



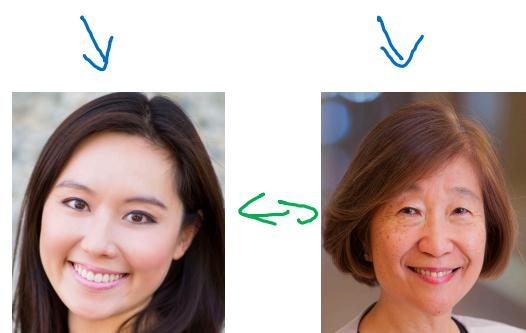
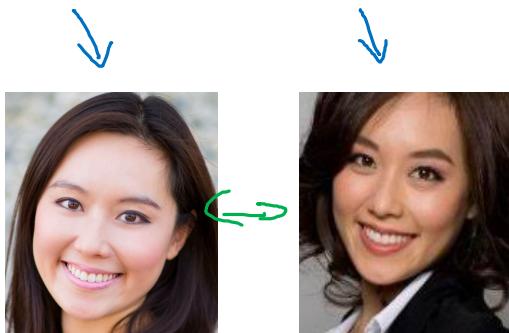
deeplearning.ai

# Face recognition

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## Triplet loss

# Learning Objective



Anchor A      Positive P

$$\frac{d(A, P) = 0.5}{\|f(A) - f(P)\|^2}$$

Want:  $\frac{\|f(A) - f(P)\|^2}{d(A, P)} + \alpha \leq 0.2$

Anchor A      Negative N

$$\frac{d(A, N) = 0.7}{\|f(A) - f(N)\|^2}$$

$$\frac{\|f(A) - f(P)\|^2 - \|f(A) - f(N)\|^2}{\|f(A) - f(P)\|^2} + \alpha \leq 0 \quad \text{Margin}$$

$f(\text{img}) = \vec{0}$

[Schroff et al., 2015, FaceNet: A unified embedding for face recognition and clustering]

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# Loss function

Given 3 images

$A, P, N$ :

$$L(A, P, N) = \max \left( \frac{\|f(A) - f(P)\|^2 - \|f(A) - f(N)\|^2 + \lambda}{\epsilon}, 0 \right)$$

$$J = \sum_{i=1}^m L(A^{(i)}, P^{(i)}, N^{(i)})$$

$A, P$

Training set:  $\underbrace{10k}_{\infty}$  pictures of  $\underbrace{1k}_{\infty}$  persons

# Choosing the triplets A,P,N

During training, if A,P,N are chosen randomly,  
 $d(A, P) + \alpha \leq d(A, N)$  is easily satisfied.

$$\underbrace{\|f(A) - f(P)\|^2}_{\approx d(A, P)} + \alpha \leq \underbrace{\|f(A) - f(N)\|^2}_{\approx d(A, N)}$$

Choose triplets that're “hard” to train on.

$$\begin{aligned} \cancel{\alpha(A, P)} + \alpha &\leq \cancel{\alpha(A, N)} \\ \frac{\alpha(A, P)}{\downarrow} &\approx \frac{\alpha(A, N)}{\uparrow} \end{aligned}$$

Face Net  
Deep Face



[Schroff et al., 2015, FaceNet: A unified embedding for face recognition and clustering]



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# Training set using triplet loss

Anchor



Positive



Negative



:

:

:



J

$$d(x^{(i)}, x^{(j)})$$

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