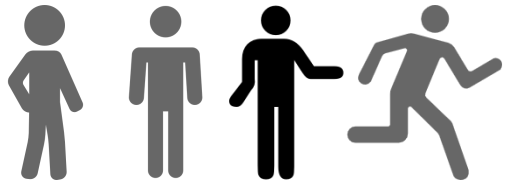
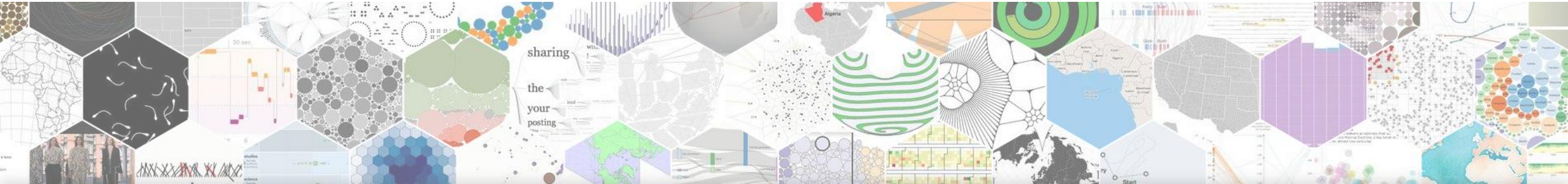
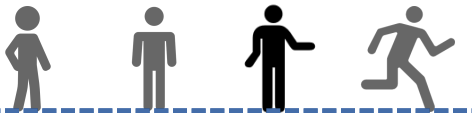
Towards Better Person Re-Identification through Interactive Visual Exploration and Incremental User Feedback



Reporter：Xiawang
Date：2022/5/31

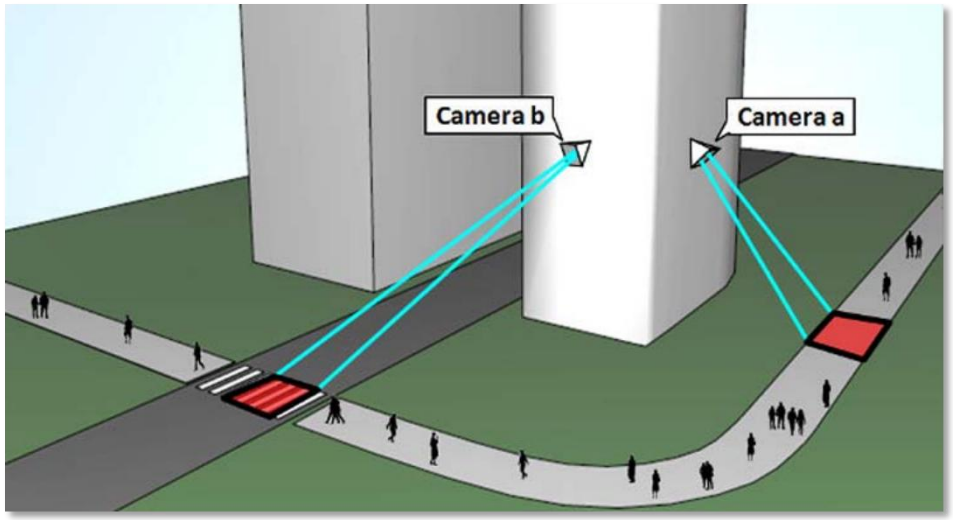


Content

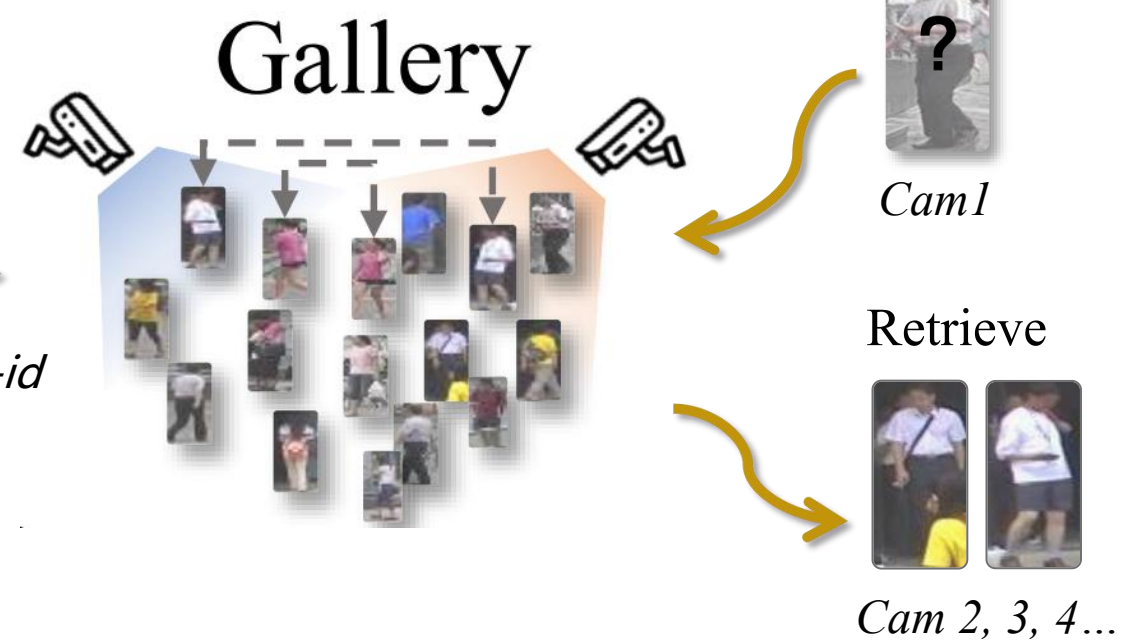


Background : What is Person Re-ID?

