Cast Search by Portrait with Face Recognition and Person Re-Identification

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Outline

☐ **Overview**
  ■ Cast search by portrait
  ■ Framework

☐ **Solutions**
  ■ Face Search
  ■ Gallery Reduction
  ■ Body Search

☐ **Results**

Cast Search by Portrait

☐ Query: image from the homepage of the cast in IMDb or TMDb

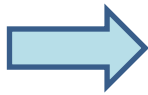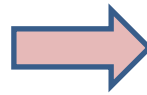☐ Gallery: candidates extracted from the key frames of the movie
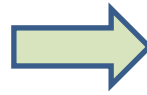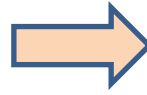
Toy Example

☐ Two-step search
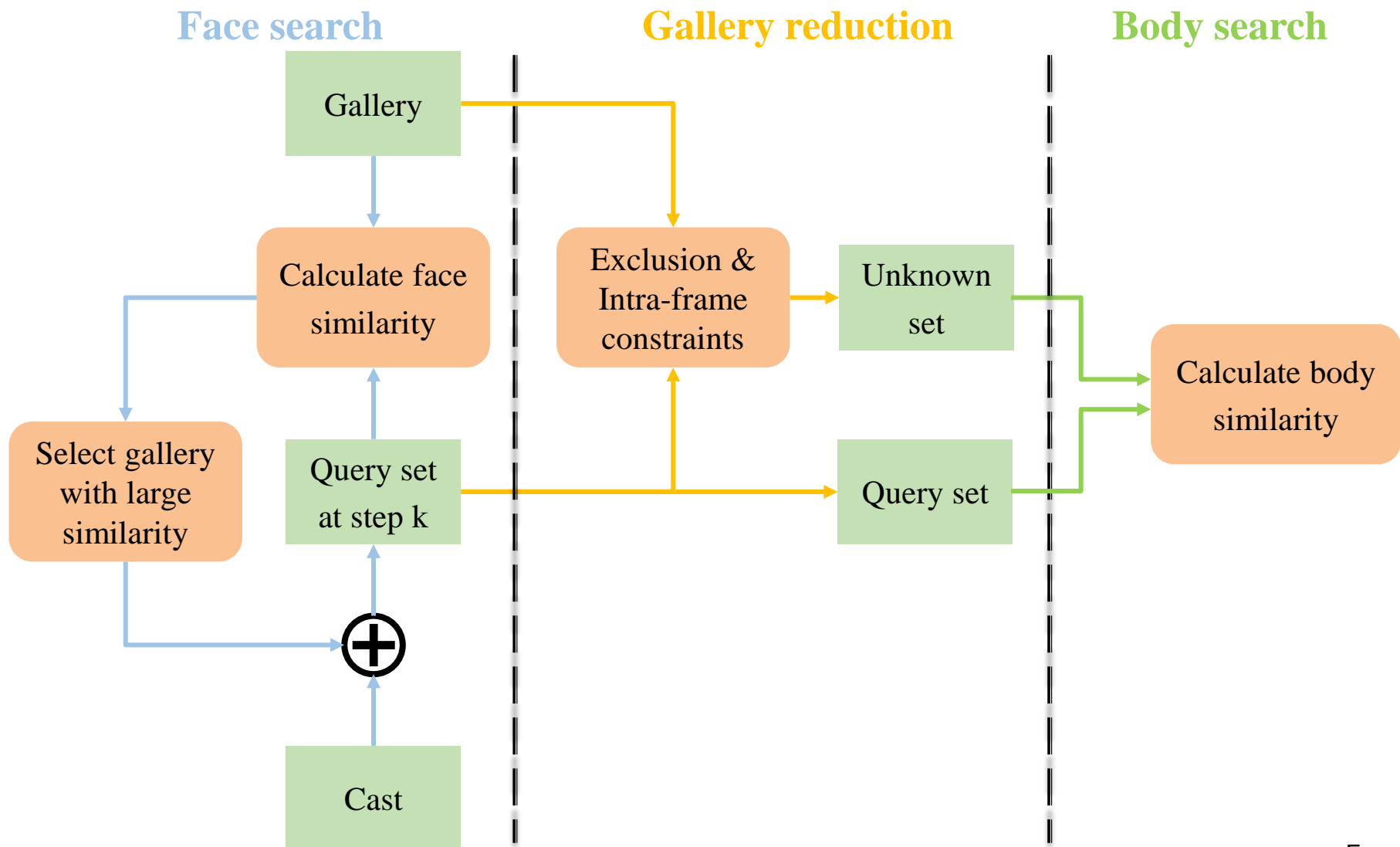   ■ Face recognition & Person re-identification

Query image

Face search results

Body search results

Framework

Outline

Face Search

- ☐ Face detection & selection
  - ■ Face detection: RetinaFace
  - ■ Face selection
    - ➢ Large detection score
    - ➢ Large bbox area
    - ➢ Small distance with image center
    - ➢ P = score * area / dist: select bbox with the largest P.

