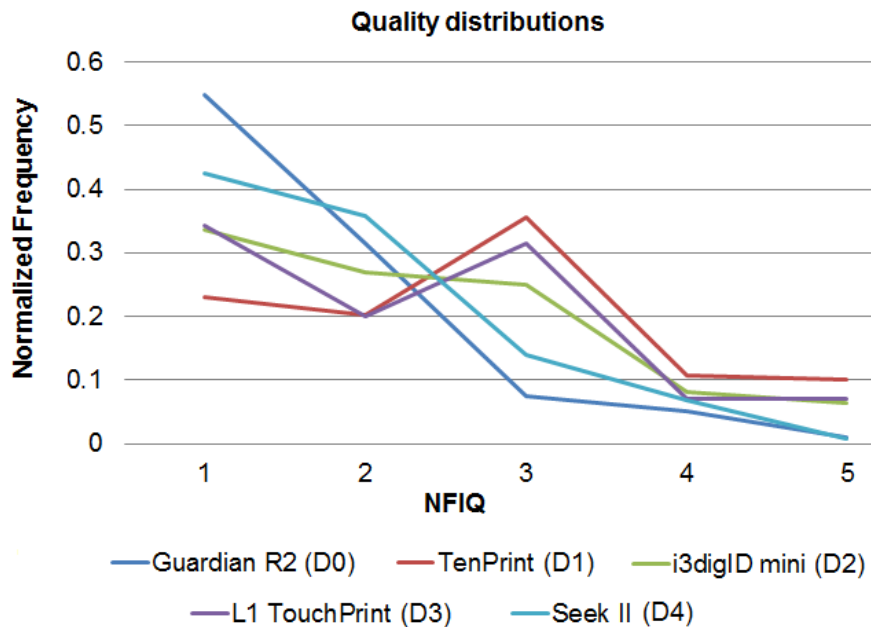
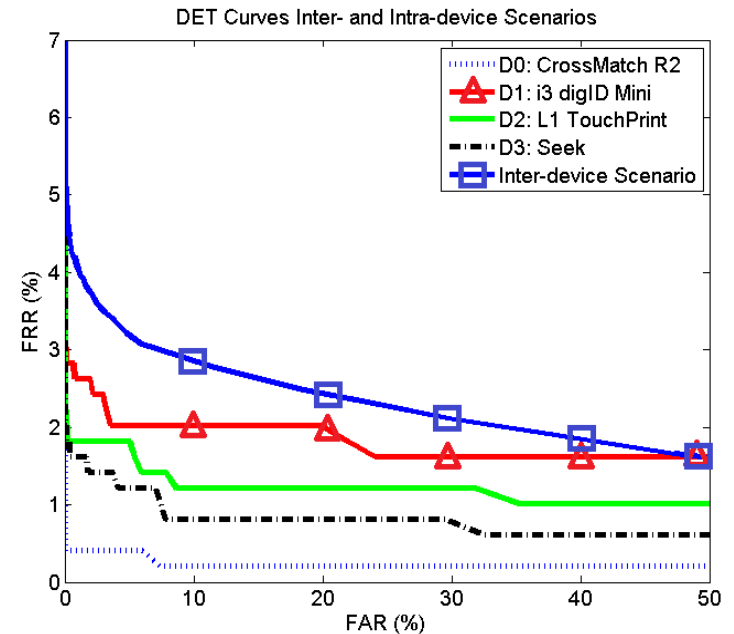


