Face Recognition

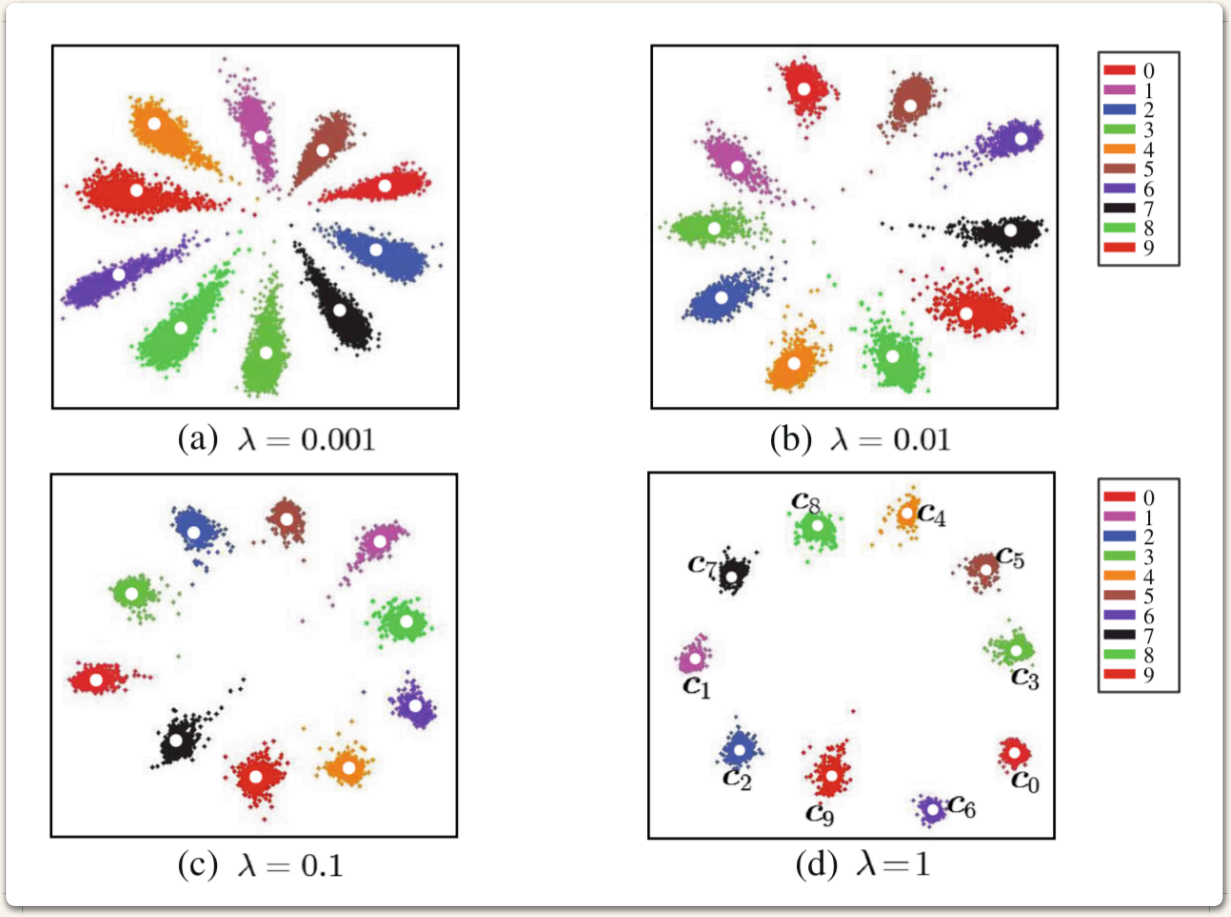
Triplet Loss （FaceNet）

Center loss

discriminative feature learning algorithm

- softmax loss 仅仅只能区分class间的异同，无法discriminate其差异的大小
- 为了 enhance intra-class compact，和inter-class discriminative。引入 Center loss，使相同类别的class聚集在center附近
  - Center Loss: $L_c = \frac{1}{2}\sum||x_i - c_{yi}||_2^2$， 其中 c_{yi} 表示 yi class 的center
- Loss function: $L = L_s + \lambda L_c$

$$L = -\sum log\frac{e^{W_{yi}^T x_i + b_{yi}}}{\sum e^{W_j^T x_i + b_j}} + \frac{\lambda}{2}\sum||x_i - c_{yi}||_2^2$$