- **Application scenarios:** Surveillance Video, Security Field
- **Target task:** identify the *same pedestrian* under *different cameras*

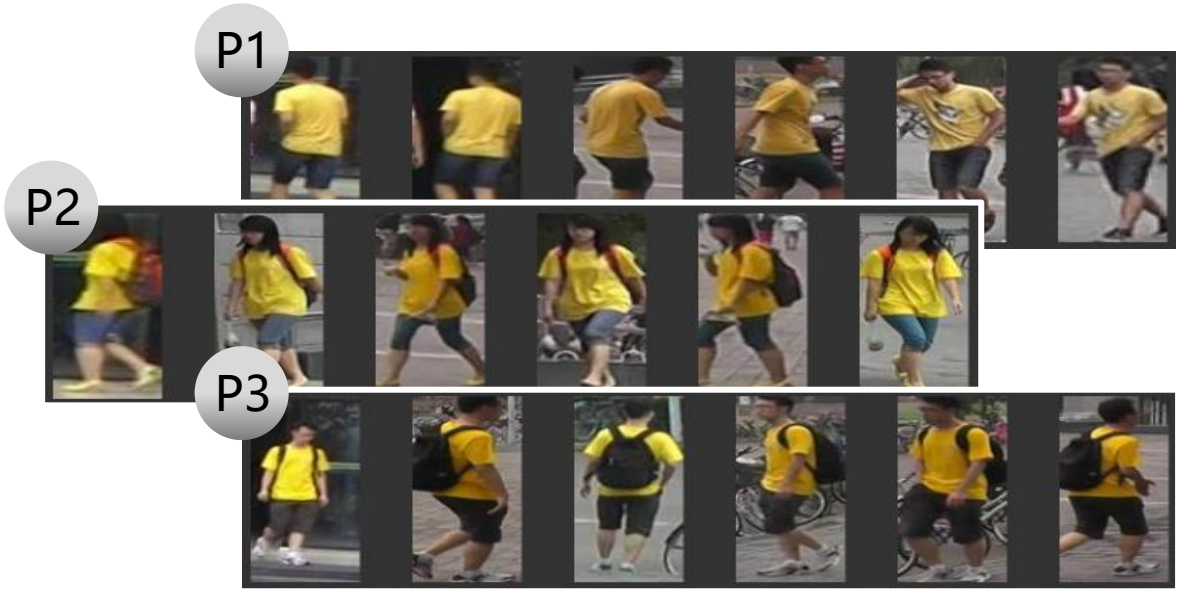


Person Re-id



Background : Difficulties in Person Re-ID

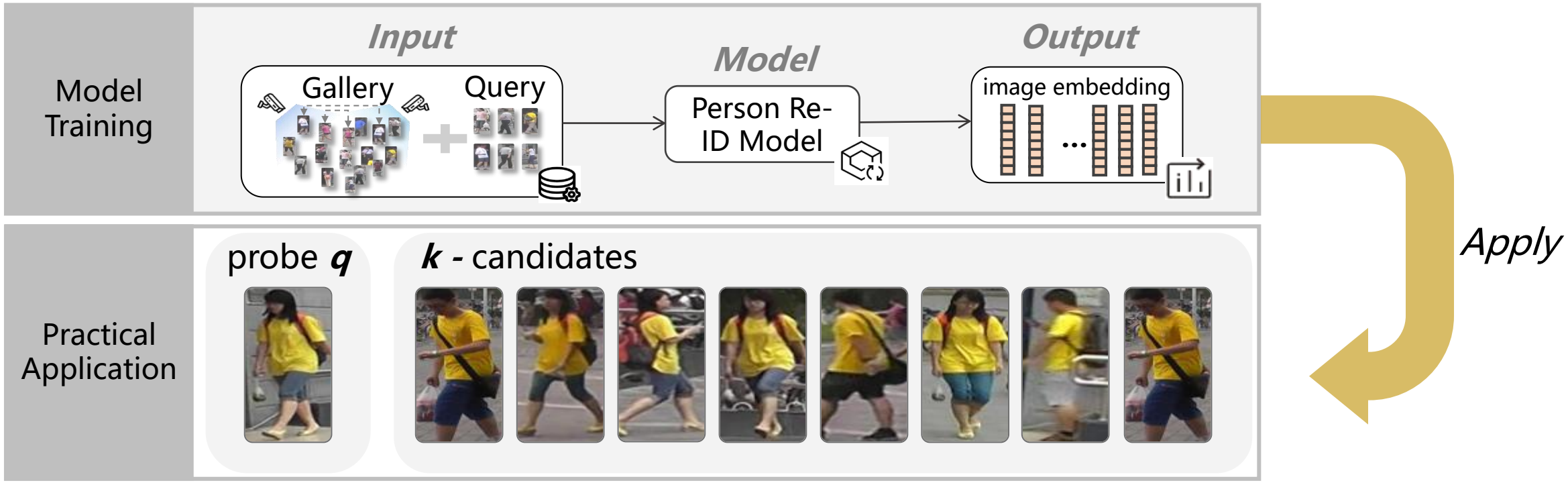
- **Challenge 1:** appearance variation of the same pedestrian is introduced due to viewing angle differences **(large inter-class differences)**
- **Challenge 2:** different pedestrians have similar appearances and require fine-grained distinction **(small intra-class differences)**



Does everyone like to wear yellow tops and dark pants?

Background: Person Re-ID in ML

- **Input-Output:** input data is *gallery* and *query*, output data is the *feature vector* of each image
- **Real-world deployment:** input probe ***q*** to the model, output ***k*** candidates sorted by similarity



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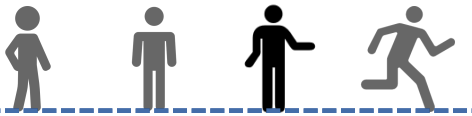


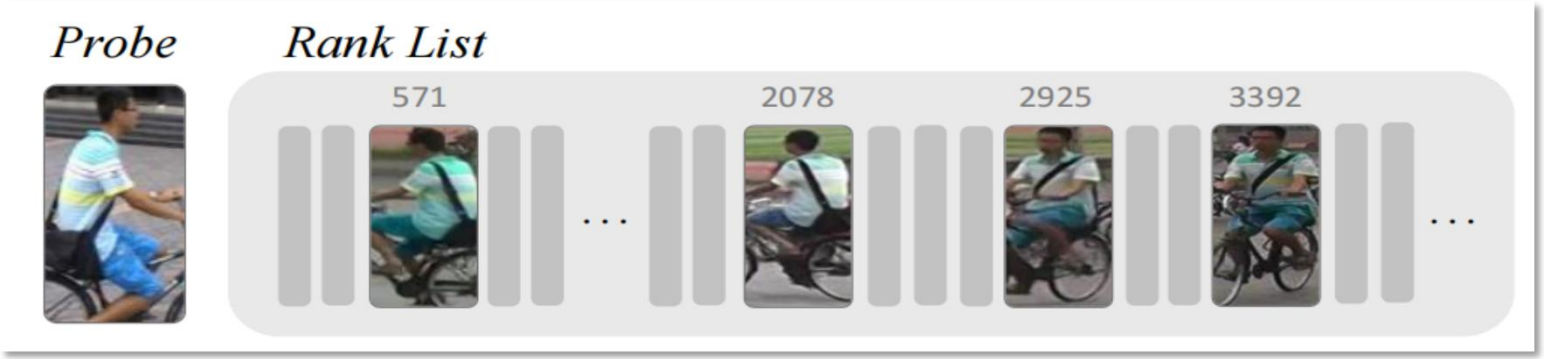
Challenges: Person Re-ID in real world

Challenge 1: Person Re-ID models are difficult to apply in real-world deployments

