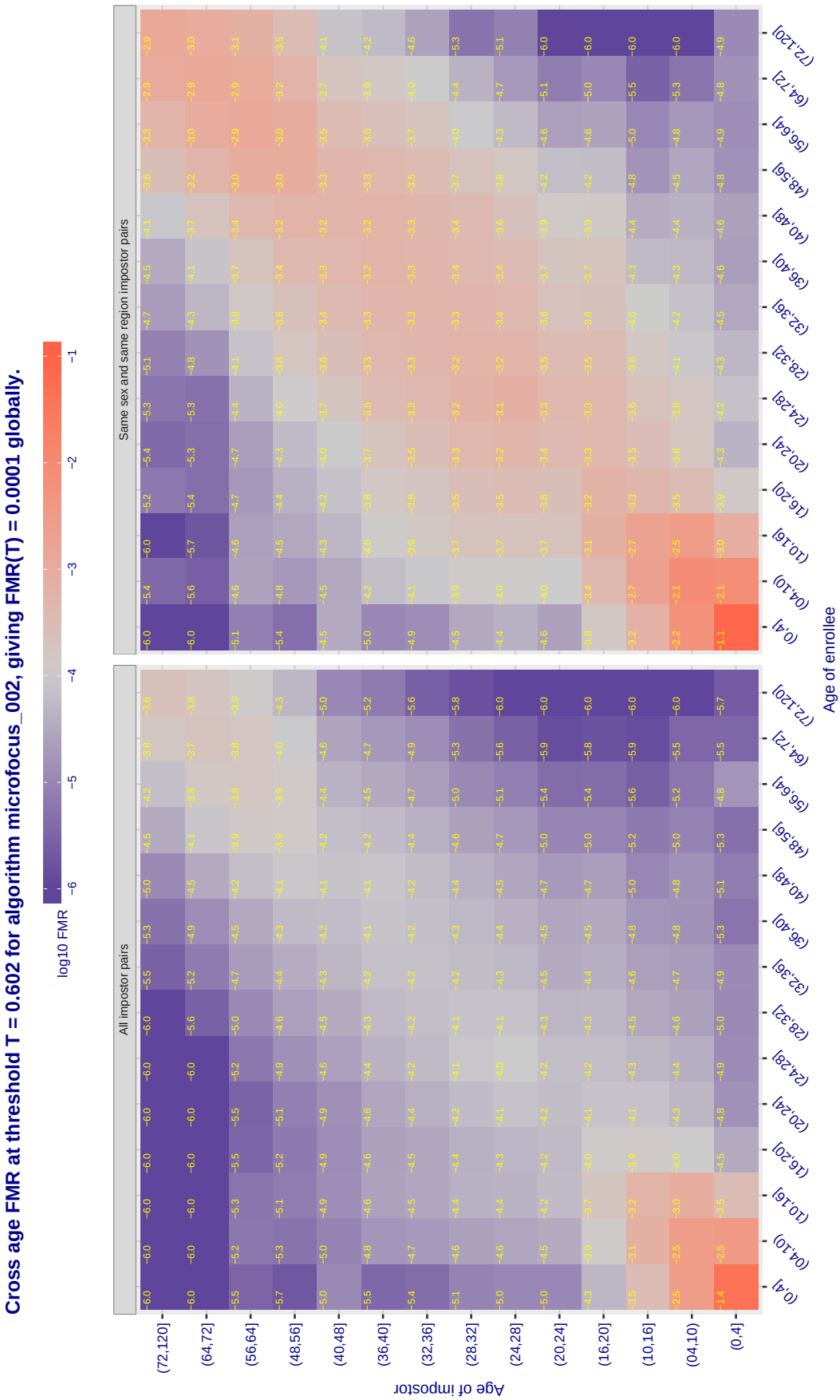


Figure 476: For algorithm microfocus-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

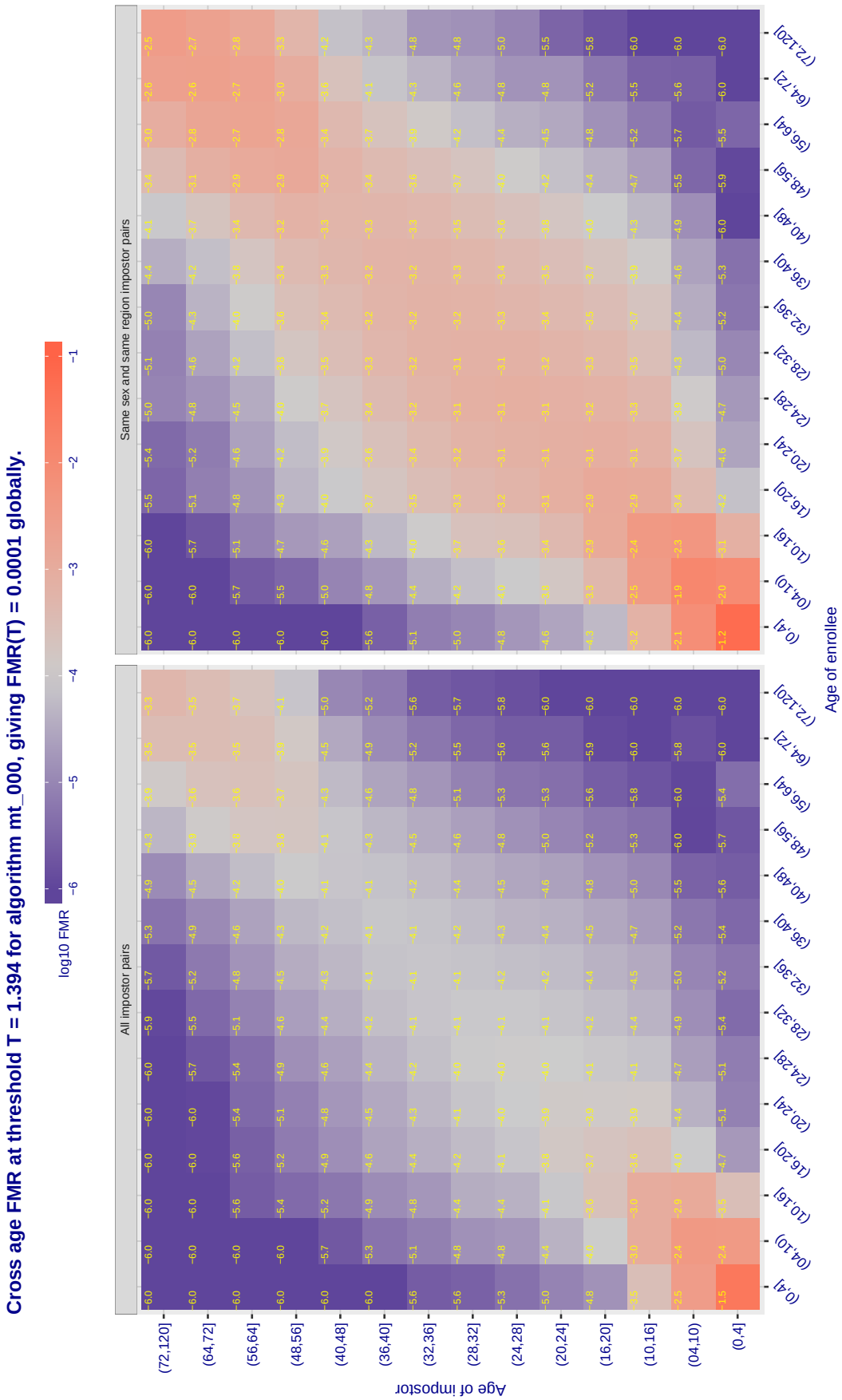


Figure 477: For algorithm mt-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

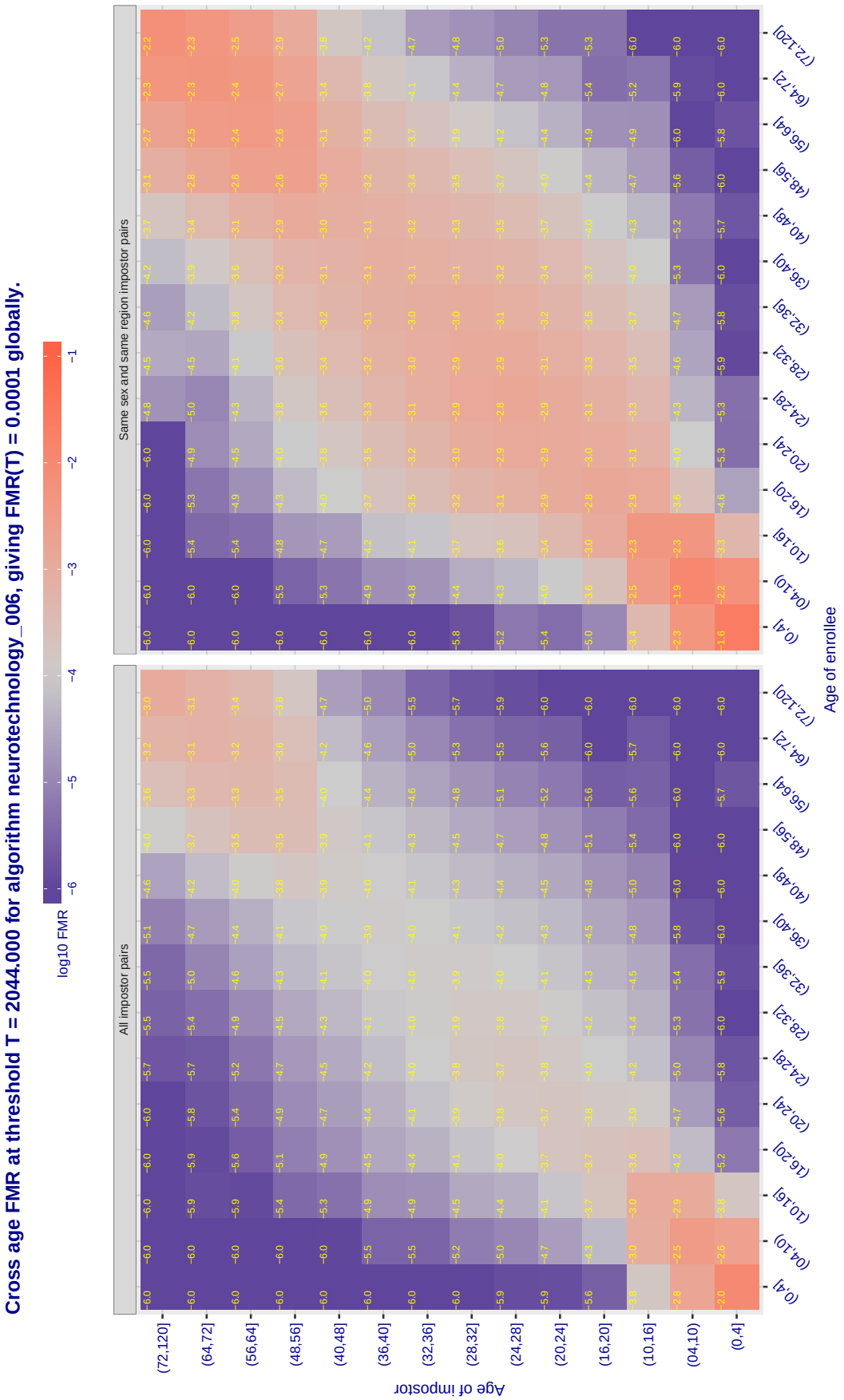


Figure 478: For algorithm neurotechnology-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

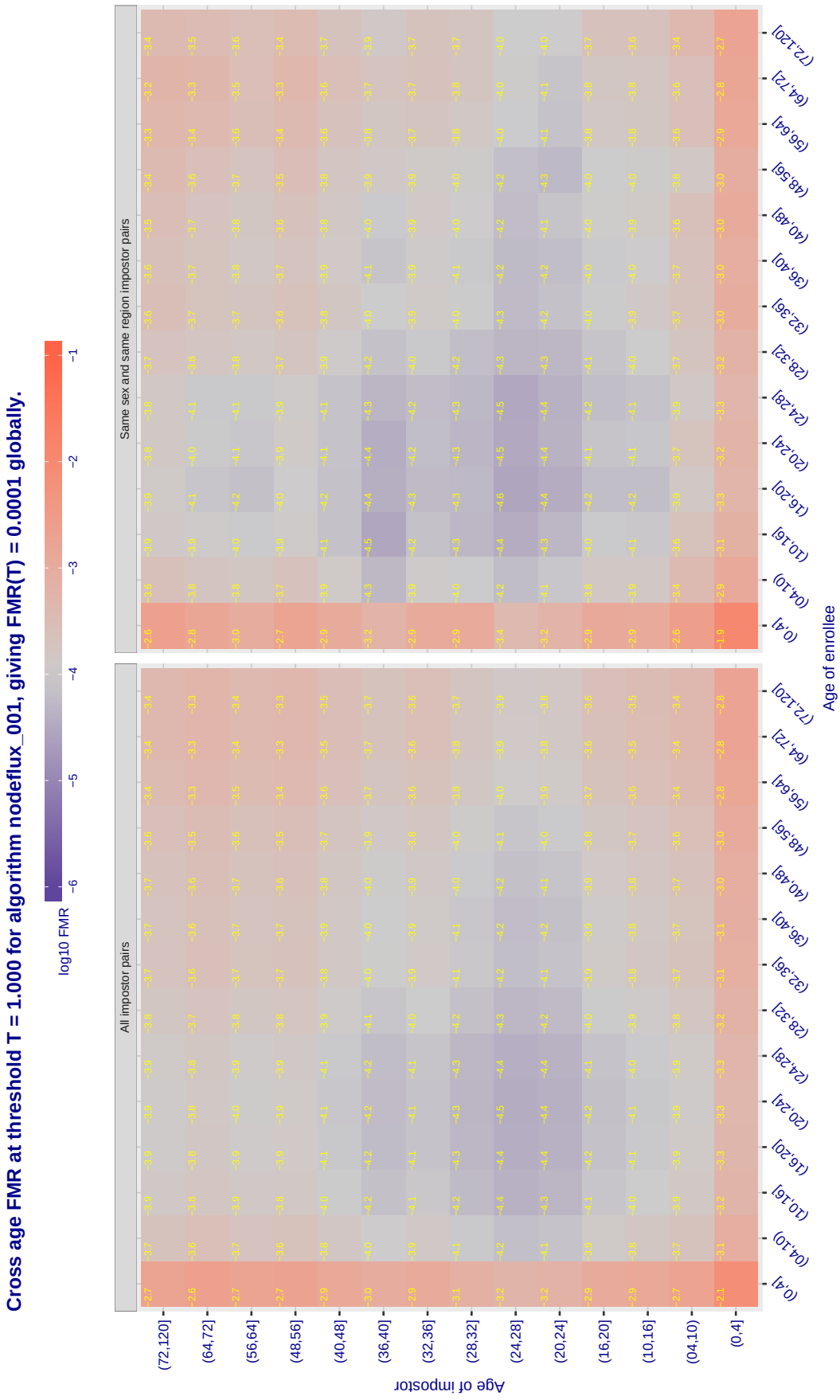


Figure 479: For algorithm nodeflux-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

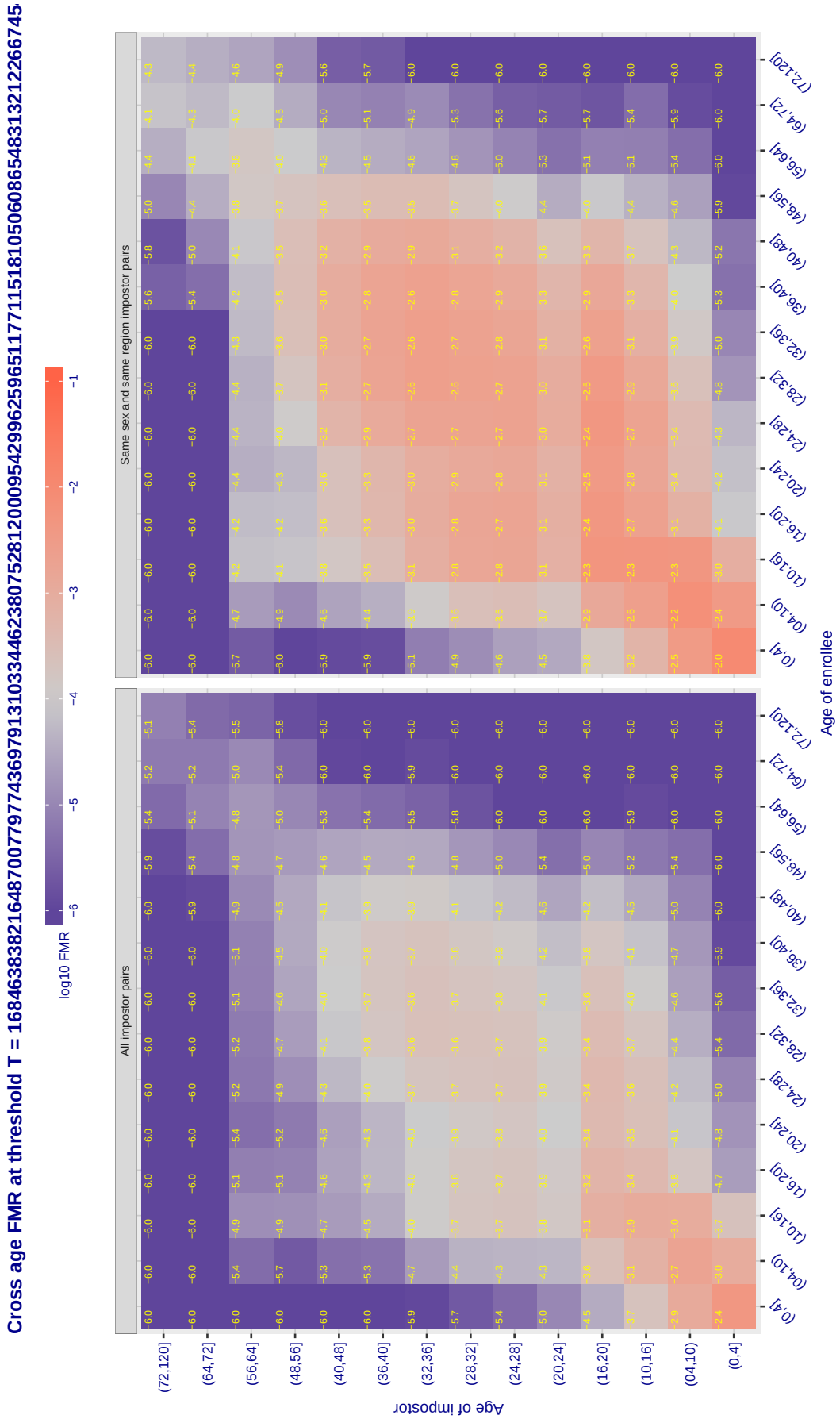


Figure 480: For algorithm notiontag-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

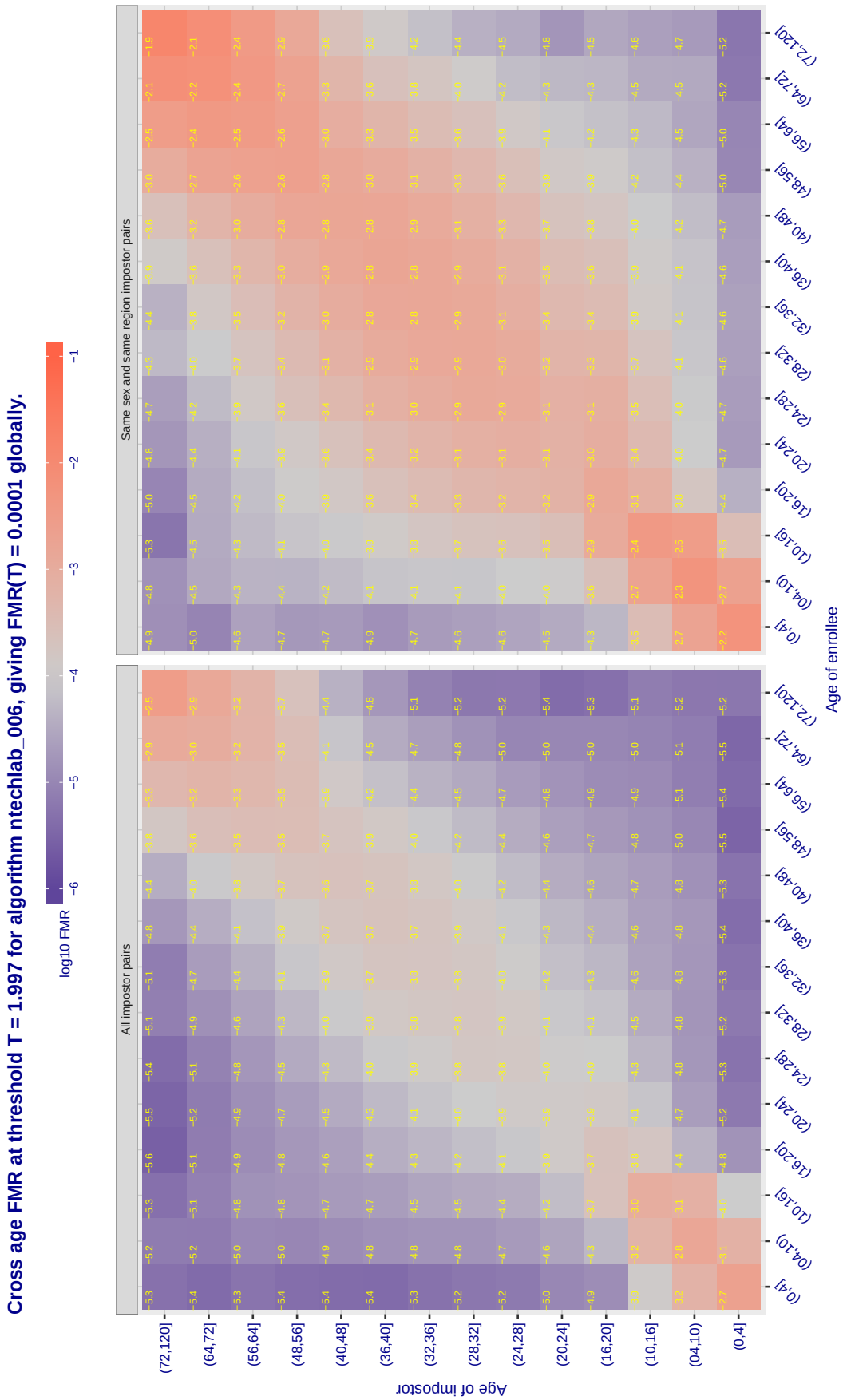


Figure 481: For algorithm ntechlab-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

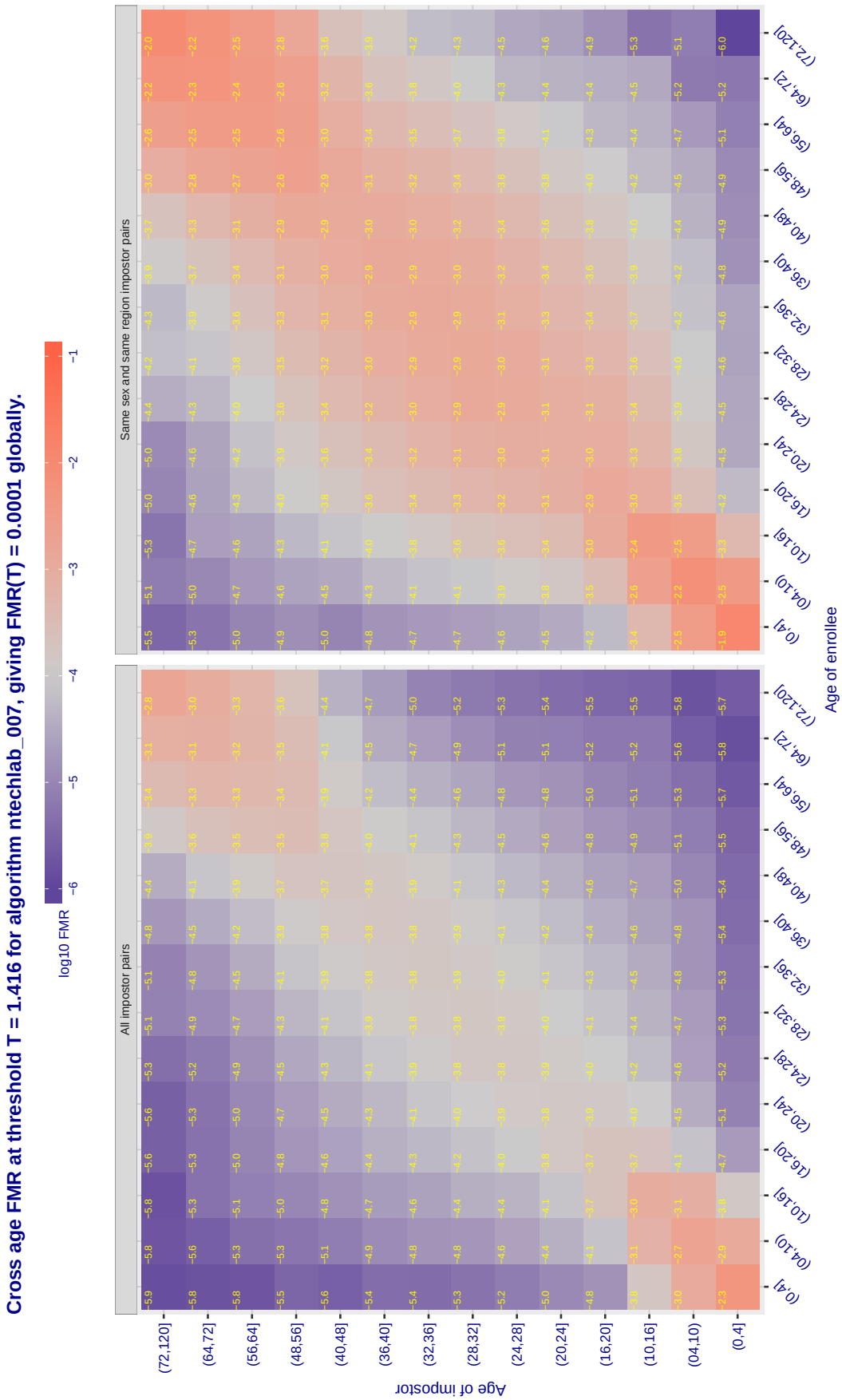


Figure 482: For algorithm ntechlab-007 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

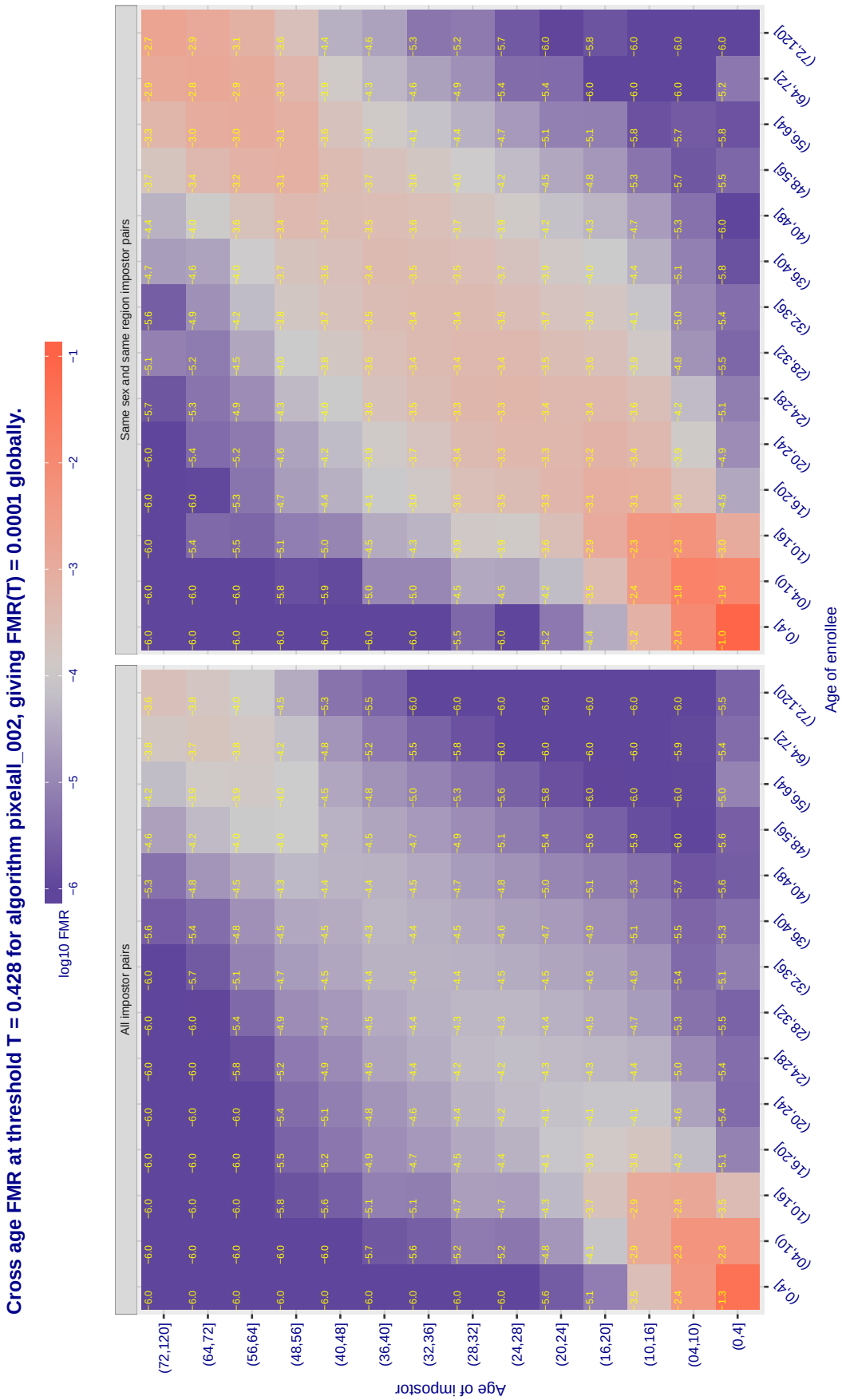


Figure 483: For algorithm pixelall-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

