

TRECVID 2008. CBCD MCG-ICT-CAS

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New Challenges

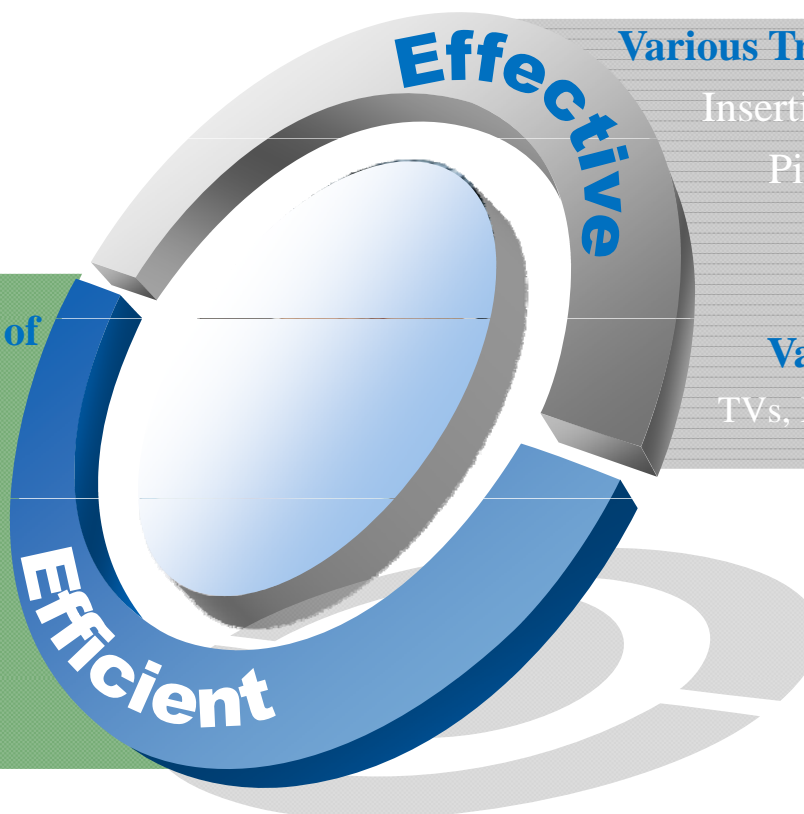
A large amount of

Dataset Videos:

200hours,
438 videos.

Query Videos:

2010 clips,
4000 minutes.



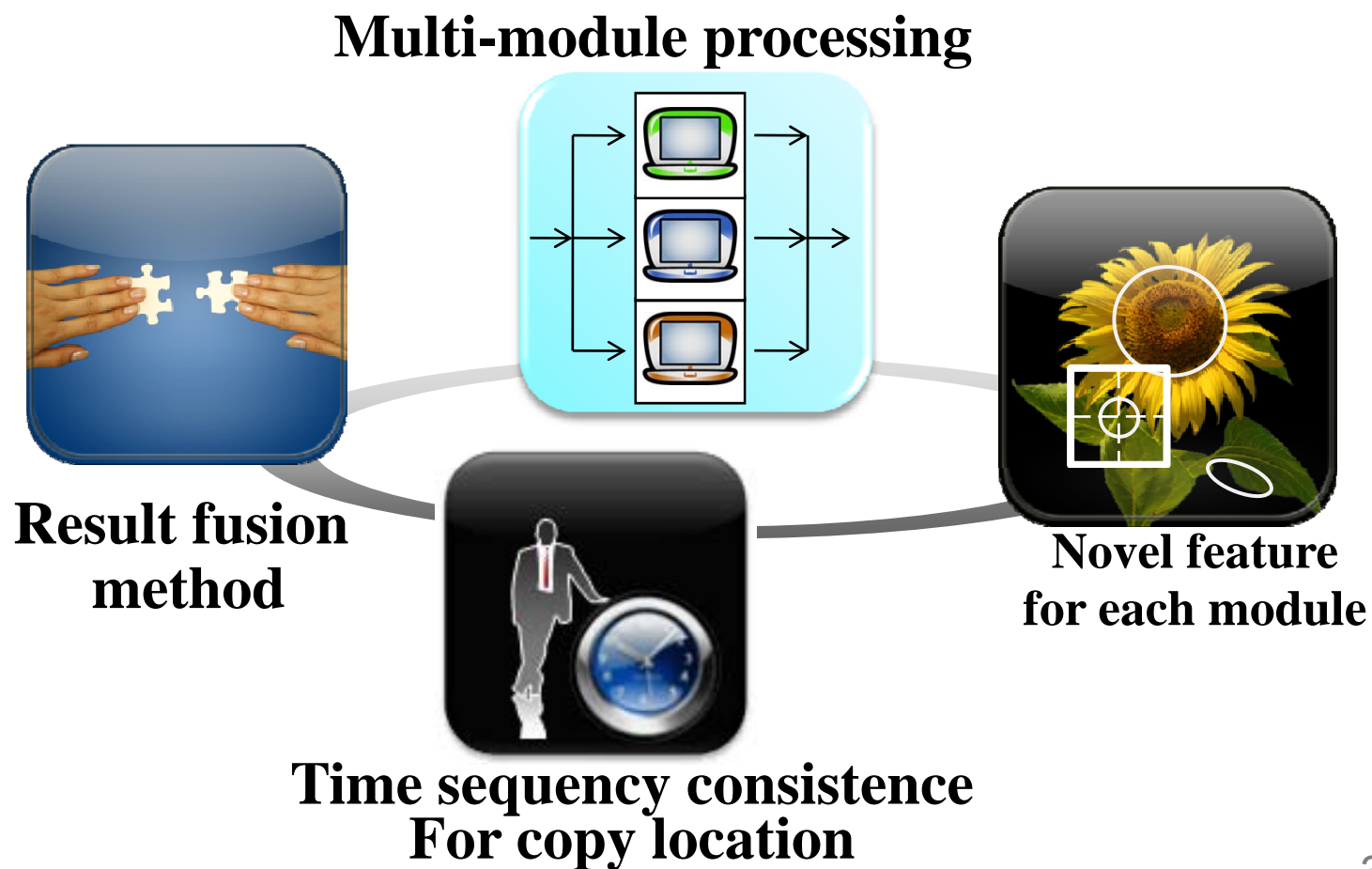
Various Transformations

Insertions of patterns,
Picture in picture,
Cam-coding,
.....

Varied Contents

TVs, Moives, Sports,...