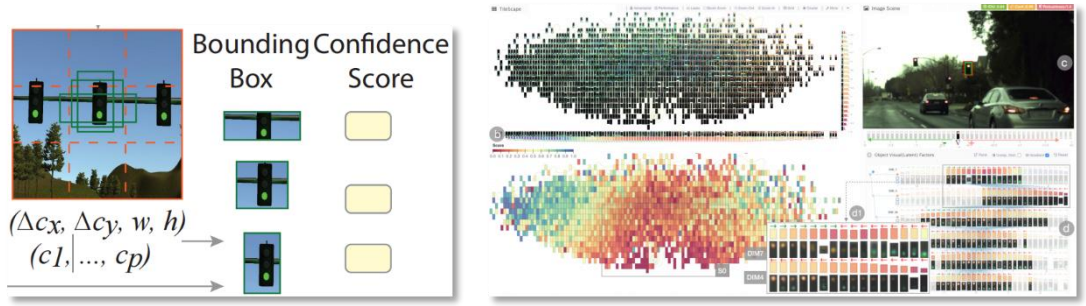
Cross-view appearance variations

Similar appearance among different people

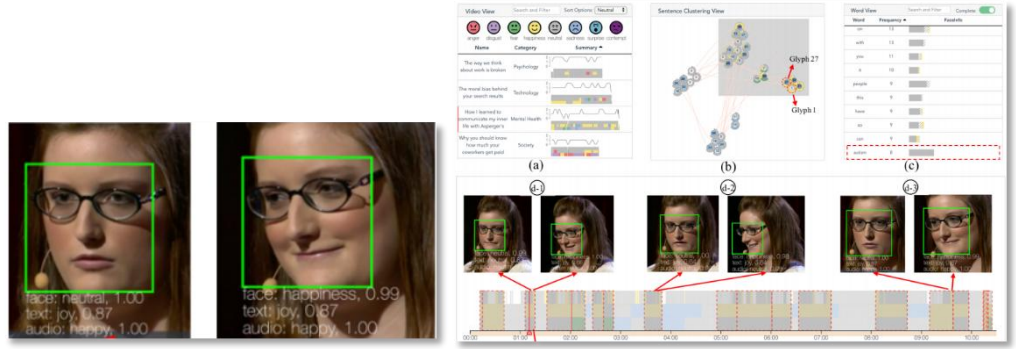
Challenge 2: Automatic Person Re-ID algorithms may get bad results



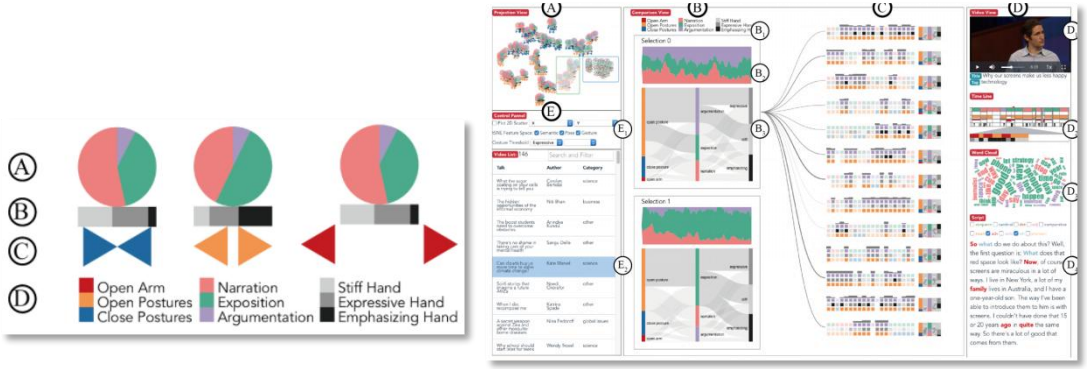
Related Works: Video X Vis



TVCG, 2020[1]



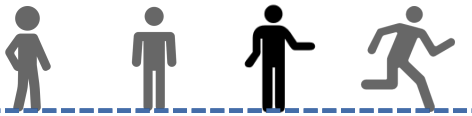
TVCG, 2019[3]



TCVG, 2018[2]

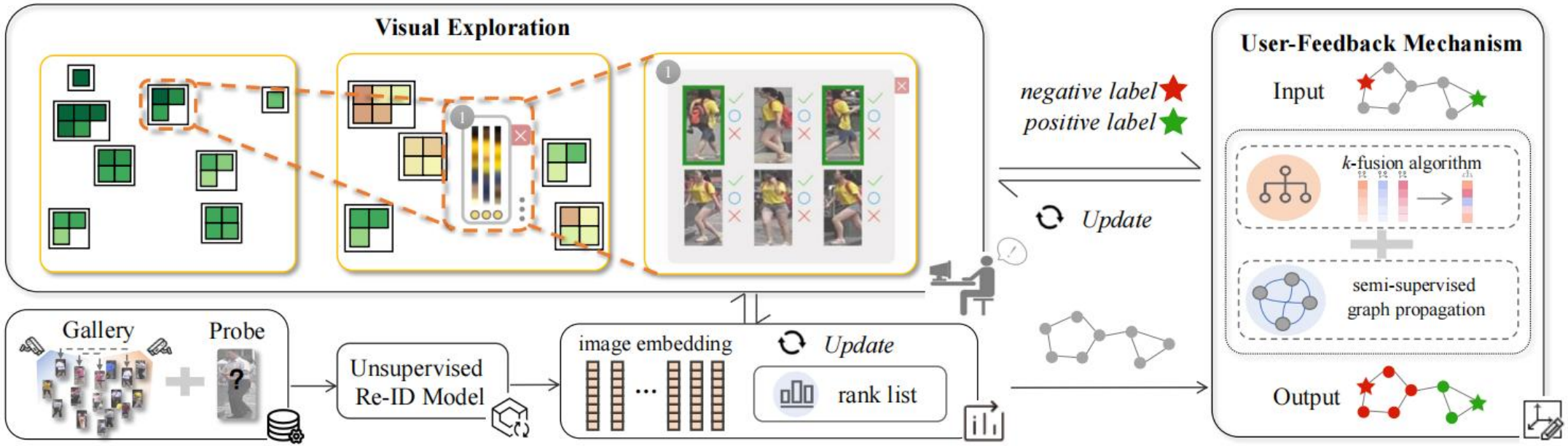
TVCG, 2020[4]