Jiankang Deng, Jia Guo, Yuxiang Zhou, Jinke Yu, Irene Kotsia, Stefanos Zafeiriou. "RetinaFace: Single-stage Dense Face Localisation in the Wild". *arXiv preprint arXiv:1905.00641, 2019.*
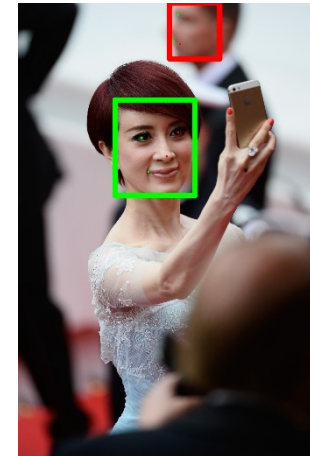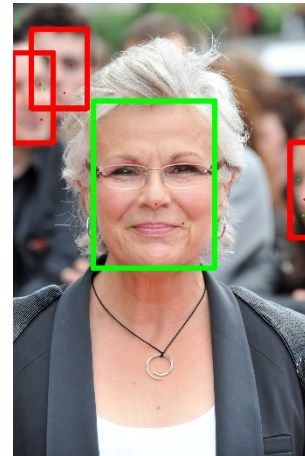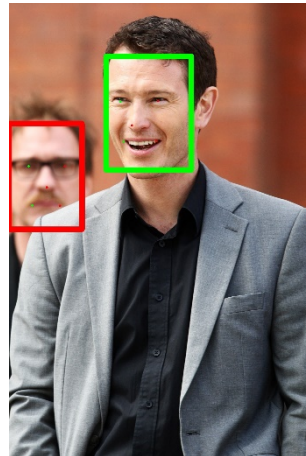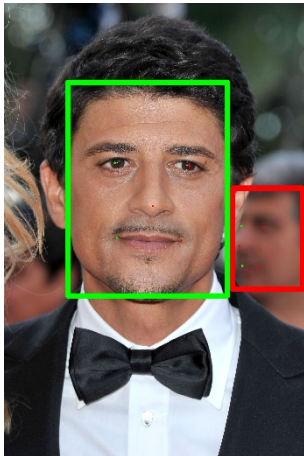
Face Search

- ☐ ArcFace for feature extraction
  - ∎ Given a movie, there are M cast images and N gallery images:
  $$C = \{c_i\}_{i=1}^{M} \quad G = \{g_j\}_{j=1}^{N}$$

- ☐ Multiple search
  - ∎ K thresholds: $th_1 \geq th_2 \cdots \geq th_K$
  - ∎ Query set for c_i at step k: Q_i^k
  - ∎ Similarity between g_j and query set Q_i^k:
  $$s_{i,j}^k = \frac{1}{|Q_i^k|} \sum_{q \in Q_i^k} s(q, g_j)$$

  - ∎ Update the query set at step k+1 Q_i^{k+1}:
  $$Q_i^{k+1} = Q_i^k \cup \{g_j | s_{i,j}^k > th_k\}$$

  - ∎ Initial query set for c_i: $Q_i^1 = \{c_i\}$
  - ∎ Face search result for c_i: $Q_i = Q_i^{K+1} - \{c_i\}$

