

Face Recognition

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Challenge of Face Recognition

Question: Why not using Softmax classifier (as in image recognition)?



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Question: Why not using Softmax classifier (as in image recognition)?

- Softmax classifier is a dense layer with Softmax activation.
- #class is large (can be millions or billions).
- #parameters in the output layer is huge!
 - Suppose the input shape of Softmax classifier is $1K$.
 - Suppose #class is $10M$.
 - Then #parameters = $1K \times 10M = 10G$.

Training

Randomly Sample a Triplet

positive \mathbf{x}^+



anchor \mathbf{x}^a



negative \mathbf{x}^-



Feature Extraction using CNN

positive

\mathbf{x}^+



\mathbf{f}



$\mathbf{f}(\mathbf{x}^+)$

anchor

\mathbf{x}^a



\mathbf{f}



$\mathbf{f}(\mathbf{x}^a)$

negative

\mathbf{x}^-

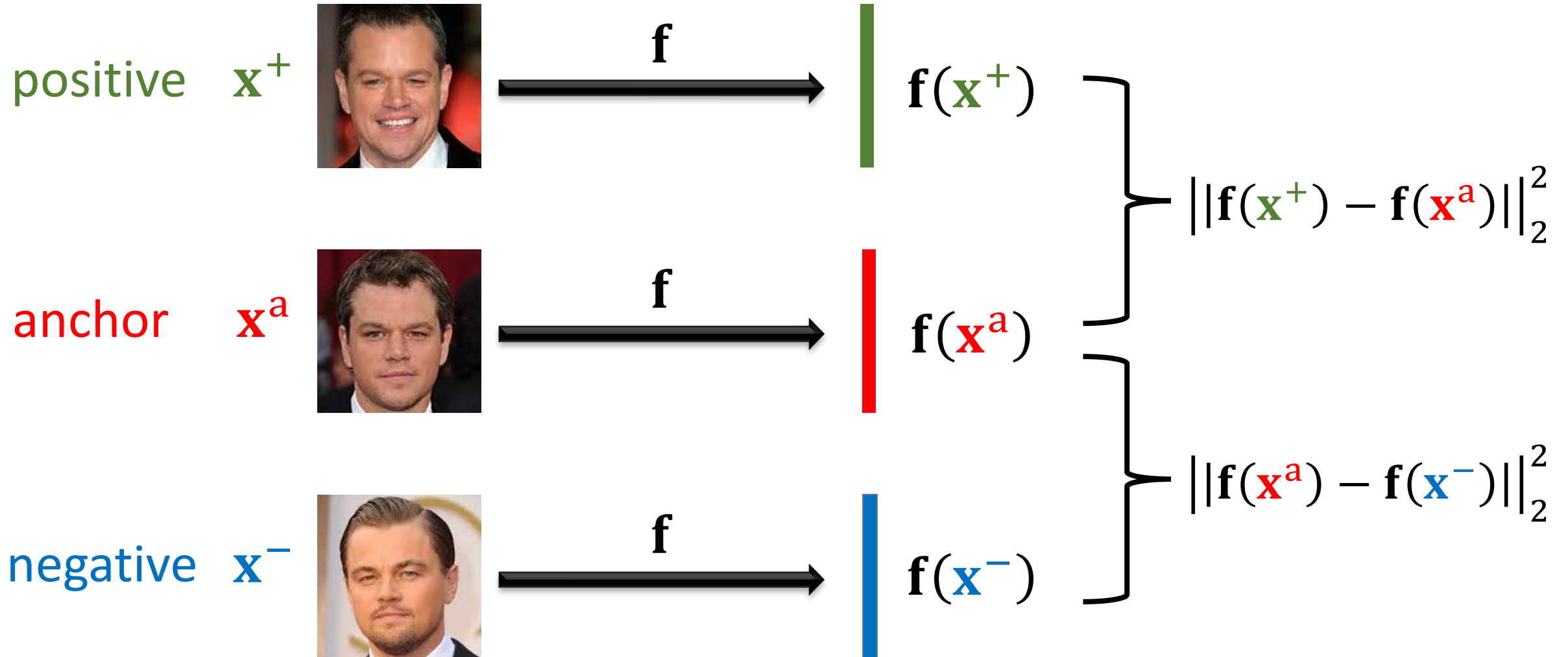


\mathbf{f}



$\mathbf{f}(\mathbf{x}^-)$

Loss Functions



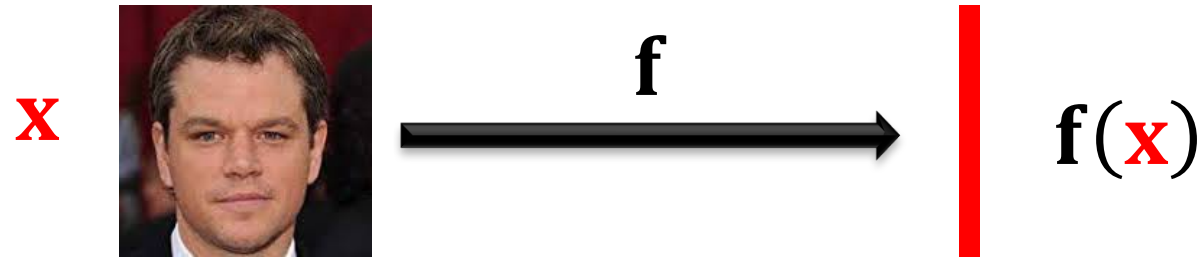
Loss Functions

- N triplets: $(\mathbf{x}_1^a, \mathbf{x}_1^+, \mathbf{x}_1^-), (\mathbf{x}_2^a, \mathbf{x}_2^+, \mathbf{x}_2^-), \dots, (\mathbf{x}_N^a, \mathbf{x}_N^+, \mathbf{x}_N^-)$.
 - N can be far larger than n (#samples).
- Optimization model:

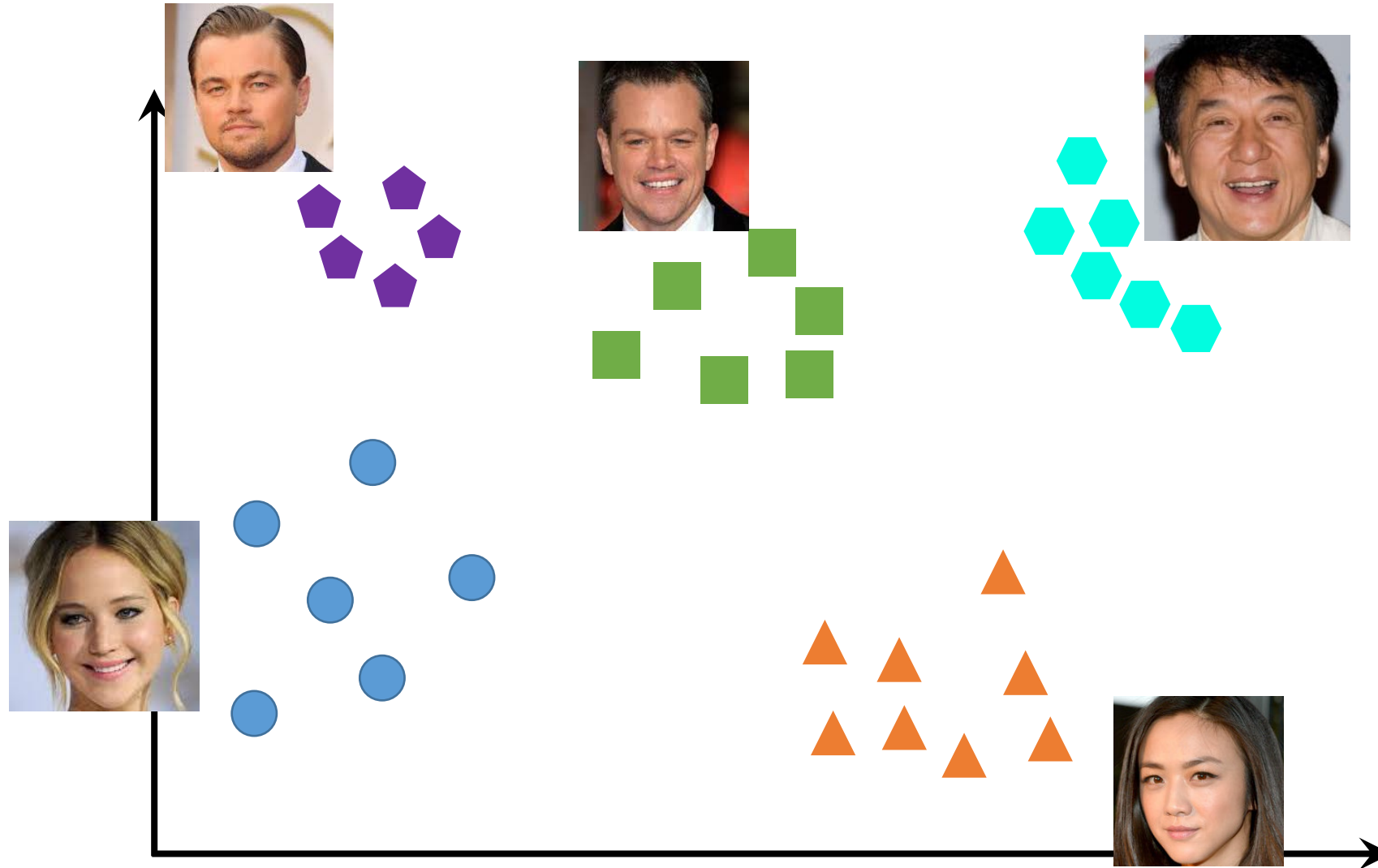
$$\min \frac{1}{N} \sum_{i=1}^N \left[\|\mathbf{f}(\mathbf{x}_i^+) - \mathbf{f}(\mathbf{x}_i^a)\|_2^2 - \|\mathbf{f}(\mathbf{x}_i^a) - \mathbf{f}(\mathbf{x}_i^-)\|_2^2 \right].$$