Our Contributions



Outline



Multi-module system



Novel feature for each module



Time sequence consistence



Result fusion



Result and discussion



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Multi-module System

Module 1

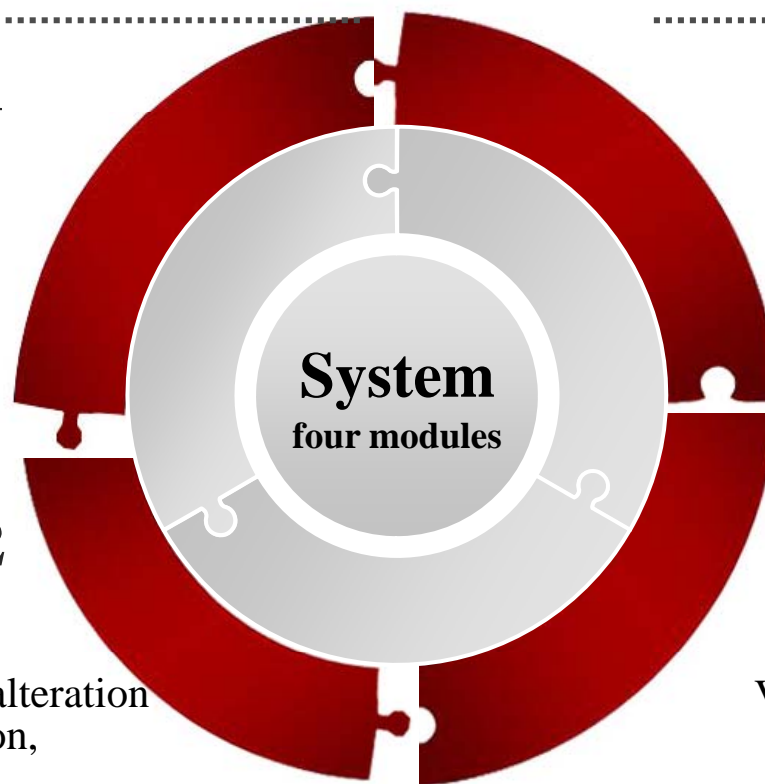
Global

Global quality decrease such as blur, adding noise,

Module 2

Local

Partial content alteration such as occlusion, shift, and crop,
(including the Picture in Picture type 2, the original video is the background)



Module 3

PIP

Picture in picture type 1
(The original video is inserted in front of a background video)

Module 4

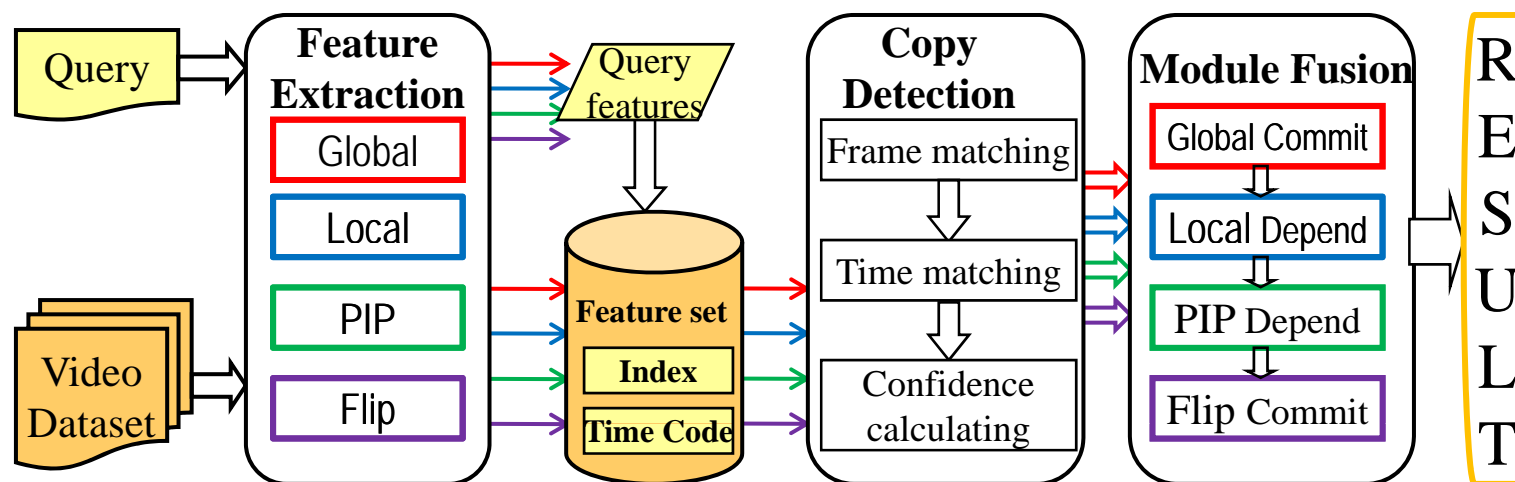
Flip

Video horizontal mirroring



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System Overview



Flowchart of ICT_MCG_CBCD System

Outline



Multi-module system



Novel feature for each module



Time sequence consistence



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Result and discussion

Feature for Global Module



Our Contributions for Global Module

- DC coefficients based **Block Gradient Histogram Feature**
- **【Advantage】** fast, low-dimension, robust to global transformations