Content

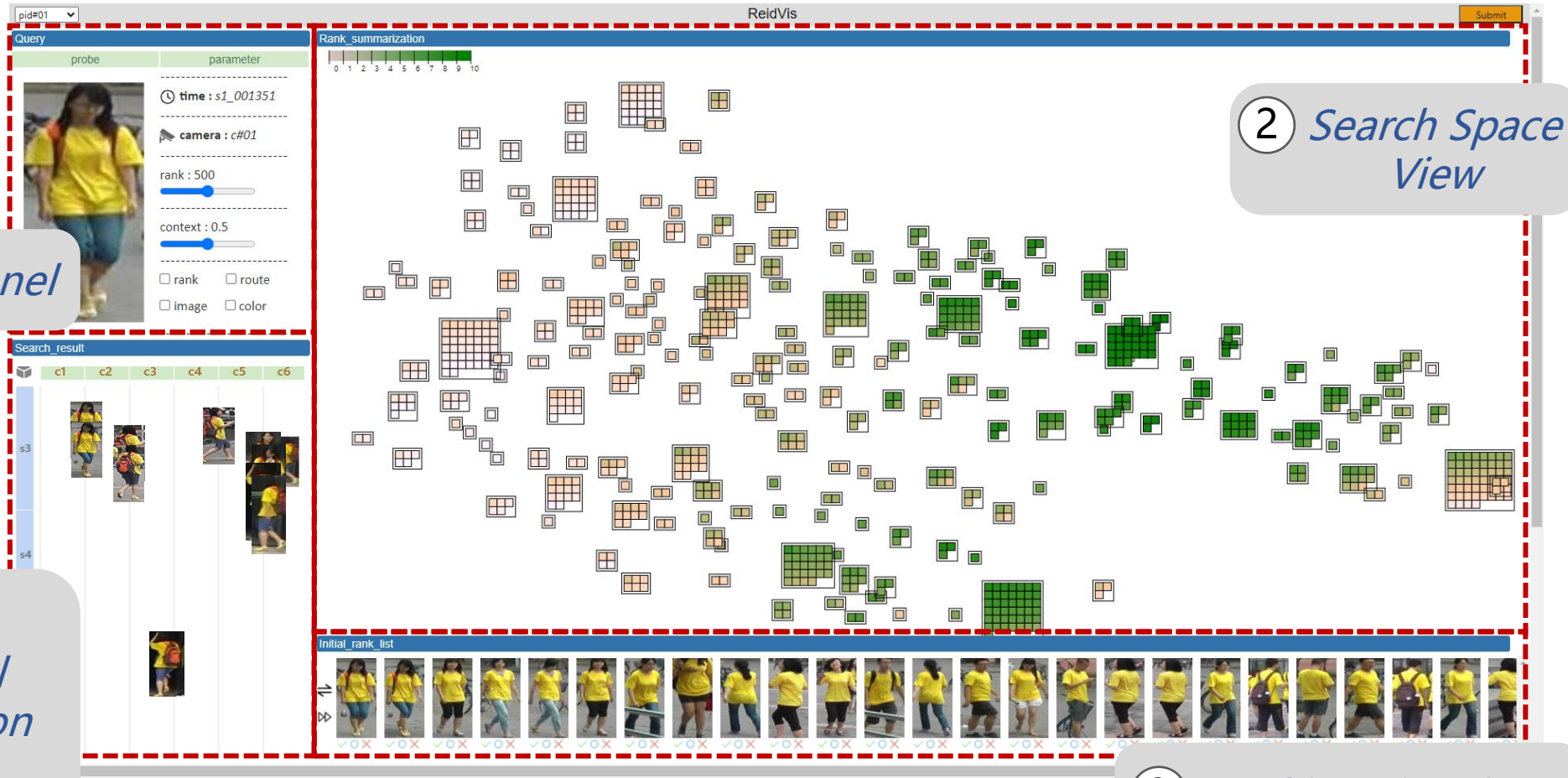


Requirements: Instance-based target tasks

- **Task 1:** Incorporate **human insights** iteratively in the post-rank refinement
- **Task 2:** **Summarize** the retrieved samples given a probe
- **Task 3:** **Guide** user to retrieve the person-of-interest in search space
- **Task 4:** Ensure the **content awareness** of the retrieved person-of-interest



Demo



1 *Probe Panel*

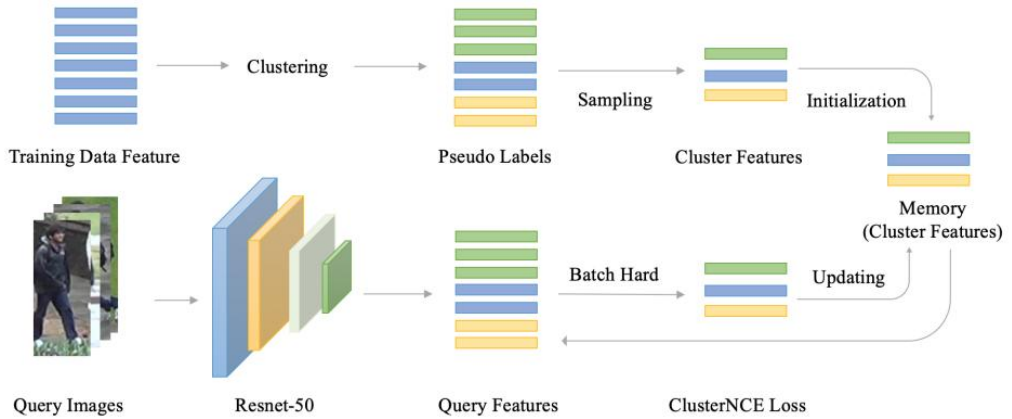
2 *Search Space View*

3 *Ranking List View*

4 *Spatio-temporal Information Panel*

Data Extraction: Extract model results

- **Dataset:** Market-1501
- **Data Extraction**
  - Step 1: acquire model generated ranking list
  - Step 2: image feature extraction
- **Data list**



[1]Dai Z, Wang G, Zhu S, et al. Cluster Contrast for Unsupervised Person Re-Identification. arXiv 2021[J]. arXiv preprint arXiv:2103.11568, 2021.

