

Weekly Report

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1 Finger Knuckle Project

1.1 Triplet Loss Function

As for all model, I trained on the all samples of left middle finger knuckle, and then test on the rest fingers with all-to-all protocol. I also fit the RSIL on the SSIM index, called RSSSIM loss, which can get the best performance at present even on the little finger knuckle. Because the little finger knuckle can be more easily deform when compared to the rest ring, middle, and index finger knuckle. At the same time I also change the RFN model to output 64 channels feature map for getting more robust matching performance.

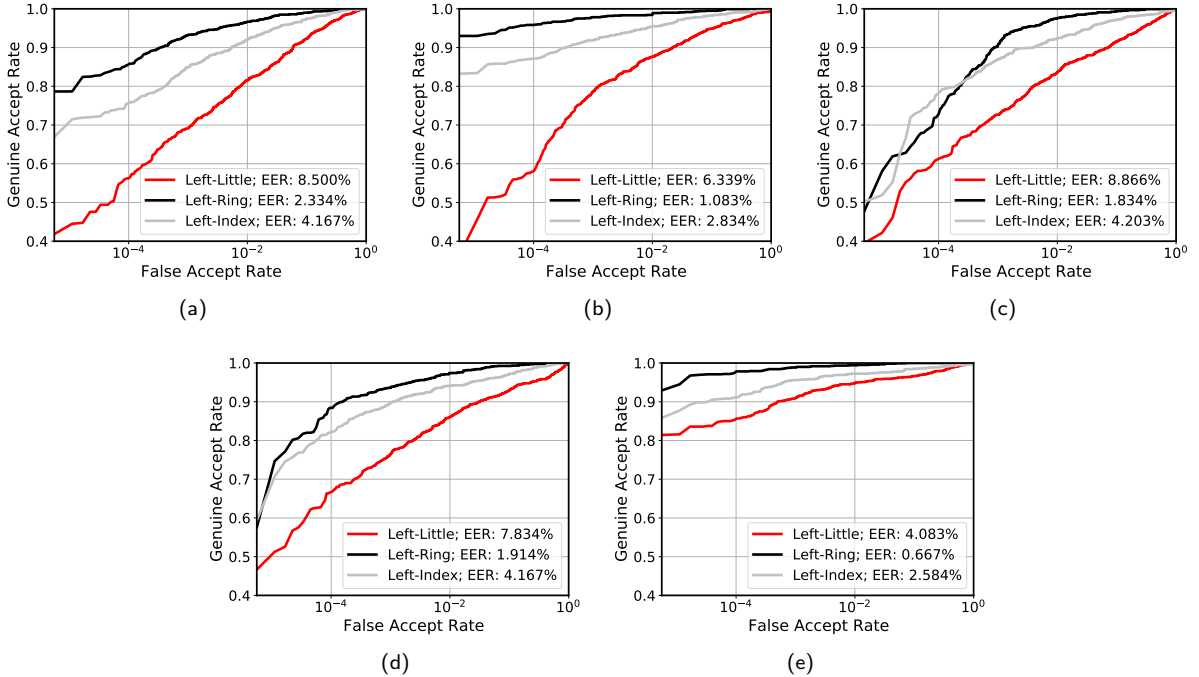


Figure 1: Comparative matching performance of different triplet loss function: (a) RFN-MSE; (b)RFN-RSIL; (c) RFN-SSIM; (d) RFN64-SSIM; (e) RFN64-RSSSIM

1.1.1 RFN64-RSSSIM

RFN64-RSSSIM can get the best performance as shown on the Fig. 1 when compared to other models. Therefore, I test the performance on the rest finger knuckle as shown on the ROC of

Fig. 2. And our performance also outperform the DON model on the Technical Report.