Prediction

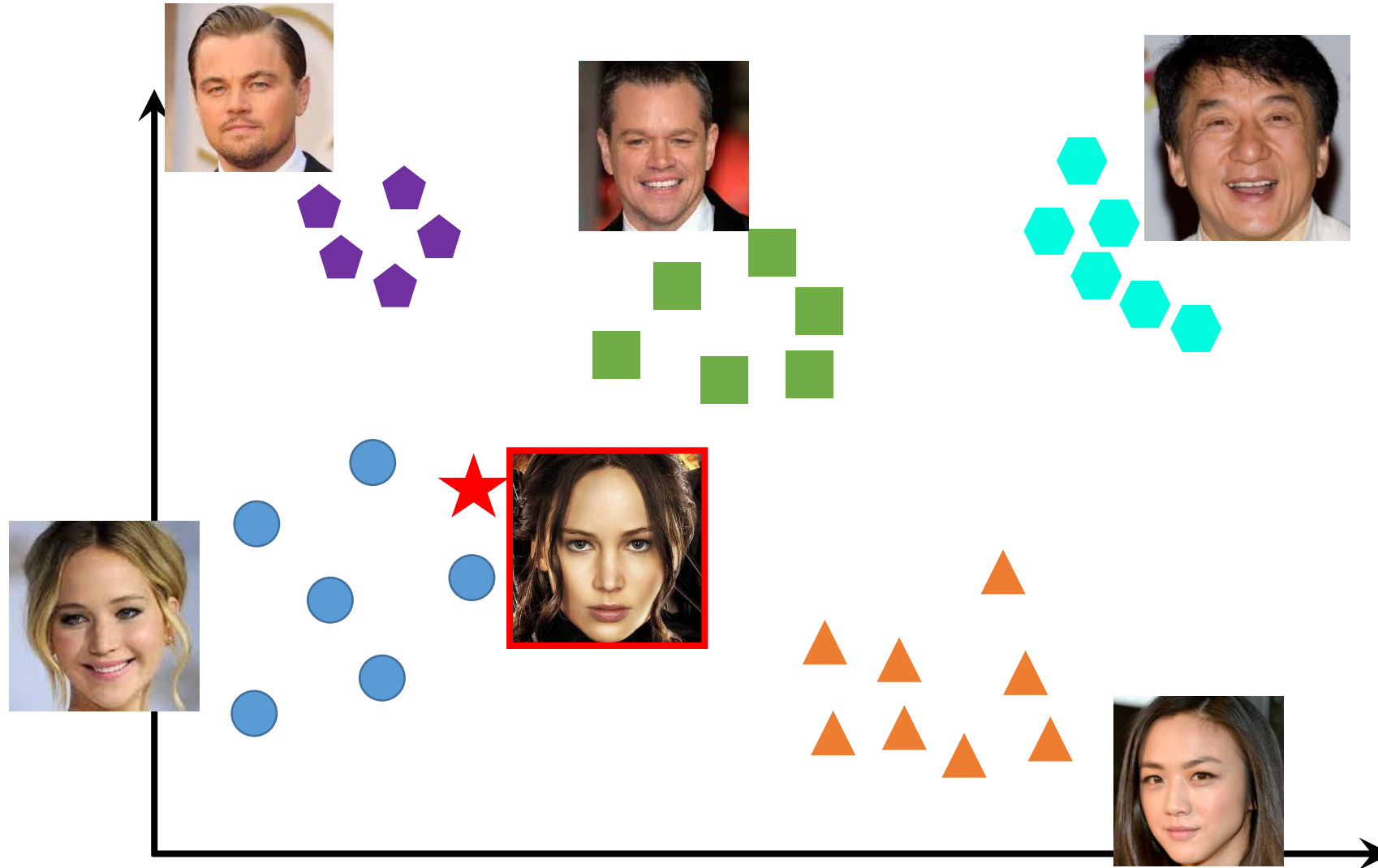
1. Feature Extraction for All the Training Photos