Varble	Description
pids	Person object ID
camids	camera ID
feature	512-dimensional vector
impath	image address
results	An array of results, used to match the Gallery image data

(1) Query

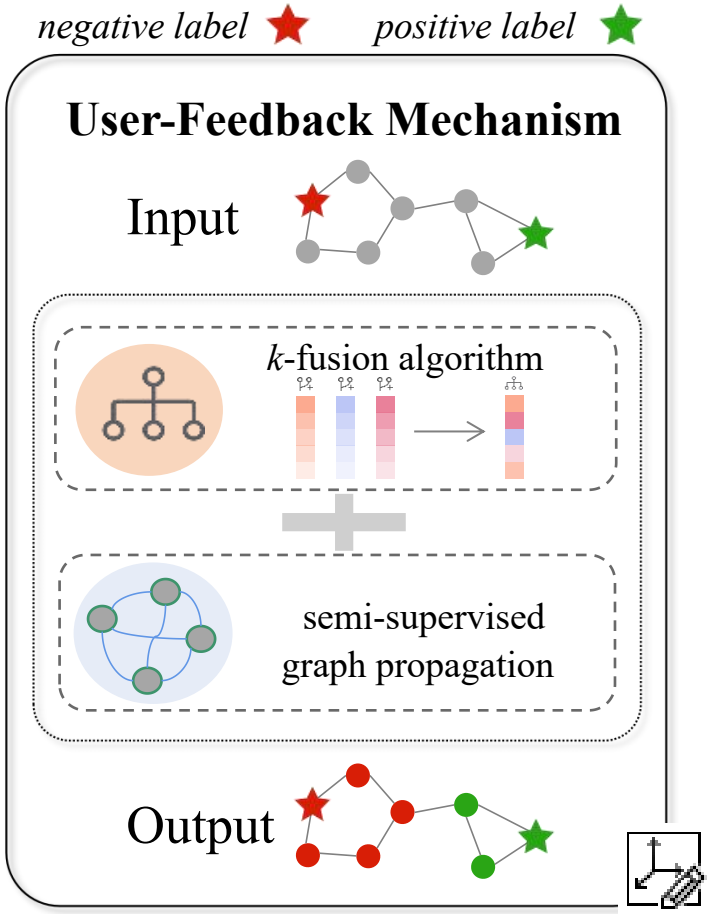
Varble	Description
pids	Person object ID
camids	camera ID
feature	512-dimensional vector
impath	image address

(2) Gallery

User-feedback Mechanism

- **Input:** Manual Label
- **Output:** Refined Ranking List
- **Algorithm:** Graph Propagation

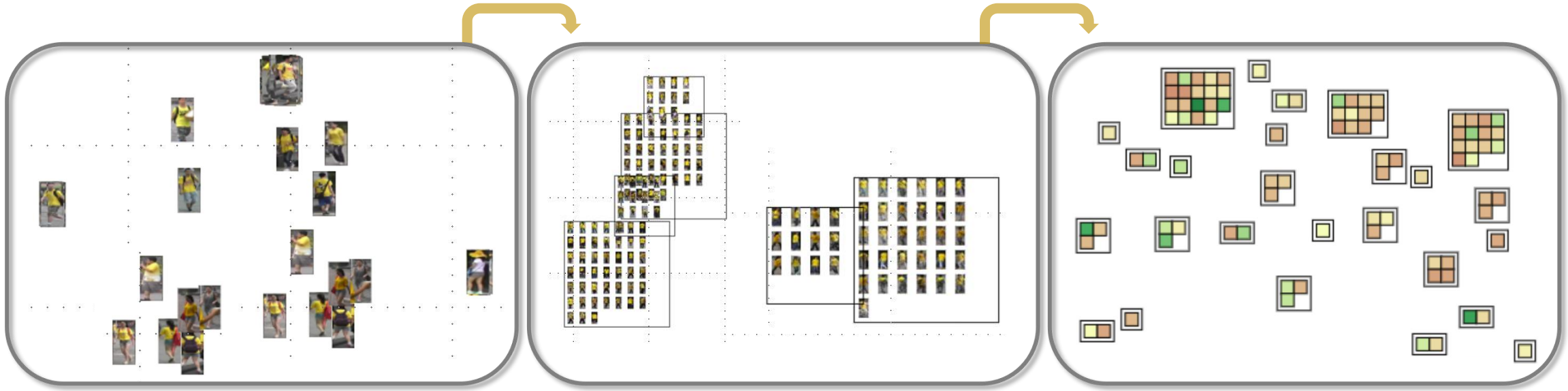
(1) Ranking List View



(2) User-feedback Mechanism

Visual Design: search space overview

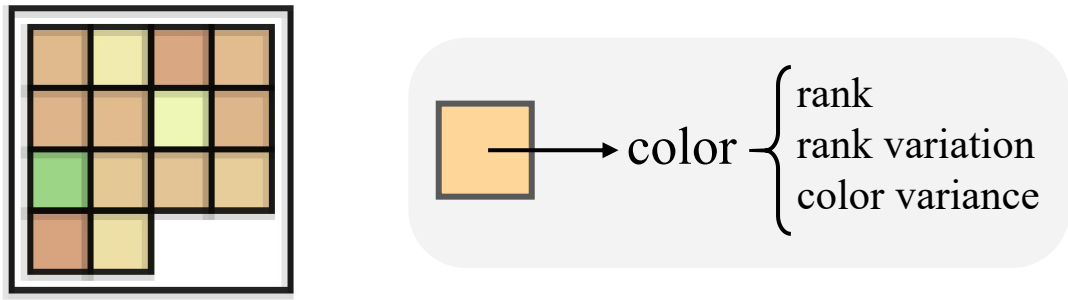
- **Step 1:** Dimensionality reduction
- **Step 2:** Clustering
- **Step 3:** Arrangement