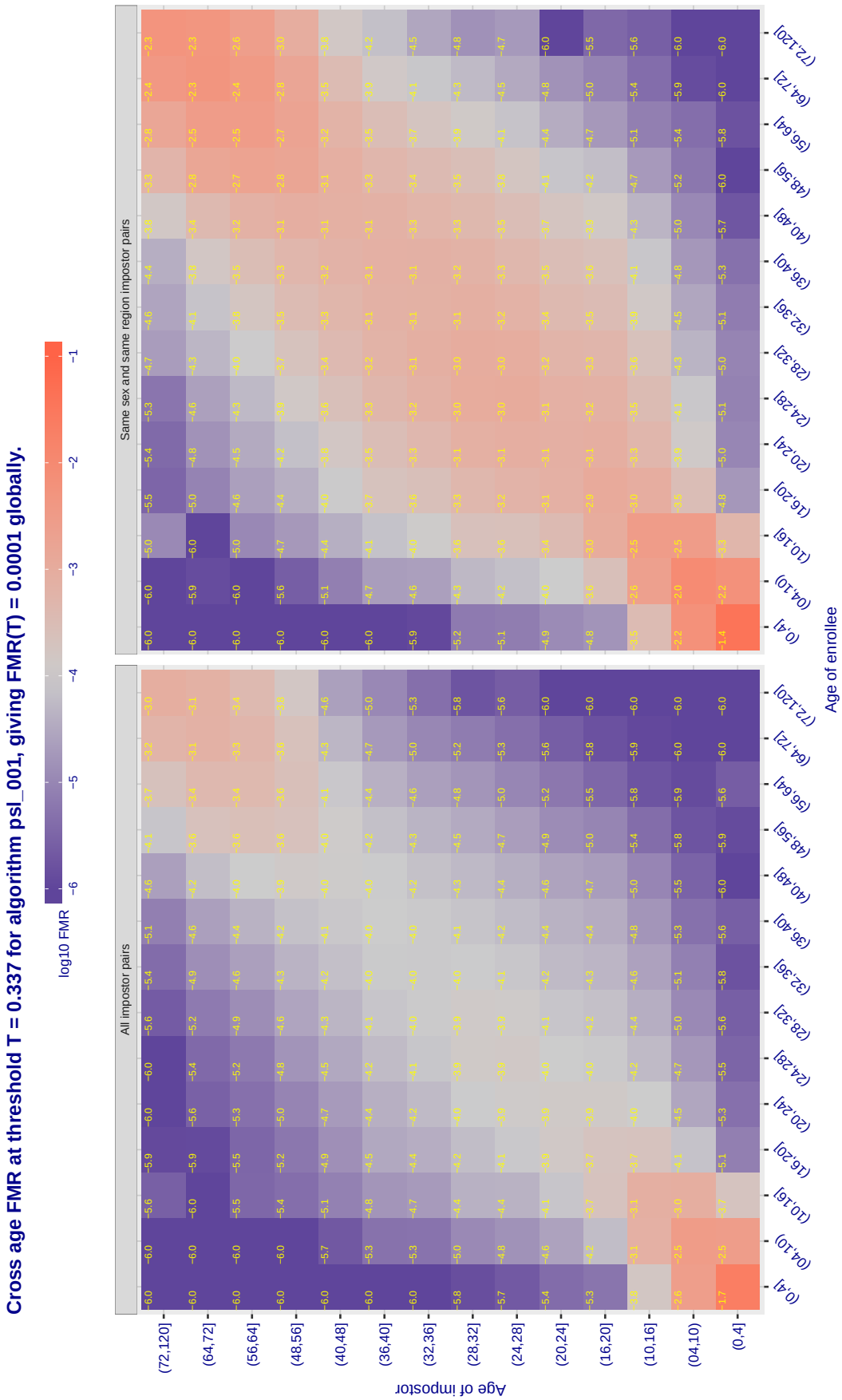


Figure 484: For algorithm psl-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

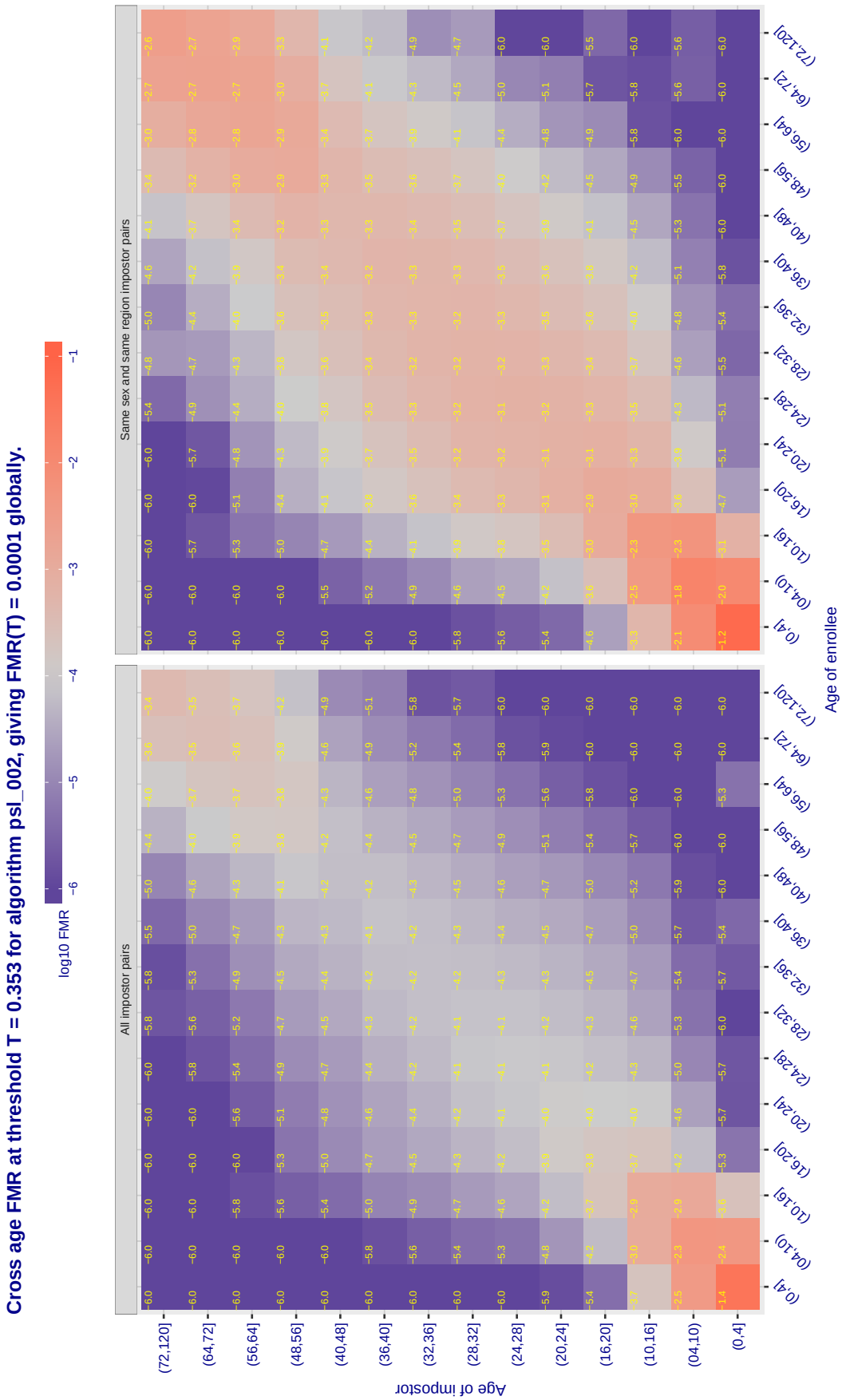


Figure 485: For algorithm psl-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

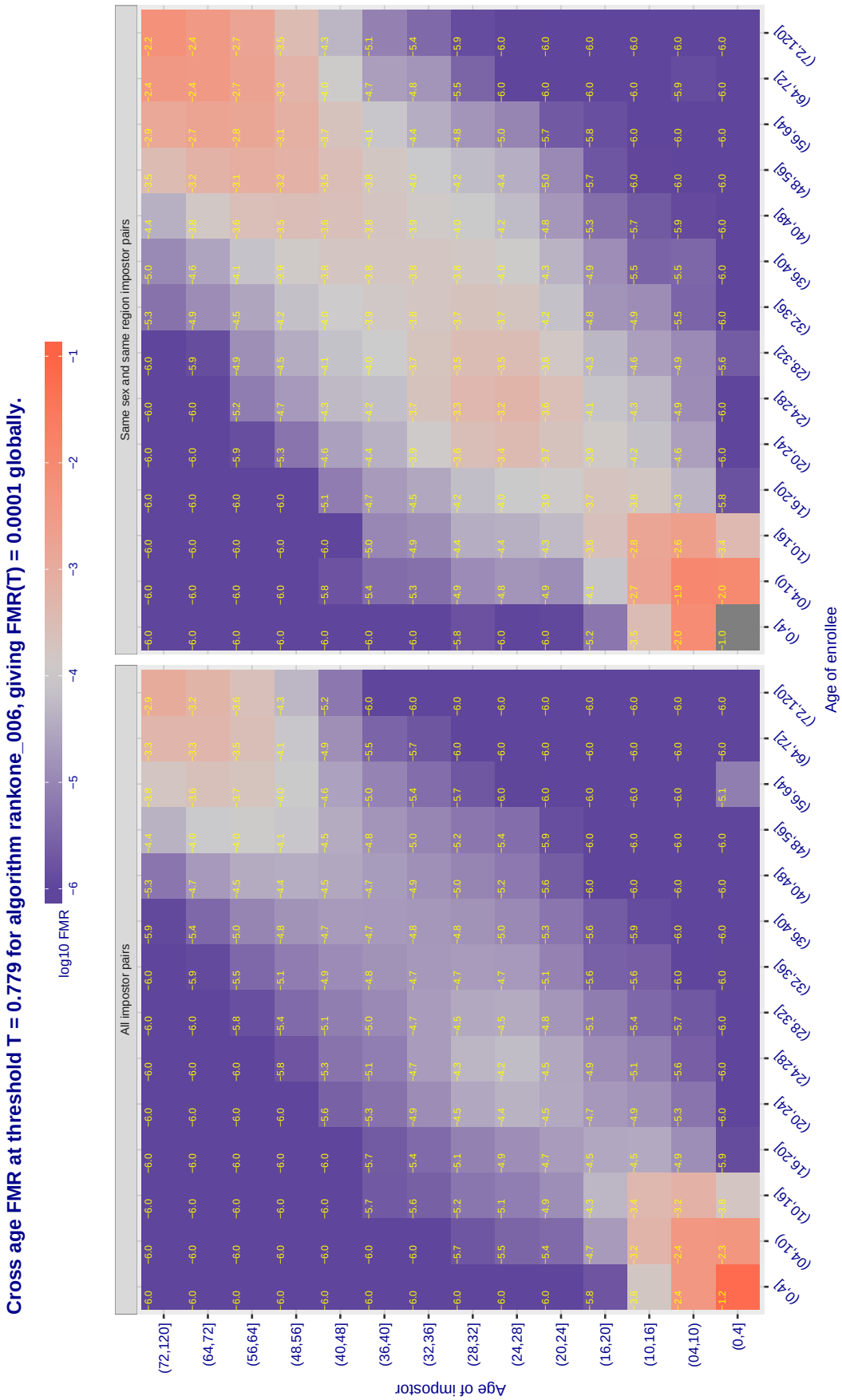


Figure 486: For algorithm rankone-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

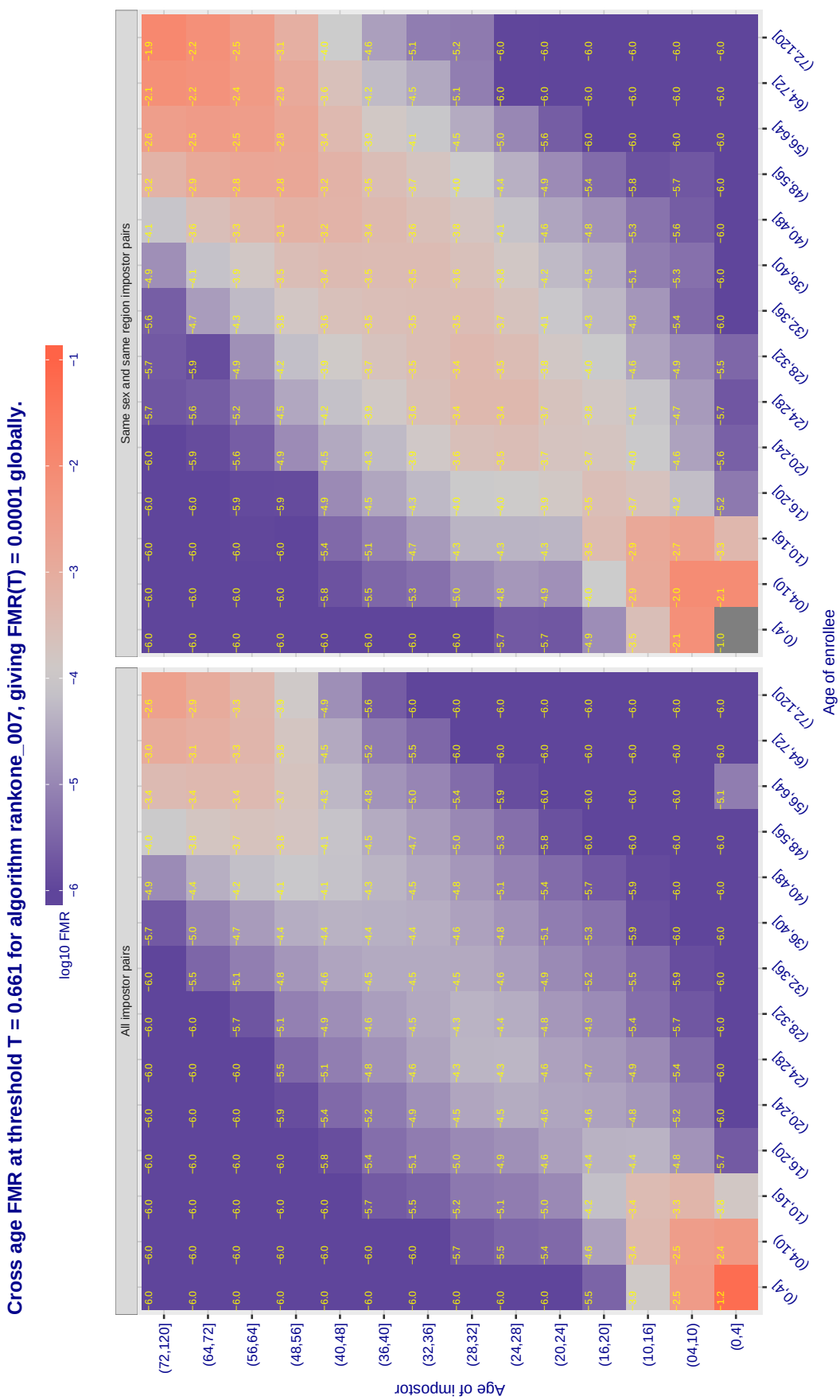


Figure 487: For algorithm rankone-007 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

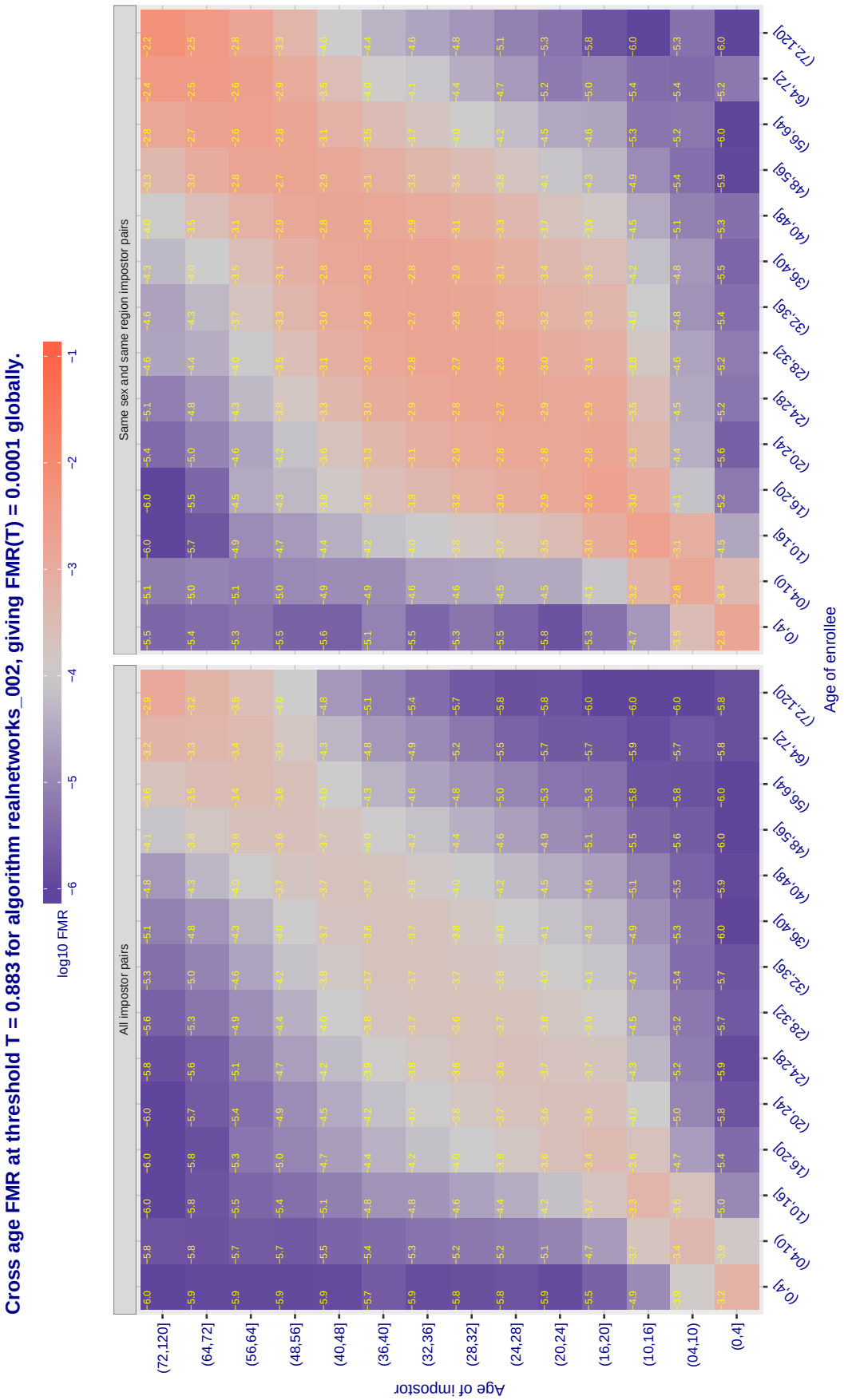


Figure 488: For algorithm realnetworks-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

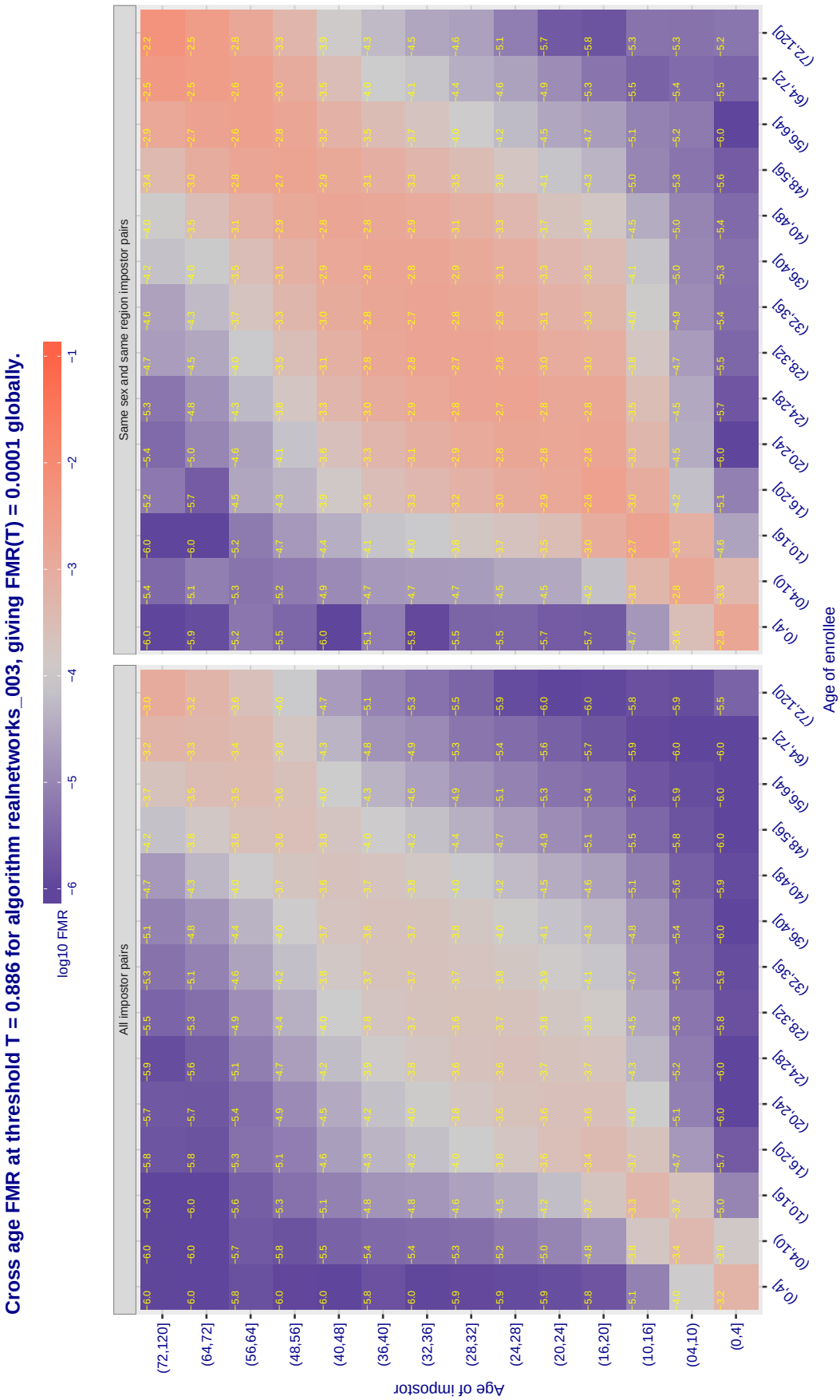


Figure 489: For algorithm realnetworks-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

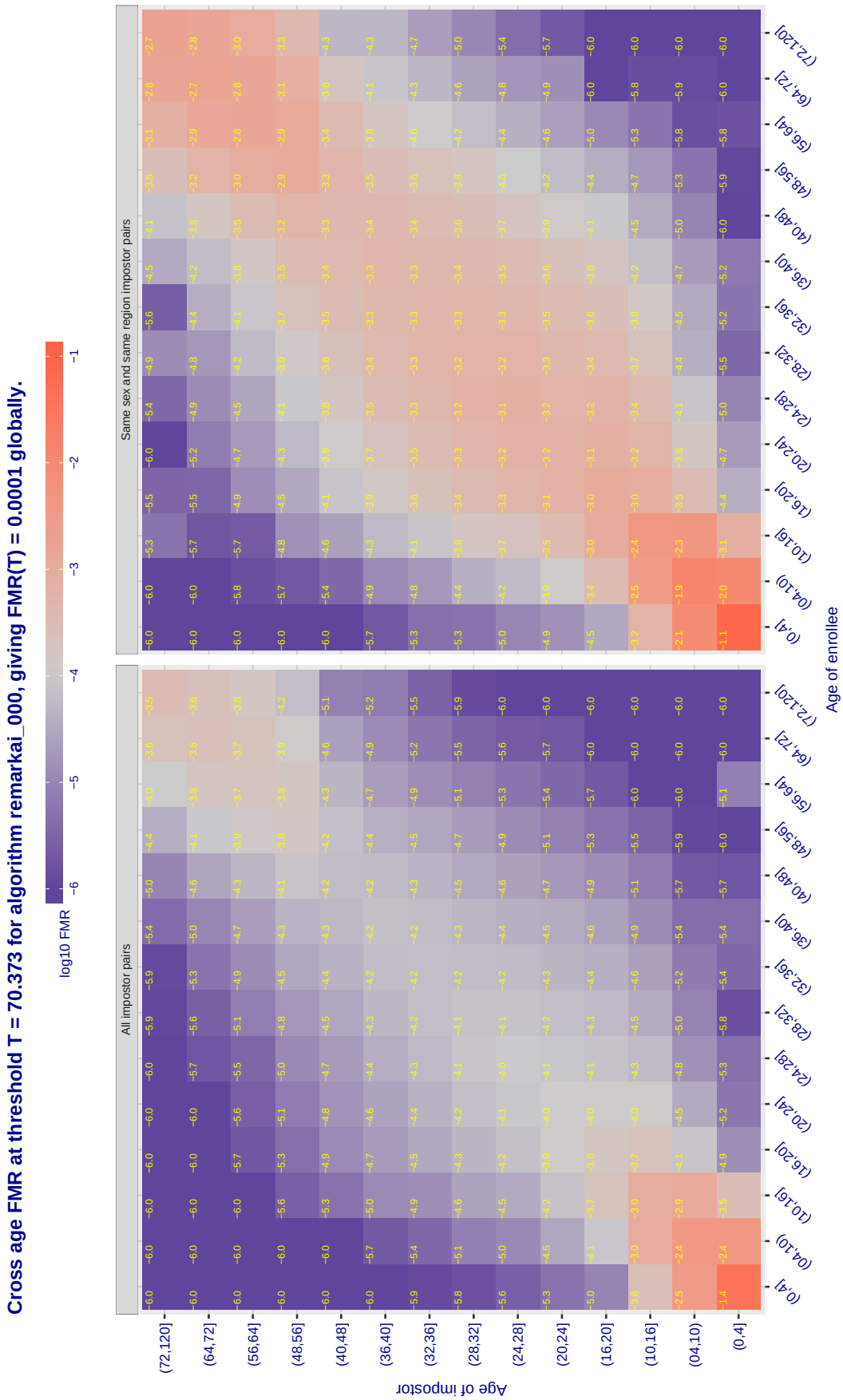


Figure 490: For algorithm remarkai-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

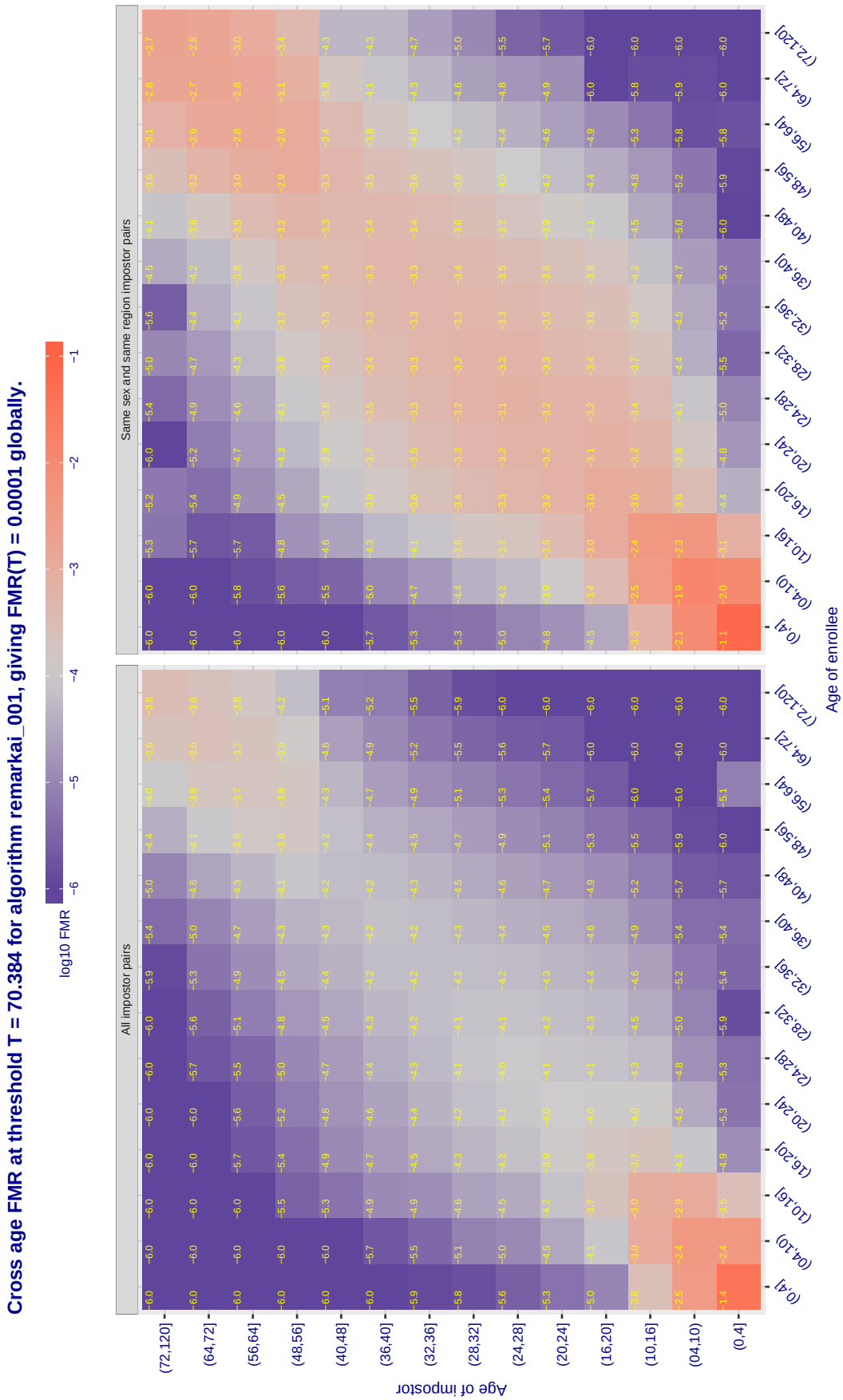


Figure 491: For algorithm remarkai-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