Block Gradient Histogram Feature

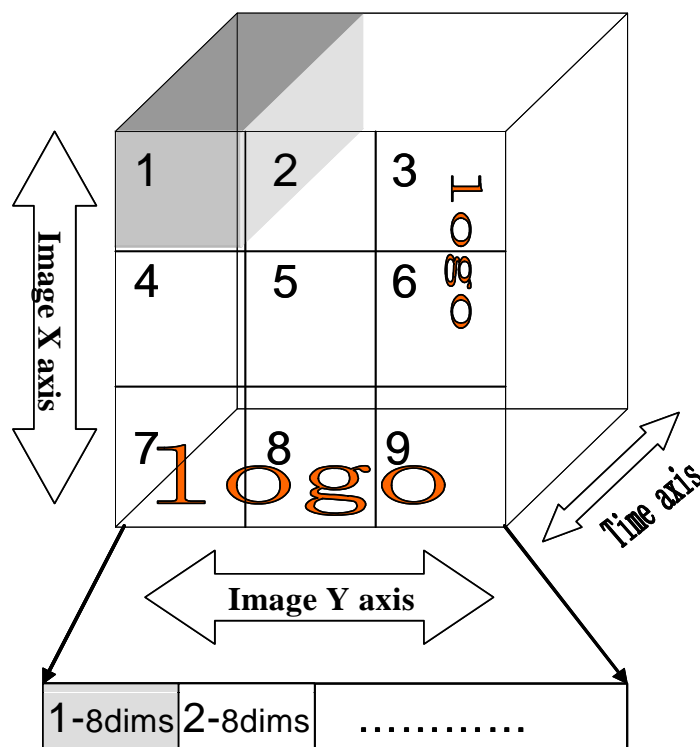


Image Block 1-Gradient of each pixe

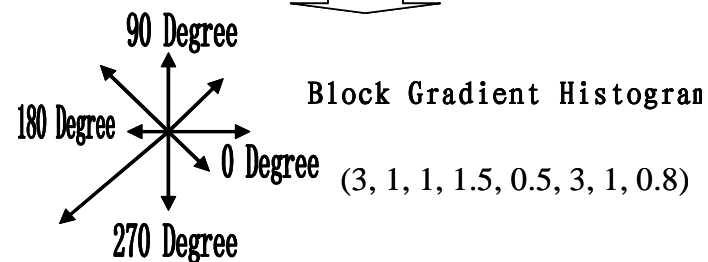
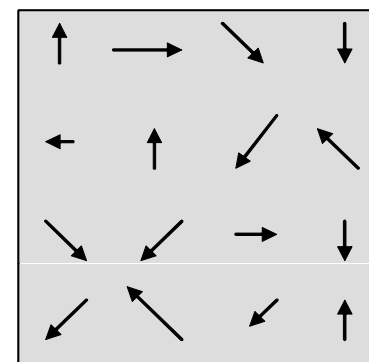
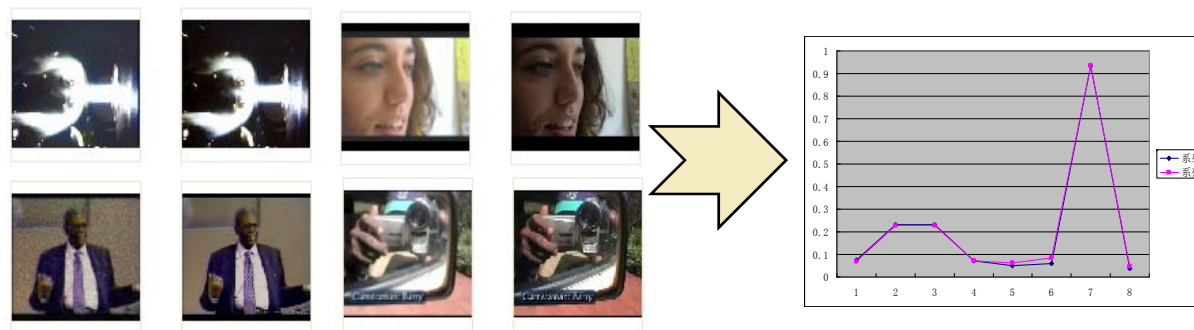


Illustration of Block Gradient Histogram for Global Module

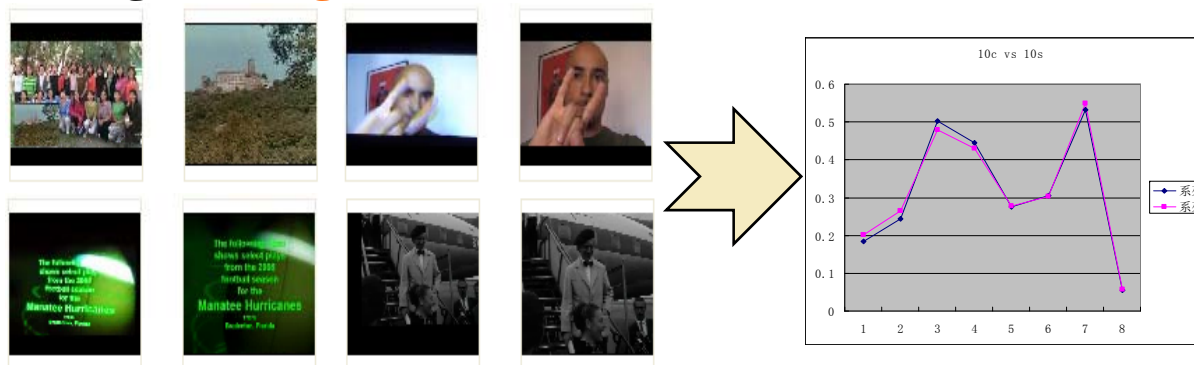
Block Gradient Histogram Feature

- The Global feature is robust to many transformations:

- Change of **image quality**:



- Change of **image content**:



Feature for Local Module



Our Contributions for Local Module

- KLT based **Local Patch Feature with Spatial Information**
- **【Advantage】** robust to partial occlusion, crop, and shift

Local Feature with Spatial Information

- To increase discriminability of local features, we present a method to add spatial information:

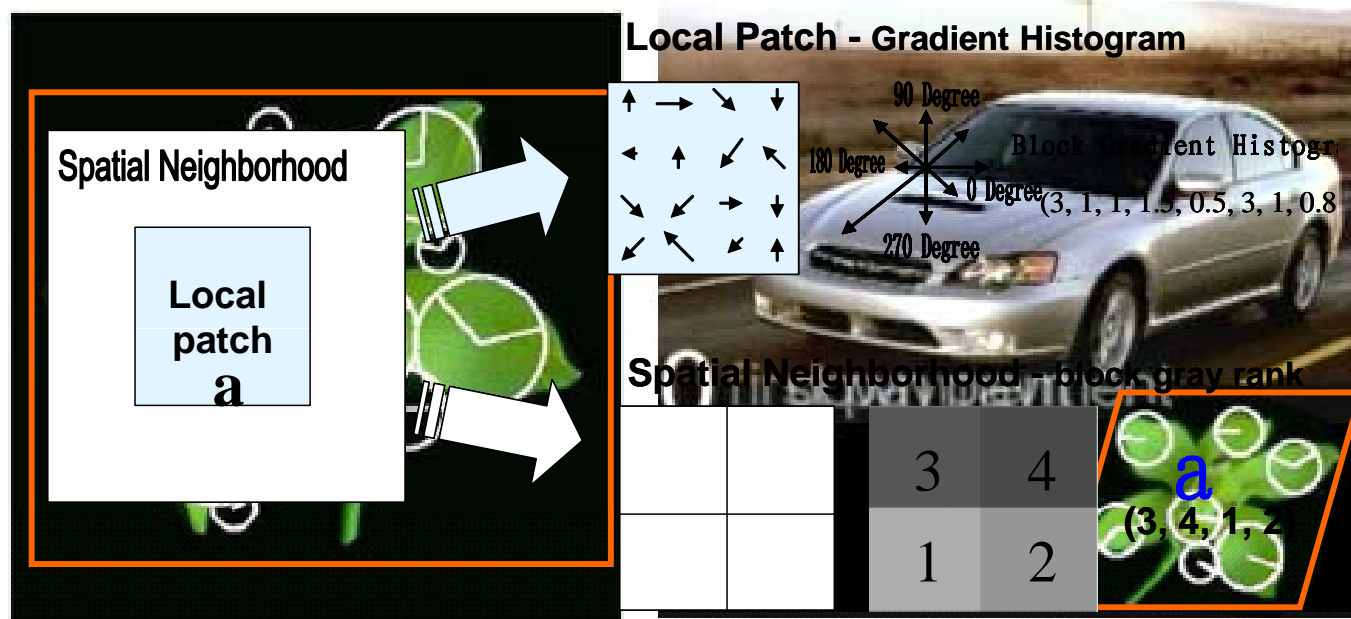
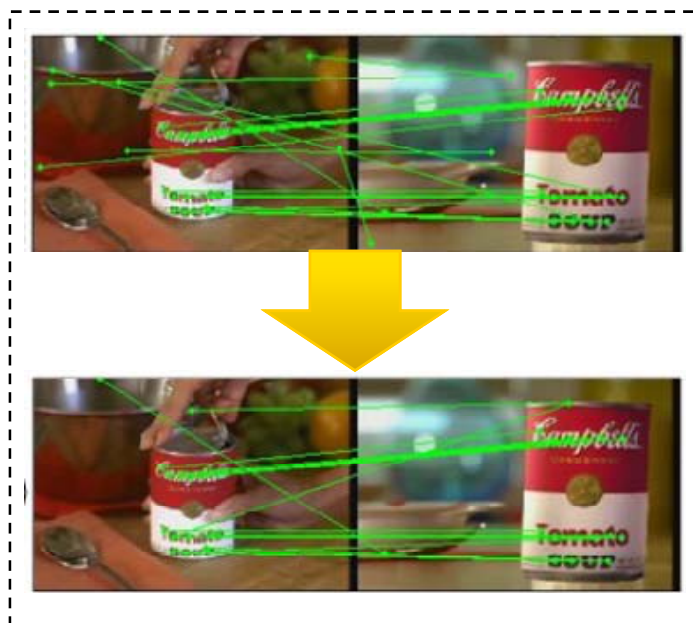


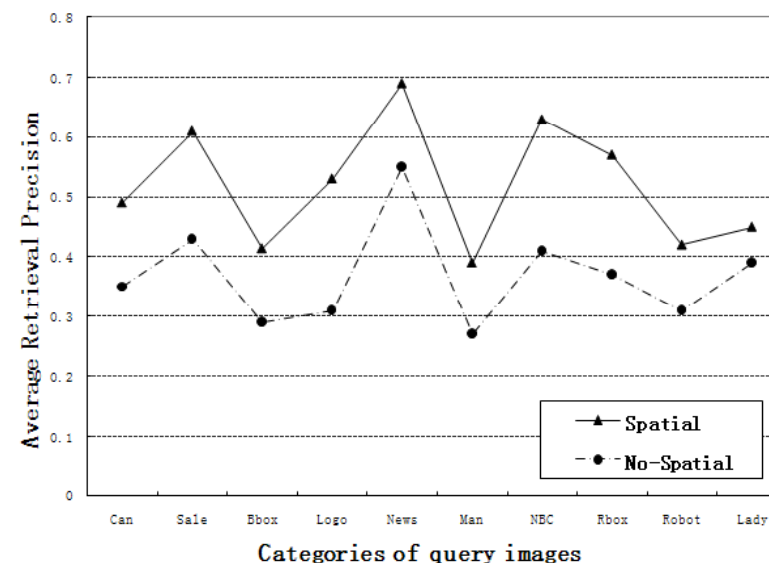
Illustration of local feature with spatial information

Local Feature with Spatial Information

- The introduction of spatial information could effectively increase discriminability of local features, thus improve the matching precision:



Comparison of matching effect before and after using spatial information



Comparison of retrieval precision before and after using spatial information



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Feature for PIP Module



Our Contributions for PIP Module

- Edge detection based **PIP boundary determination**
- Block Gradient Histogram features extraction for PIP region(the same as global module)
- **【Advantage】** robust to change of scale and position, simple and fast than scale-invariant local feature based method



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PIP Boundary Detection

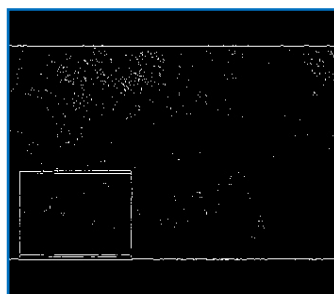
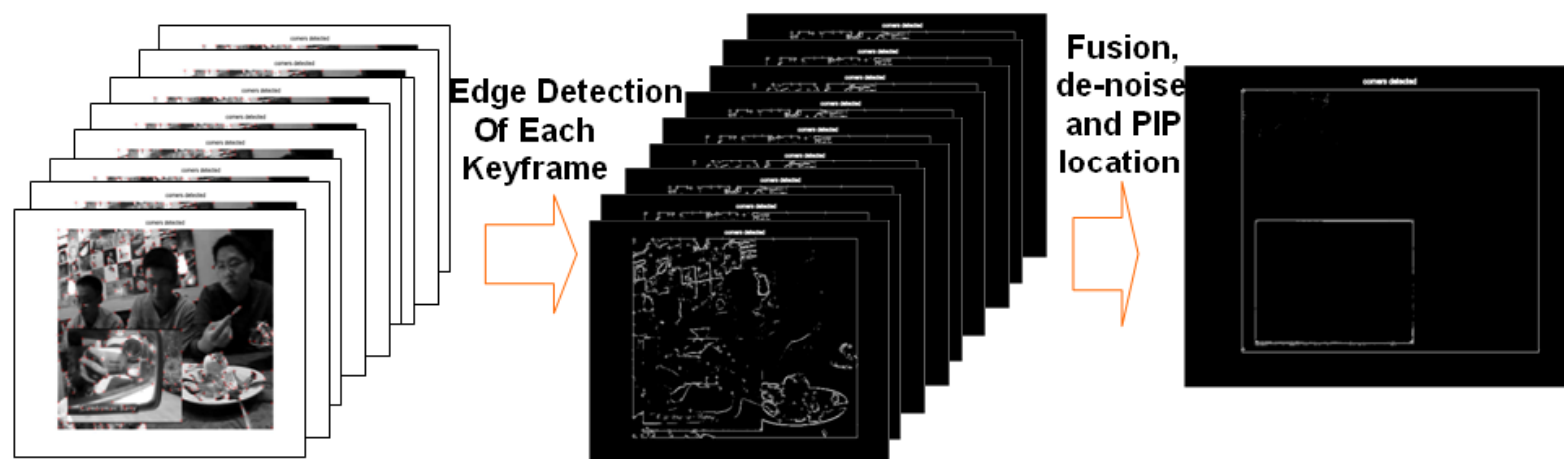