Jiankang Deng, Jia Guo, Niannan Xue, Stefanos Zafeiriou. "ArcFace: Additive Angular Margin Loss for Deep Face Recognition". *CVPR, 2019*.
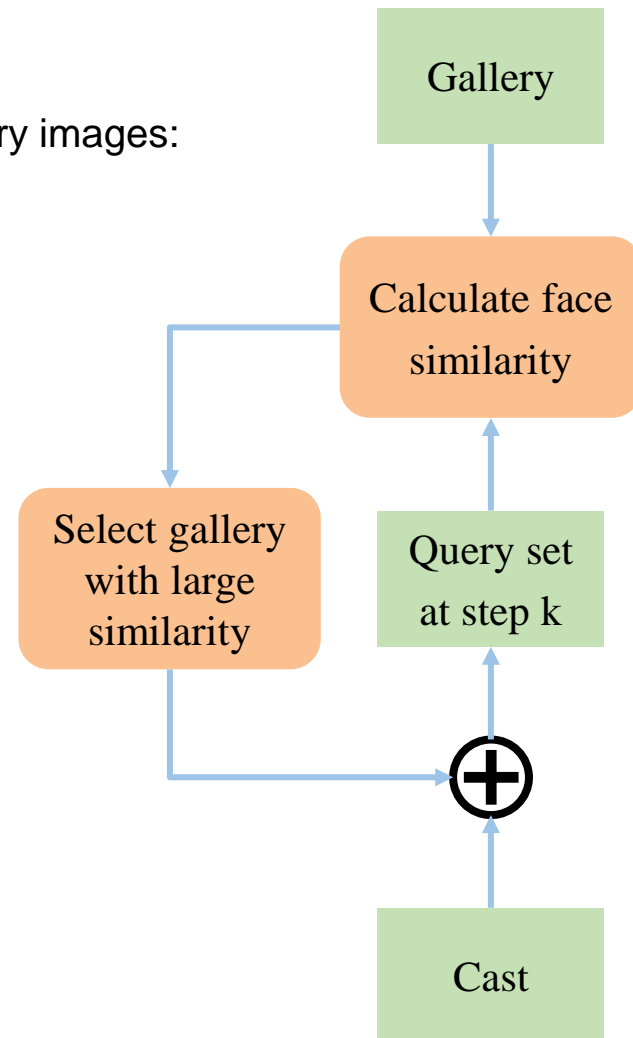
Gallery Reduction

☐ Exclusion Constraint (EC)
- If g_j is in the query set of c_i, with great possibilities, g_j is the true match of c_i.
- So g_j is not the true match of any other c_k.

☐ Intra-Frame Constraint (IFC)
- If g_j is in the query set of c_i, the candidates in the same frame with g_j are not the true match of c_i.
- All candidates in the same frame with any image in the query set of c_i :
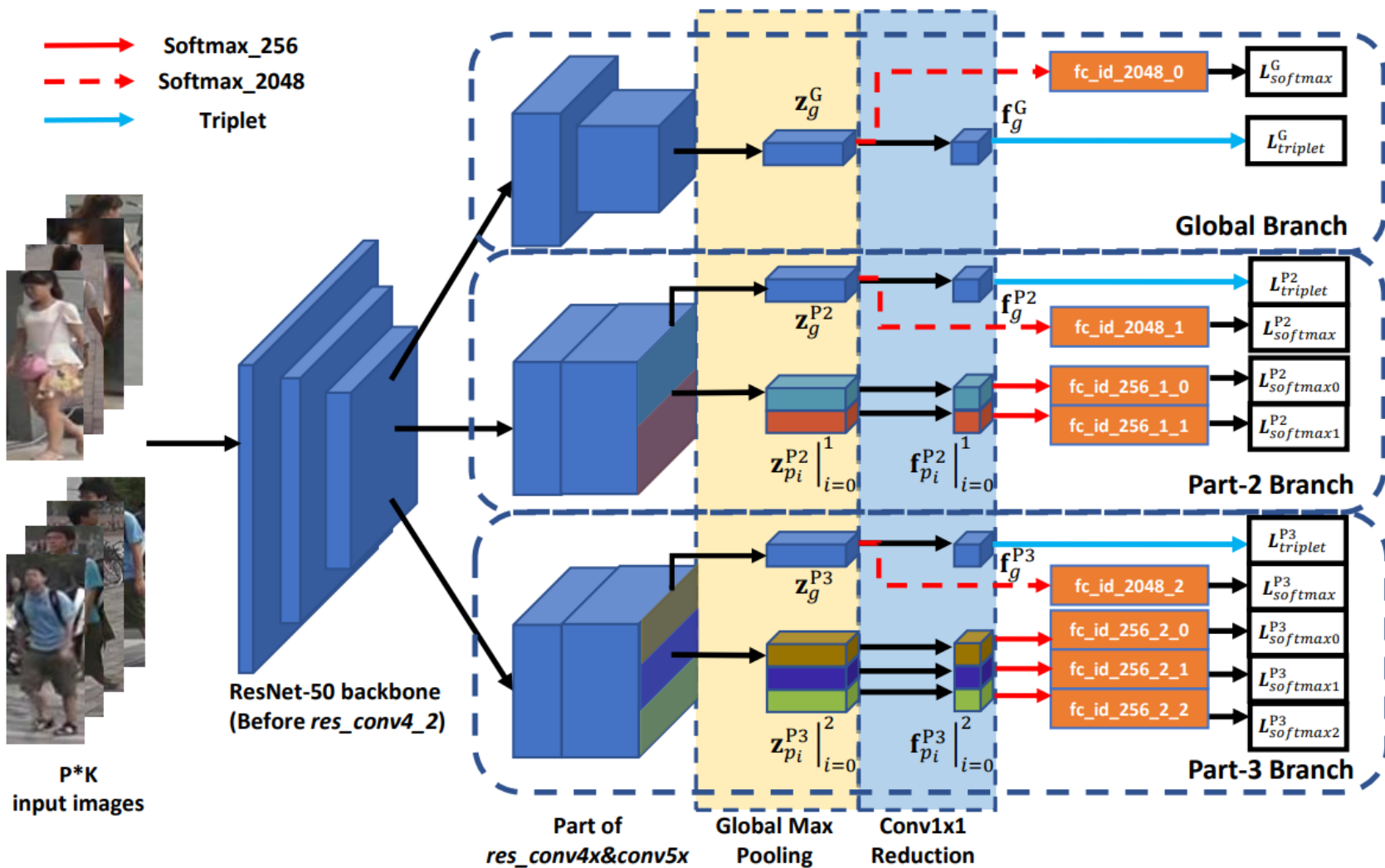
$$F_i = \{g_j | \exists g_k \in Q_i : f_j = f_k\}$$