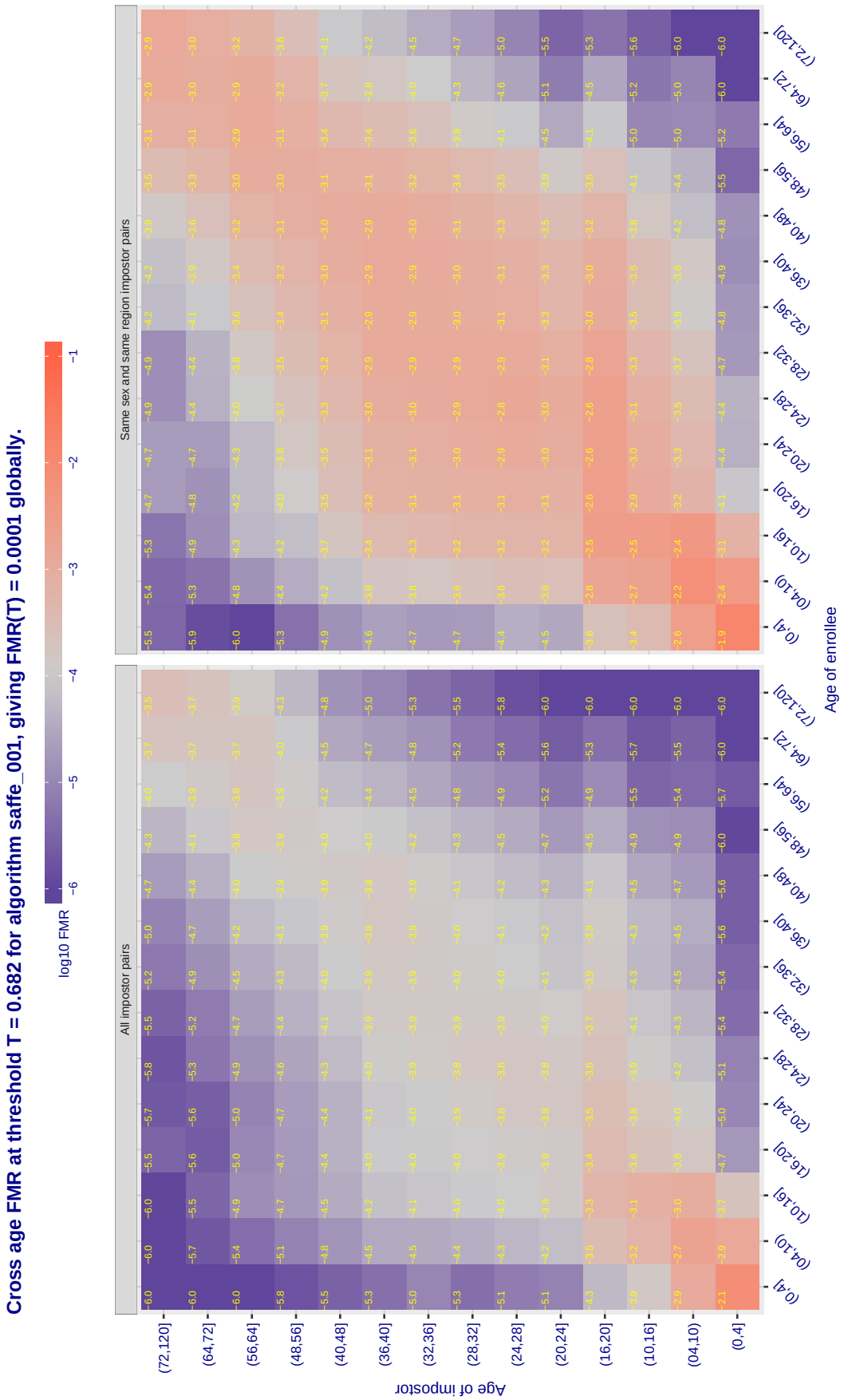


Figure 492: For algorithm saffe-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

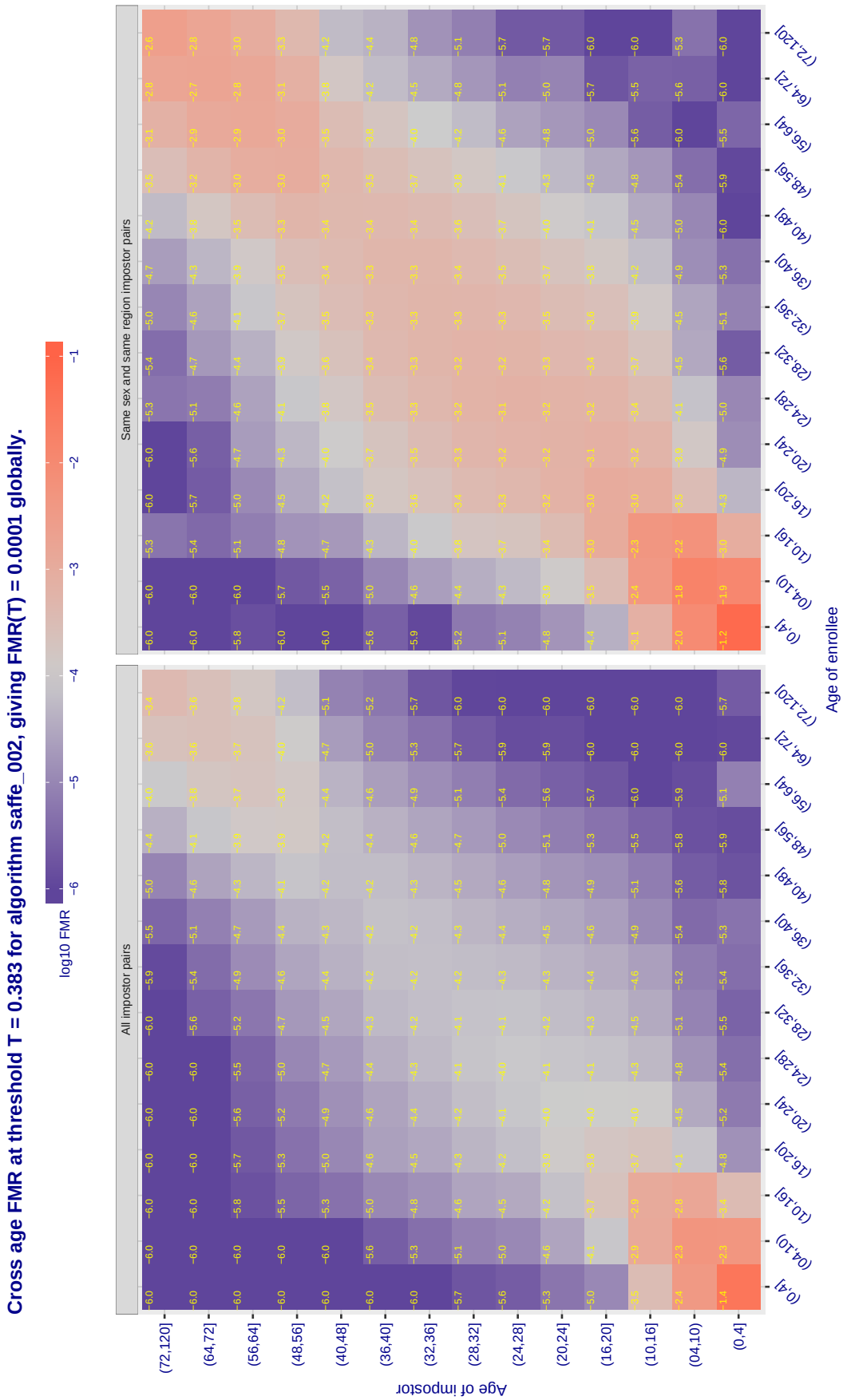


Figure 493: For algorithm saffe-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

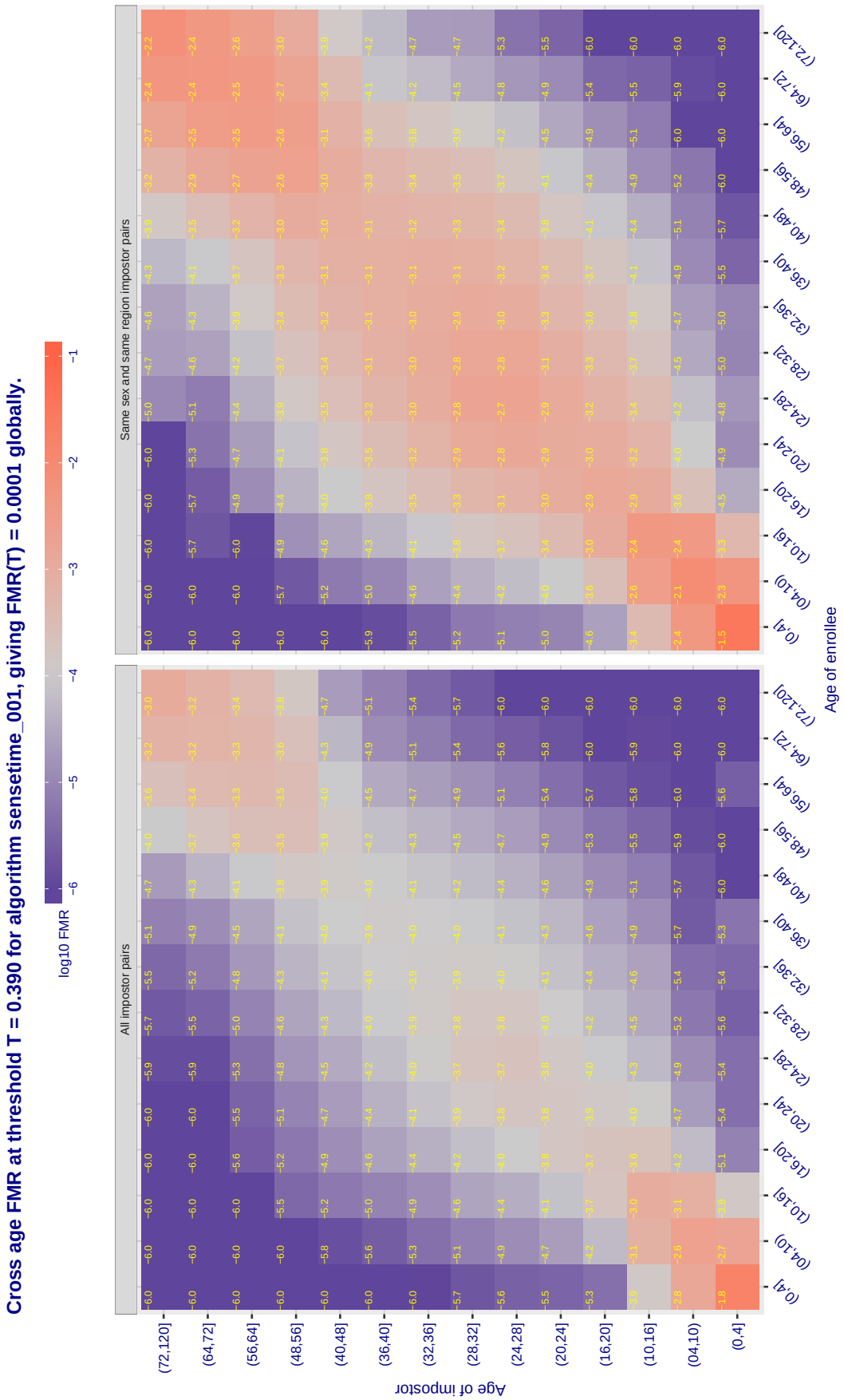


Figure 494: For algorithm sensetime-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

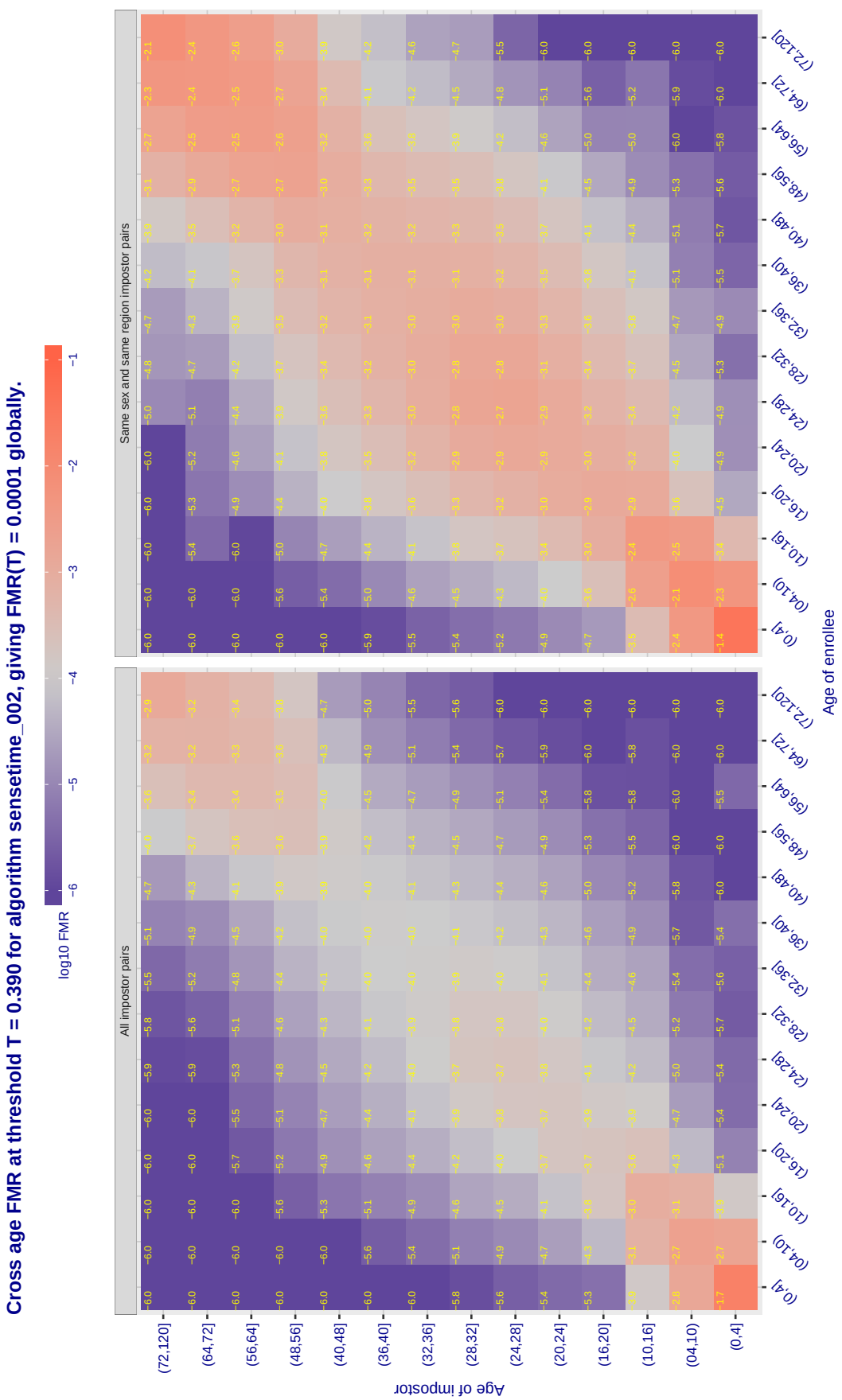


Figure 495: For algorithm sensetime-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

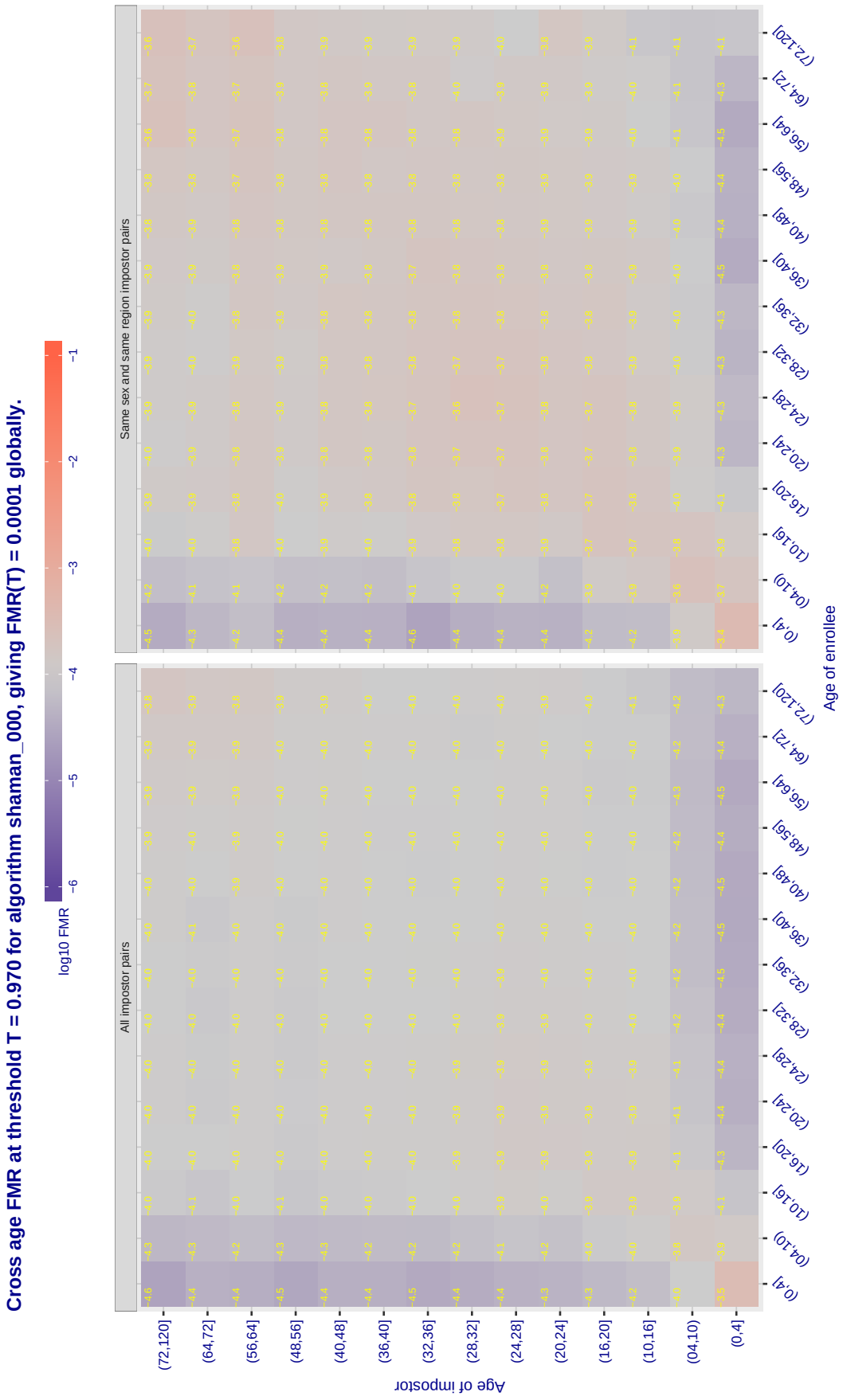


Figure 496: For algorithm shaman-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

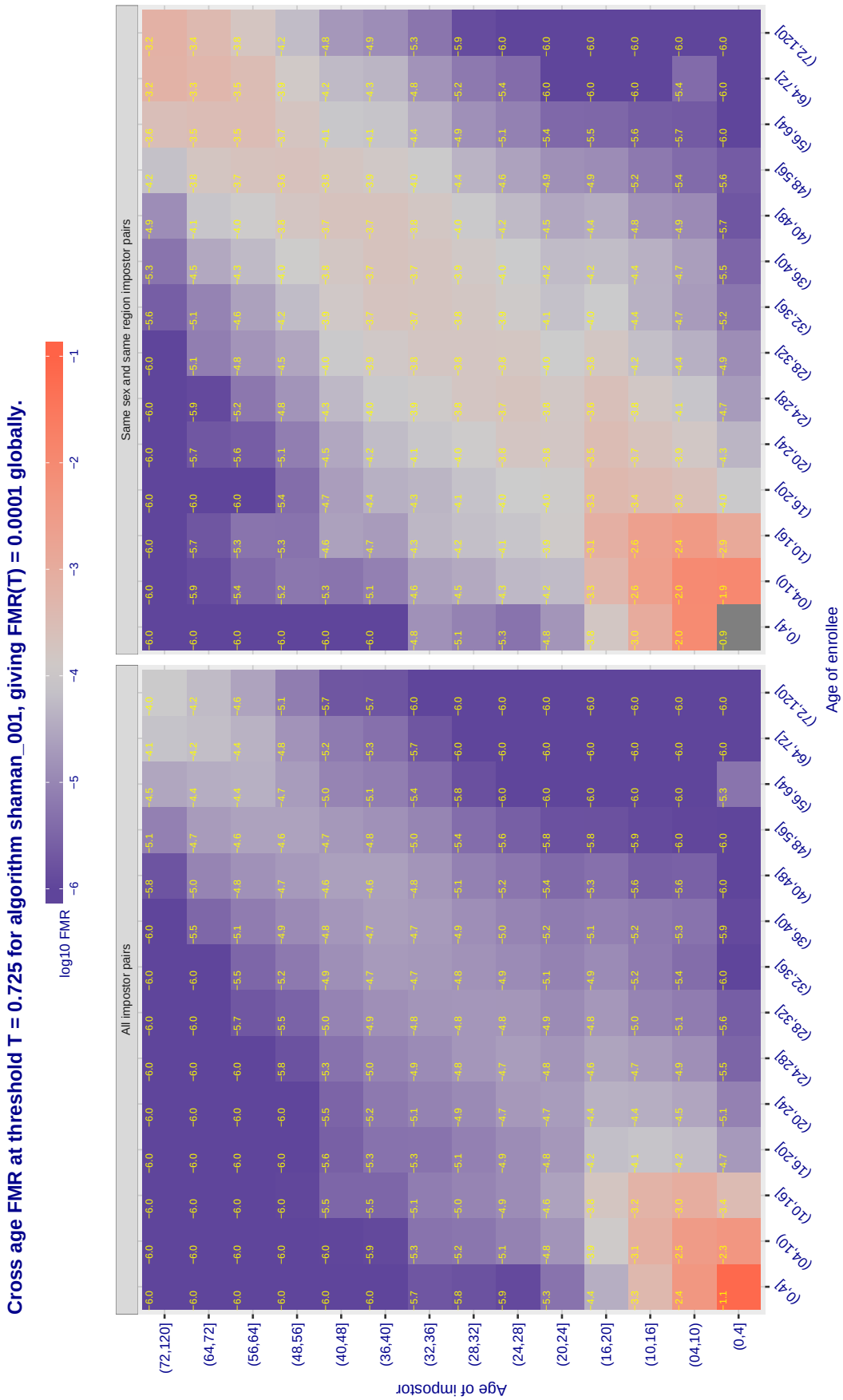


Figure 497: For algorithm shaman-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

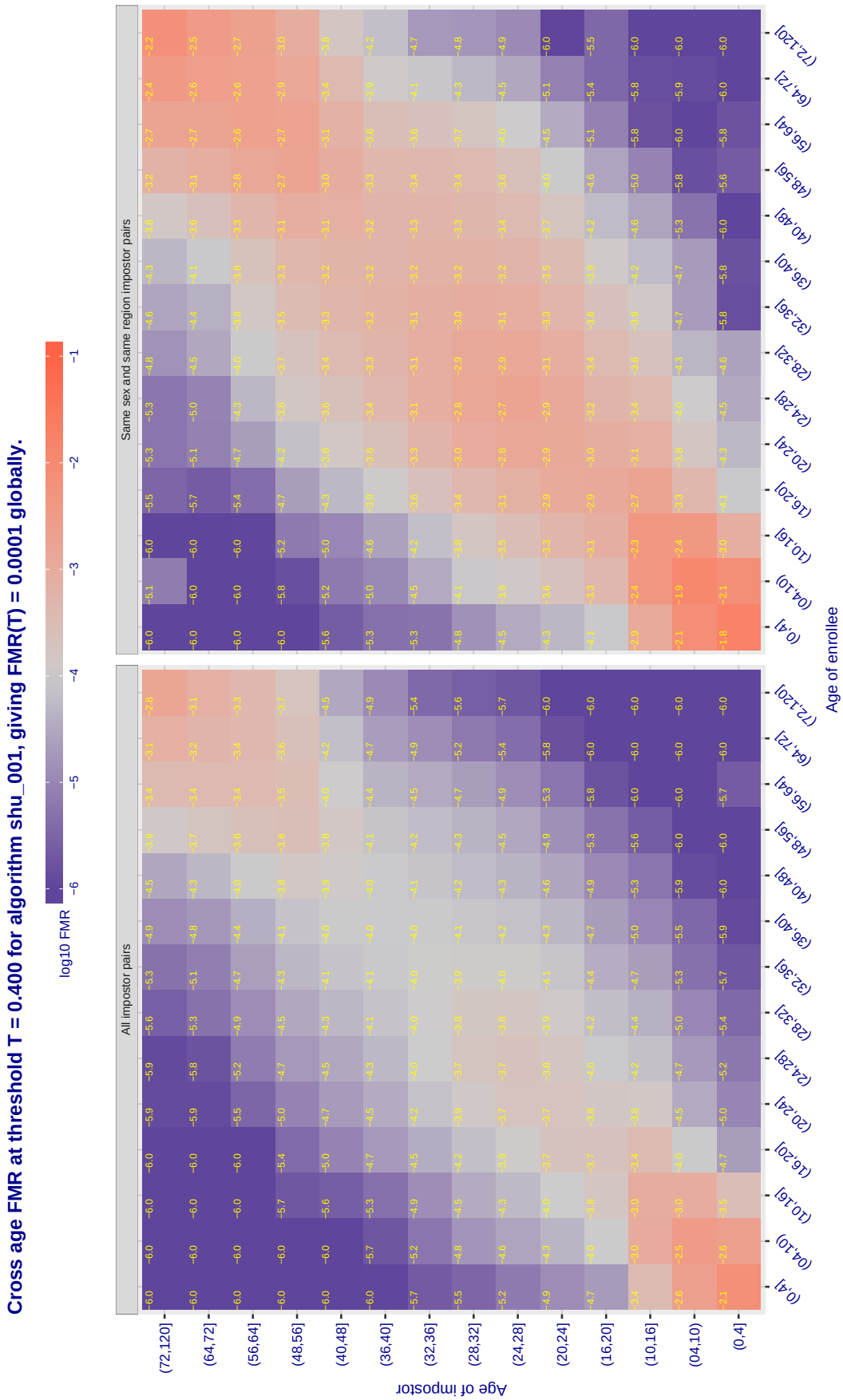


Figure 498: For algorithm shu-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

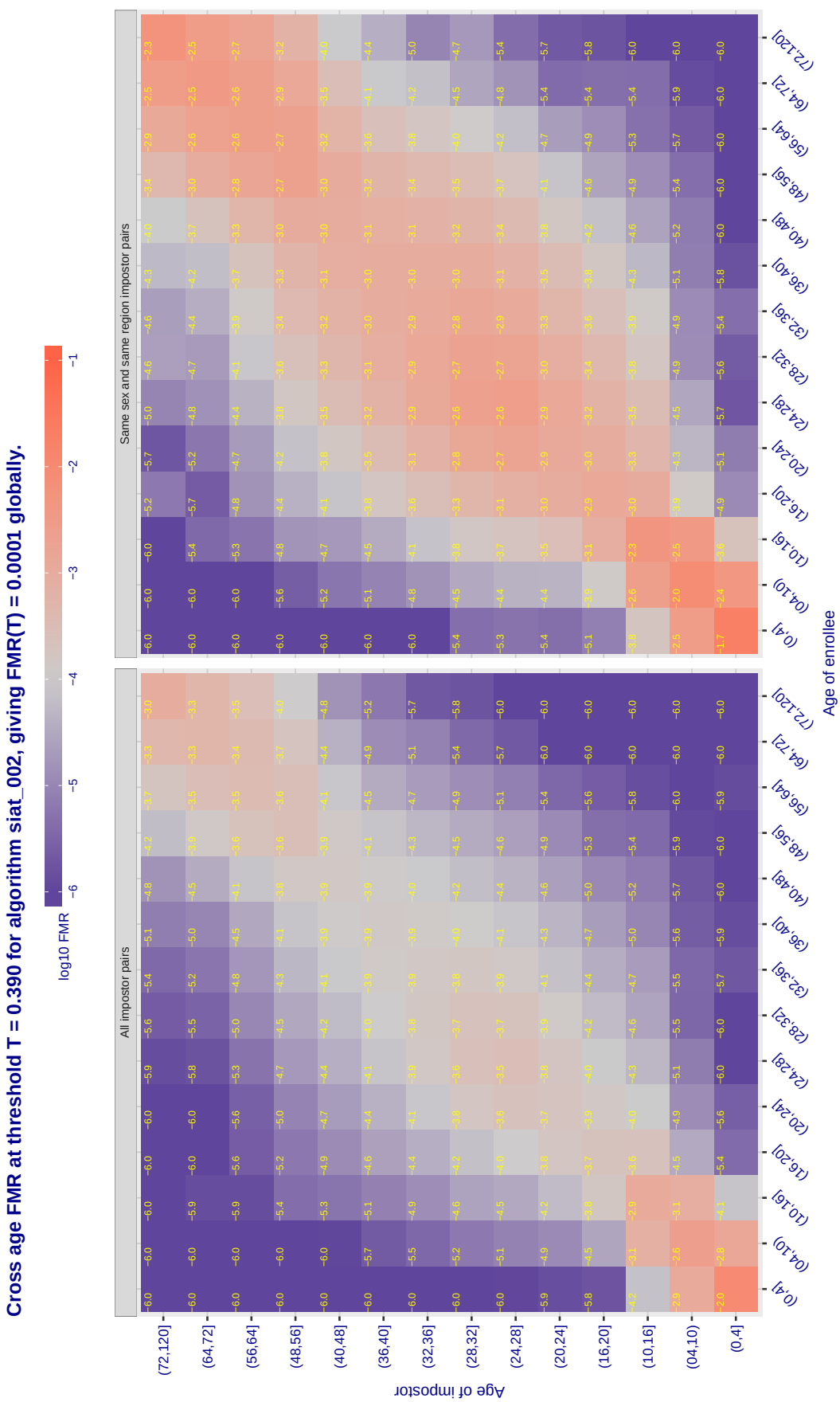


Figure 499: For algorithm siat-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