Illustration of PIP boundary location and some instances



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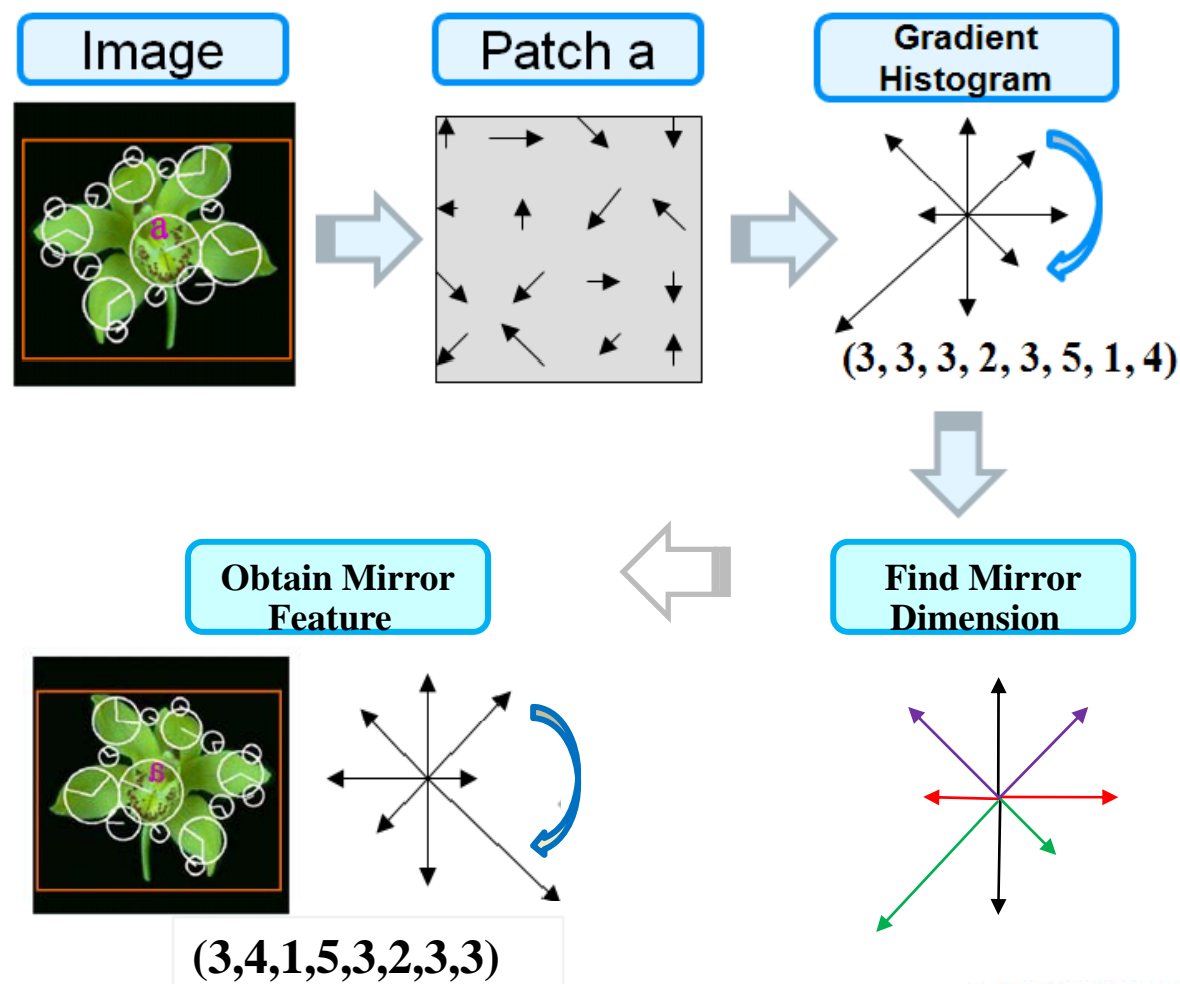
Feature for Flip Module



Our Contributions for Flip Module

- **Vertical Mirror feature**
- Global features and local features extraction for flip module(the same as previous steps)
- **【Advantage】** robust to vertical mirror, simple and fast