☐ Gallery Reduction
- Query set of c_i : Q_i
- Unknown set of c_i : $U_i = G - \bigcup_m Q_m - F_i$

Body model

☐ Multi-Granularity Network (MGN)

Body Search

☐ Person re-identification model
- Train the MGN model with cross entropy loss and batch hard triplet loss.
- Compute the features of query set and unknown set.

☐ KNN feature
- For each feature, find its K nearest neighbors, and use these K neighbors to update the feature by a weighted sum operation.

☐ Top-k similarity
- The similarity between g_j and query set Q_i is the mean of the top-k similarities.

Guanshuo Wang, Yufeng Yuan, Xiong Chen, Jiwei Li, Xi Zhou. "Learning discriminative features with multiple granularities for person re-identification". *ACMMM, 2018*.
Alexander Hermans, Lucas Beyer, Bastian Leibe. "In Defense of the Triplet Loss for Person Re-Identification". *arXiv preprint arXiv:1703.07737, 2017*.

Outline

Results

☐ Face Search & Gallery Reduction

- ■ Multiple search: improve both precision and recall
- ■ IFC: Intra-Frame Constraint
- ■ EC: Exclusion Constraint

Method	mAP	Precision	Recall
Wider	60.01	-	-
Single	71.92	92.08	63.20
Multiple	72.96	93.24	66.10
Multiple + IFC	73.14	-	-
Multiple + EC	75.54	-	-
Multiple + IFC + EC	75.74	-	-

Results

□ Body Search

- ■ Body: about 10% improvement
- ■ Top-k: Top-k similarity
- ■ KNN: KNN feature
- ■ Re-ranking: k-reciprocal re-ranking

Method	mAP
Face	75.74
Face + Body	86.10
Face + Body + Top-k	86.34
Face + Body + KNN	87.29
Face + Body + Top-k + KNN	87.70
Face + Body + Top-k + KNN + re-ranking	87.98

Zhun Zhong, Liang Zheng, Donglin Cao, Shaozi Li. "Re-ranking person re-identification with k-reciprocal encoding". *CVPR, 2017*.

Results

□ Model Fusion
  - Face models: resnet200, resnet269
  - Body models: resnet152, resnext101, densenet201

Face	Body	mAP
Resnet200	Densenet201	87.70
Resnet269	Densenet201	87.53
All	Densenet201	87.83
All	Resnet152	87.55
All	Resnext101	87.78
All	All	88.10

Thank You!