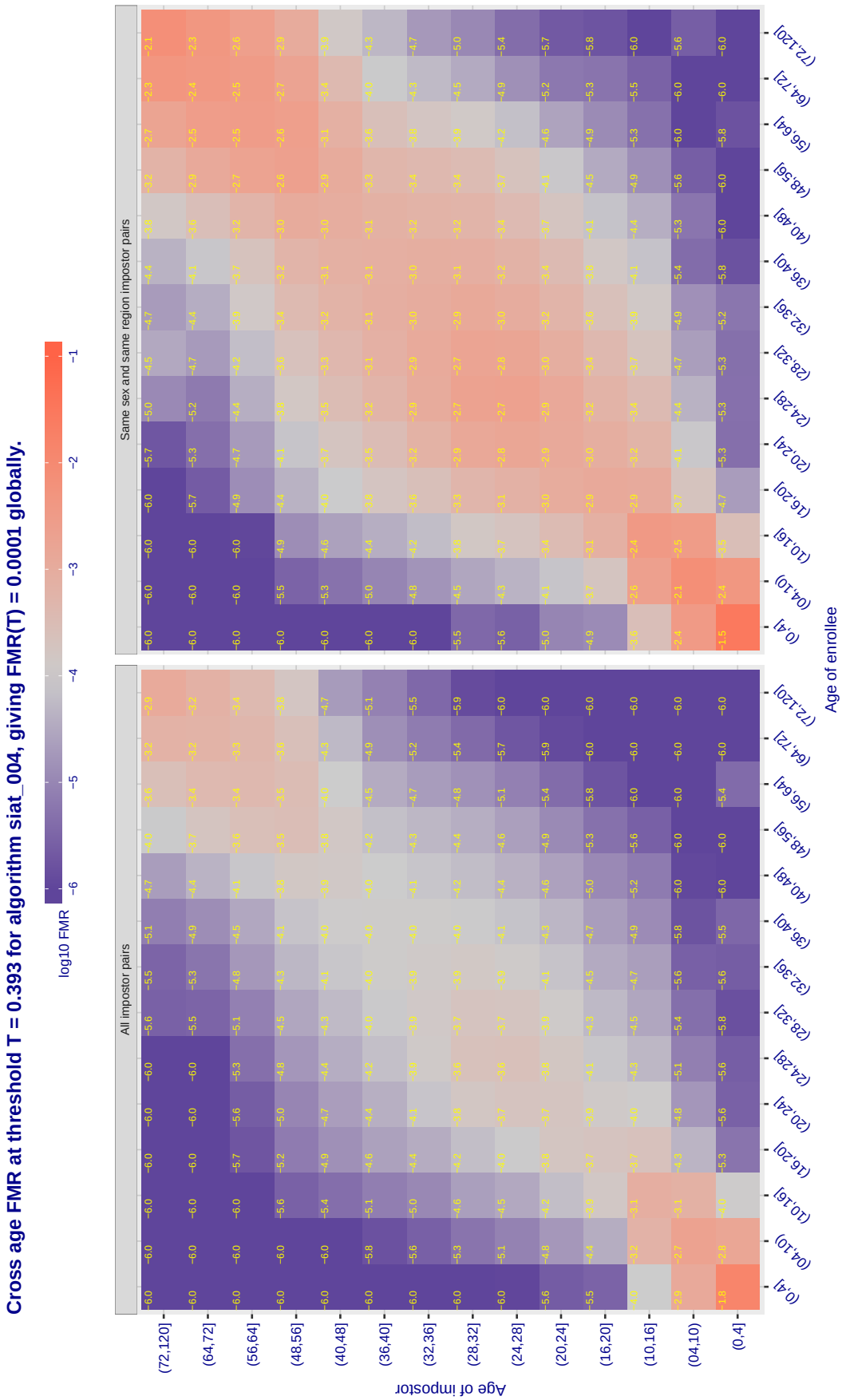


Figure 500: For algorithm siat-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

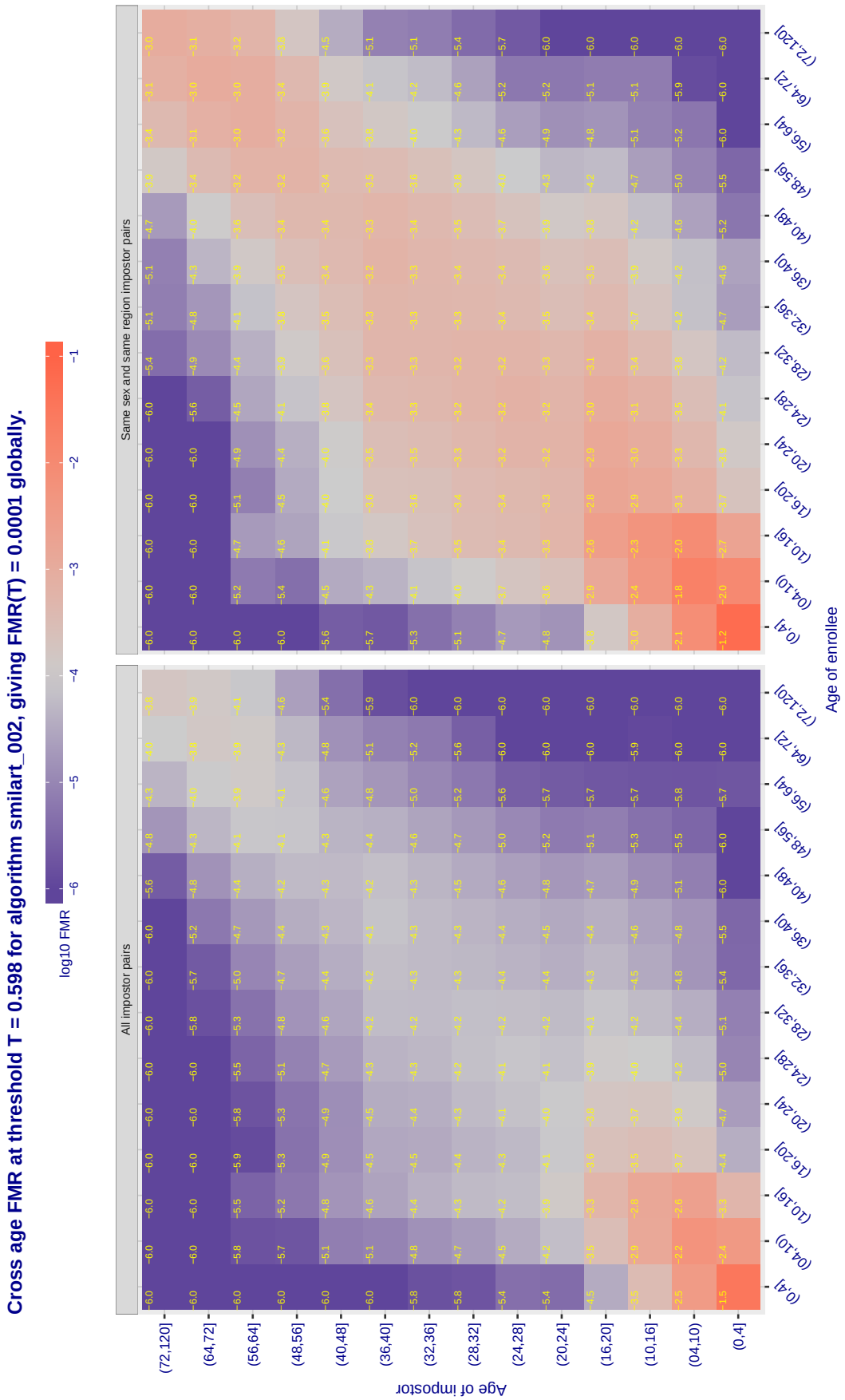


Figure 501: For algorithm smilart-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

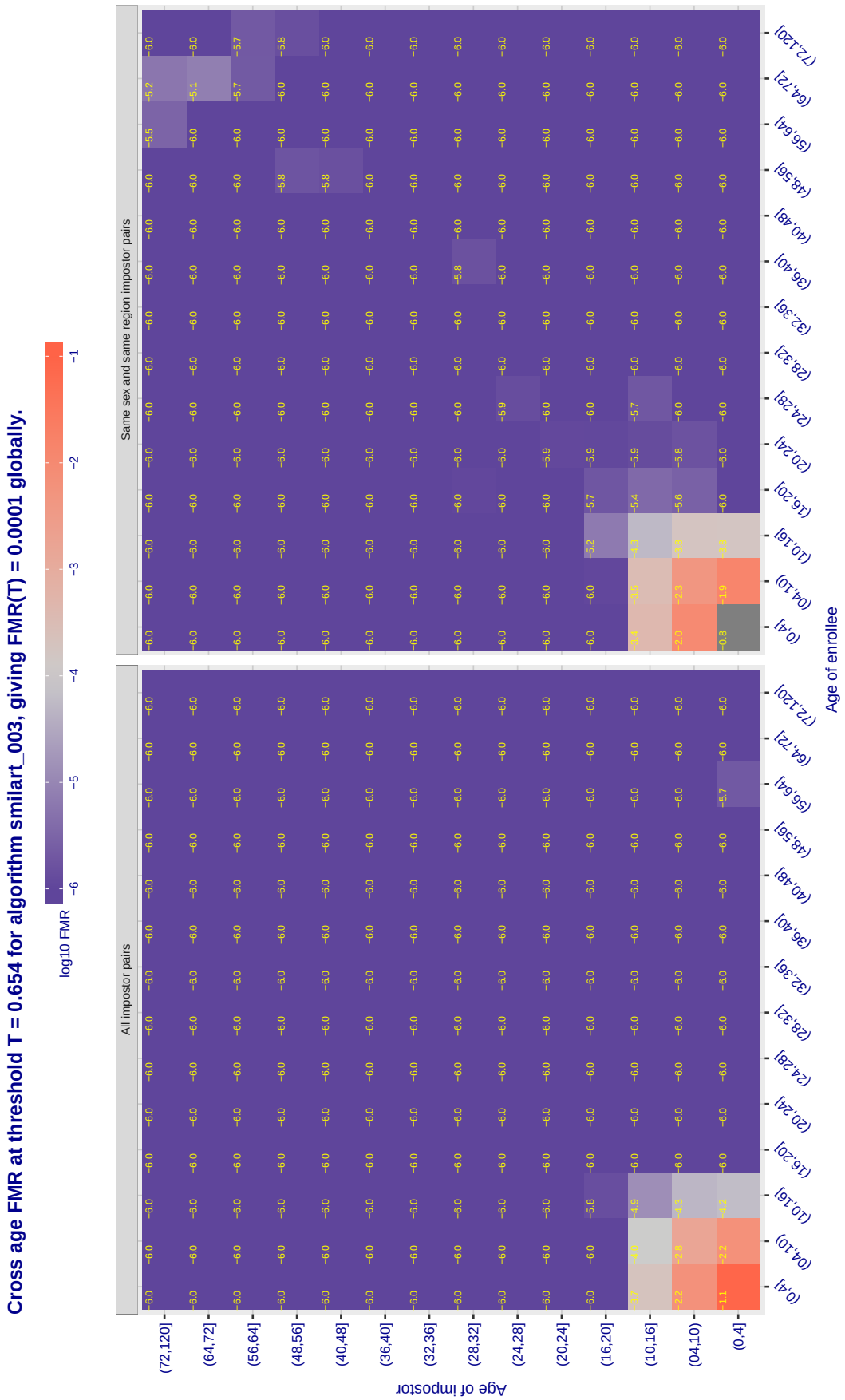


Figure 502: For algorithm smilart-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

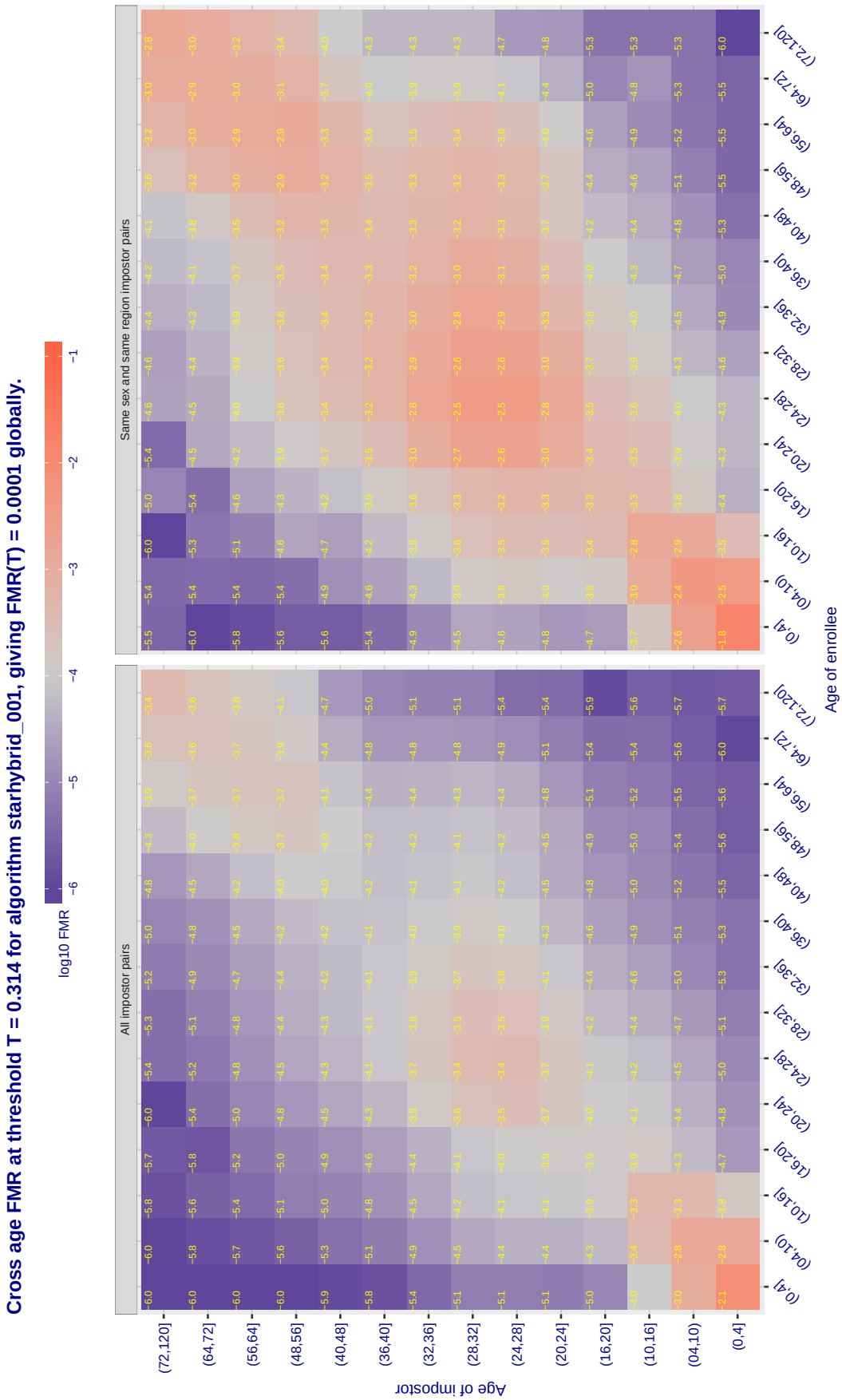


Figure 503: For algorithm starhybrid-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

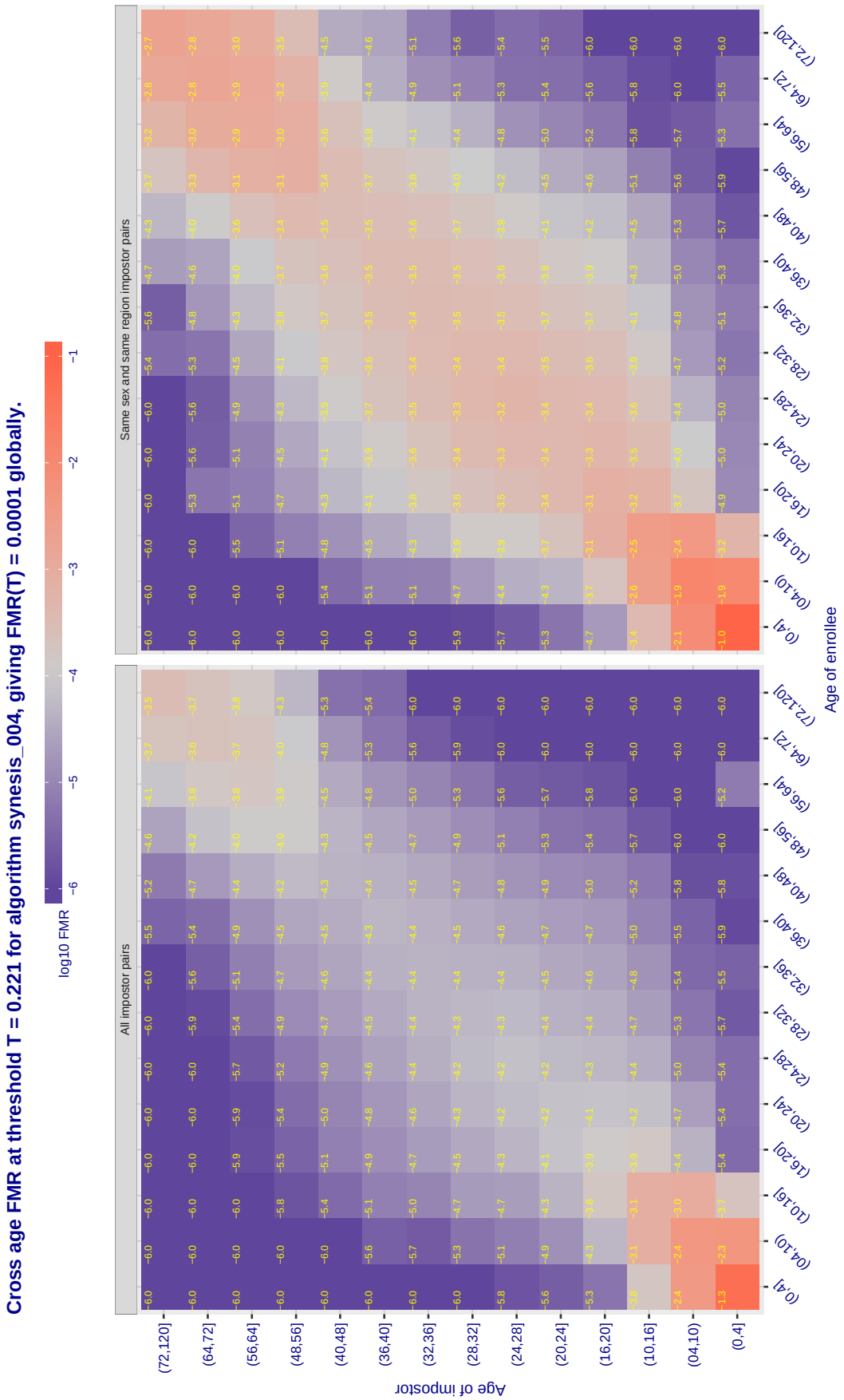


Figure 504: For algorithm synesis-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

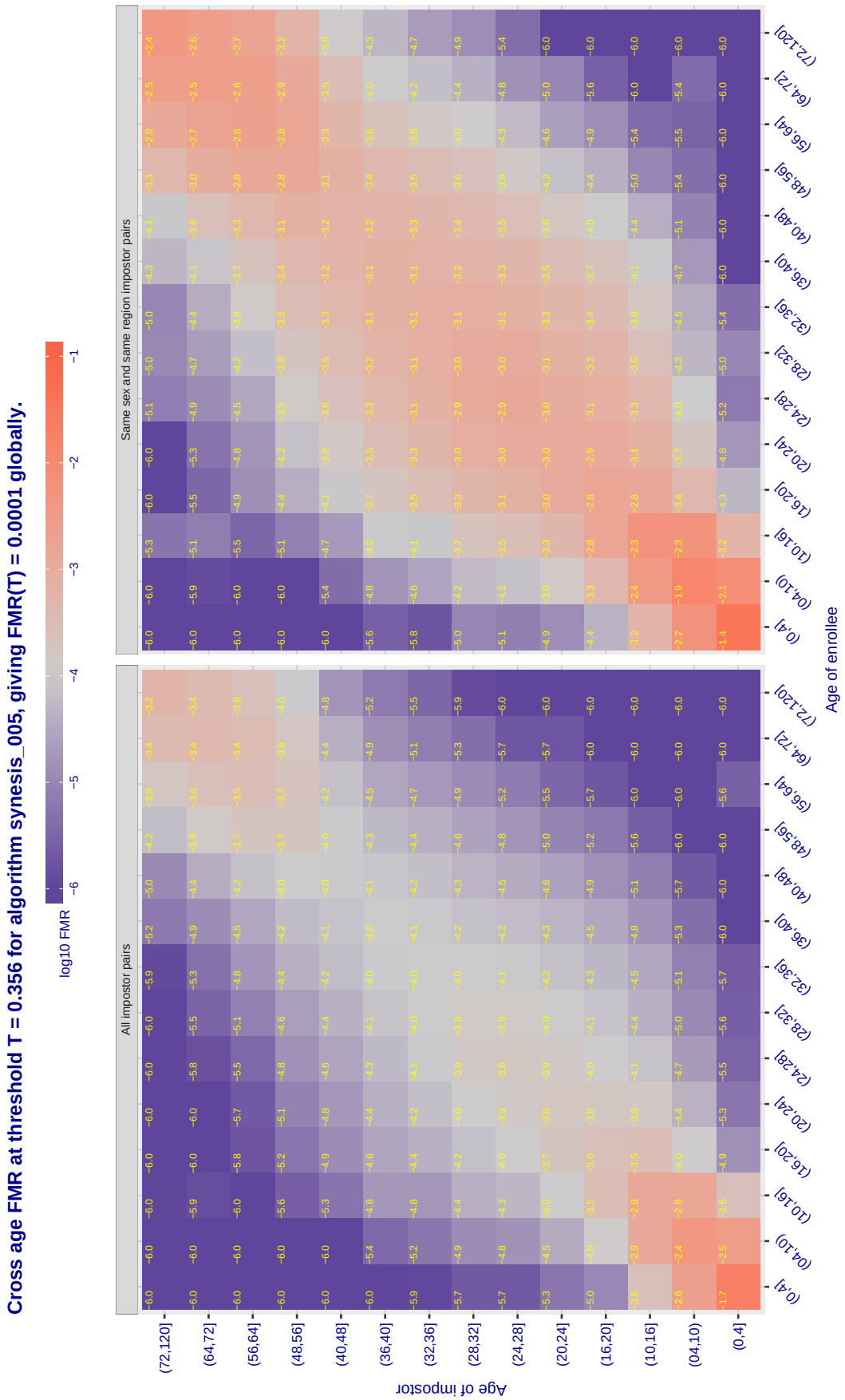


Figure 505: For algorithm synesis-005 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

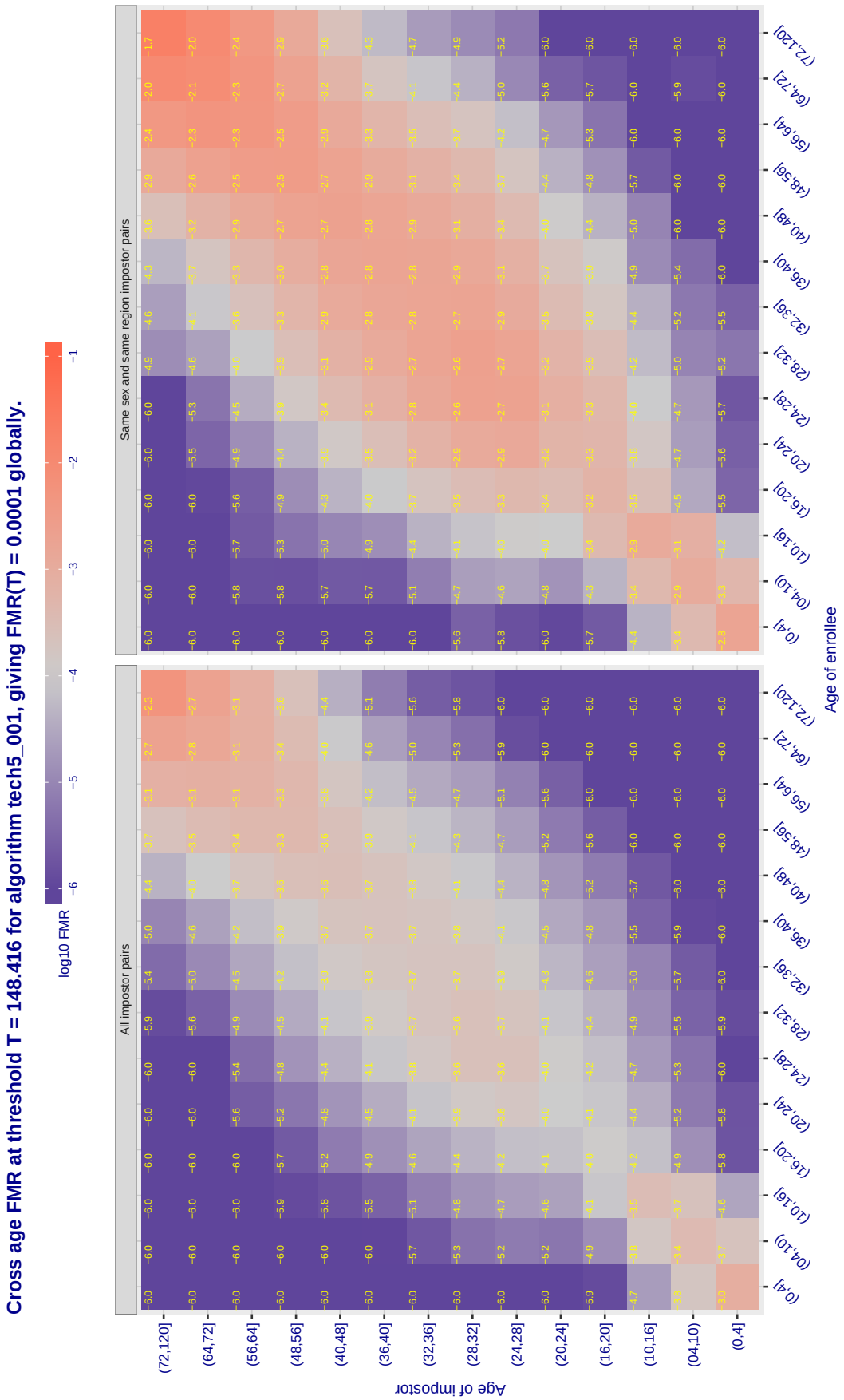


Figure 506: For algorithm tech5-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

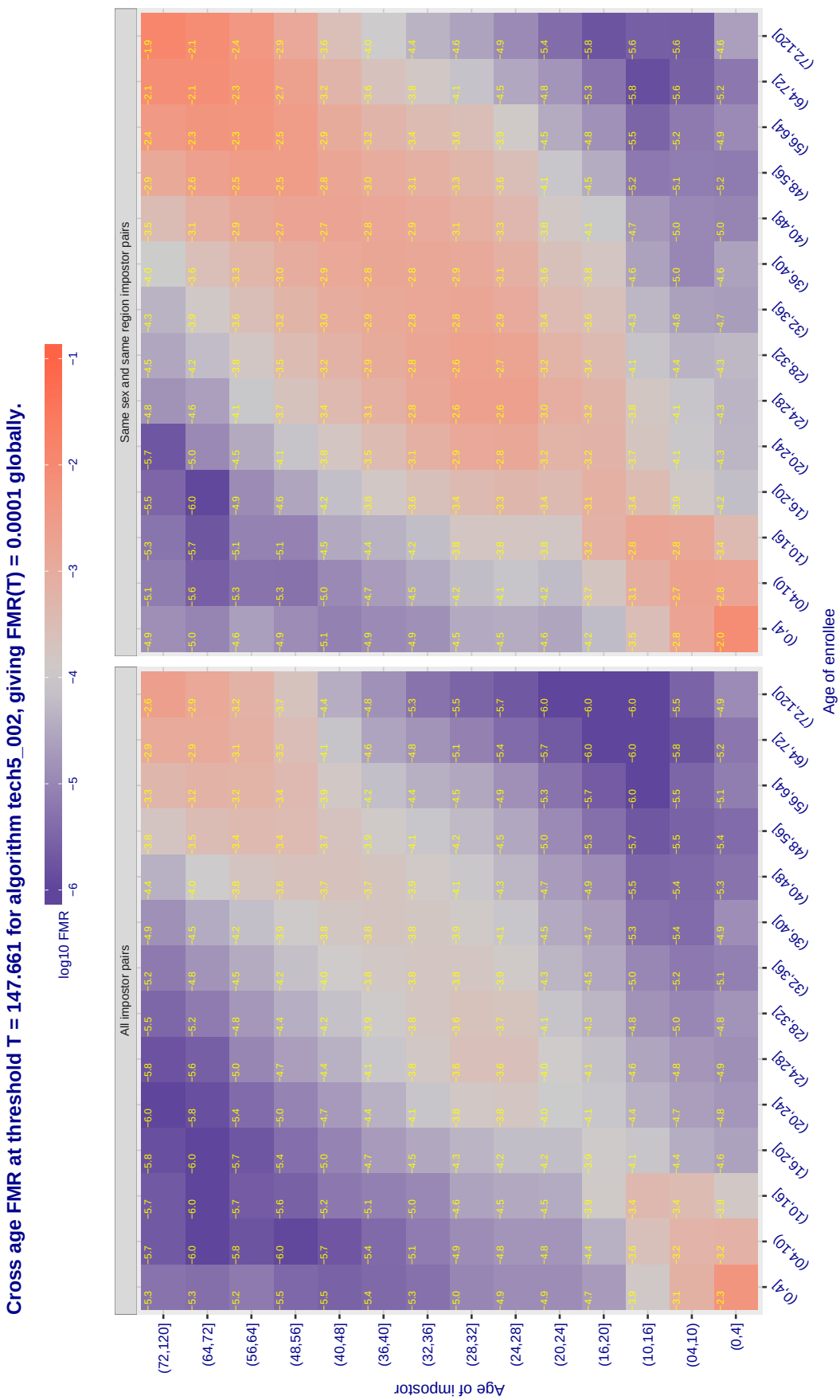


Figure 507: For algorithm tech5-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

