A   Algorithmic pipeline of the synthesizing process

Algorithm 1 illustrates the pipeline of the synthesizing process. N and S represent the number of identities and number of samples per identity. The between identity randomness and within identity randomness are represented by different collors.

Algorithm 1 Algorithmic pipeline for creases synthesis

```
 1: for i ∈ {1, 2, .., N} do
 2:     m = randint(3, 5)
 3:     n = randint(5, 15)
 4:     P = random(0, 1, size=(m, 3, 2))
 5:     Q = random(0, 1, size=(n, 3, 2))
 6:     for j ∈ {1, 2, .., S} do
 7:         Pⁱⱼ += random(P, std=0.04)
 8:         Qⁱⱼ += random(Q, std=0.01)
 9:         bg = random_select(imagenet)
10:         Sⁱⱼ = synthesize(Pⁱⱼ, Qⁱⱼ, bg)
11:     end for
12: end for
```

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6:    **for** $j \in \{1, 2, .., S\}$ **do**
7:       P_j^i += random(P, std=0.04)
8:       Q_j^i += random(Q, std=0.01)
9:       bg = random_select(imagenet)
10:      S_j^i = synthesize(P_j^i, Q_j^i, bg)
11:    **end for**
12: **end for**

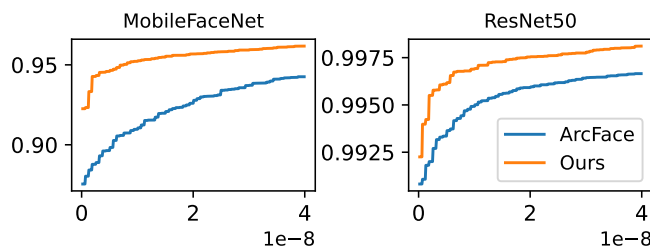---

B   FAR *v.s.* TAR curves

Fig. 6: FAR *v.s.* TAR curves of ArcFace (AF) and our method on the million-scale dataset.

C   Example synthesized images and ROIs

Fig. 8 and Fig. 9 present example synthesized images without and with imagenet images as the background.
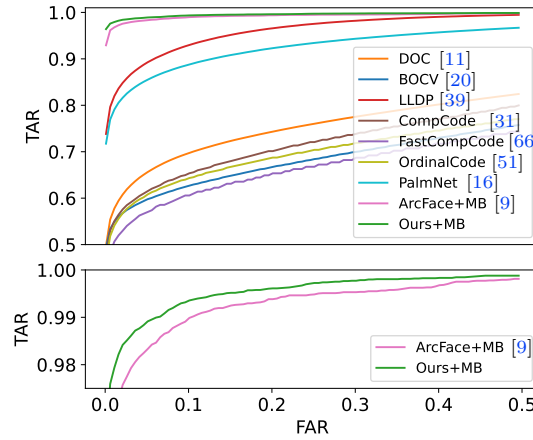
Fig. 7: FAR *v.s.* TAR curves of various methods under the open-set 1:1 settings. The ArcFace and our method are based on the MobileFaceNet backbone.

Fig. 8: Example of synthesized images without imagenet images as background. Each row contains sample of the same identity.

Fig. 9: Example of synthesized images with imagenet images as background. Each row contains sample of the same identity.

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| CASIA | COEP | MOHI | WEHI | PolyU-MS | GPDS | PolyU 2d+3d |

Fig. 10: Example ROIs of different datasets.

D   Details about the million-scale dataset

The images of the the dataset are collected parallelly in three places by 19 difference mobile phones (different brands and modes) and 2 IoT cameras. Images of each identity was collected in one seesion by 4 devices (2 IoT and 2 random mobile phones) and 4 different man-made light conditions. We provide selected

Fig. 11: Example images of two identities (each row corresponds to an identity) our million-scale dataset.

palms of two identities in the figure below (zoom in for details).