(1) Iteration 1 (2) Iteration 2 (3) Iteration 3

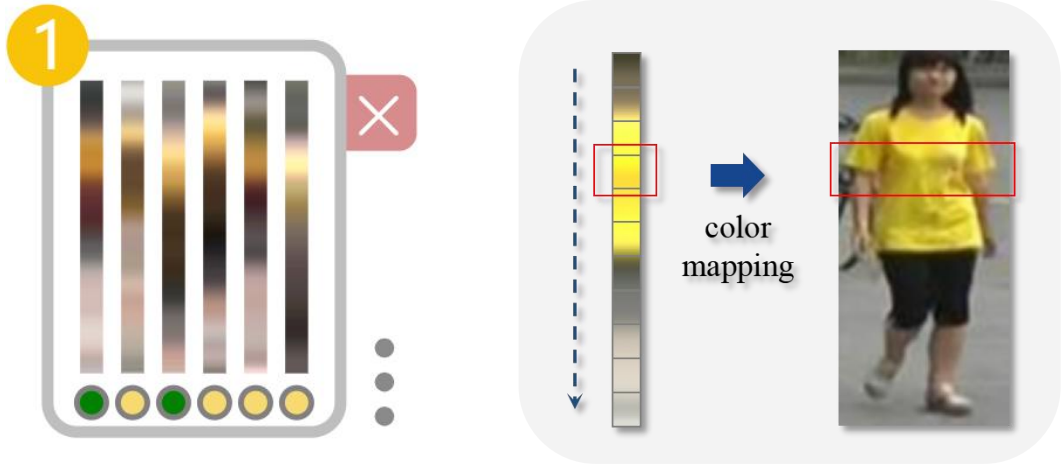
Visual Design: search space design

- **Attribute-based visual encoding**
  - rank-based colormap
  - rank variation-based colormap
  - color variance-based colormap



(1) Attribute-based visual encoding

- **Pixel-based visual encoding**
  - Compress the image horizontally
  - Smooths image colors vertically