Rotation-Invariant Feature



Outline



Multi-module system



Novel feature for each module



Time sequence consistence 



Result fusion



Result and discussion

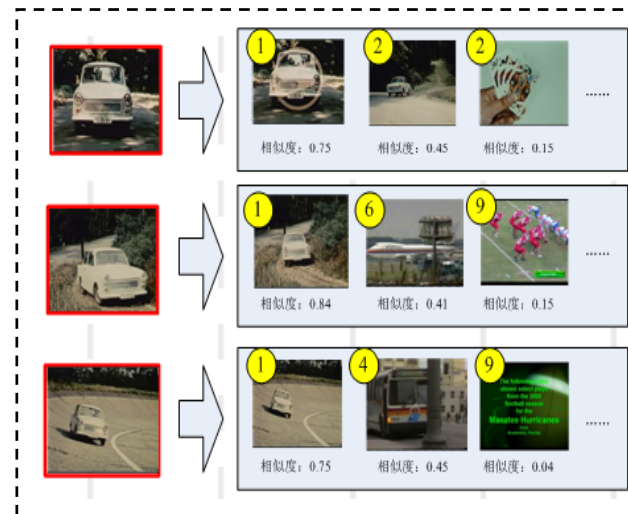


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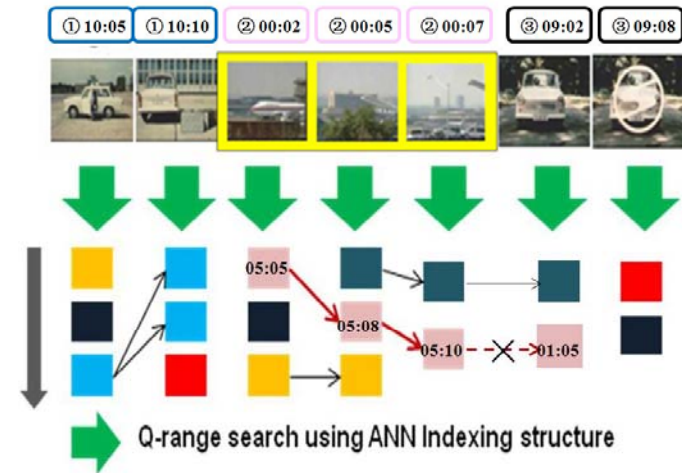
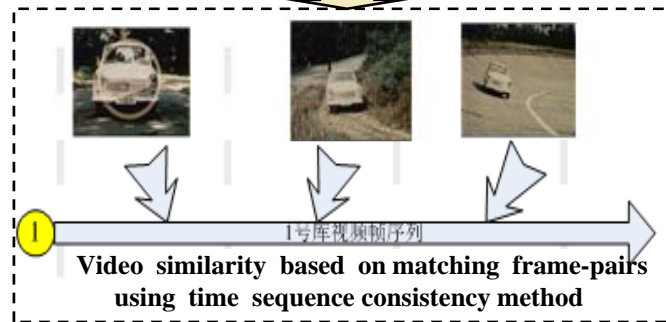
(2)

Time Sequence Consistency method

Result of matching frame



Result of matching video



Graph for copy location

$$M = \max_{i,j,X} \sum_{l=i}^j weight(node_l) \quad (1)$$

$$location = \begin{cases} frame_i \rightarrow frame_j \text{ of } Video_x, & \text{if } M > \beta \\ none, & \text{else} \end{cases} \quad (2)$$

Outline



Multi-module system



Novel feature for each module



Time sequence consistence



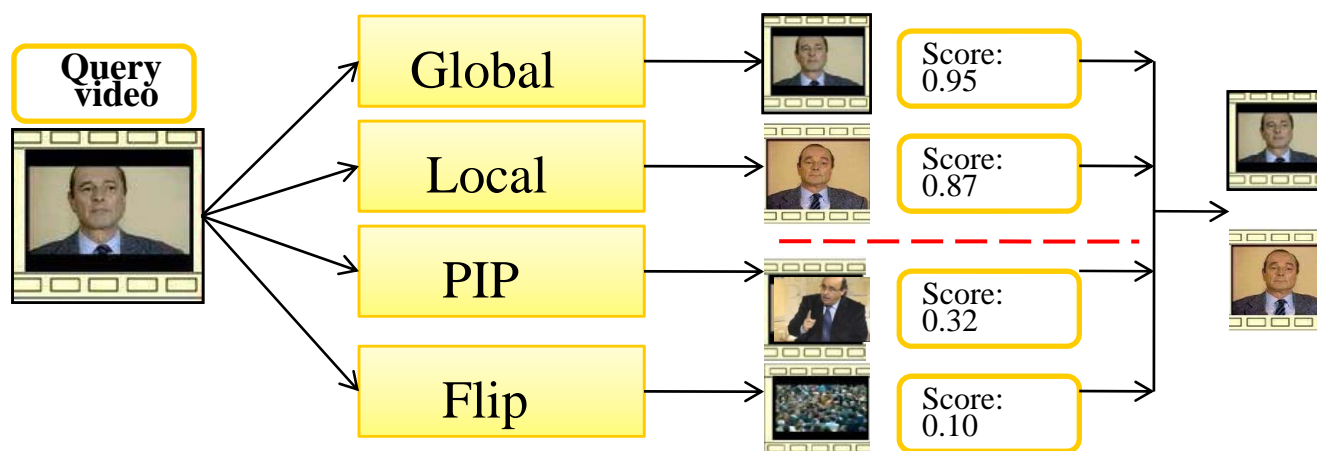
Result fusion



Result and discussion

Result Fusion Method

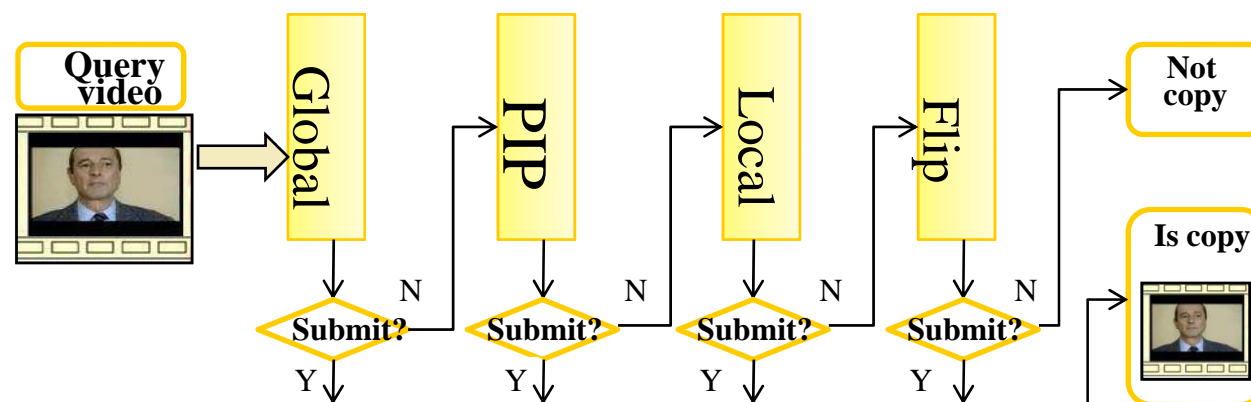
- We tried number of fusion methods including **non-hierarchical** method and **hierarchical** method.
- **Non-hierarchical** method means we use 4 modules to calculate each query separately at the same time, and only the one with high score will be submitted.



【 character 】 simple but slow, high recall but low precision,
hard to determine the score threshold

Result Fusion Method

- We tried number of fusion methods including **non-hierarchical** method and **hierarchical** method.
- **Hierarchical method** submits the result of each module in some sequence. For each query, if any previous module has found its corresponding video, we submit the result, and then turn to process the next query.