Sensor Diversity

- Impact of Sensors on Image Quality

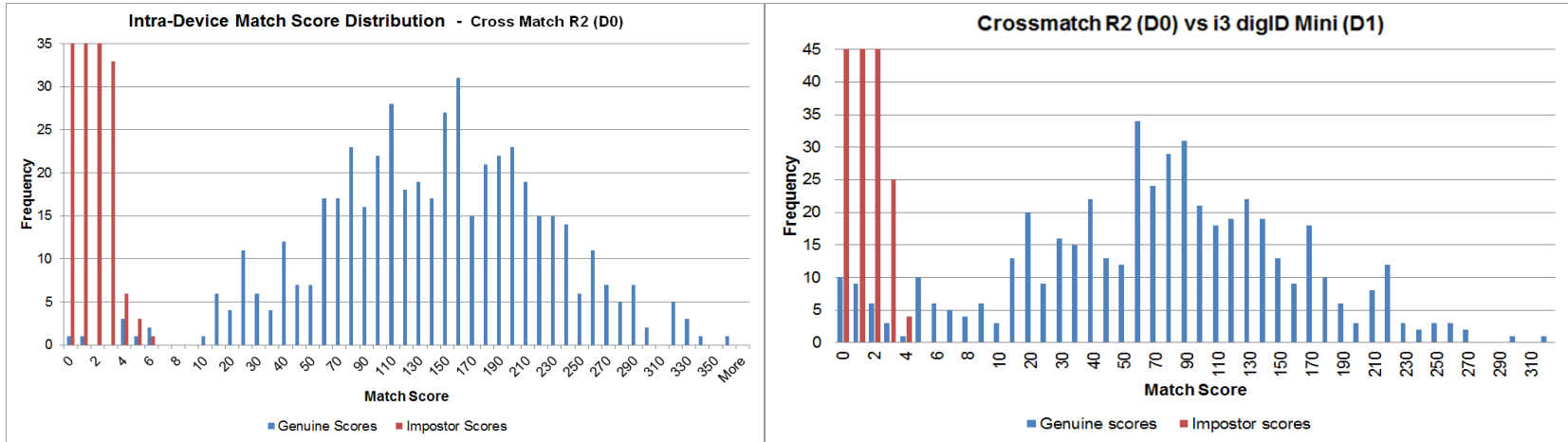


- Impact of Sensors on Matching Algorithm

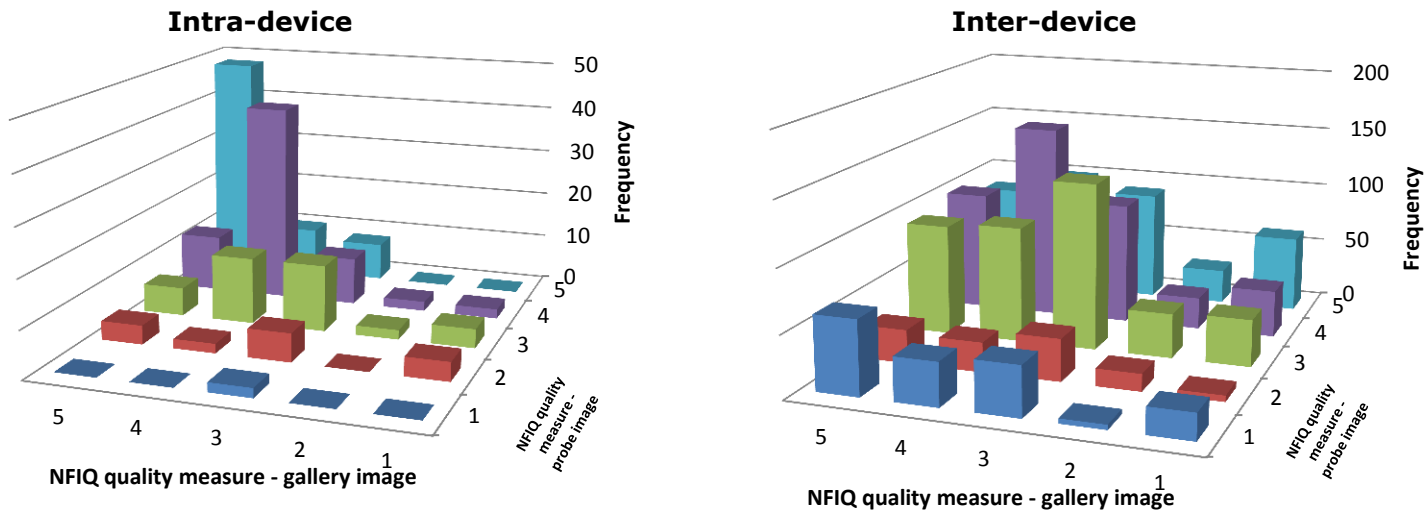