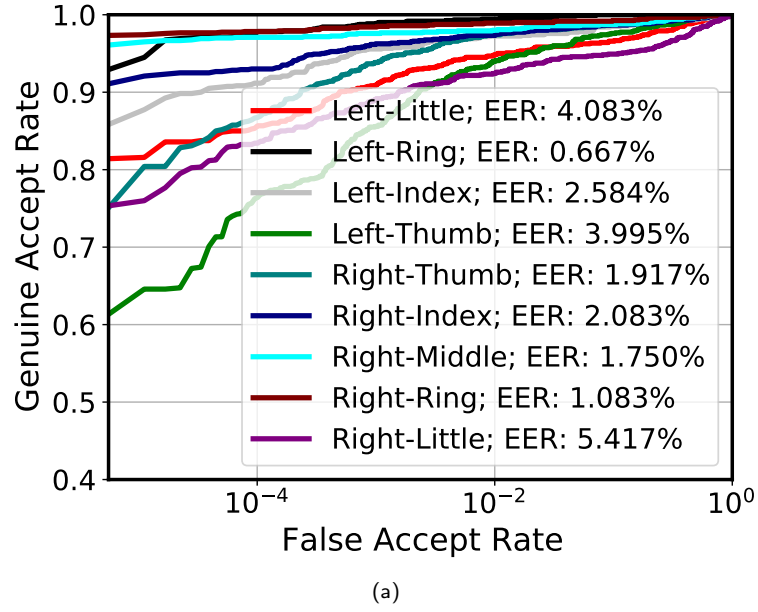


Figure 2: Comparative matching performance of RFN64-RSSIM model ROC curve.

1.2 Score Fusion

I fused the RFN64-RSSIM (trained with triplet loss) finger knuckle matching scores and fingerprint matching scores using different method. As for different finger knuckle, the weight of fusion score can be different.

1.2.1 Dynamic

Table 1: Dynamic score fusion

| | Finger Knuckle | | | | | | | |
|-----|----------------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 5 | 5 | 6 | 7 | 8 | 9 |
| W | 0.35 | 0.25 | 0.5 | 0.1 | 0.5 | 0.15 | 0.3 | 0.5 |
| EER | 1.50% | 0.57% | 1.67% | 0.50% | 0.83% | 0.33% | 0.42% | 0.58% |

1.2.2 Holistic

Table 2: Holistic score fusion

| | Finger Knuckle | | | | | | | |
|-----|----------------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 9 |
| W | 0.45 | 0.35 | 0.65 | 0.15 | 0.6 | 0.2 | 0.4 | 0.65 |
| EER | 1.50% | 0.57% | 1.68% | 0.50% | 0.83% | 0.33% | 0.42% | 0.66% |

Table 3: Nonlinear score fusion

| | Finger Knuckle | | | | | | | |
|-----|----------------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 9 |
| W | 0.55 | 0.45 | 0.9 | 0.15 | 0.85 | 0.25 | 0.5 | 0.9 |
| EER | 1.50% | 0.58% | 1.70% | 0.50% | 0.91% | 0.33% | 0.42% | 0.67% |

1.2.3 Nonlinear

1.3 Quadruplet Loss Function

Then I trained RFN64-RSSSIM model with quadruplet loss function, the performance can clearly be shown on the Fig. 3. When can clearly get a conclusion that the quadruplet loss can increase the matching performance with slightly when compaed the Fig. 3 a and c.

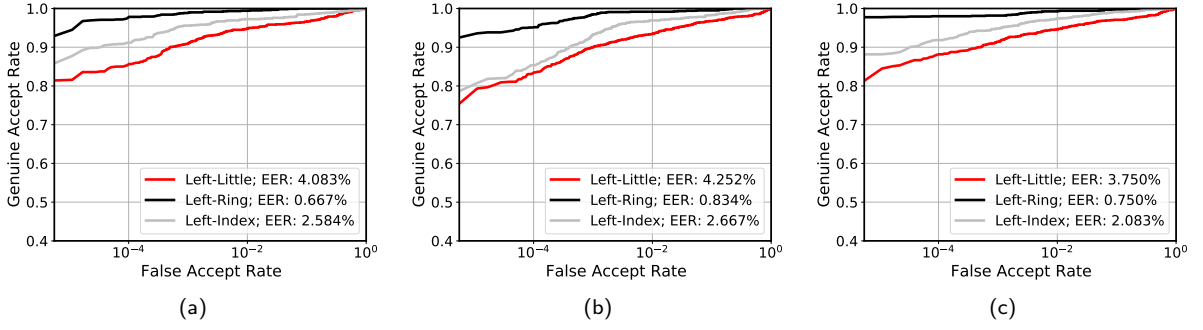


Figure 3: Comparative matching performance with quadruplet loss function: (a) triplet loss function; (b) $\alpha_1=0.5$ and $\alpha_2=0.2$; (c) $\alpha_1=0.5$ and $\alpha_2=0.3$