【 character 】 fast and high precision, but depend heavily on process sequence

Outline



Multi-module system



Novel feature for each module



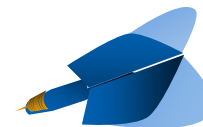
Time sequence consistence



Result fusion

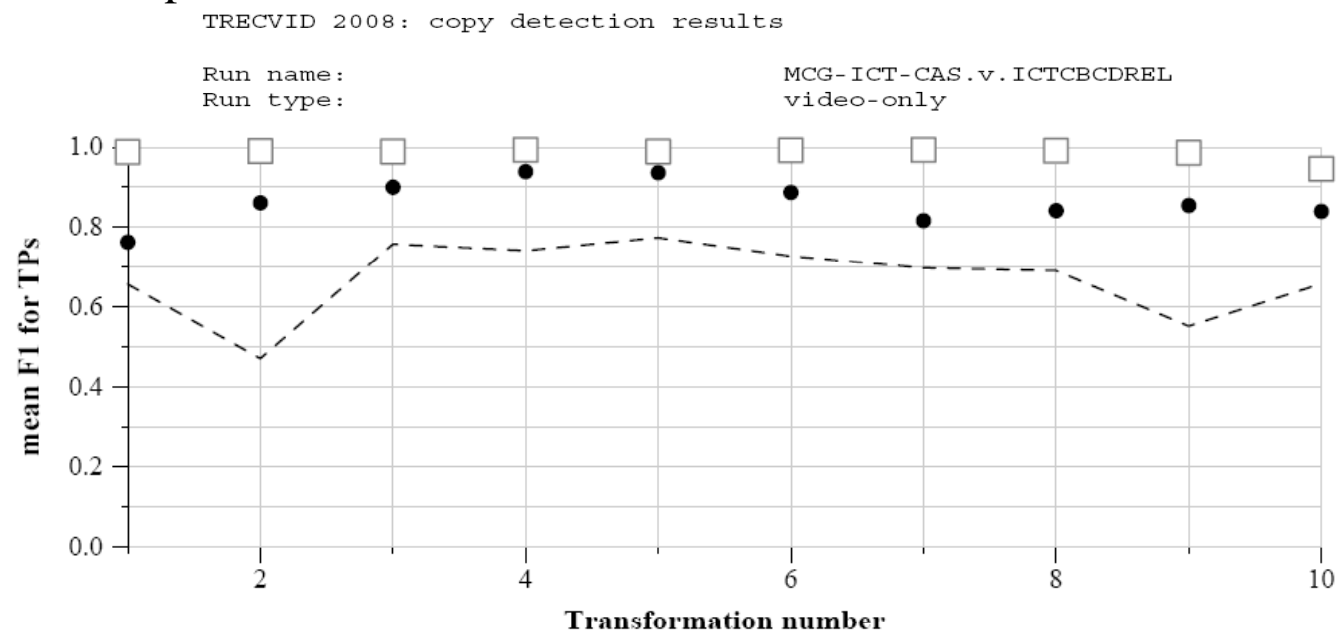


Result and discussion



Result and Discussion

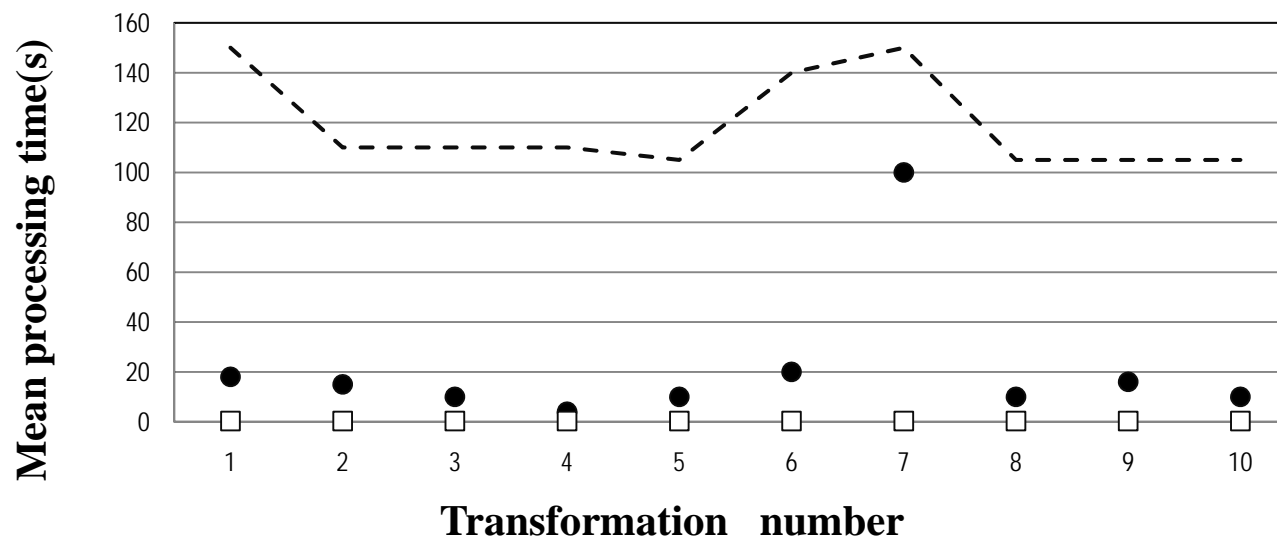
- Tested in the CIVR07_CBCD dataset, the **hierarchical method** performs best for most queries, and processing time is reduced greatly.
- The results of our system in TRECVID2008_CBCD in accordance with the phenomena.