Sensor Diversity

- Impact of Device Diversity on Matching

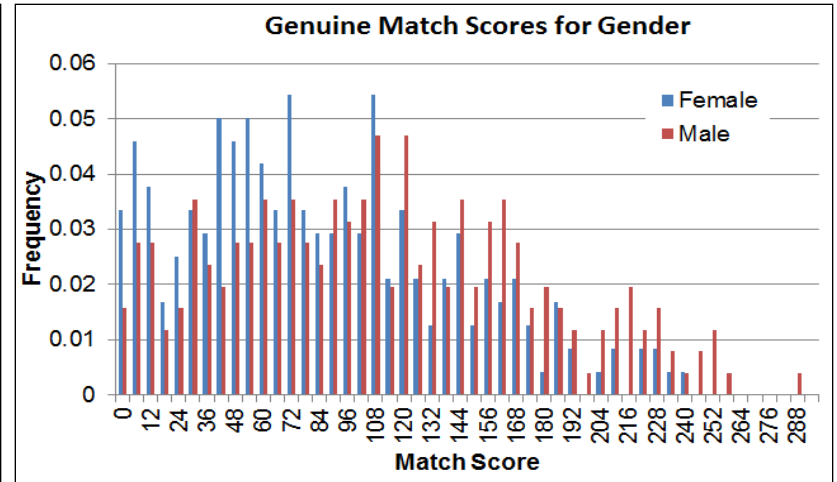
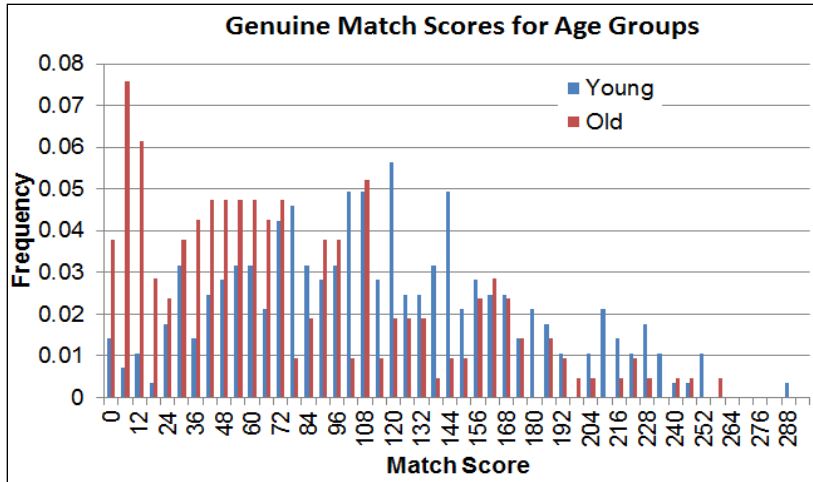