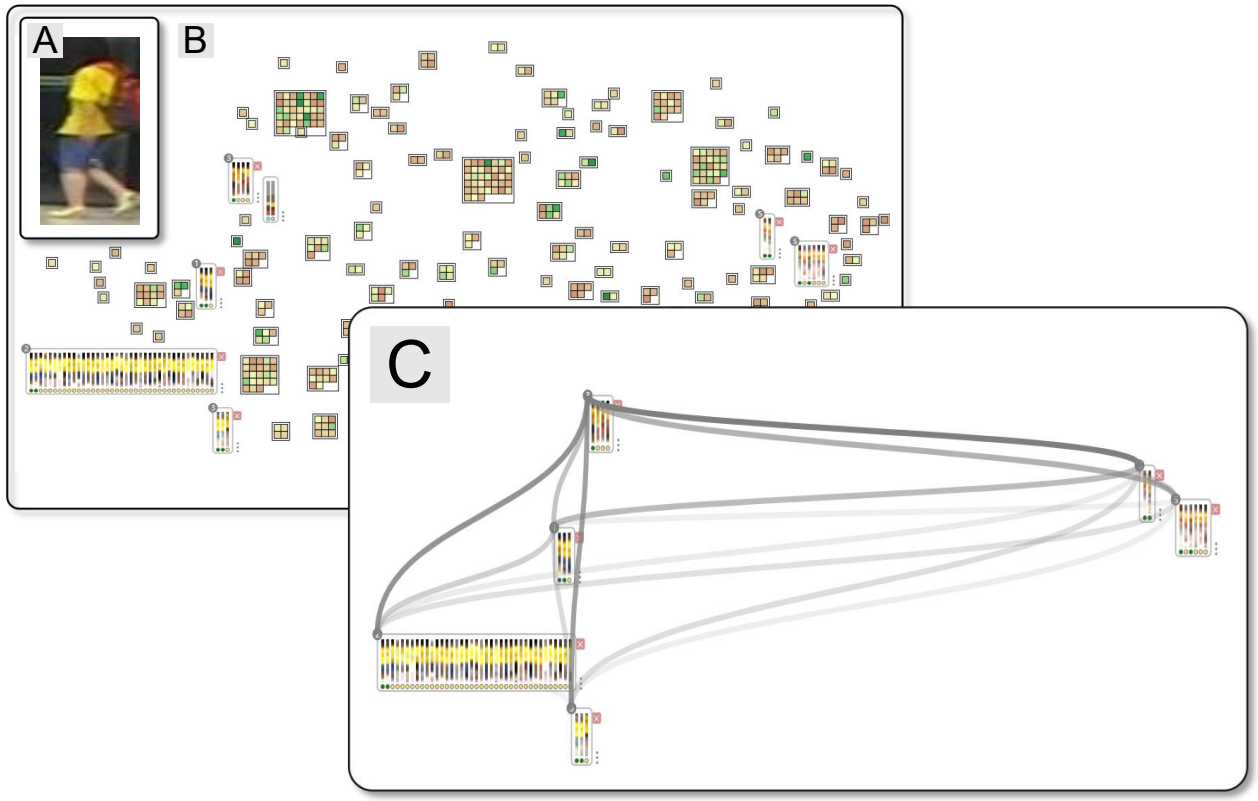


(2) Pixel-based visual encoding

Visual Design: search space design

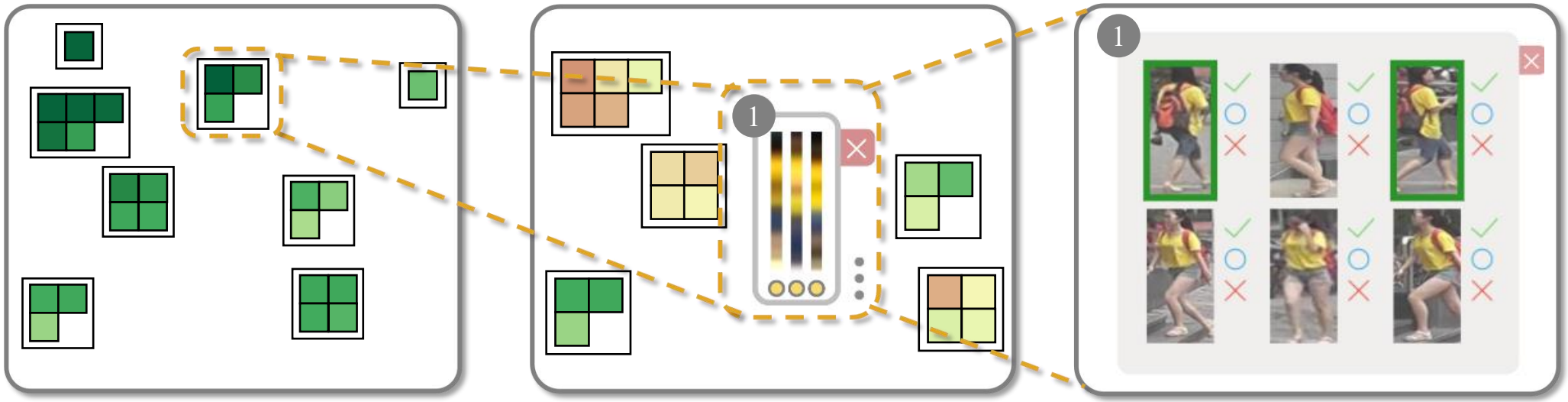
Association-Based Visual Coding

- show relationship in the historical feedback
- color transparency represents the color difference between nodes



Visual Design: interactions in search space

- **Multi-level exploration**
  - Attribute-based visual encoding
  - Pixel-based visual encoding
  - image-based visual encoding

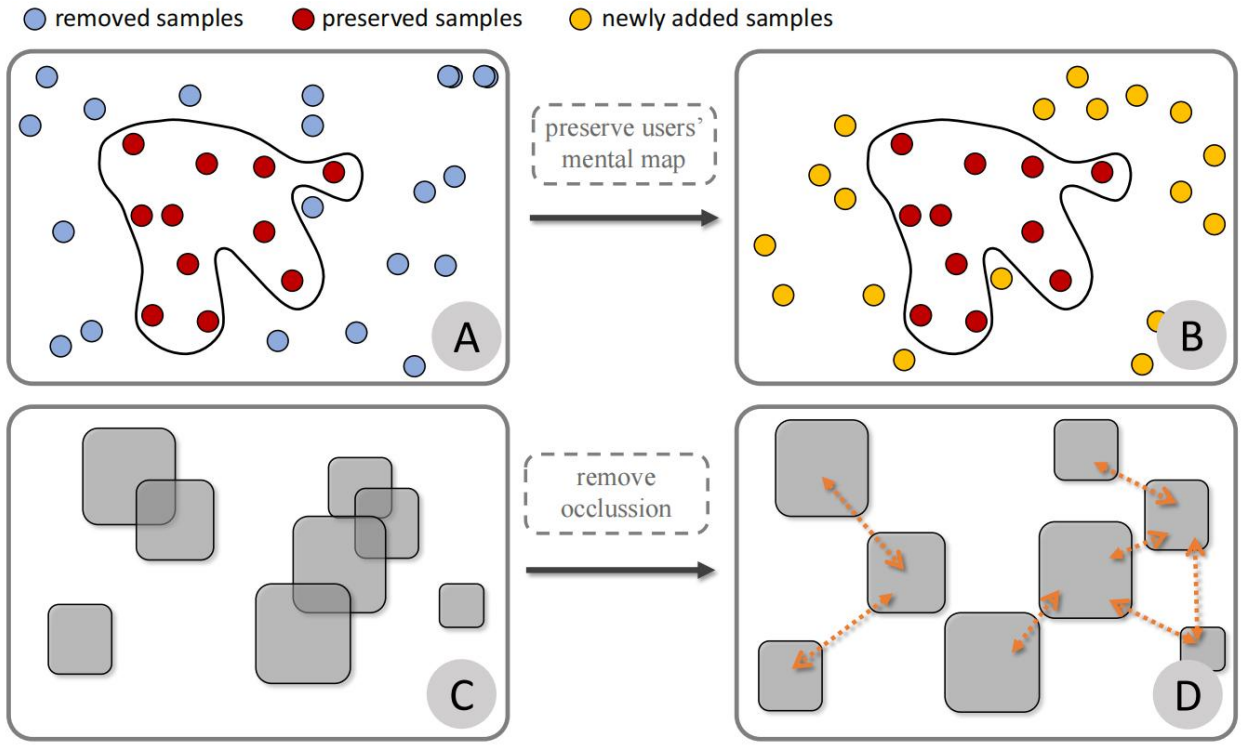


(1) (2) (3)

Visual Design: layout algorithm in search space

Optimization goals

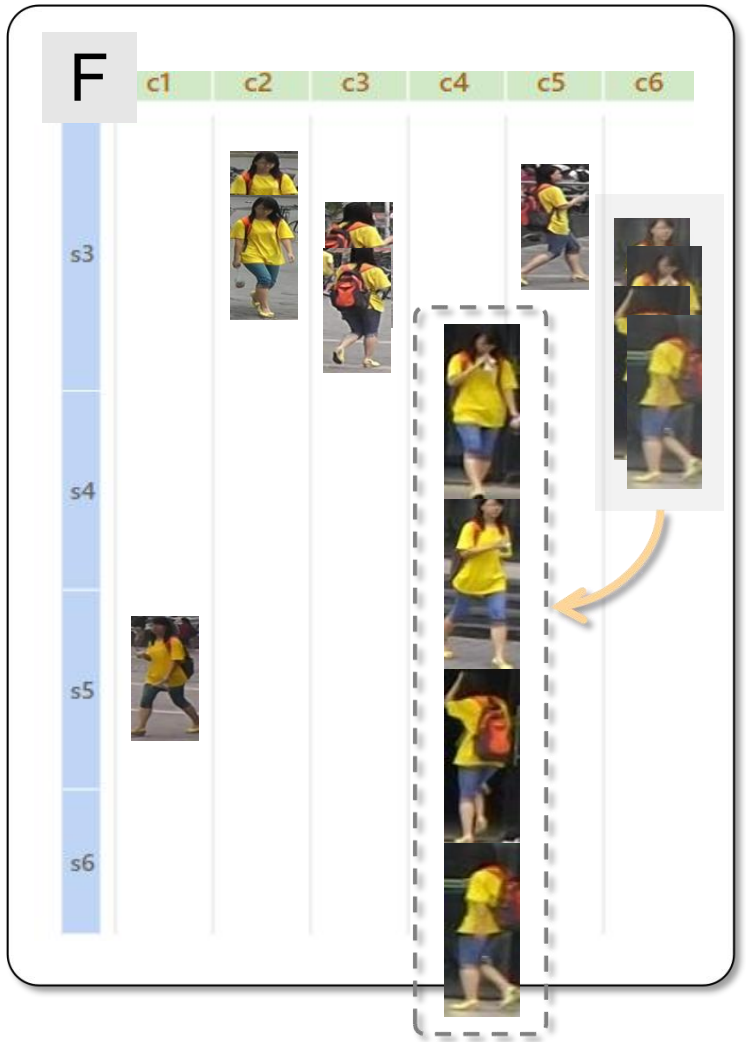
- Ensure the stability of the incremental layout
- Remove the occlusion between nodes