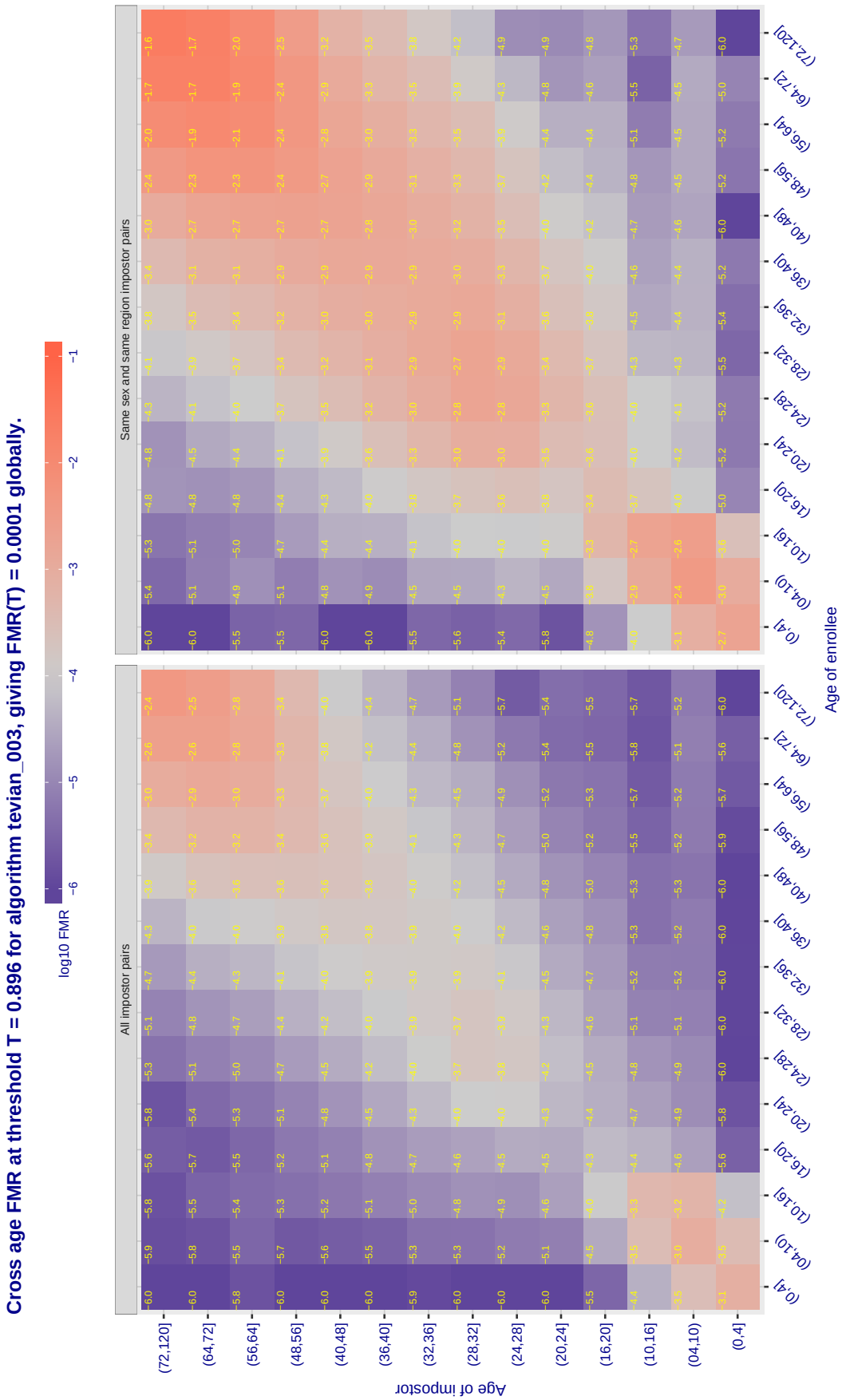


Figure 508: For algorithm tevian-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

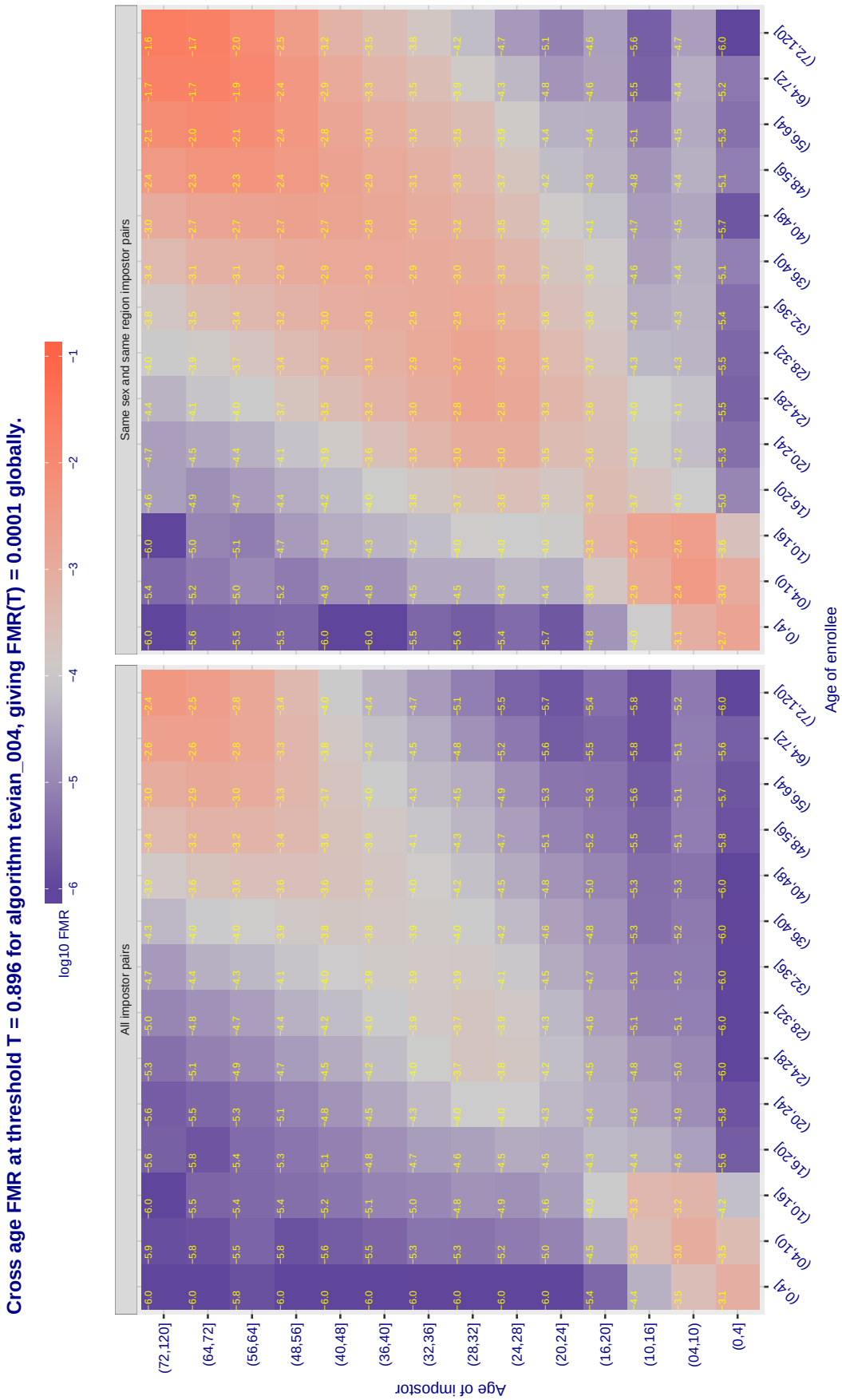


Figure 509: For algorithm tevian-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

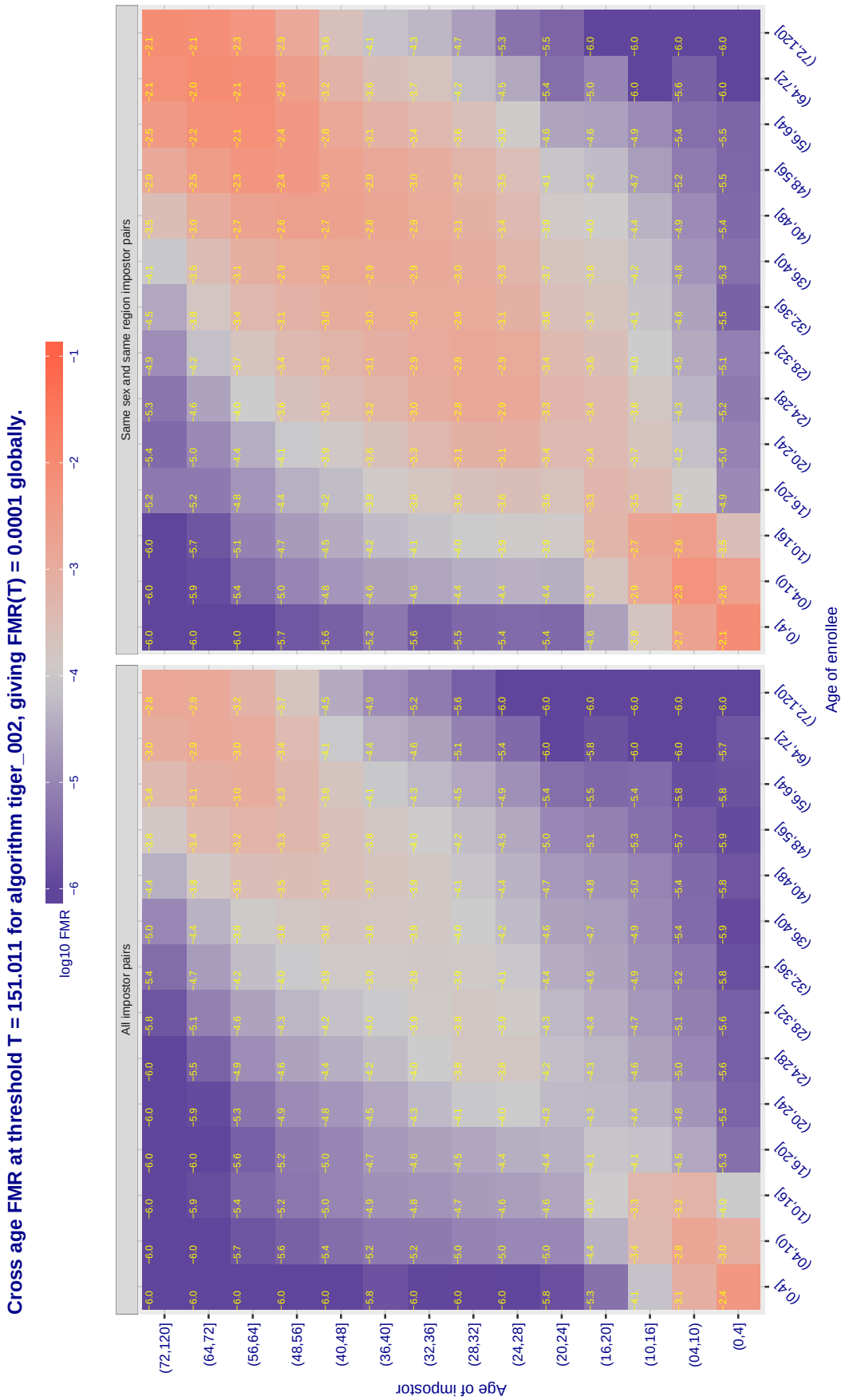


Figure 510: For algorithm tiger-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

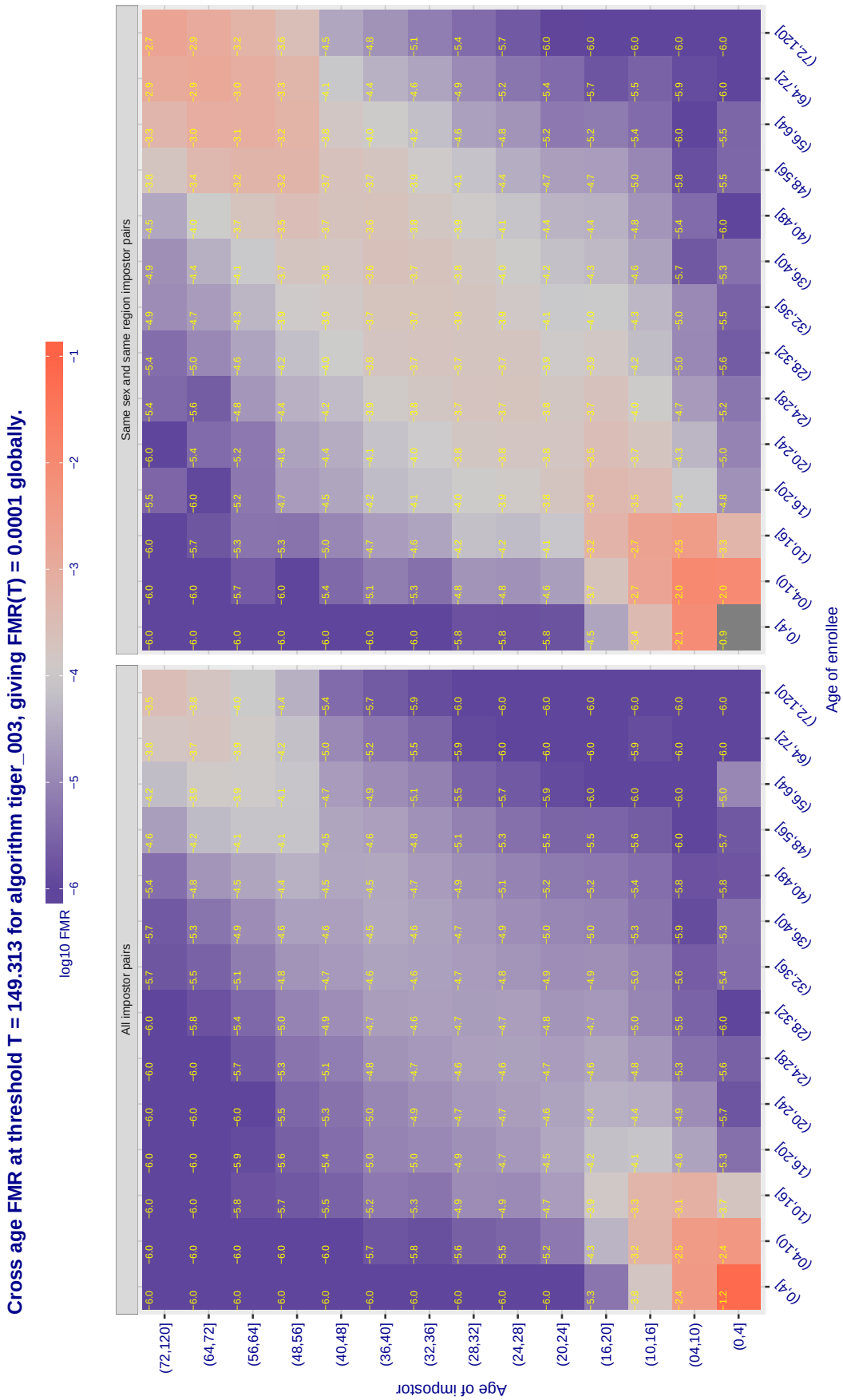


Figure 511: For algorithm tiger-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

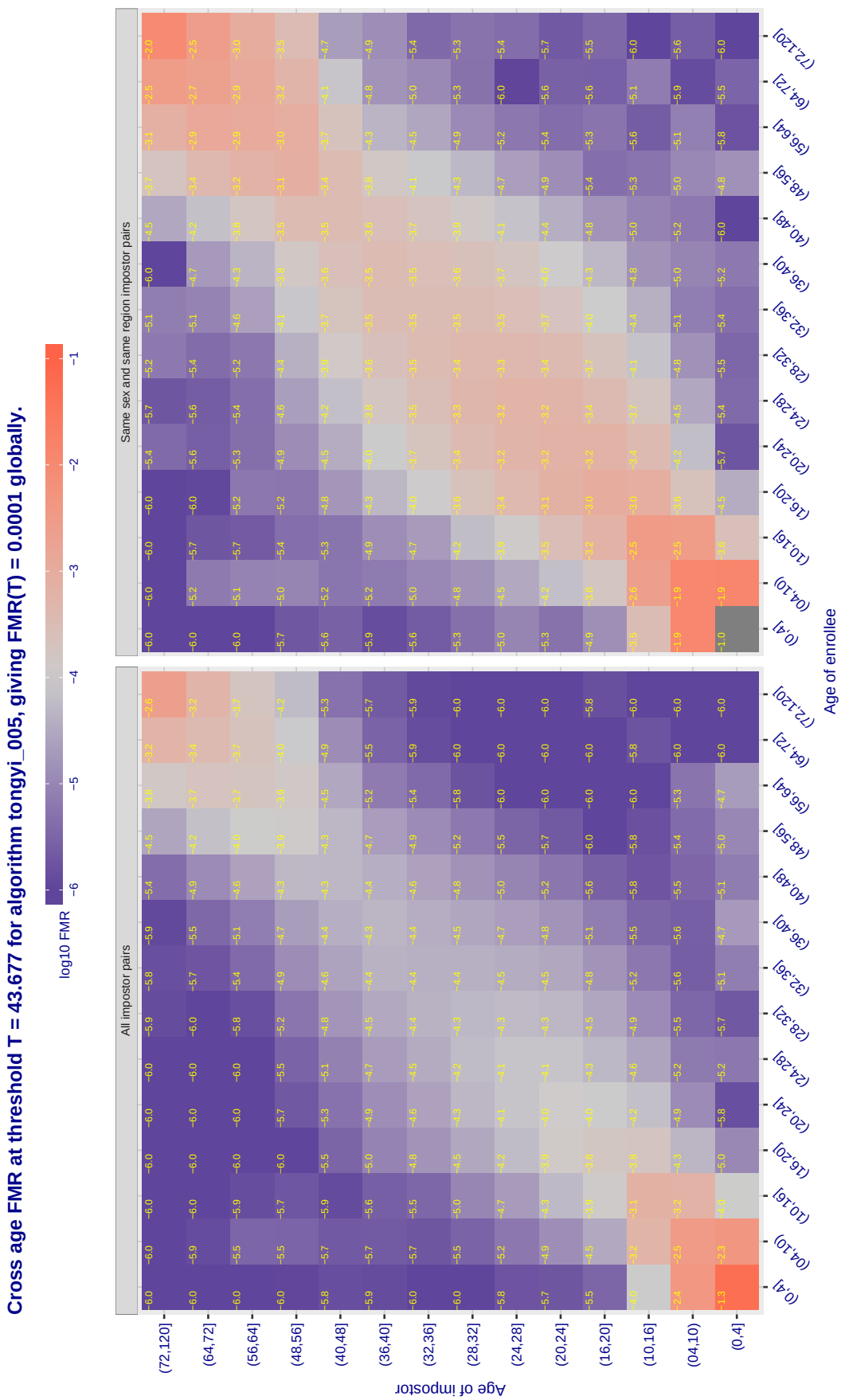


Figure 512: For algorithm tongyi-005 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

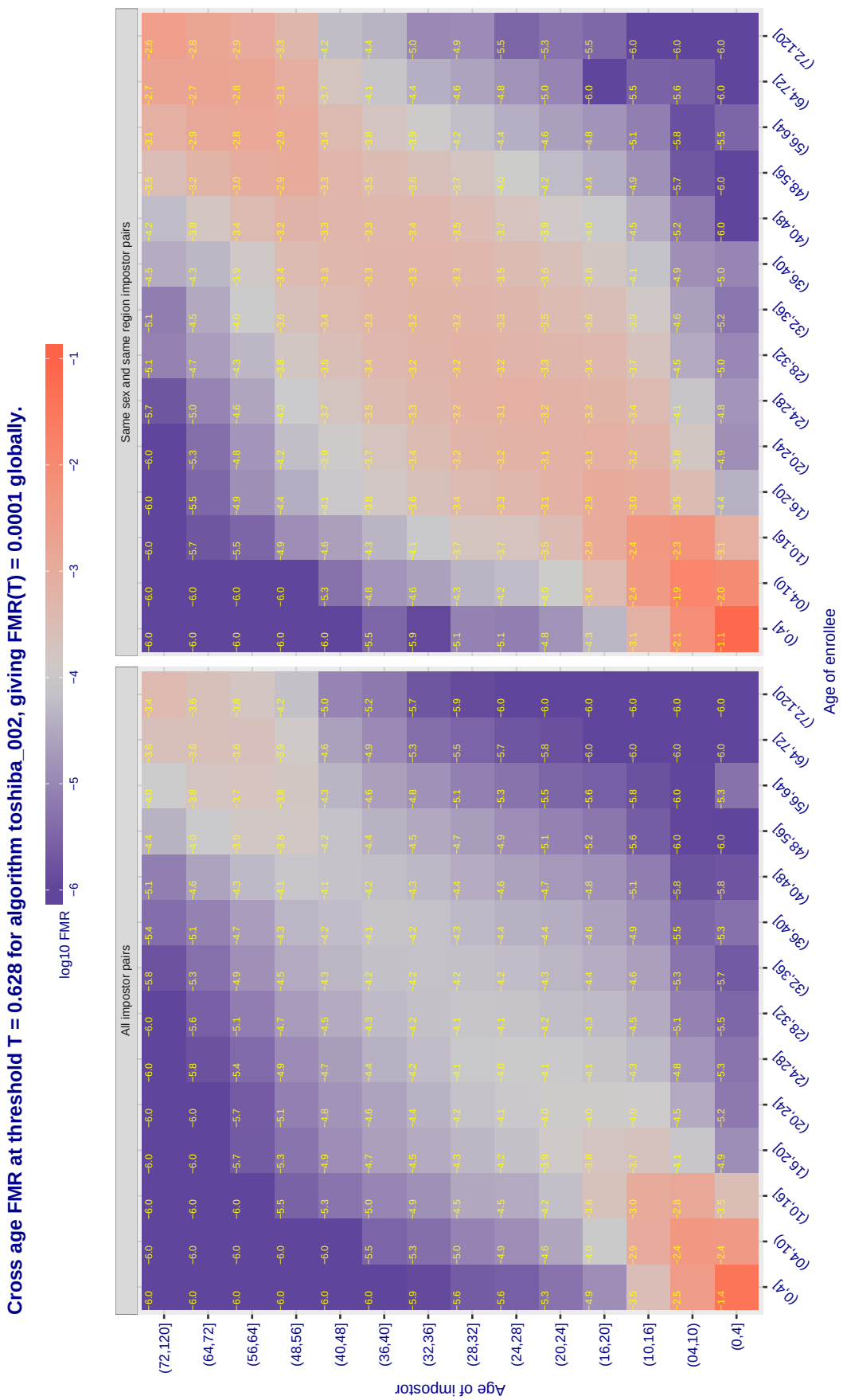


Figure 513: For algorithm toshiba-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

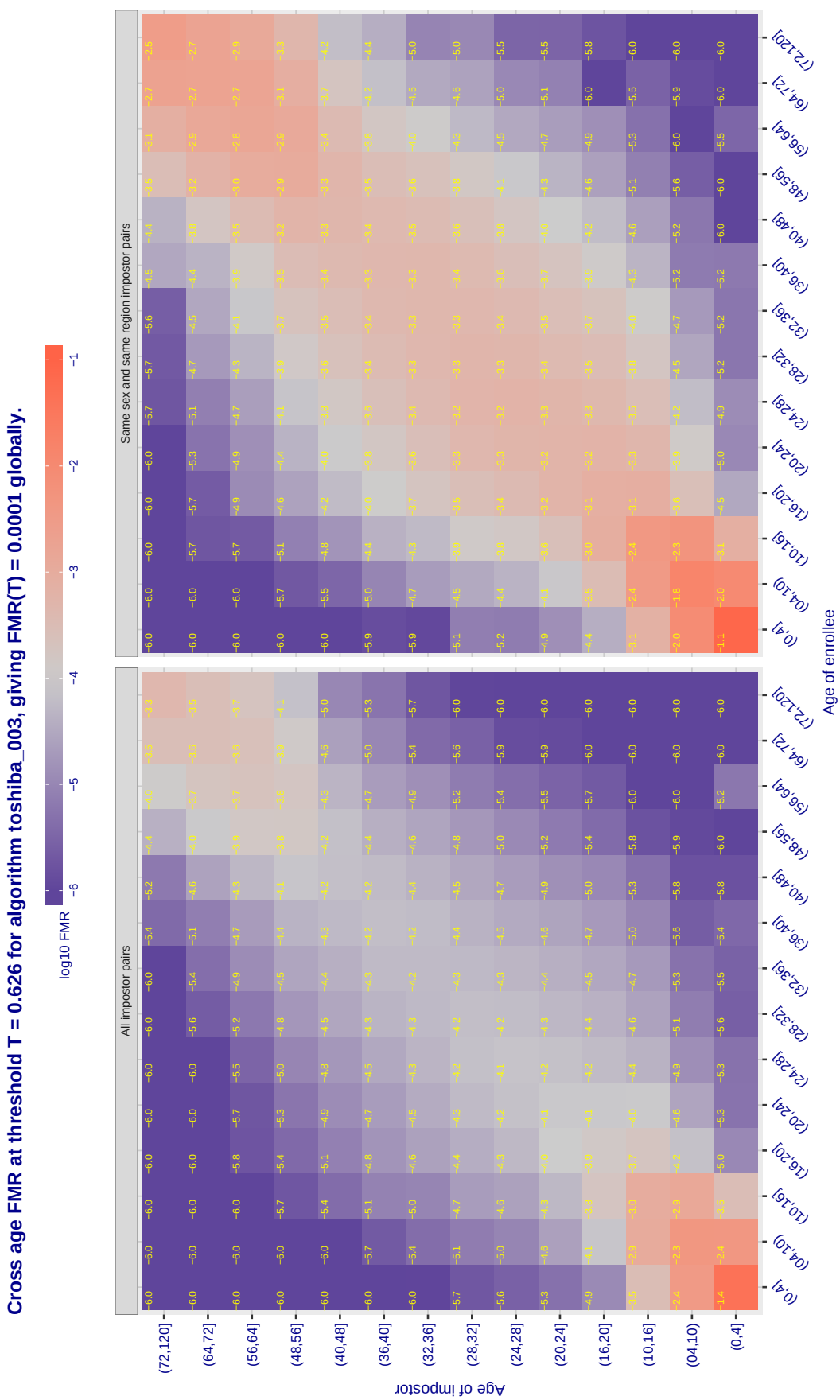


Figure 514: For algorithm toshiba-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

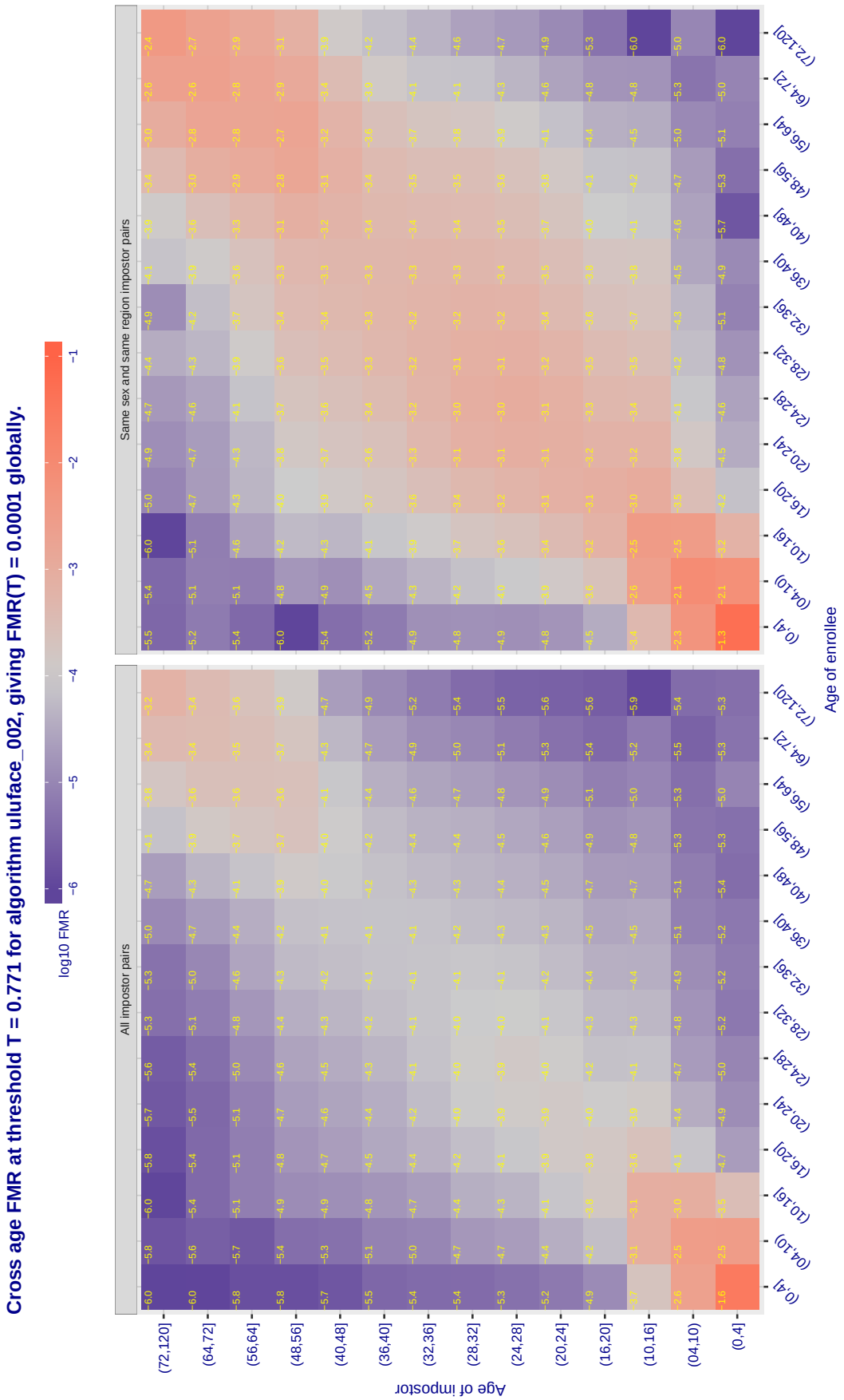


Figure 515: For algorithm uluface-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