- Impact of Device Diversity and Image Quality on Matching

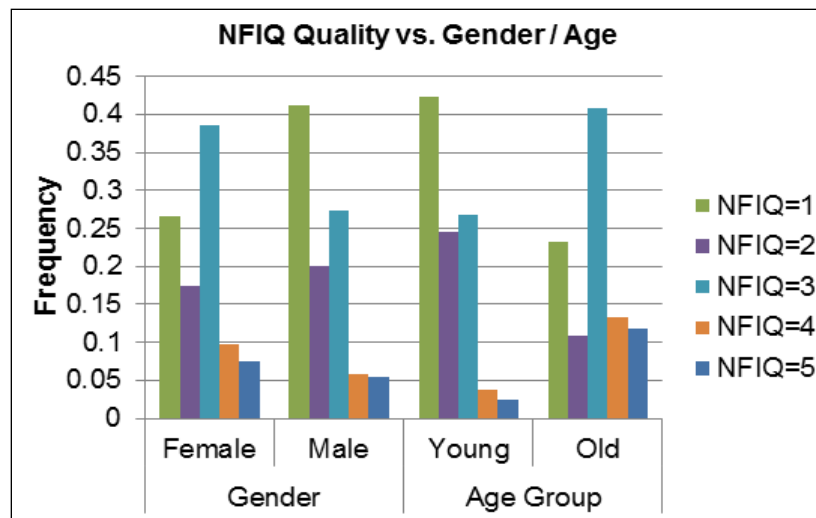


Diversity from Soft Biometrics

- Impact of Age / Gender on Matching Algorithms



- Impact of Age / Gender on Image Quality



- Age Groups
 - Young: 18-29
 - Elderly: 30-75
- TouchPrint 5300 device

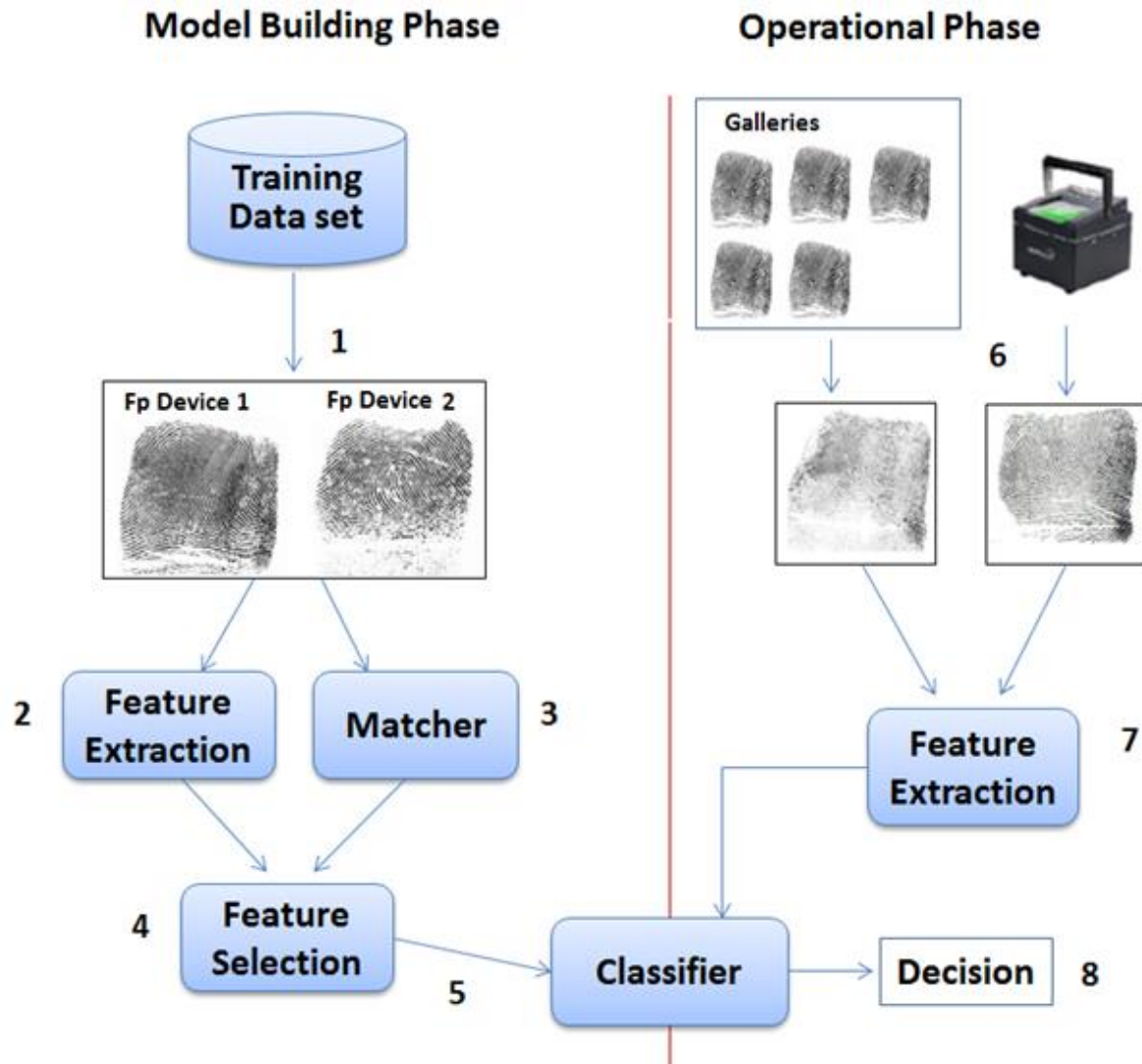
Related Works

1. Image Quality (local gradients) for **score calibration** [1]
 - Biosecure DS2 database, 207 subjects
 - **Thermal vs. Optical**
 - Results: TER is reduced from 15.834% to 15.150% (at EER)
 - Weakness: association of each device with a quality cluster