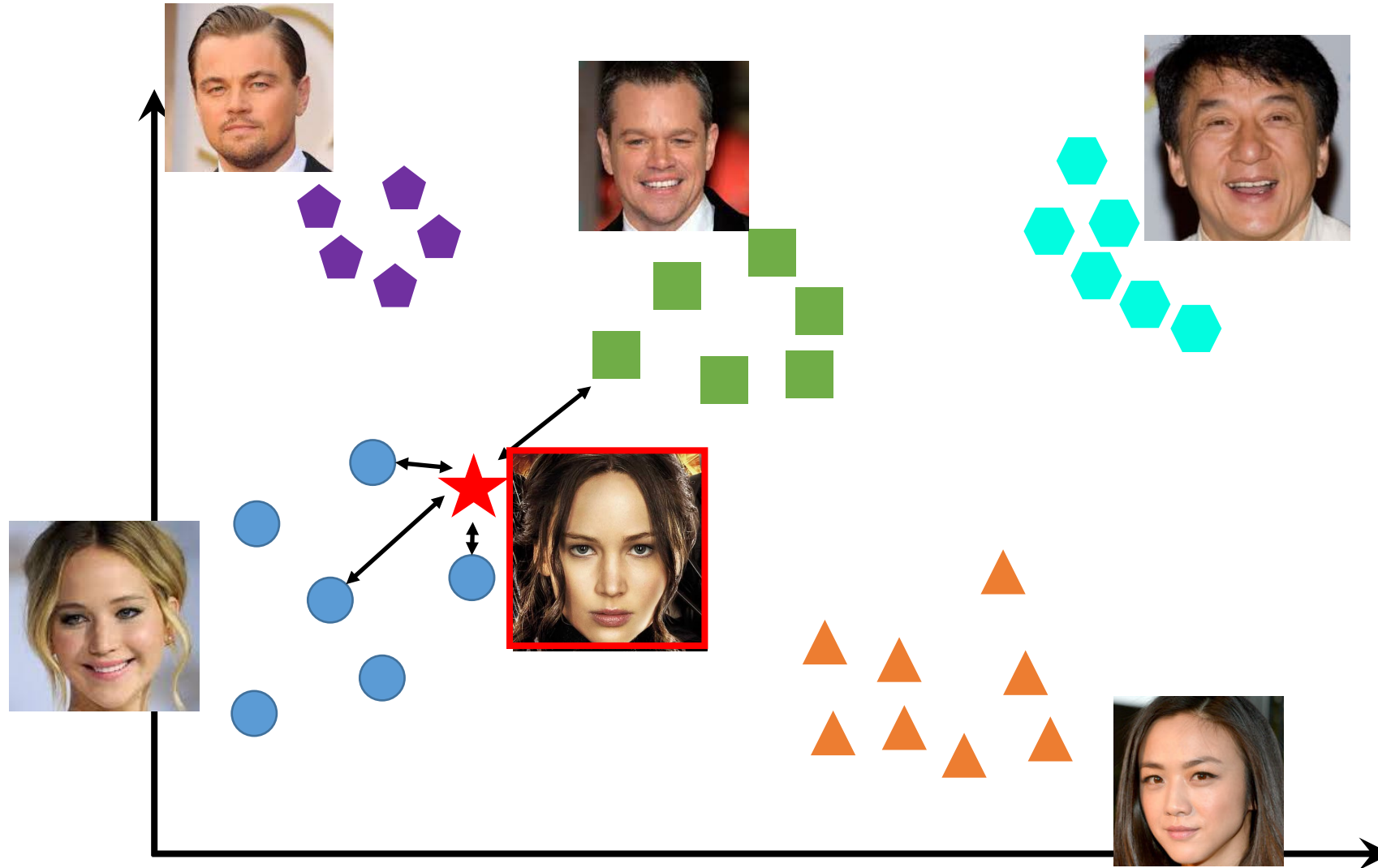
1. Feature Extraction for All the Training Photos



2. Feature Extraction for Test Sample



3. KNN Classifier



Keras Implementation

- <http://krasserm.github.io/2018/02/07/deep-face-recognition/>