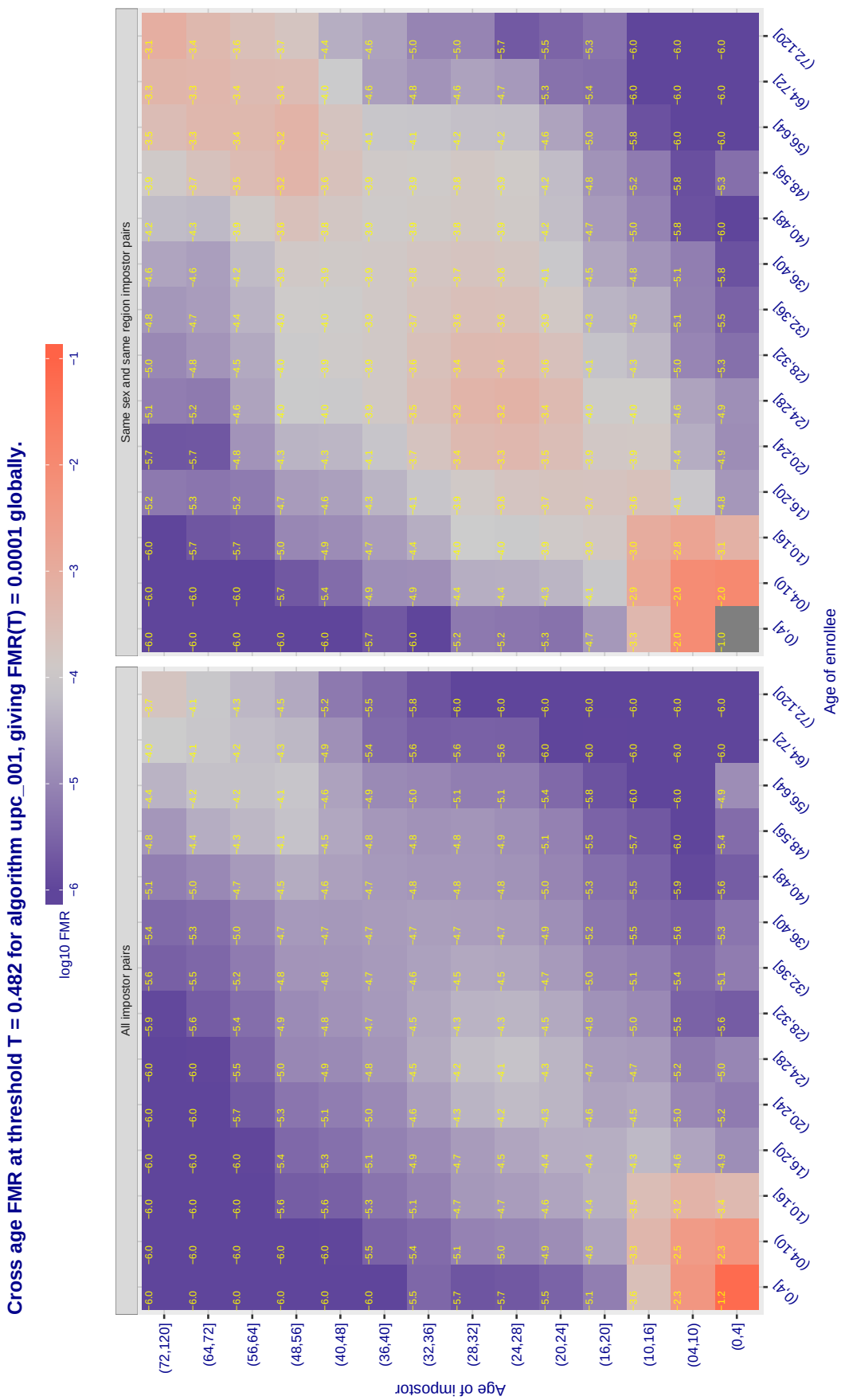


Figure 516: For algorithm upc-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

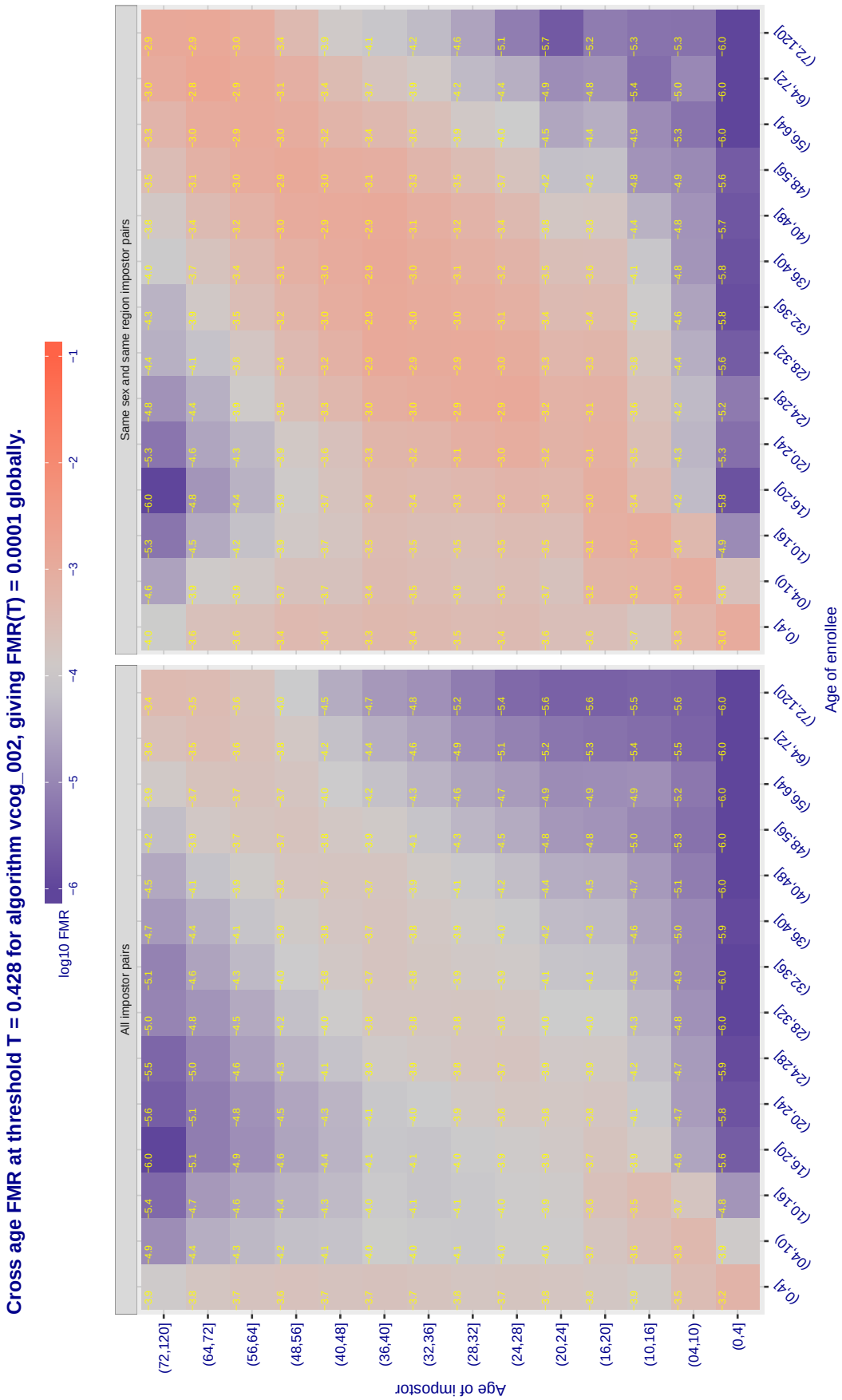


Figure 517: For algorithm vcog-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

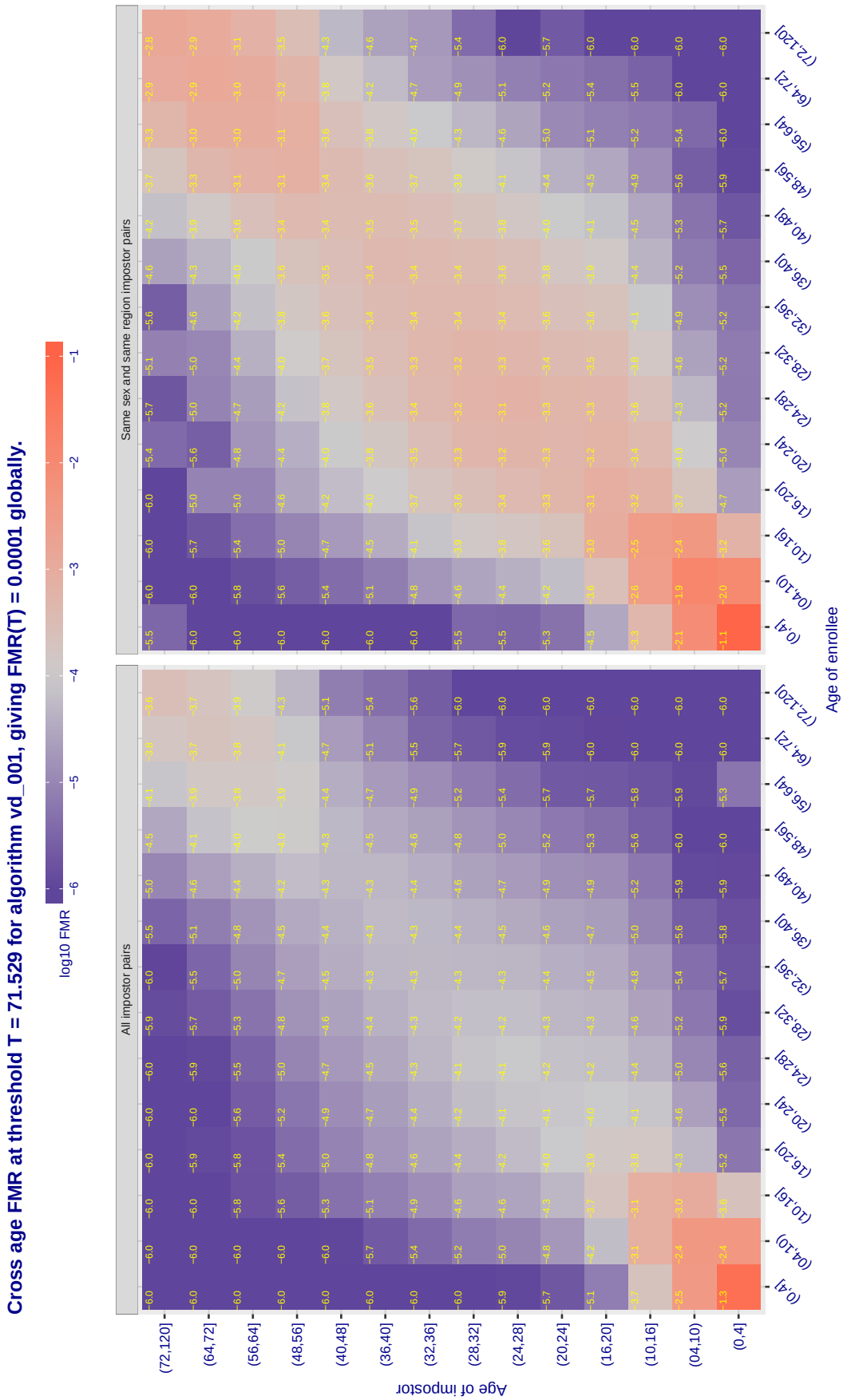


Figure 518: For algorithm vd-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

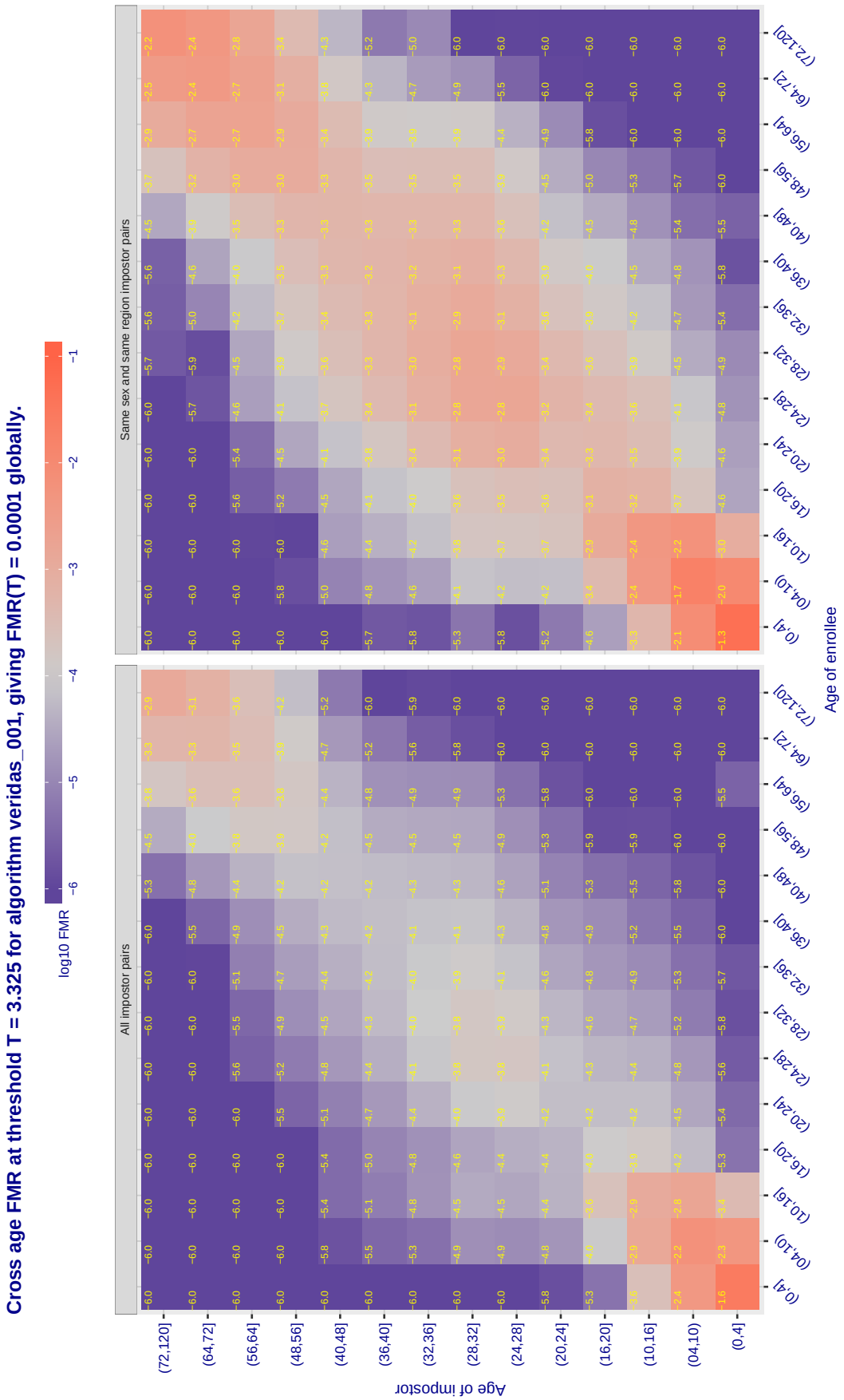


Figure 519: For algorithm veridas-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

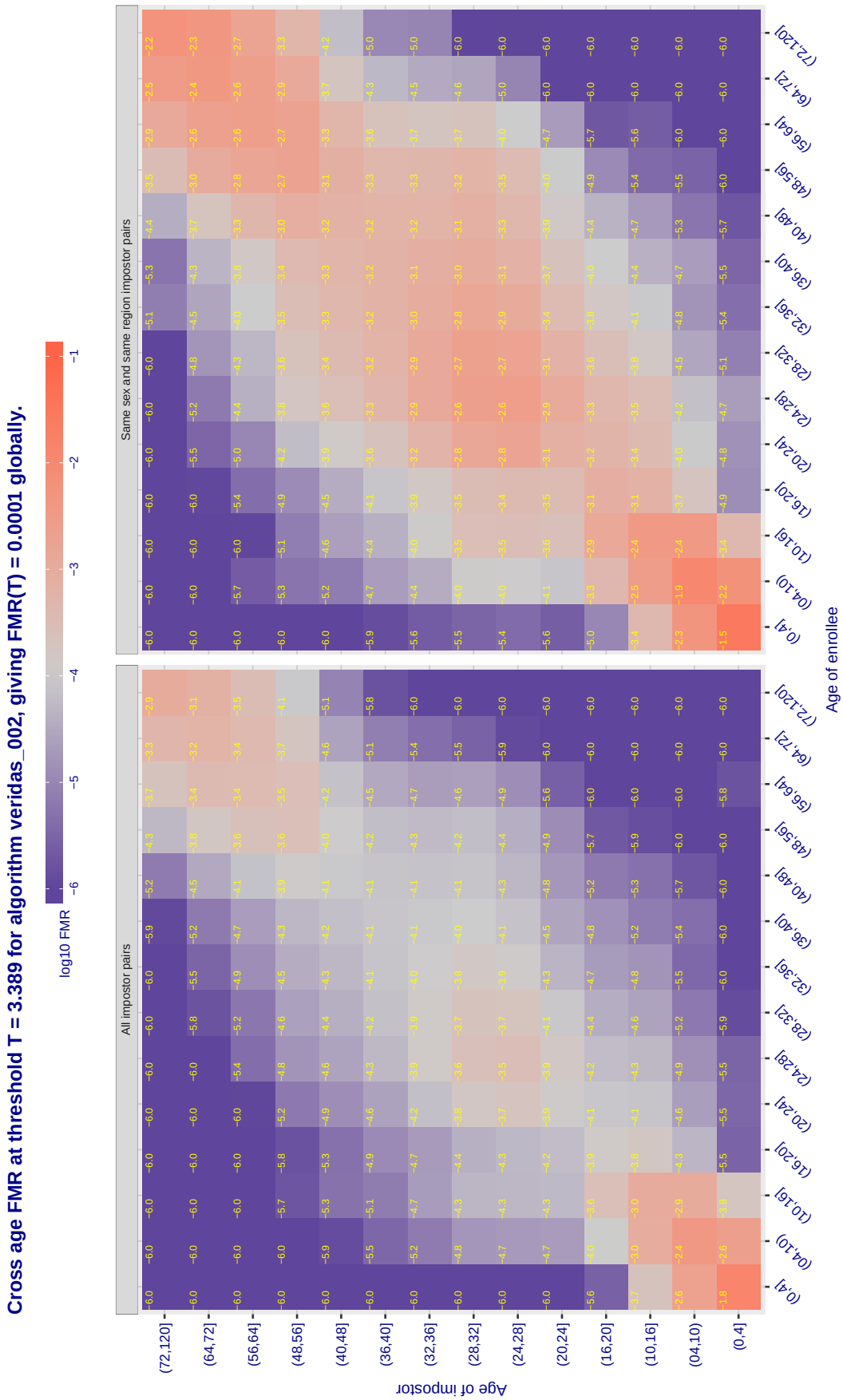


Figure 520: For algorithm veridas-002 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

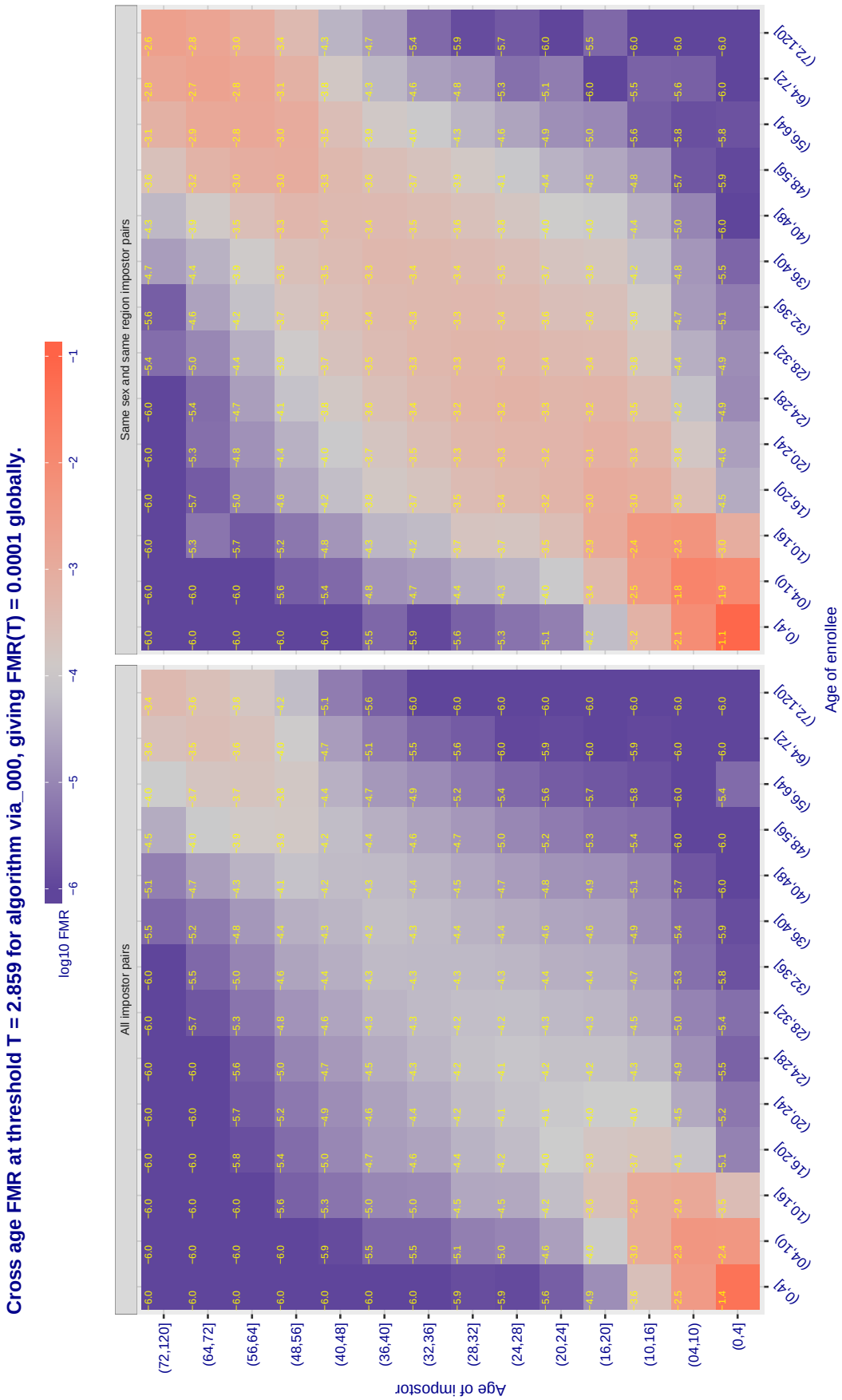


Figure 521: For algorithm via-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

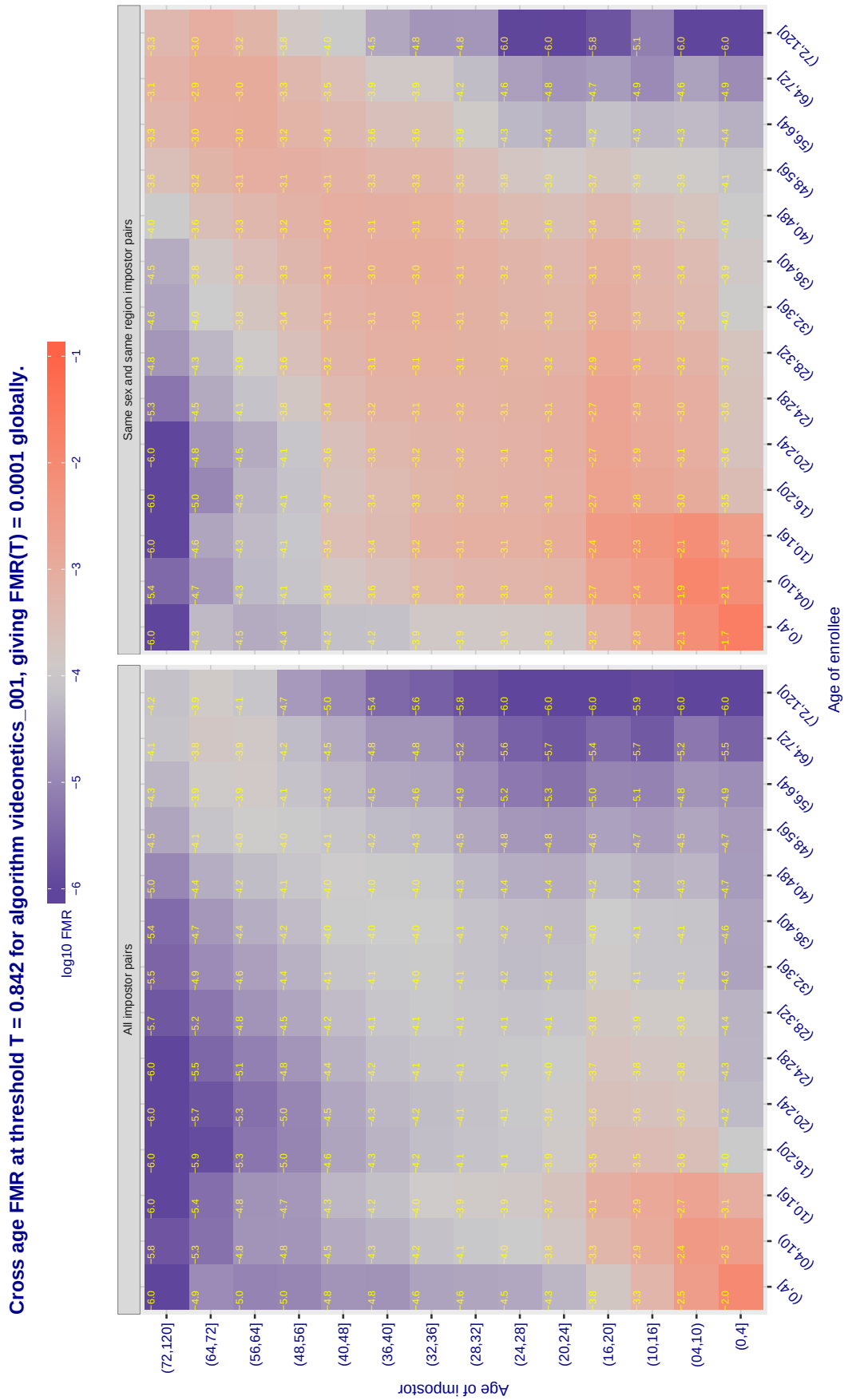


Figure 522: For algorithm videonetics-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

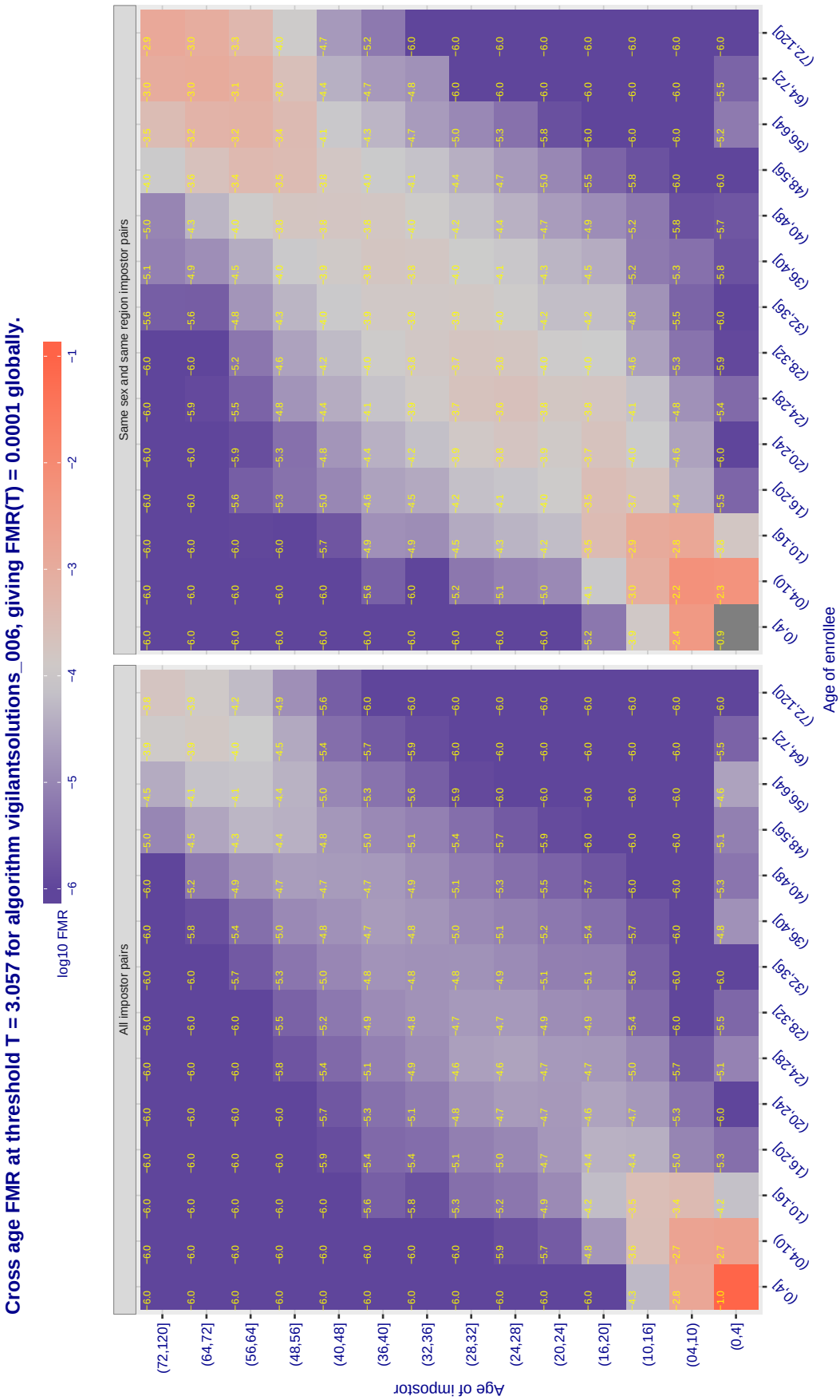


Figure 523: For algorithm vigilantsolutions-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

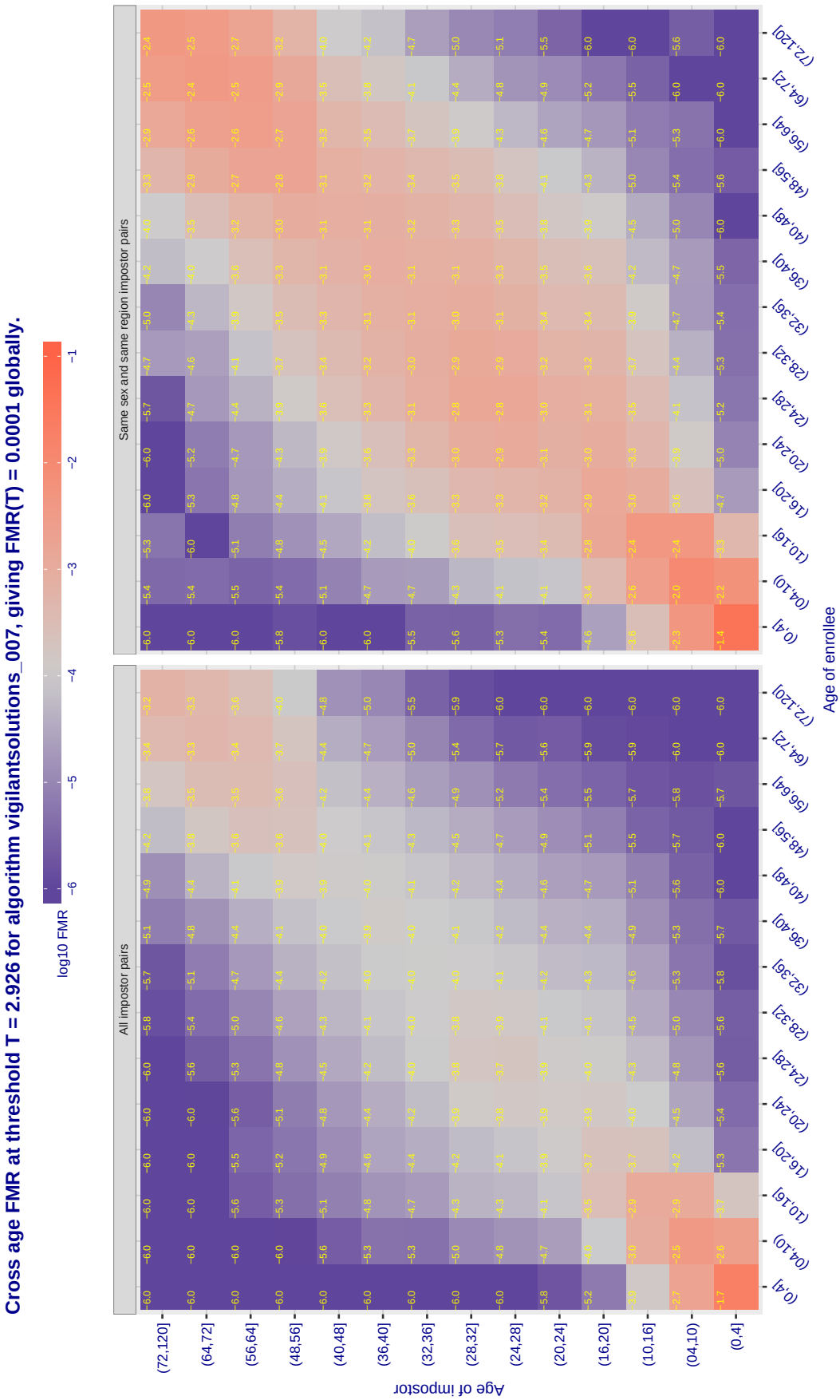


Figure 524: For algorithm vigilantsolutions-007 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

