

Weekly Report

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1 Joint Finger Knuckle and Fingerprint Verification

1.1 RFN64-RSSSIM with Quadruplet Loss

The quadruplet loss can increase inter-class variance and decrease intra-class variance result in more robust cluster when compared to the triplet loss function. Because the loss used two hard margin for training, the second margin is weak margin when compared to the first hard margin. The second margin is to help the original triplet loss for lower intra-class variance. For getting the best hard margin of quadruplet loss, we have tested the matching performance under changed α and $\alpha2$ from the Table 1.

Table 1: Matching performance with different quadruplet margin

Loss	α	$\alpha2$	Left-Little		Left-Ring		Left-Index	
			EER	GAR	EER	GAR	EER	GAR
RSSSIM	0.5	0.2	4.25%	83.00%	0.83%	96.00%	2.67%	85.50%
RSSSIM	0.5	0.3	3.75%	88.00%	0.75%	98.00%	2.08%	92.00%
RSSSIM	0.5	0.4	4.53%	87.00%	1.08%	97.00%	2.58%	92.00%
RSSSIM	0.5	0.5	3.75%	86.50%	0.67%	97.00%	1.92%	91.00%
RSSSIM	0.6	0.3	4.45%	88.50%	0.67%	97.50%	1.92%	94.00%
RSSSIM	0.6	0.4	3.43%	84.00%	0.50%	97.00%	1.92%	89.50%
RSSSIM	0.6	0.5	4.00%	68.00%	0.50%	89.50%	2.00%	84.00%
RSSSIM	0.5	0	4.08%	85.50%	0.67%	97.00%	2.58%	91.00%

From the above Table 1, we can find two cases which was bolded can get the best finger knuckle matching performance on the little, ring, and index finger knuckle of left hand. Therefore, we use two of them to test finger knuckle matching performance on the rest finger knuckle from the Table 2. The performance of RSSSIM-0.5-0.3 and RSSSIM-0.6-0.3 are similar with each other, but the RSSIM-0.6-0.3 is slightly better than the RSSSIM-0.5-0.3.

1.2 Finger Knuckle and Fingerprint Score Fusion

I have tried dynamic, holistic, and nonlinear fusion method to fusion finger knuckle matching score and fingerprint matching score. After comparing these three different fusion method, the performance of dynamic and holistic method are similar, and all of them are better than the nonlinear fusion method. As a result, the performance of holistic method is slightly better than the dynamic method, then I choose it to show the fusion performance as shown on the Fig. 1

Table 2: Compare RSSSIM-0.5-0.3 and RSSSIM-0.6-0.3 matching performance

Performance		RSSSIM-0.5-0.3	RSSSIM-0.6-0.3
Left-Little	EER	3.75%	4.45%
	GAR	88.00%	88.50%
Left-Ring	EER	0.75%	0.67%
	GAR	98.00%	98.00%
Left-Index	EER	2.08%	1.92%
	GAR	92.00%	92.00%
Left-Thumb	EER	3.75%	3.50%
	GAR	76.00%	81.00%
Right-Thumb	EER	2.25%	2.58%
	GAR	82.00%	90.50%
Right-Index	EER	1.75%	1.92%
	GAR	94.00%	95.00%
Right-Middle	EER	1.58%	1.58%
	GAR	97.00%	98.00%
Right-Ring	EER	1.17%	1.08%
	GAR	97.50%	98.00%
Right-Little	EER	6.00%	5.39%
	GAR	84.00%	83.00%

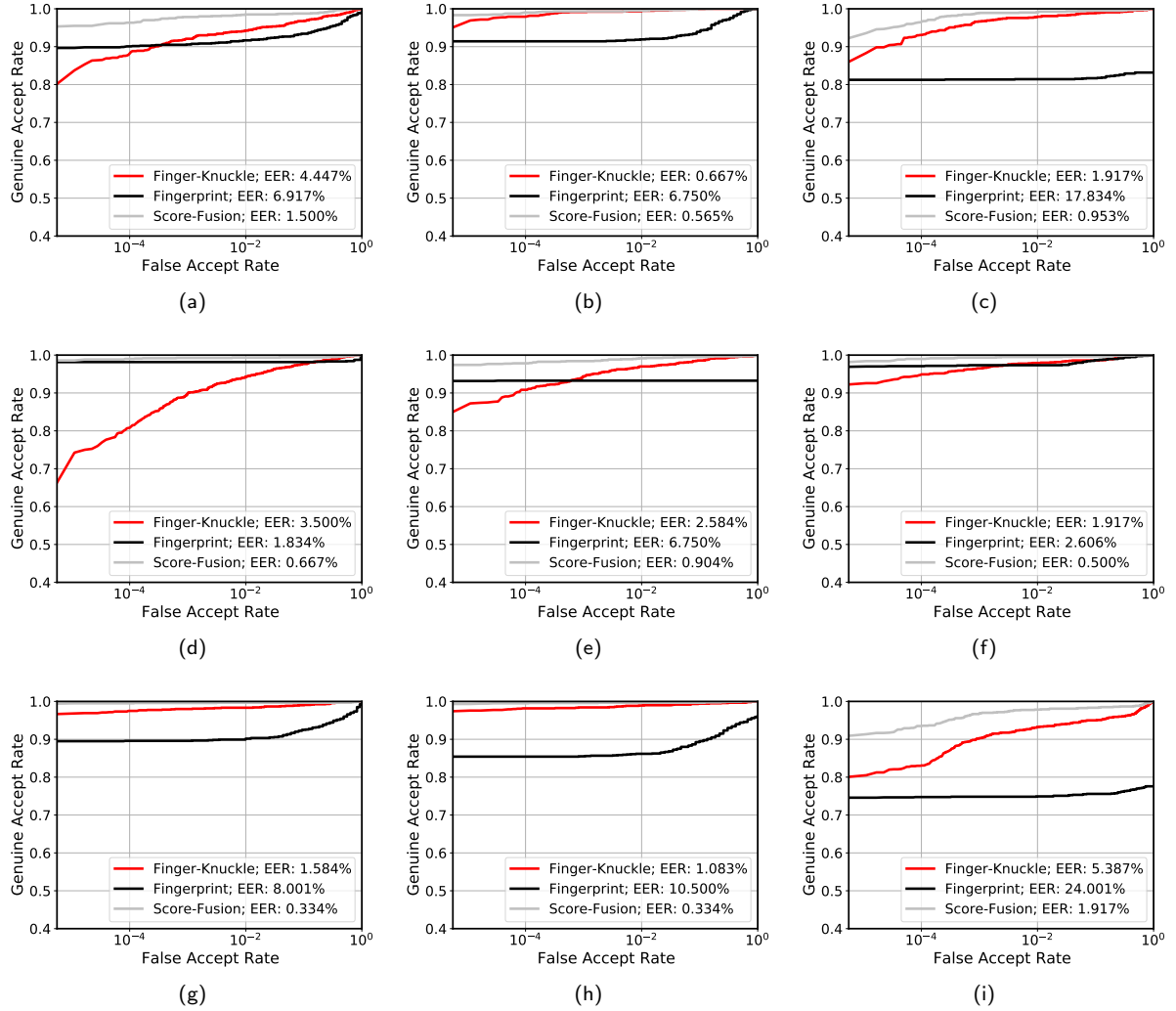


Figure 1: Verification performance using holistic method to fusion finger knuckle and fingerprint matching score. (a) left little, (b) left ring, (c) left index, (d) left thumb, (e) right thumb, (f) right index, (g) right middle, (h) right ring, (i) right little.