2. Distortion compensation model [2]
 - **Optical vs. Capacitive**
 - WVU data set of 71 subjects, MSU data set of 128 subjects
 - Results: at FAR= 0.01% GAR from 35% to 75% (Verifinger)
 - Weakness: **non-linear** transformation of minutiae points, old sensors

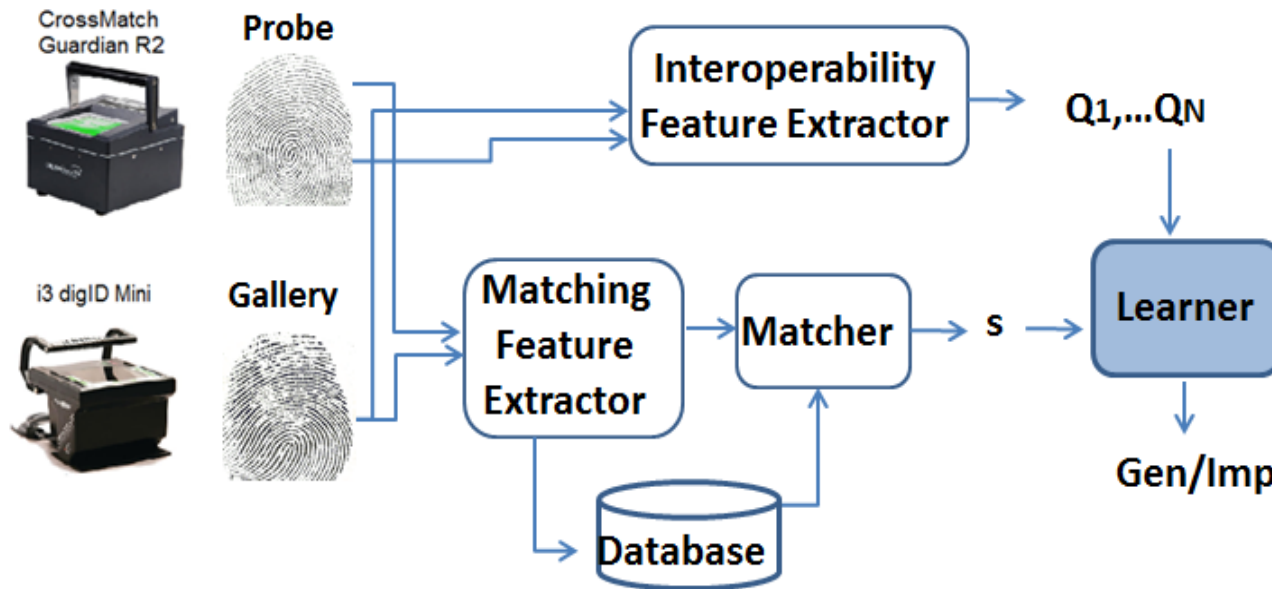
[1] Poh, N., Kittler, J.; Bourlai, T., "Quality-Based Score Normalization With Device Qualitative Information for Multimodal Biometric Fusion," *IEEE Trans. on SMC*, 2010

[2] Ross, A., and Nadgir R., "A thin-plate spline calibration model for fingerprint sensor interoperability", *IEEE Transactions on KDE* , 2008

