Performance depends on source of enrollment and verification templates

"Excess" FNMR = $FNMR_{XYZ} - FNMR_{ZZZ}$

= 0.023 – 0.014

Verification Template Generator

Enrollment Template Generator

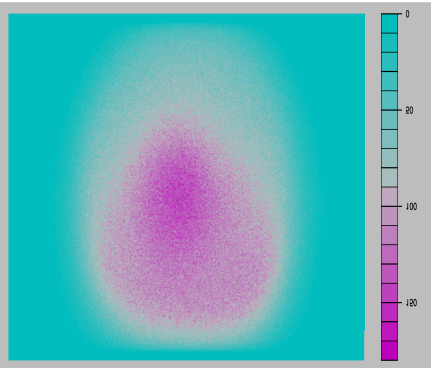
	A	B	C	D	E	F	G	H	I
A	0.019	0.034	0.038		0.047	0.038	0.054	0.059	0.041
B	0.028	0.021	0.029	0.017	0.034	0.028	0.028	0.071	0.053
C	0.039	0.034	0.019	0.020	0.040	0.019	0.047	0.106	0.072
D	0.026	0.025	0.023		0.035	0.023	0.034	0.070	0.049
E	0.034	0.030	0.029	0.023	0.030	0.030	0.037	0.083	0.058
F	0.040	0.035	0.019	0.021	0.040	0.019	0.047	0.107	0.072
G	0.037	0.024	0.033	0.021	0.034	0.033	0.024	0.087	0.068
H	0.056	0.085	0.108	0.066	0.119	0.109	0.127	0.081	0.084
I	0.046	0.070	0.078	0.052	0.085	0.078	0.100	0.097	0.053

Top left portion of Table 11a in NIST IR 7296. Scenario 2. Matcher D.

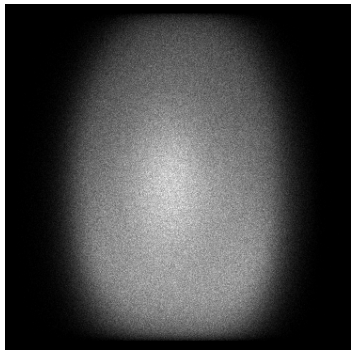
Interoperability Models

Regression Models	
	When matcher Z compares templates from generators A and B it produces an "excess" error over it's native performance.
Model 1	$FNMR_{ABZ} - FNMR_{ZZZ} \sim RegionalOverlap(T_A, T_B) + NonUniformity(T_A) * NonUniformity(T_B)$
Model 2	$FNMR_{ABZ} - FNMR_{ZZZ} \sim RegionalOverlap(T_A, T_B) + Matcher + NonUniformity(T_A) * NonUniformity(T_B)$
where	$RegionalOverlap(T_A, T_B) = P_A(x, y) \cdot P_B(x, y)$ (i.e. dot product) P_B = Estimated 2D PDF for template generator B A measure of similarity between where A and B are finding minutiae
and	$NonUniformity(T_A) = Energy(HighPassFilter(P_A(x, y)))$ A scalar measure of local non-uniformity in minutiae occurrence. Used here as a proxy for minutiae location quantization.

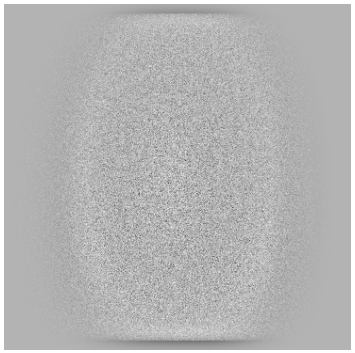
Non-uniformity as Proxy for Minutiae Misplacement



false color original

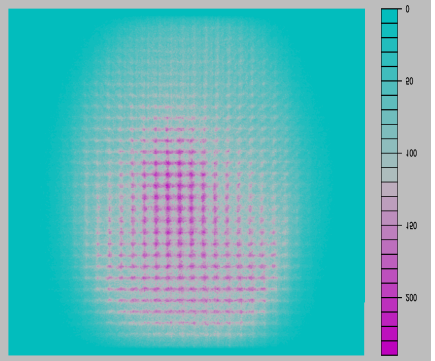


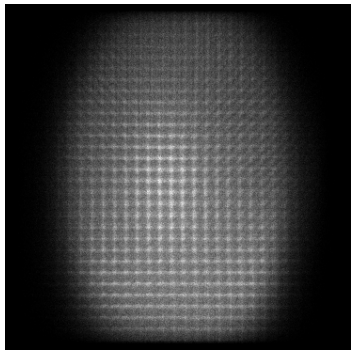
original

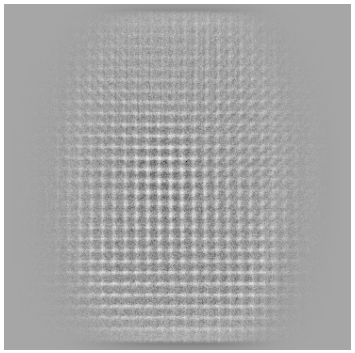


high pass filtered

Local non-uniformity is 0.011







Local non-uniformity is 0.029

Interoperability Models :: Results

- Model 1: Adjusted $R^2 = 0.49$
- Model 2: Adjusted $R^2 = 0.60$
- Non-uniformity (high frequency content) positively contributes to “excess” FNMR
- Non-uniformity in both the enrollment and verification templates negatively contributes to FNMR
- Regional overlap negatively contributes to “excess” FNMR
- The matcher significantly contributes to “excess” FNMR, positively and negatively
- All effects above are strongly significant
- The regression is imperfect
  - There are missing explanatory variables (minutiae angle encoding differences and other).

Standards Activity INCITS 378

- A revision of INCITS 378 is progressing through M1
  - Posted as M1/06-0680, September 13 2006
- It includes refined guidance on minutia placement

Standards Activity 19794-2

Text from New Work Item Proposal: SC37N1656
Approved per National Body vote Sep 14: SC37N1787

Scope

The scope of the proposed new work item is to standardise methods for the binarisation of gray-scale finger images, for the thinning of ridges (skeletonisation), and for the extraction of location, direction, and type of minutiae from ridge skeletons.

Purpose and Justification

Interoperability tests have shown that the location, the direction, and the type of minutiae extracted by different minutiae extraction subsystems from the same finger image tend to be different. This is due to supplier-specific image-processing algorithms. However, in order to achieve interoperability between subsystems from different suppliers, it is important that the individual minutiae extraction algorithms yield matchable minutiae. This can be achieved by standardising a minutiae extraction method. The results obtained from different minutiae extraction algorithms can then be compared to a well-defined ground truth, which is obtained by applying the standard minutiae extraction method. This would allow the suppliers to compensate for any biases that their minutiae extraction algorithms may produce.

Conclusions

- FNMR is lowest when both templates and the matcher come from the same supplier ("native")
- FNMR is lower when both templates come from one supplier
- Template generation is idiosyncratic
- Syntactic conformance is not enough for interoperability
- Some template generators are semantically non-conformant
  - Non-conformance is evident in the 2D minutiae occurrence density.
- Such non-conformance degrades interoperability
- Single image-template analysis is necessary to explain empirical MINEX results further
- Extraction algorithm standardization should embed testing
- Offline technology testing is suited to measurement of core algorithmic interoperability

Thank you

The MINEX report is online
http://fingerprint.nist.gov/minex04/

Ongoing MINEX program
http://fingerprint.nist.gov/minex

Feedback will be welcomed.

For further information contact

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