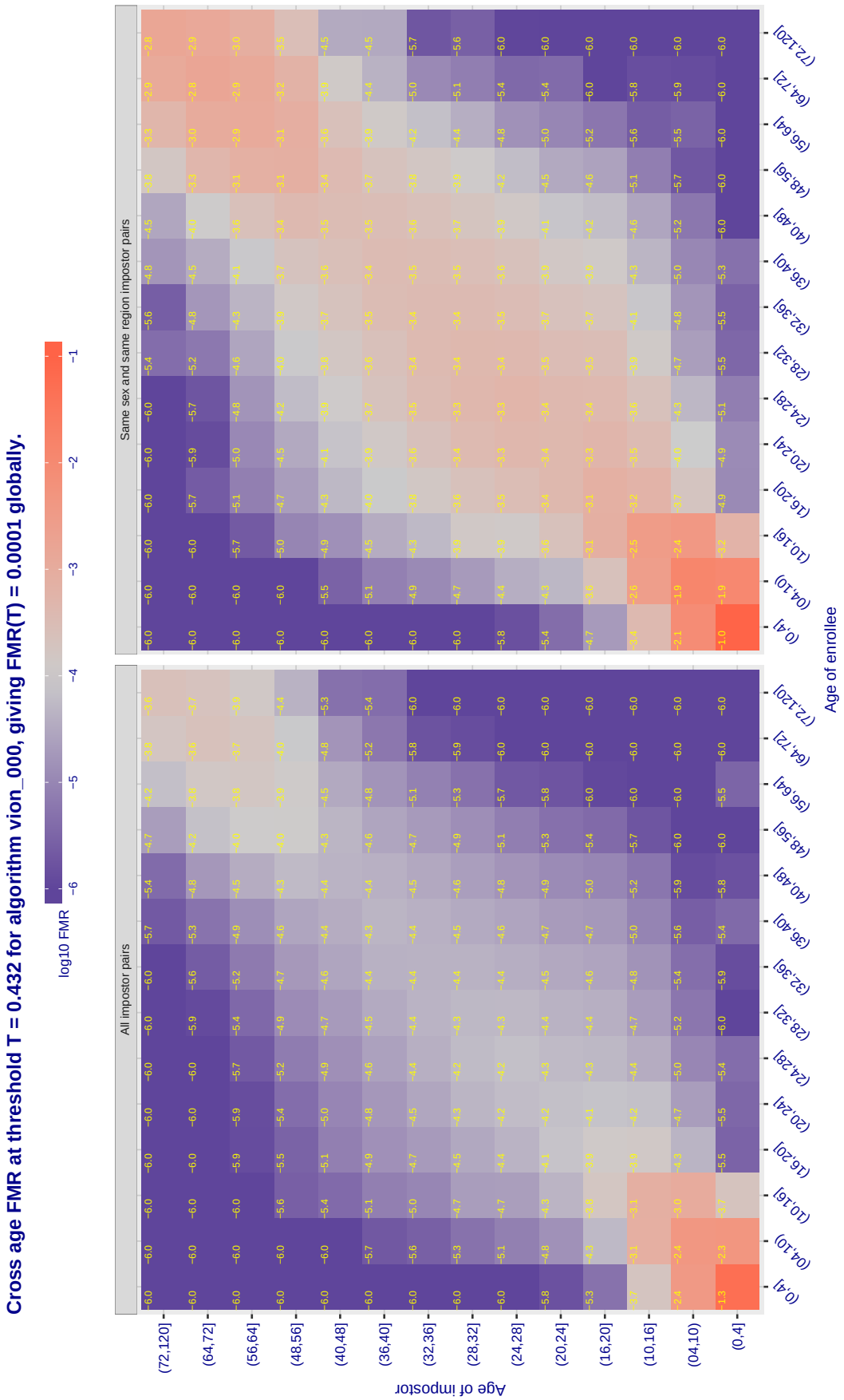


Figure 525: For algorithm vion-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

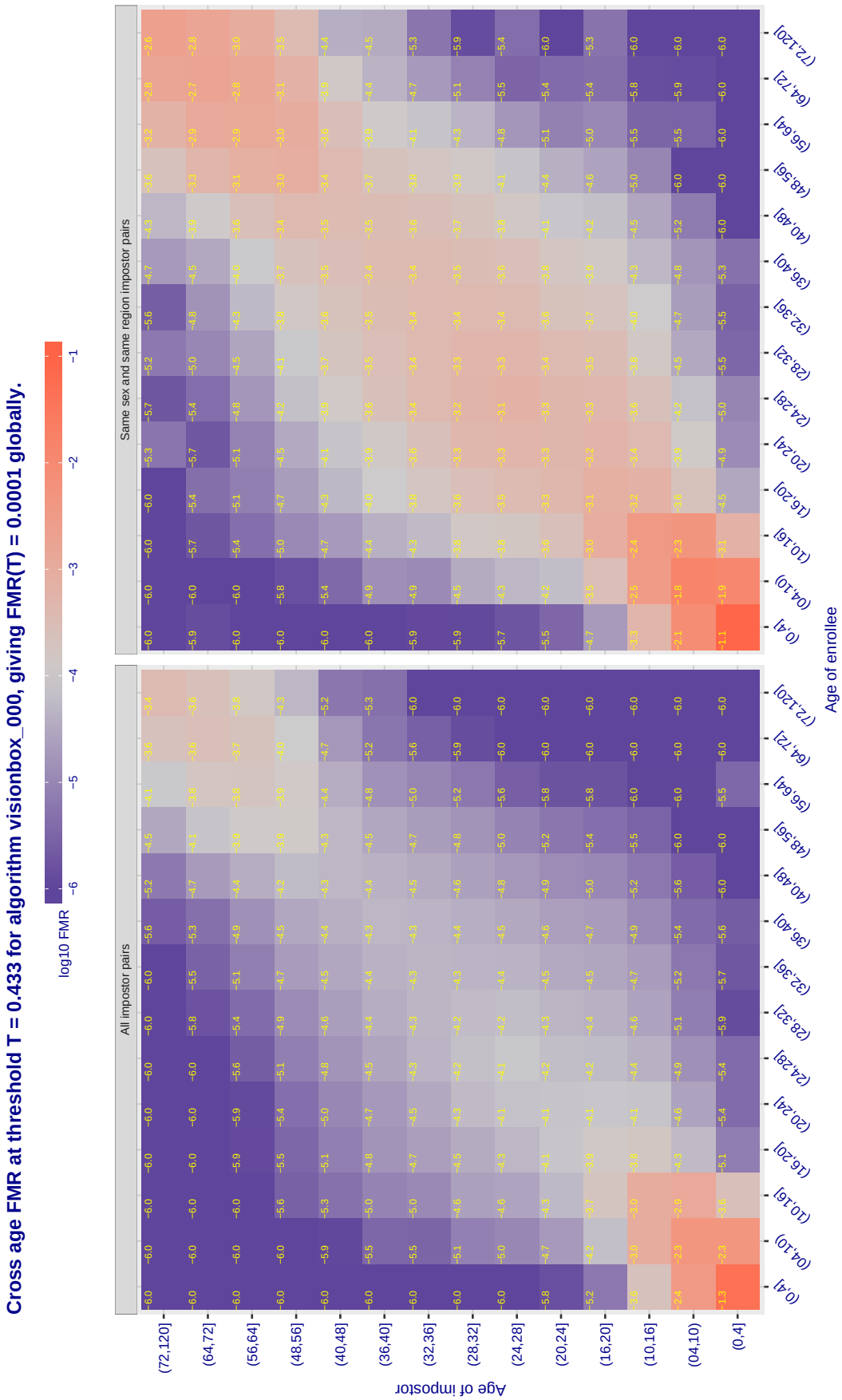


Figure 526: For algorithm visionbox-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

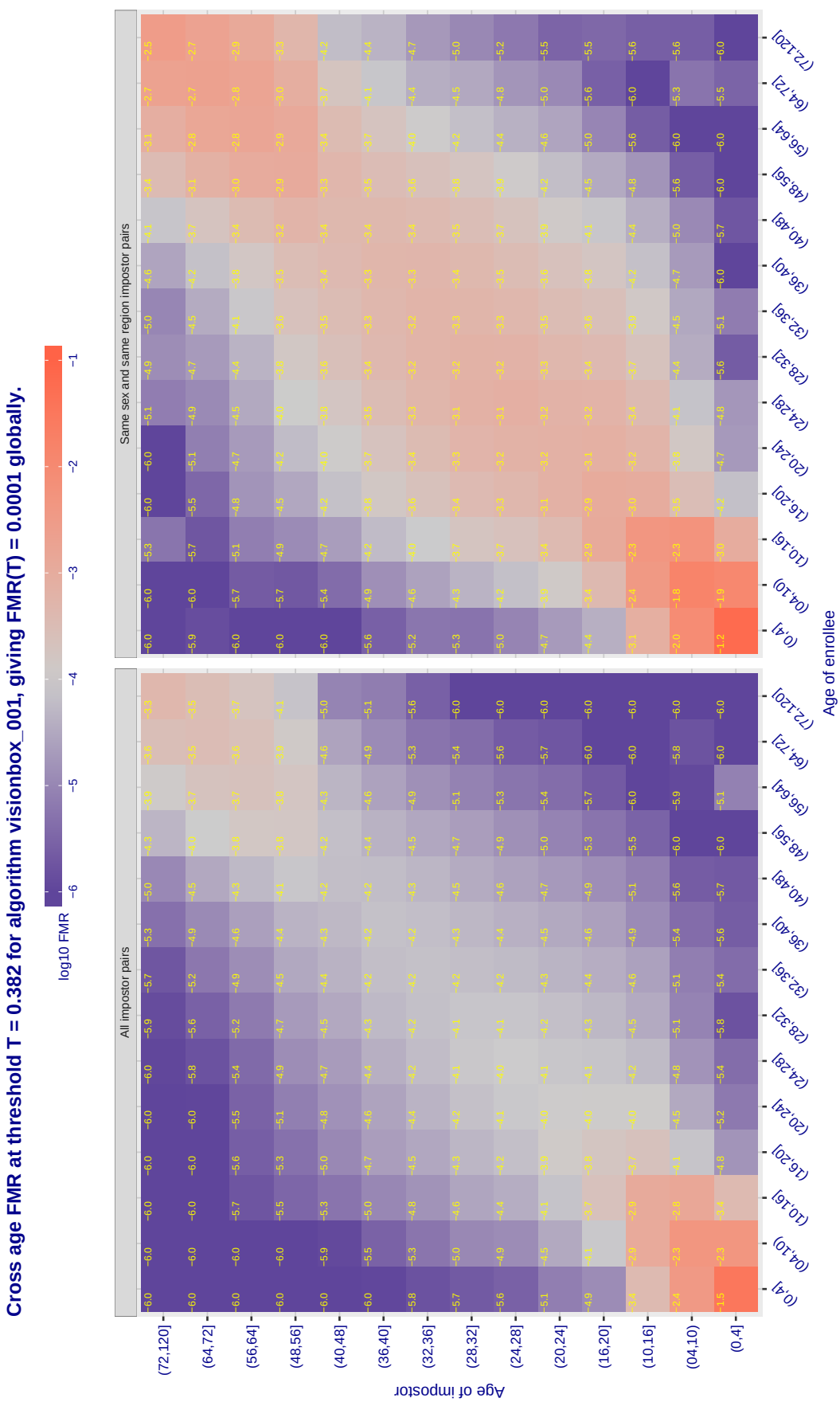


Figure 527: For algorithm visionbox-001 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

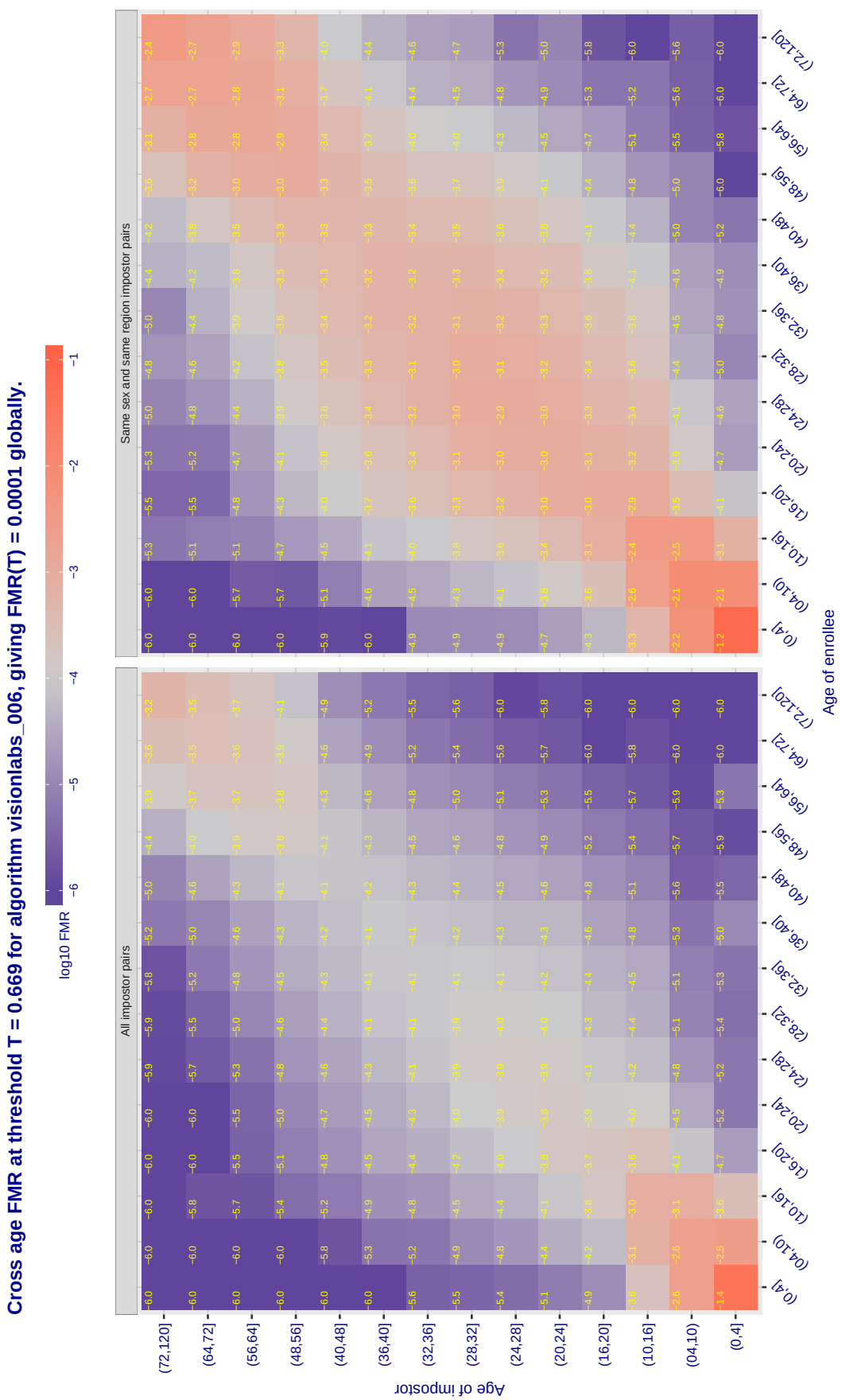


Figure 528: For algorithm visionlabs-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

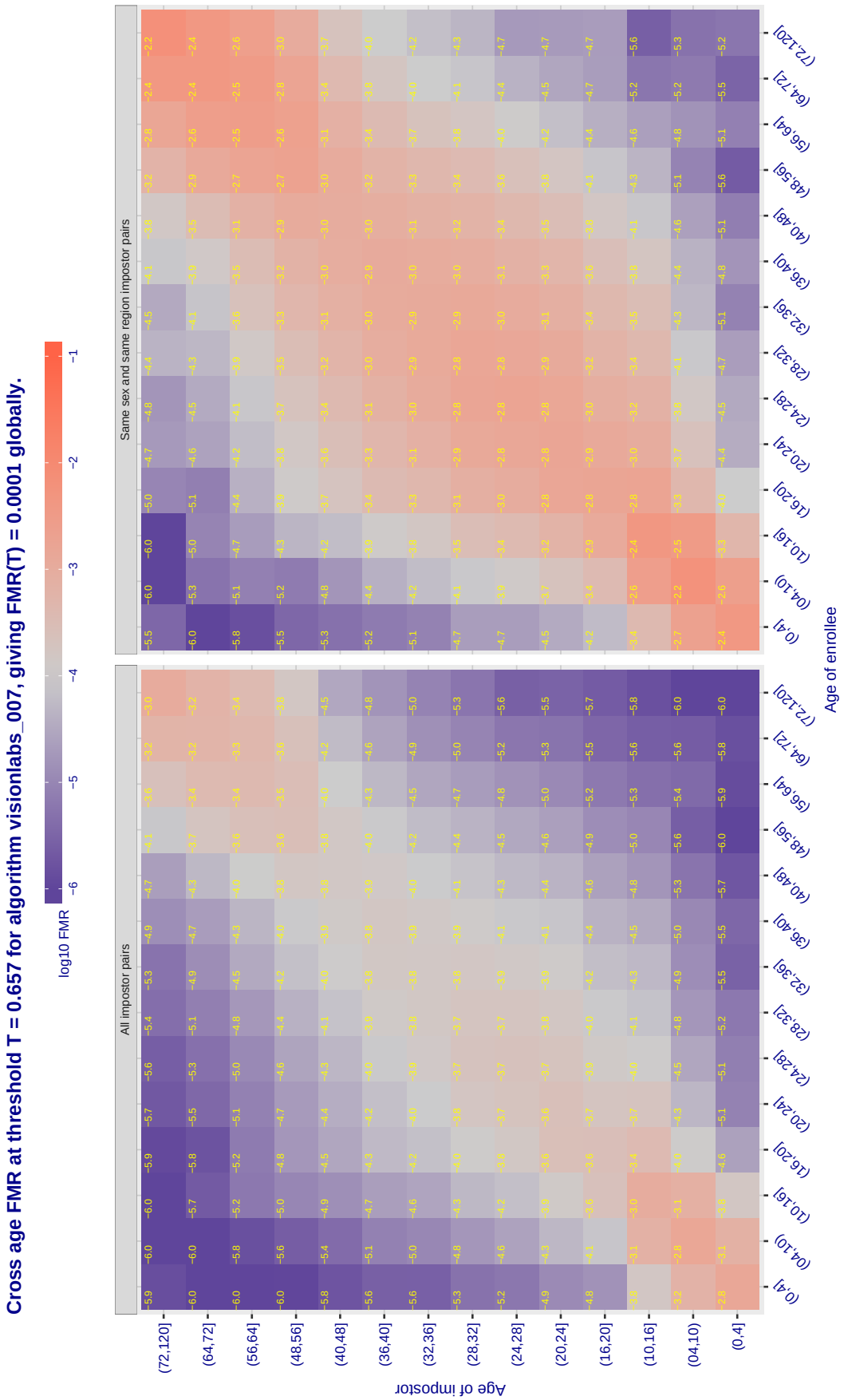


Figure 529: For algorithm visionlabs-007 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

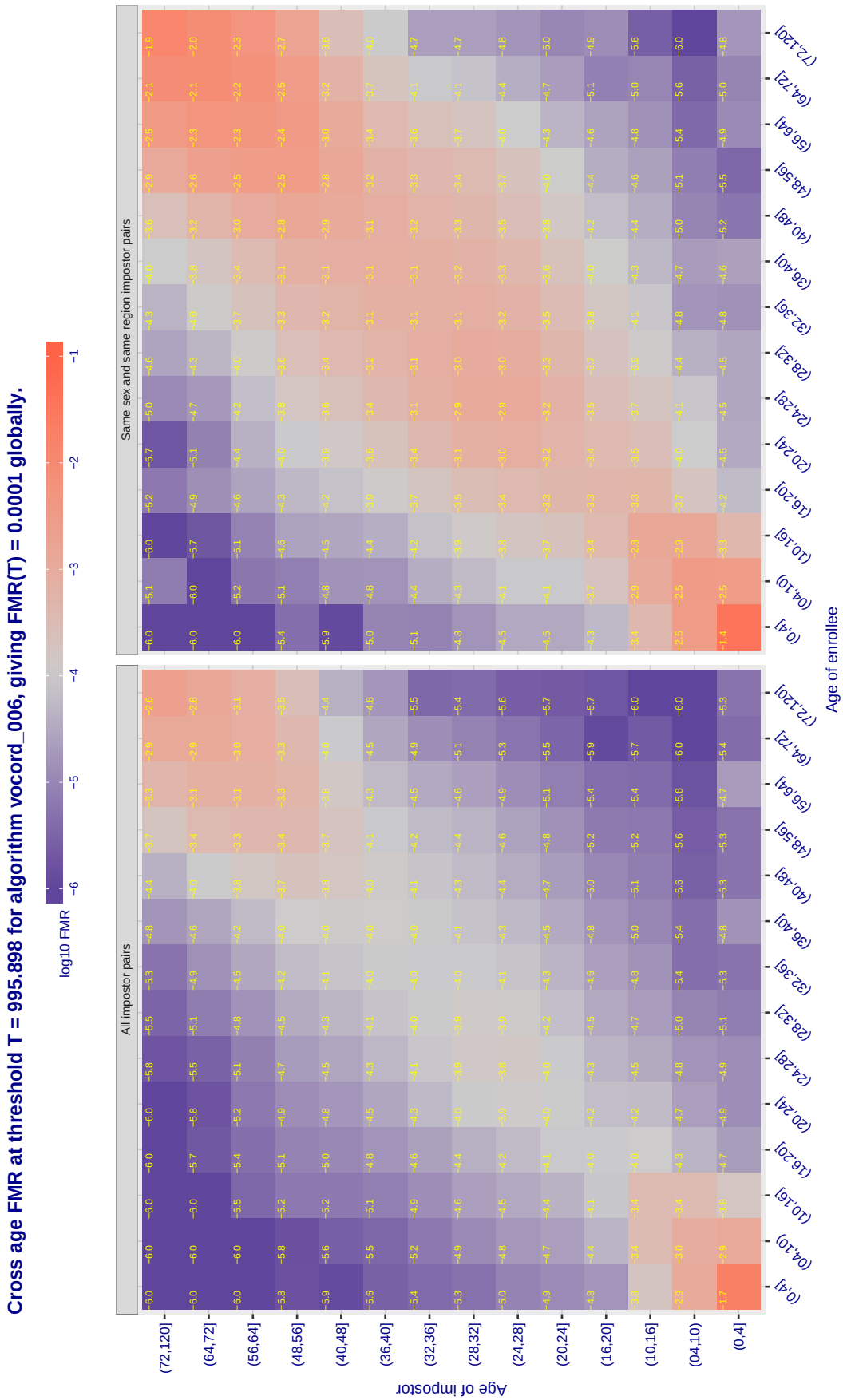


Figure 530: For algorithm vocord-006 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

FNMR(T) "False non-match rate"
FMR(T) "False match rate"

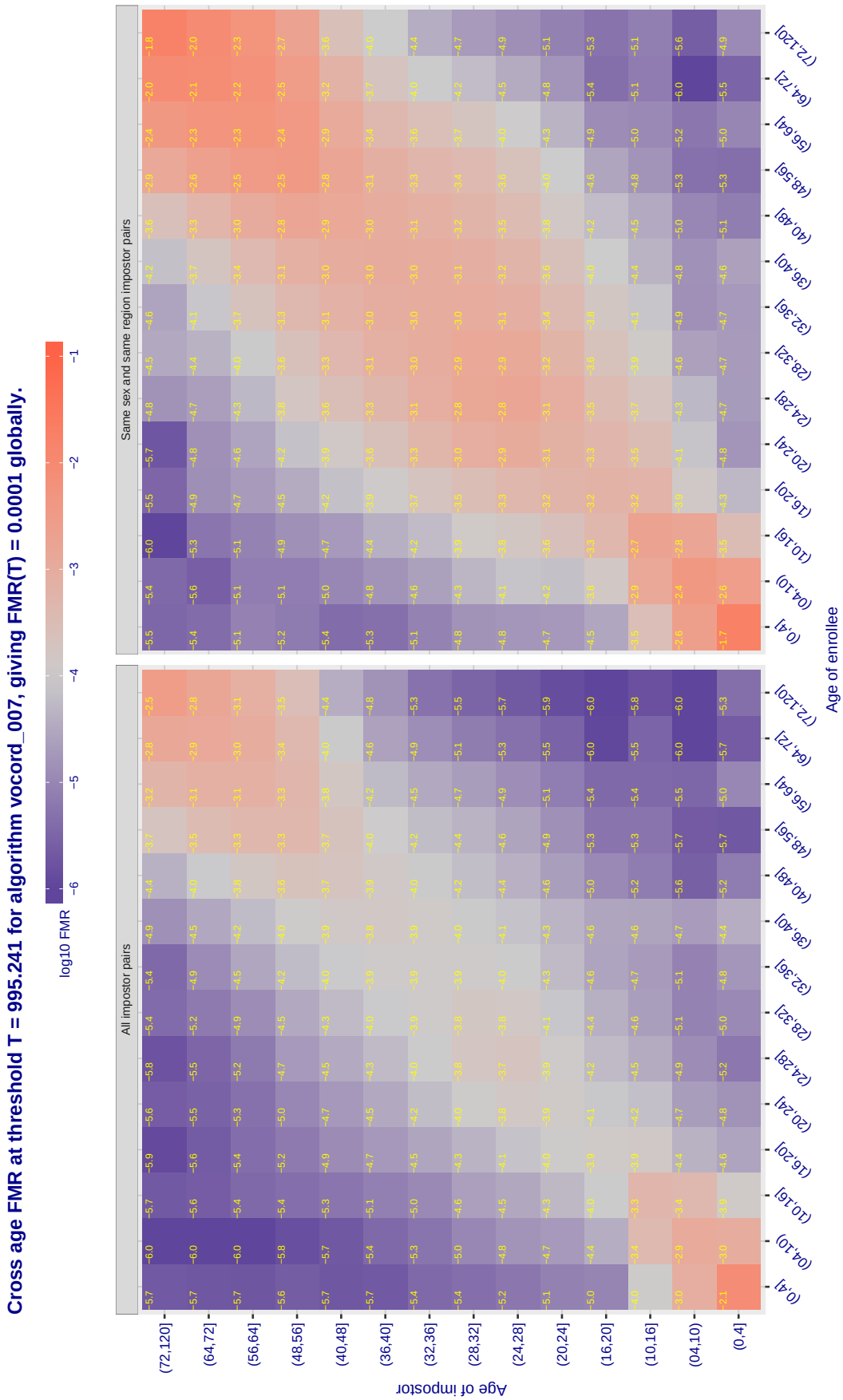


Figure 531: For algorithm vocord-007 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

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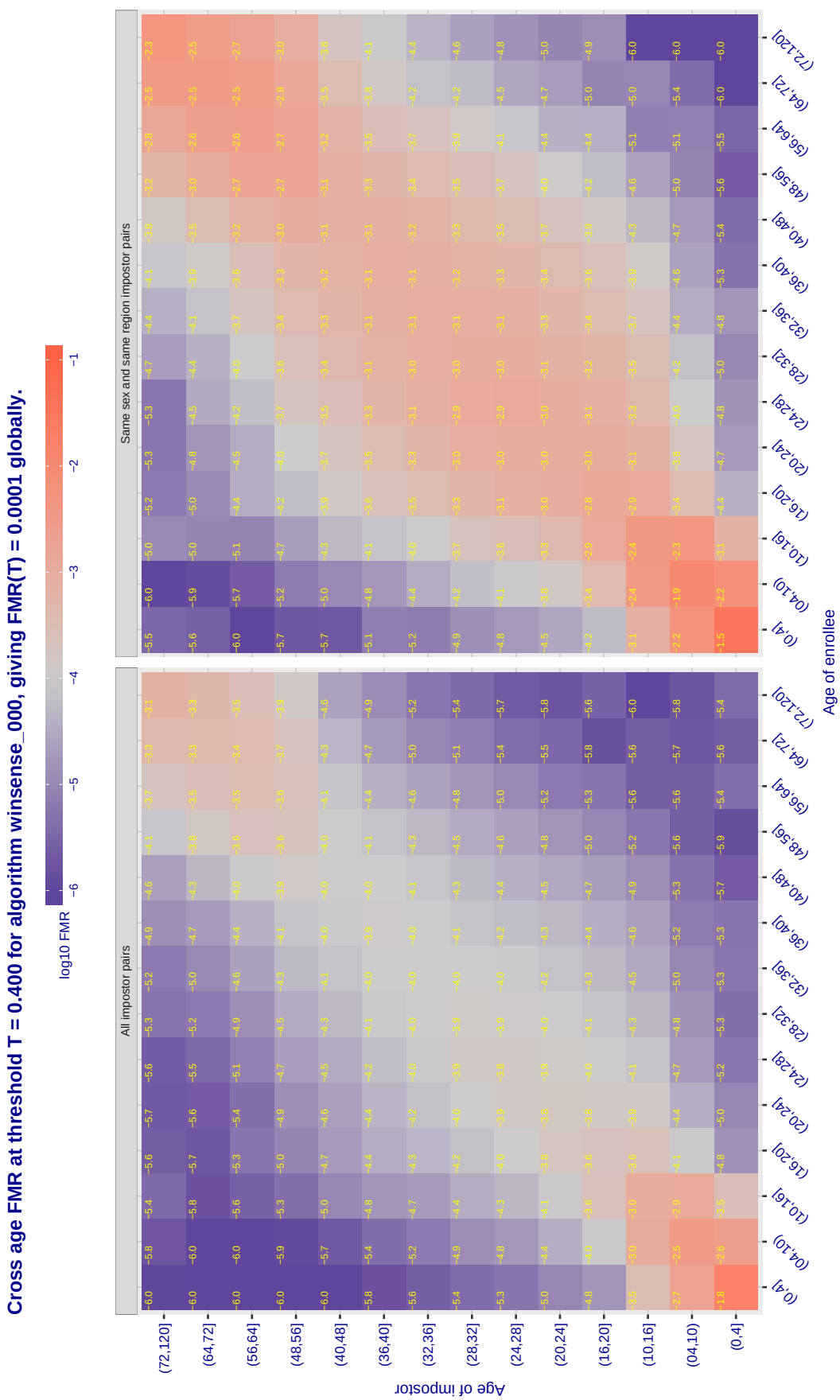

