Marginal Loss for Deep Face Recognition

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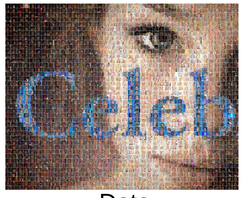
Introduction

Deep Face Recognition: Data, Network, and Loss.

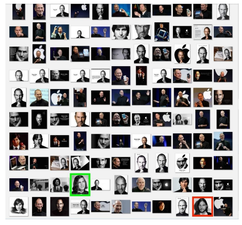


Data

Network

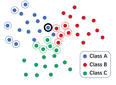
Loss

Overview



MS-Celeb-1M
(80K ids, 4M images)

ResNet (BN) -27



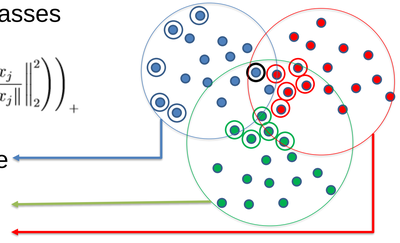
Marginal-loss

Marginal Loss

Optimization Objective: minimizing the intra-class variations while keeping the distances of inter-classes

$$L_m = \frac{1}{m^2 - m} \sum_{i,j,i \neq j}^{m} \left(\xi - y_{ij} \left(\theta - \left\| \frac{x_i}{\|x_i\|} - \frac{x_j}{\|x_j\|} \right\|_2^2 \right) \right)_+$$

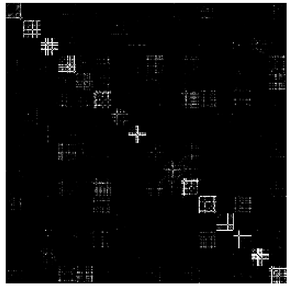
- Decrease intra-class distance
- Increase inter-class distance



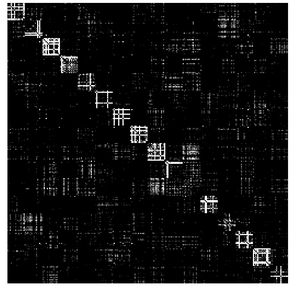
Marginal pairs

Experiments

- Marginal Loss Enhancement: Off-line class centre ranking



Random



Nearest neighbour

- Labelled Face in the Wild (LFW) & Youtube Face (YTF)

Methods	Images	LFW (%)	YTF (%)
DeepID [SCWT14]		99.47	93.20
VGG Face [PVZ15]	2.6M	98.95	97.30
Deep Face [TYRW14]	4M	97.35	91.40
Fusion [TYRW15]	500M	98.37	
FaceNet [SKP15]	200M	99.63	95.10
Baidu [LDB+15]	1.3M	99.13	
Center Loss [WZLQ16]	0.7M	99.28	94.9
Range Loss [ZFW+16]	1.5M	99.52	93.70
Multibatch [TRSS+16]	2.6M	98.8	
Aug [MTH+16]	0.5M	98.06	
Softmax Loss	4M	98.87	94.16
Marginal Loss	4M	99.48	95.98

- Cross-Age Celebrity Dataset (CACD) and AgeDB

Methods	Acc (%)
High-Dimensional LBP [CCWS13]	81.6
Hidden Factor Analysis [GLL+13]	84.4
Cross-Age Reference Coding [CCH14]	87.6
LF-CNNs [WLQ16]	98.5
Human Average	85.7
Human Voting	94.2
Centre Loss [WZLQ16]	97.475
Marginal Loss	98.95

Methods	5 Yr	10 Yr	20 Yr	30 Yr
VGG Face [PVZ15]	93.15	92.18	89.15	85.08
Centre Loss [WZLQ16]	95.93	95.15	93.07	90.72
Marginal Loss	98.12	97.95	97.15	95.75

5 Yr
10 Yr
20 Yr
30 Yr

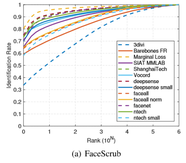
- Mega Face
- Intra-variance of Probe Set

FaceScrub

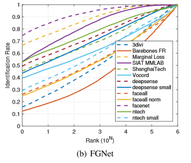
Challenging Age Variations

FG-Net

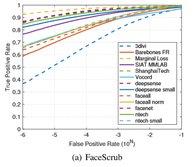
- CMC&ROC curves of different methods with 1M distractors on Set1.



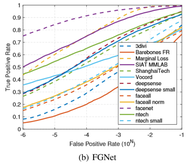
(a) FaceScrub



(b) FGNet



(a) FaceScrub



(b) FGNet

- Identification rates and verification TAR at 10e-6 FAR

Methods	protocol	Id (%)	Ver(%)
YouTu Lab	Large	**83.290**	91.340
DeepSense V2	Large	81.298	**95.993**
Vocord deepVo1.2	Large	80.258	77.143
Google FaceNet v8	Large	70.496	86.473
GRCCV	Small	77.677	74.887
SphereFace	Small	75.766	90.045
DeepSense	Small	70.983	82.851
Centre Loss [WZLQ16]	Small	65.234	76.516
Marginal Loss	Large	80.278	92.640

FaceScrub

Methods	protocol	Id (%)	Ver(%)
Google FaceNet v8	Large	**74.594**	**75.550**
SIATMMLAB	Large	71.247	67.954
DeepSense V2	Large	63.632	56.767
SIAT MMLAB	Small	55.304	50.144
SphereFace	Small	47.555	40.094
DeepSense	Small	43.540	29.610
Marginal Loss	Large	66.432	43.703

FG-Net

Reference

- Wen Y, Zhang K, Li Z, et al. A discriminative feature learning approach for deep face recognition. ECCV, 2016
- Tadmor O, Wexler Y, Rosenwein T, et al. Learning a metric embedding for face recognition using the multi-batch method. NIPS, 2016.
- Zhang X, Fang Z, Wen Y, et al. Range Loss for Deep Face Recognition with Long-tail. arXiv:1611.08976, 2016.