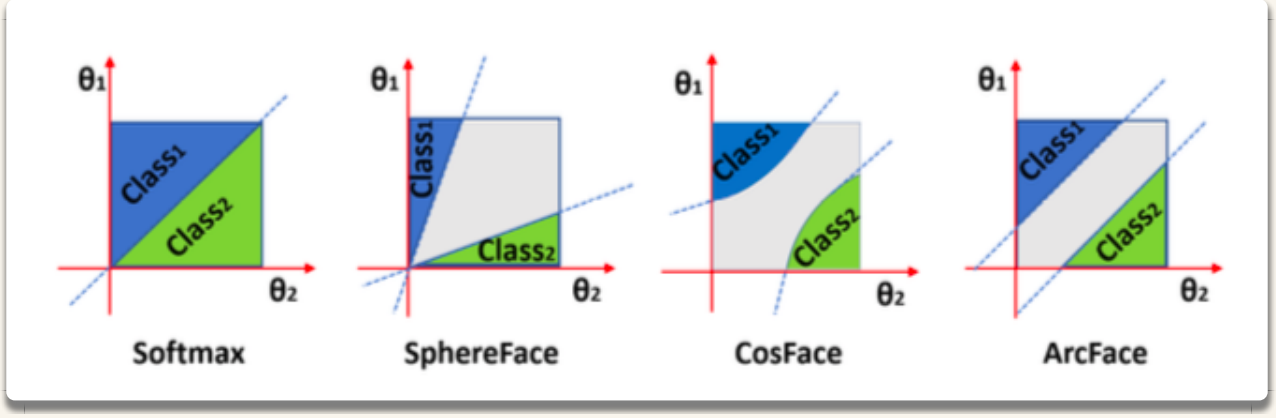


ArcFace

- 将softmax中 $W_{yi}^T x_i = ||W_j|| \cdot ||x_i|| cos\theta_j$，通过L2正则使 $||Wj|| = 1$ ， $||x_i||$ rescale to s
- 计算 $arccos\theta_{yi}$ 得到feature x_i 和 ground truth weight W_{yi} 的角度
- ArcFace:
  - 惩罚项m用来增大种内关系和种间差异 (enhance the intra-class compactness and inter-class discrepancy)

$$L_3 = -\frac{1}{N}\sum_{i=1}^{N}\log\frac{e^{s(\cos(\theta_{y_i}+m))}}{e^{s(\cos(\theta_{y_i}+m))}+\sum_{j=1,j\neq y_i}^{n}e^{s\cos\theta_j}}. \tag{3}$$

- Geometric Difference 几何差异
  - 虚线表示决策边界



Margin of Lost

Loss Functions	Decision Boundaries
Softmax	$(W_1 - W_2)\, x + b_1 - b_2 = 0$
L-Softmax [126]	$\|\|x\|\| \left(\|\|W_1\|\| \, cos(m\theta_1) - \|\|W_2\|\| \, cos(\theta_2)\right) > 0$
A-Softmax [125]	$\|\|x\|\| \left(cosm\theta_1 - cos\theta_2\right) = 0$
CosineFace [205]	$\hat{x}\left(cos\theta_1 - m - cos\theta_2\right) = 0$
ArcFace [42]	$\hat{x}\left(cos\left(\theta_1 + m\right) - cos\theta_2\right) = 0$