The Proposed Approach



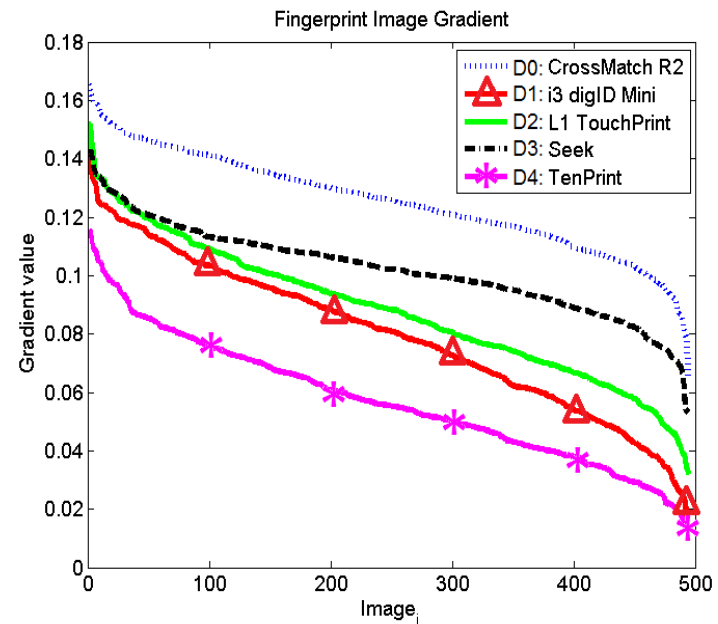
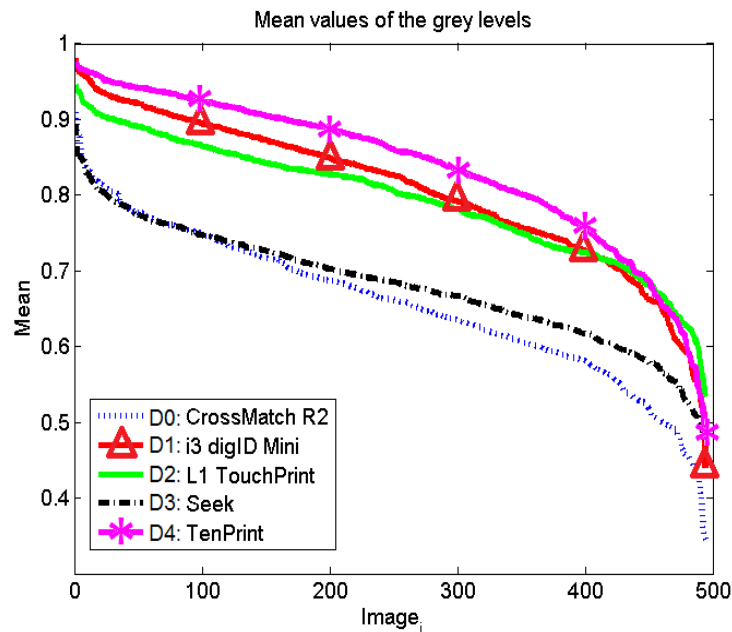
The Proposed Approach



- Compensation **after** matching
- Modeling qualitative information of the **device** and how it relates to match score
- The set of interoperability features is concatenated with the match score
- E. Marasco, L. Lugini, B. Cukic, T. Bourlai, “**Minimizing the impact of Low Interoperability between Optical Sensors**”, IEEE Sixth International Conference on Biometrics: Theory, Applications and Systems (BTAS) 2013, pp. 1-8, Washington D.C. (USA).