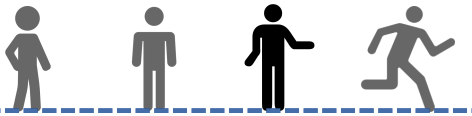
Visual Design: spatiotemporal panel

Spatio-temporal Information Panel

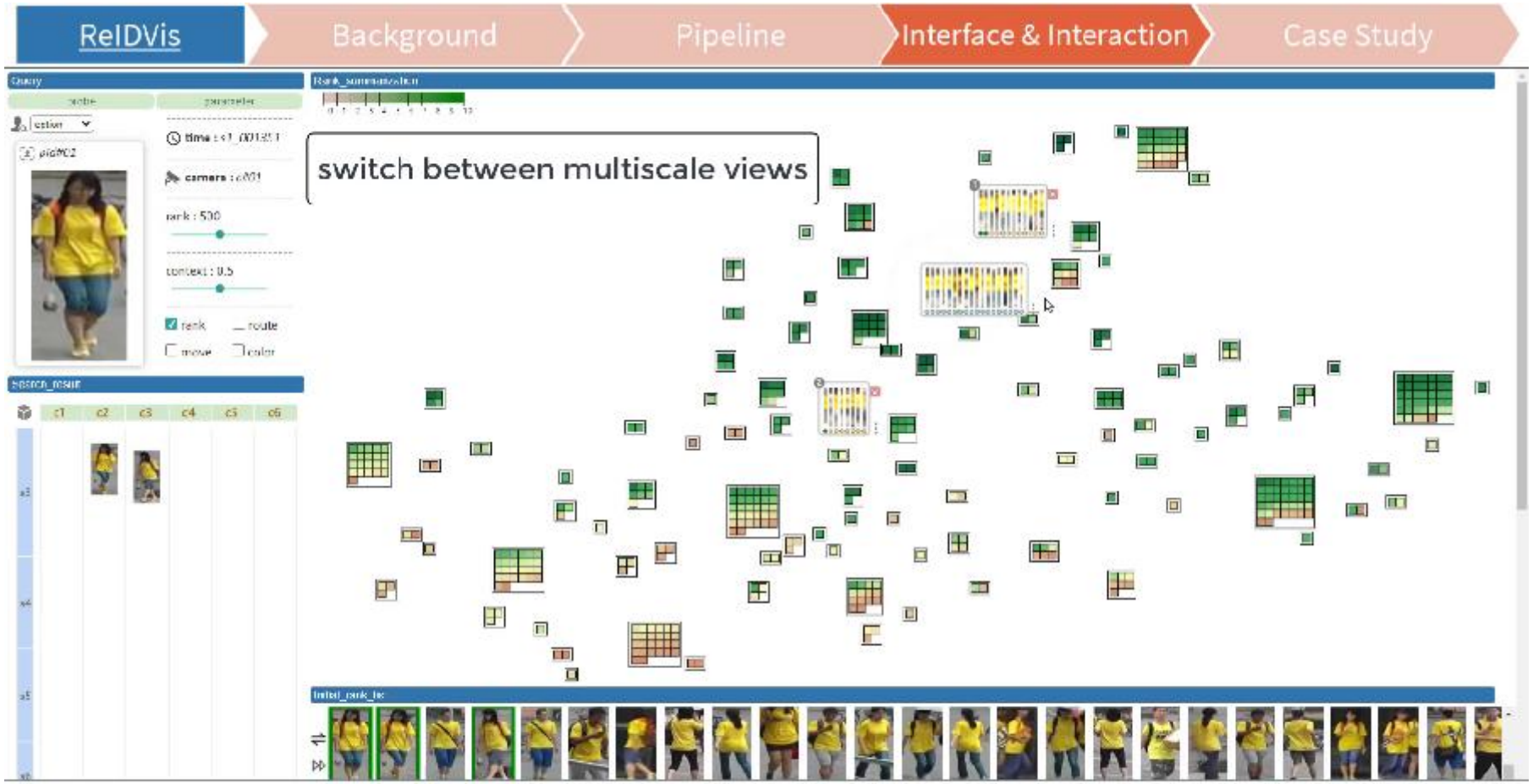
- Displays spatiotemporal information for each retrieved image in a 2D coordinate
- X-axis: cameras information
- Y-axis: time information



Content



Case study: video demo



Users can switch views in rank, route, move and color modes.

References

[1] L. Guo, L. Zou, et al. "VATLD: A Visual Analytics System to Assess, Understand and Improve Traffic Light Detection." IEEE Transactions on Visualization and Computer Graphics. 2020.

[2] H. Zeng, X. Wang, et al. "EmoCo: Visual Analysis of Emotion Coherence in Presentation Videos." IEEE Transactions on Visualization and Computer Graphics. 2019.

[3] H. Zeng, X. Shu, et al. "EmotionCues: Emotion-oriented Visual Summarization of Classroom Videos." IEEE Transactions on Visualization and Computer Graphics. 2020.

[4] A. Wu and H. Qu. "Multimodal Analysis of Video Collections: Visual Exploration of Presentation Techniques in TED Talks." IEEE Transactions on Visualization and Computer Graphics. 2018.

Thanks For Your Attention!