Figure 532: For algorithm winsense-000 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

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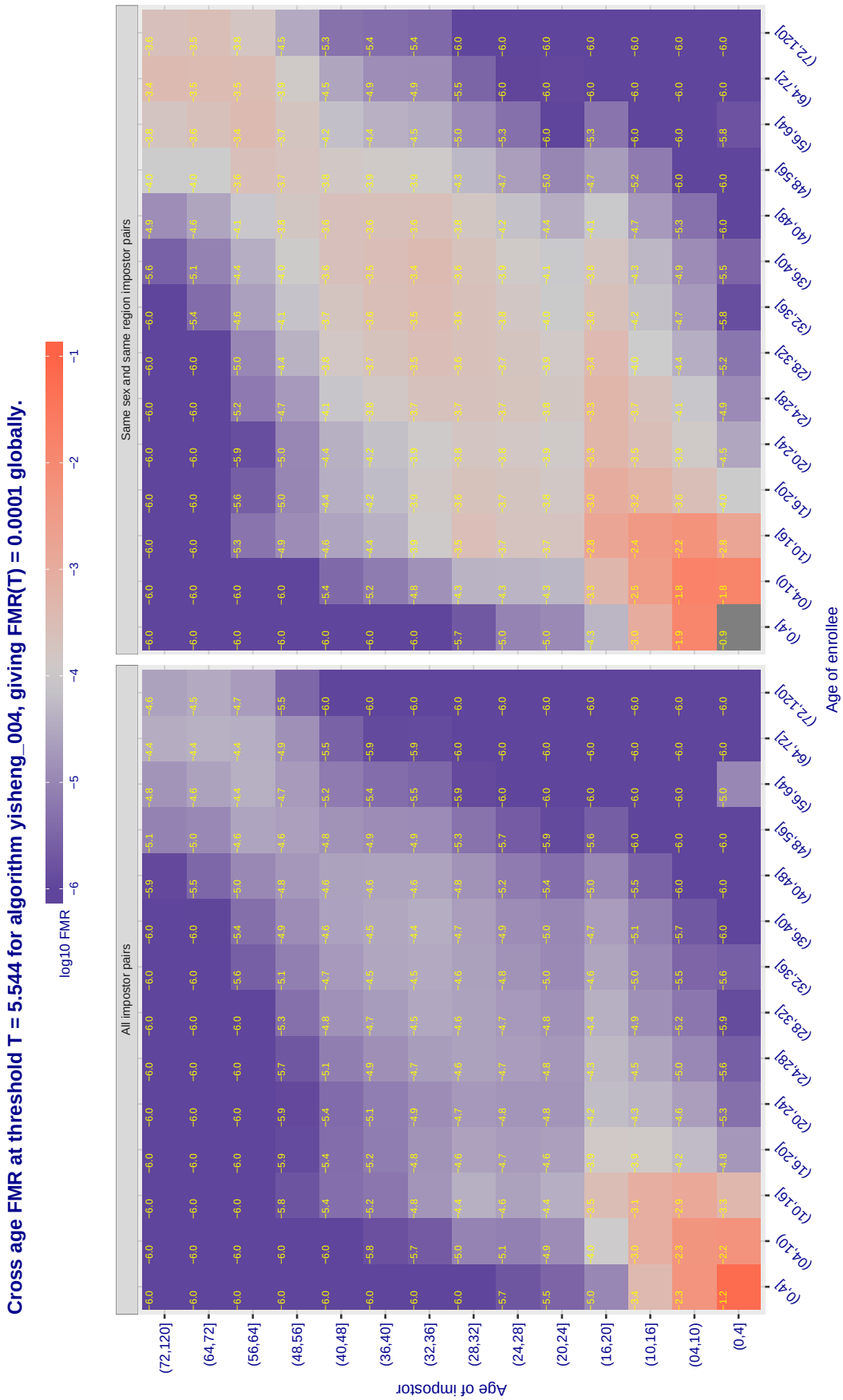

Figure 533: For algorithm yisheng-004 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

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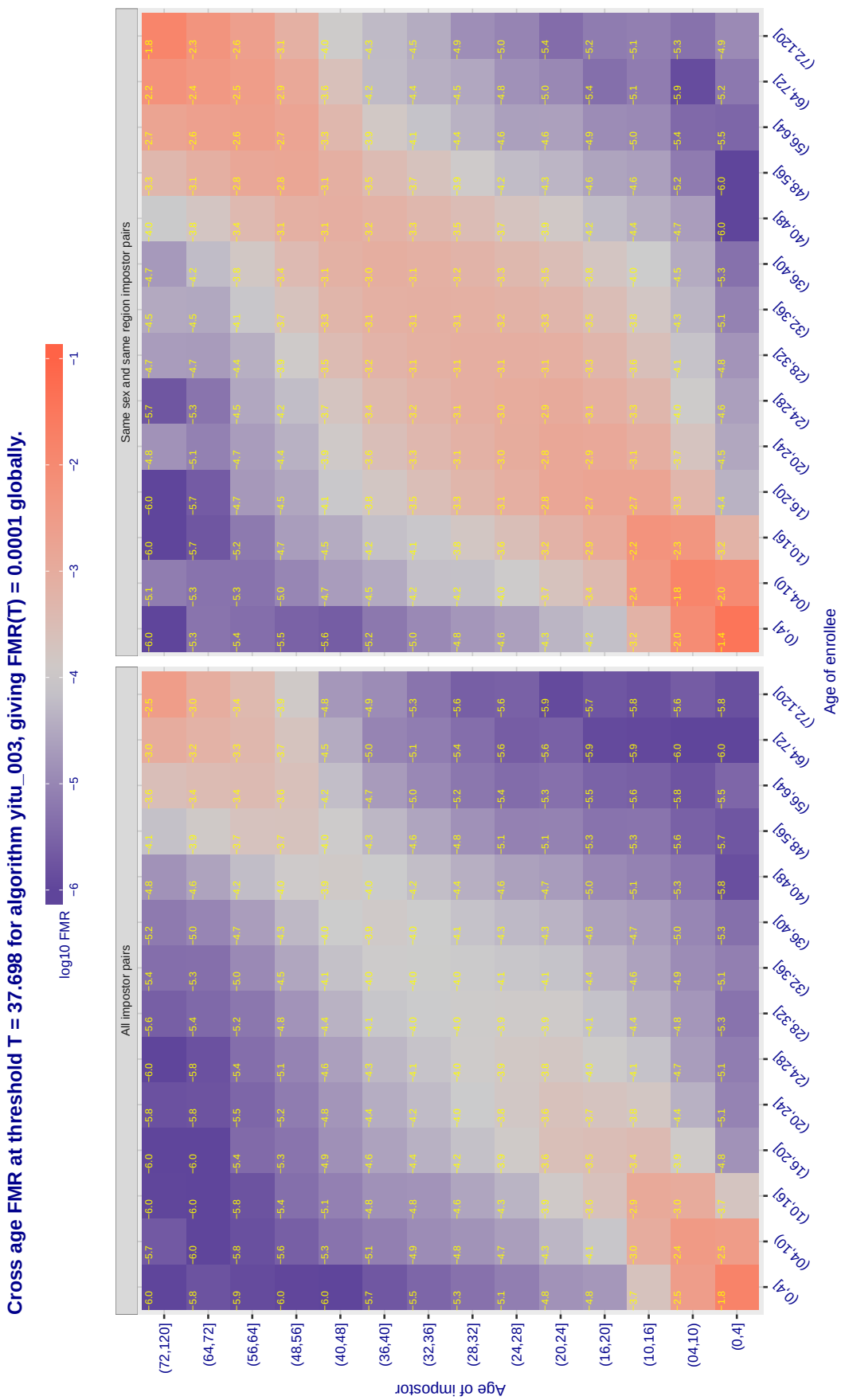

Figure 534: For algorithm yitu-003 operating on visa images, the heatmap shows false match observed over impostor comparisons of faces from different individuals who have the given age pair. False matches are counted against a recognition threshold fixed globally to give FMR = 0.001 over all on the order of 10^{10} impostor comparisons. The text in each box gives the same quantity as that coded by the color. Light colors present a security vulnerability to, for example, a passport gate.

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Accuracy Terms + Definitions

In biometrics, Type II errors occur when two samples of one person do not match – this is called a **false negative**. Correspondingly, Type I errors occur when samples from two persons do match – this is called a **false positive**. Matches are declared by a biometric system when the native comparison score from the recognition algorithm meets some **threshold**. Comparison scores can be either **similarity scores**, in which case higher values indicate that the samples are more likely to come from the same person, or **dissimilarity scores**, in which case higher values indicate different people. Similarity scores are traditionally computed by **fingerprint** and **face** recognition algorithms, while dissimilarities are used in **iris recognition**. In some cases, the dissimilarity score is a distance; this applies only when **metric** properties are obeyed. In any case, scores can be either **mate** scores, coming from a comparison of one person's samples, or **nonmate** scores, coming from comparison of different persons' samples. The words **genuine** or **authentic** are synonyms for mate, and the word **impostor** is used a synonym for nonmate. The words mate and nonmate are traditionally used in identification applications (such as law enforcement search, or background checks) while genuine and impostor are used in verification applications (such as access control).

A **error tradeoff** characteristic represents the tradeoff between Type II and Type I classification errors. For verification this plots false non-match rate (FNMR) vs. false match rate (FMR) parametrically with T.

The error tradeoff plots are often called **detection error tradeoff (DET)** characteristics or **receiver operating characteristic** (ROC). These serve the same function but differ, for example, in plotting the complement of an error rate (e.g. TMR = 1 – FNMR) and in transforming the axes most commonly using logarithms, to show multiple decades of FMR. More rarely, the function might be the inverse Gaussian function.

More detail and generality is provided in formal biometrics testing standards, see the various parts of ISO/IEC 19795 Biometrics Testing and Reporting. More terms, including and beyond those to do with accuracy, see ISO/IEC 2382-37 Information technology -- Vocabulary -- Part 37: Harmonized biometric vocabulary

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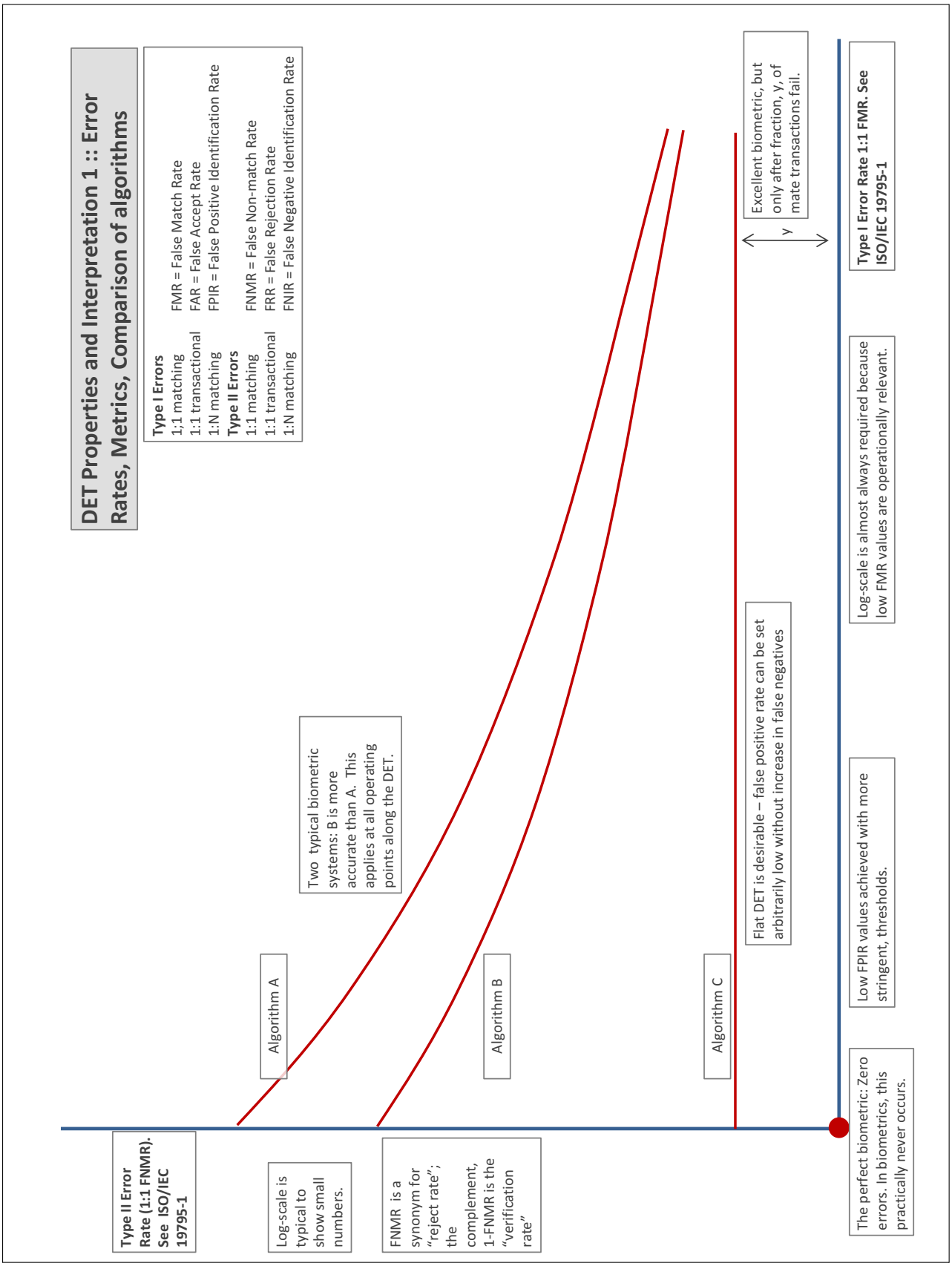

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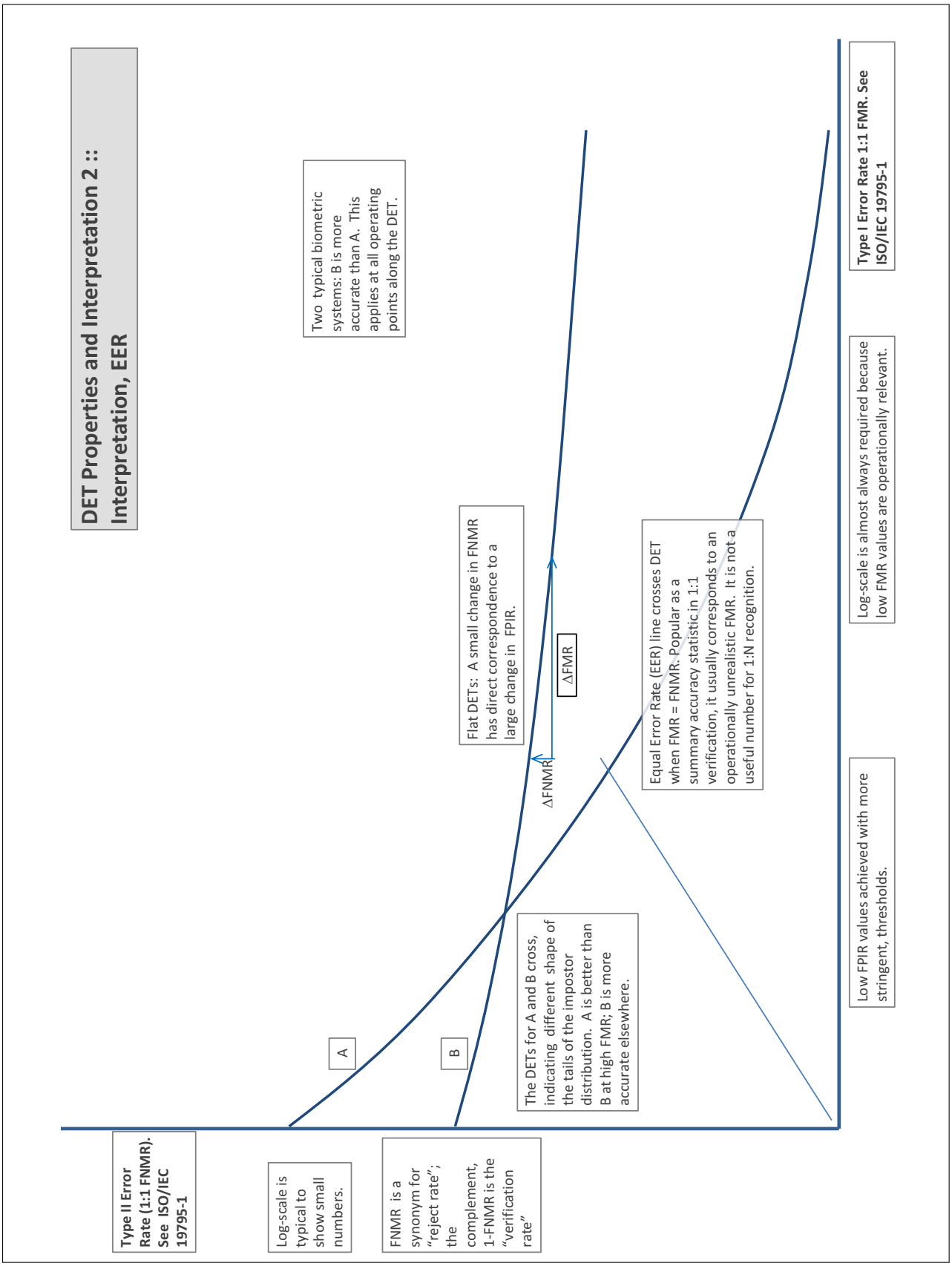

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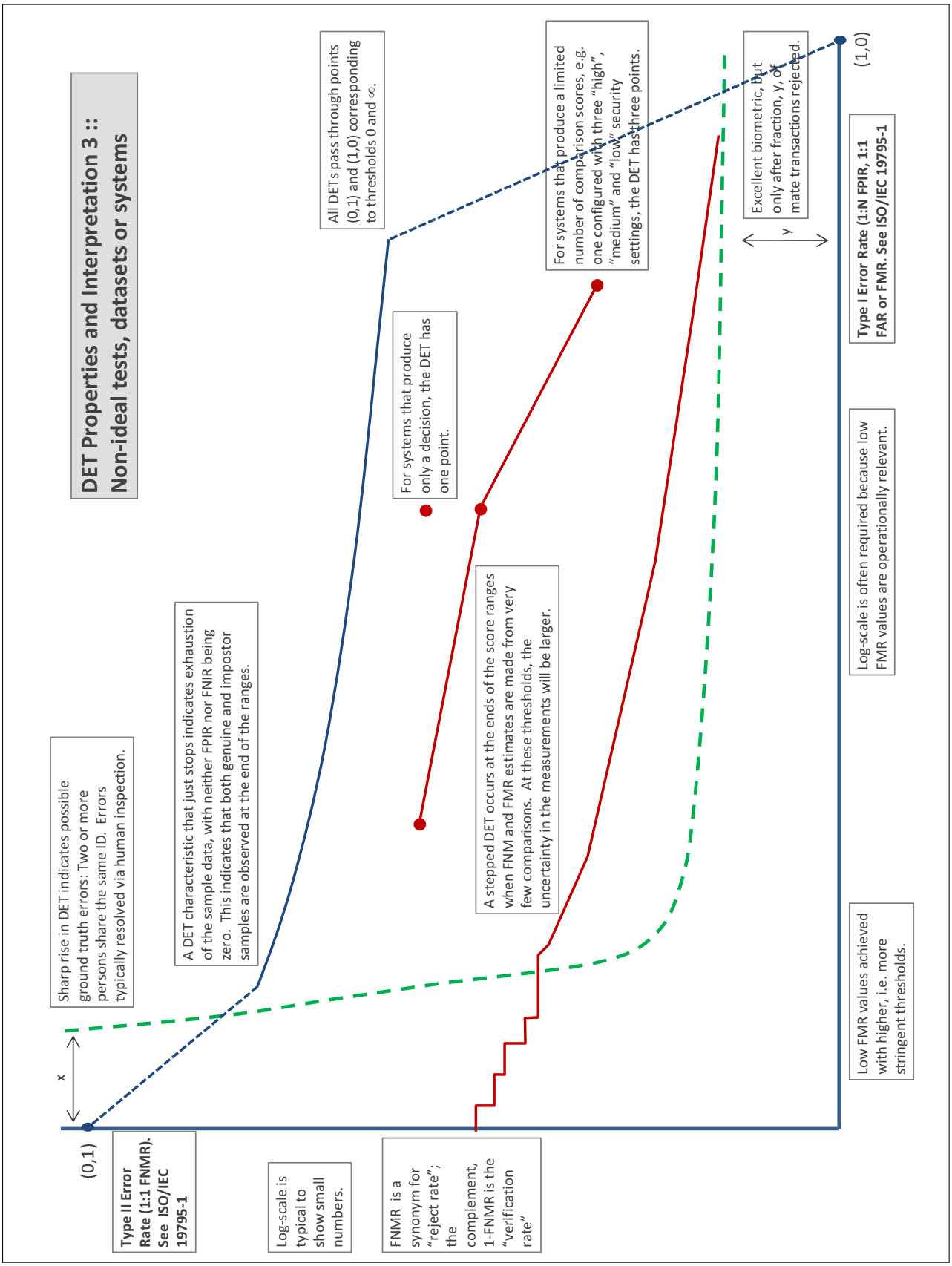

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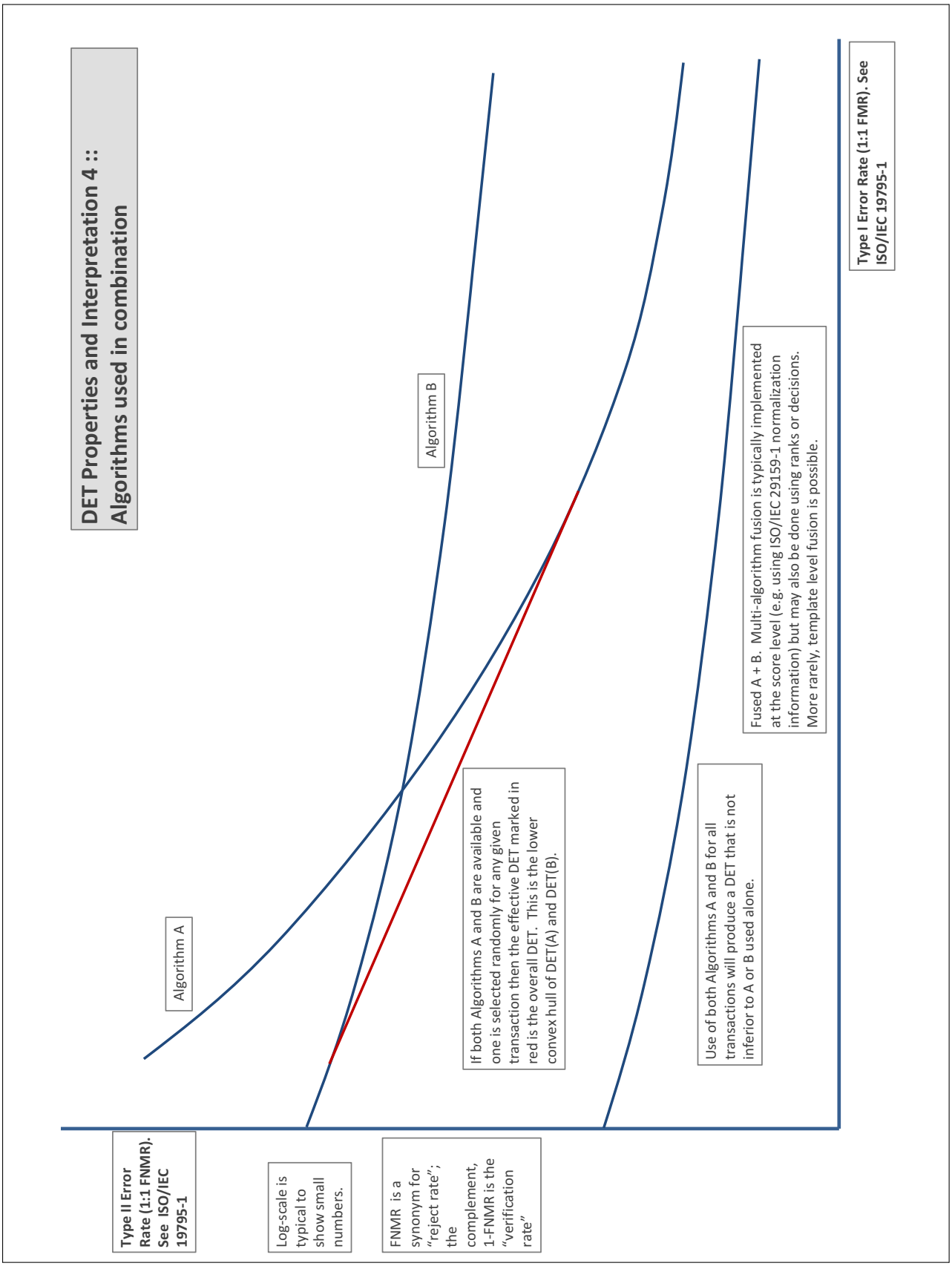

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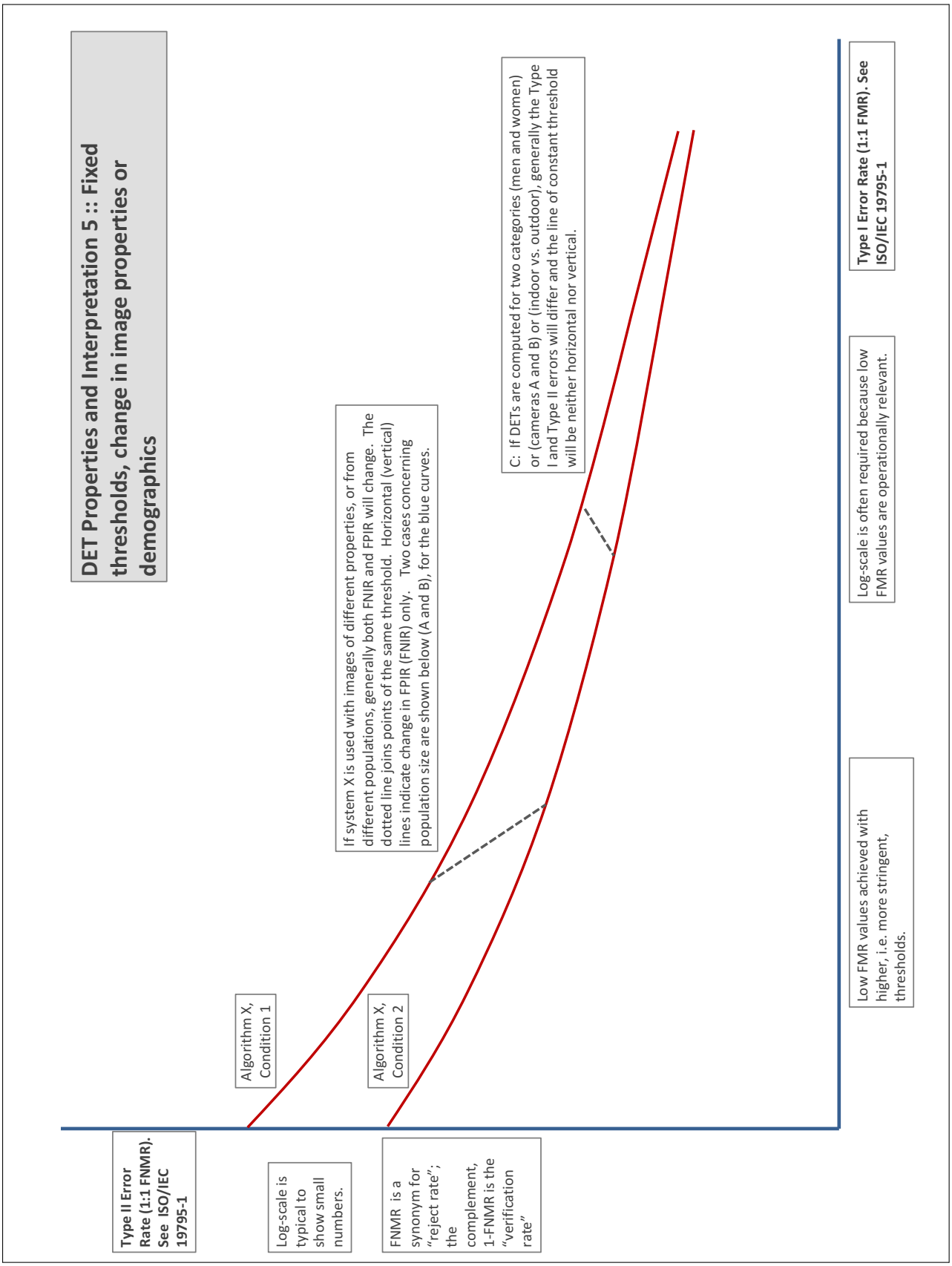

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References

[1] P. Jonathon Phillips, Amy N. Yates, Ying Hu, Carina A. Hahn, Eilidh Noyes, Kelsey Jackson, Jacqueline G. Cavazos, Géraldine Jeckeln, Rajeev Ranjan, Swami Sankaranarayanan, Jun-Cheng Chen, Carlos D. Castillo, Rama Chellappa, David White, and Alice J. O'Toole. Face recognition accuracy of forensic examiners, superrecognizers, and face recognition algorithms. *Proceedings of the National Academy of Sciences*, 115(24):6171–6176, 2018.

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