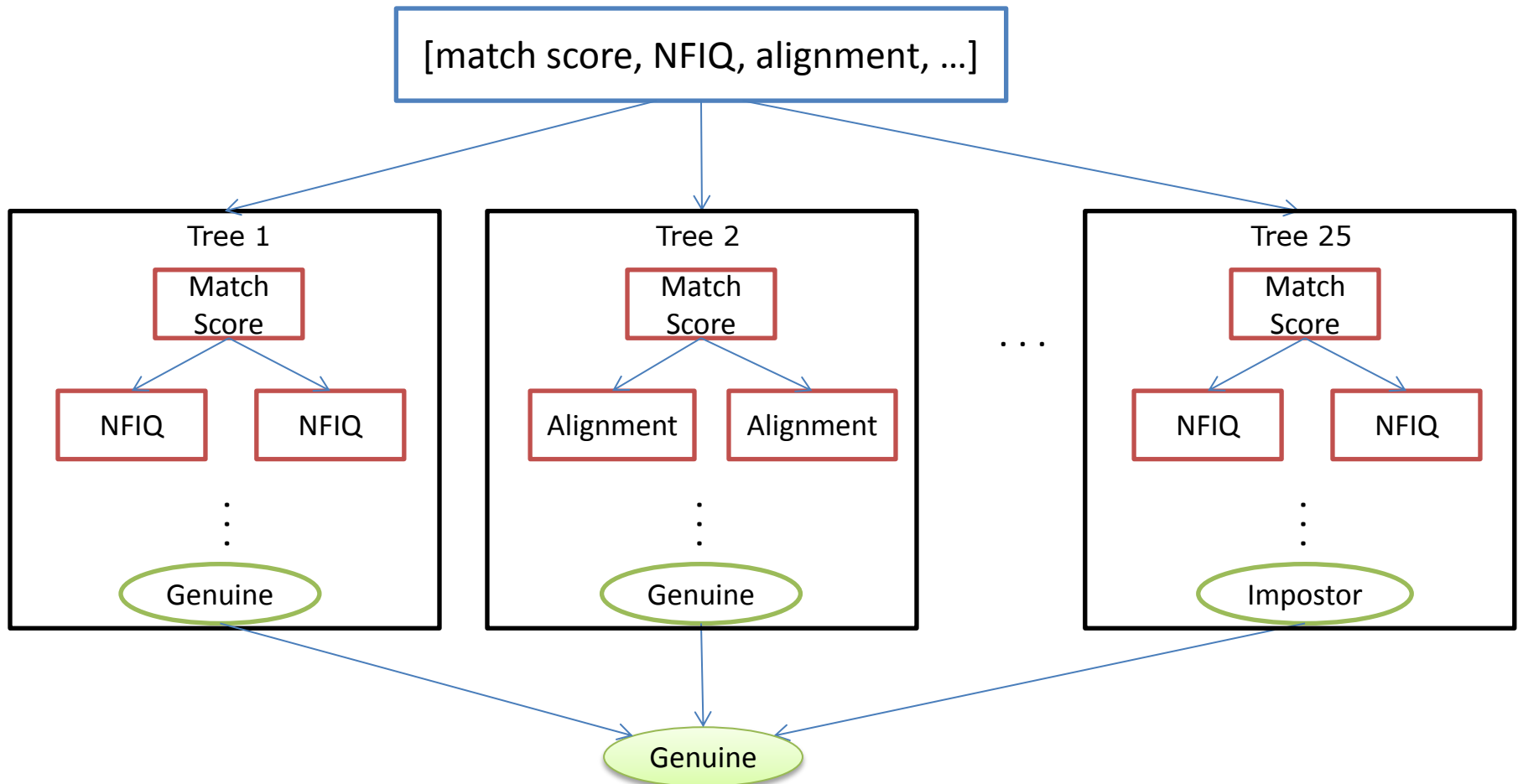
Sample Interoperability Features

- Image quality (NFIQ and MITRE)
- Minutiae count
- Pattern noise
- Intensity-based statistics
- Alignment



Classification

- Random Forest-based classification
- 10-Fold Cross Validation (25% training)



Results

- Using a preliminary set of features

| Learner | Training | FMR | FNMR | Baseline | |
|---------------|------------------------------|--------|--------|------------|-------------|
| Random Forest | 10-Fold CV 10 Trees | 0.006% | 3.279% | FMR | FNMR |
| | 25% 10-Fold CV (25 Trees) | 0.005% | 3.741% | 0.005% | 6.696% |
| | | | | 1.982% | 3.741% |

- Error rates of commercial fingerprint matchers increase when images are acquired using **different** devices
- Compensation **after** matching achieves a significant **improvement** of cross-device accuracy

Thanks for your attention!

Any Questions?

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