Run score (dot) versus median (---) versus best (box) by transformation

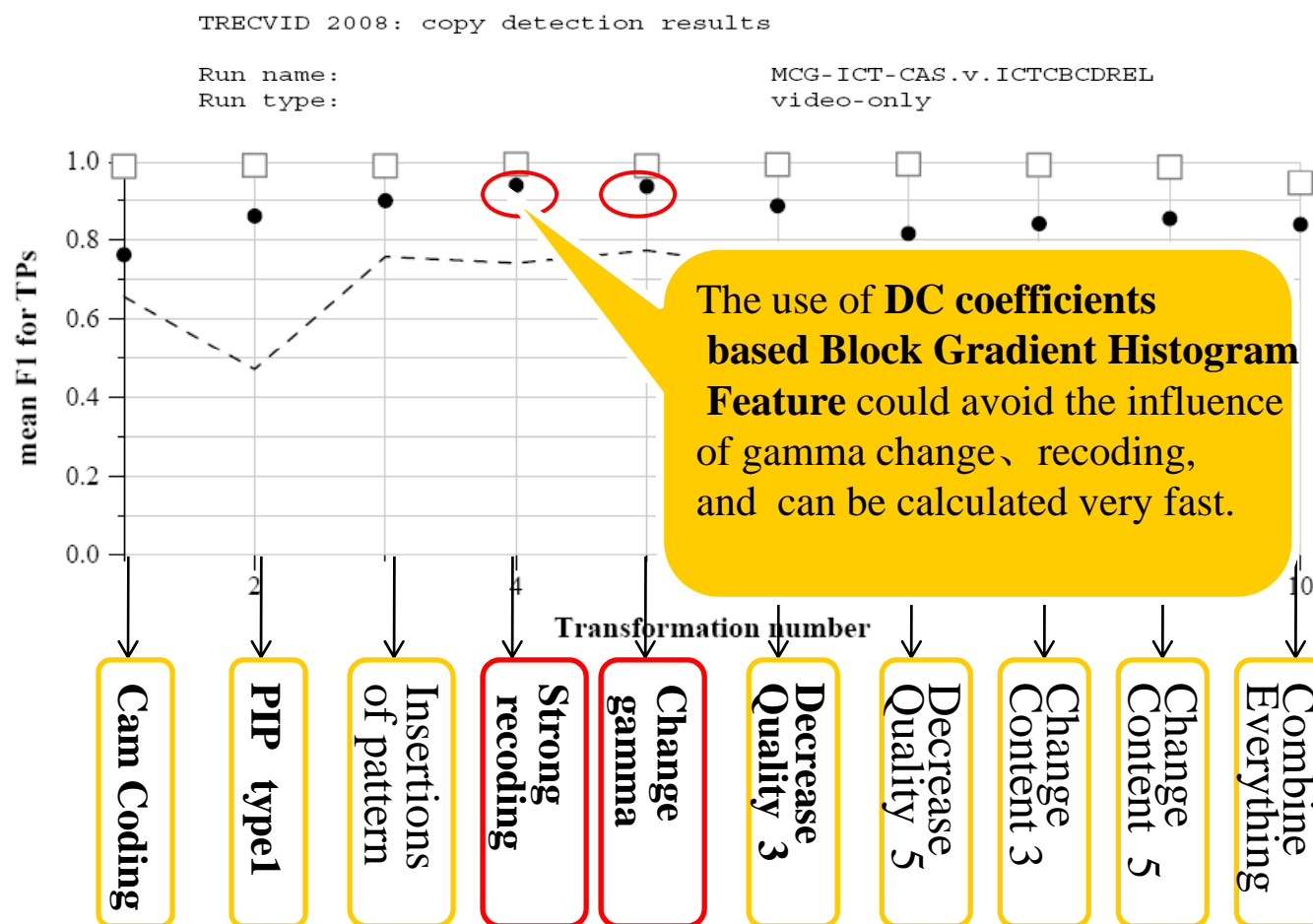
Result and Discussion

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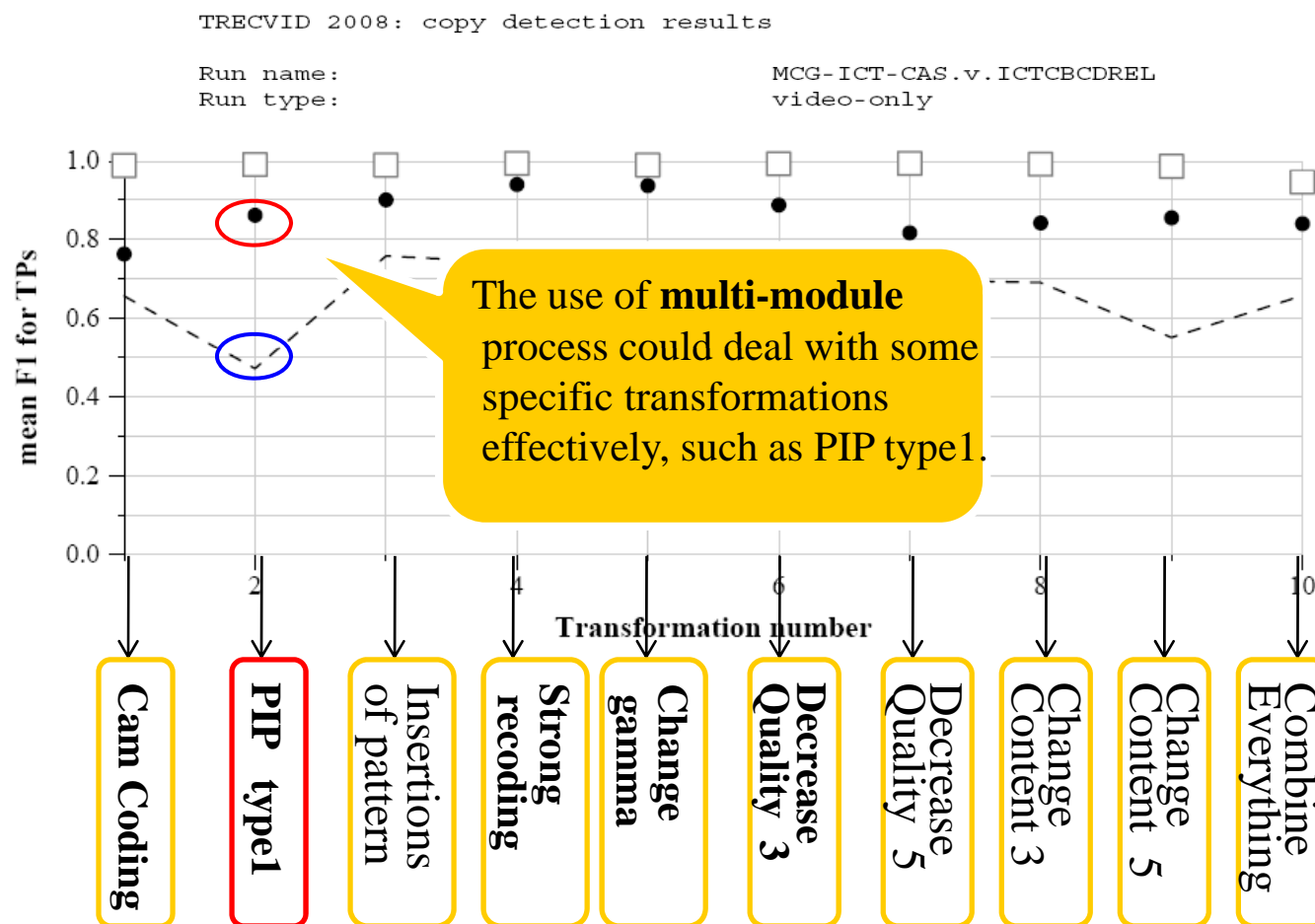


Run score (dot) versus median (---) versus best (box) by transformation

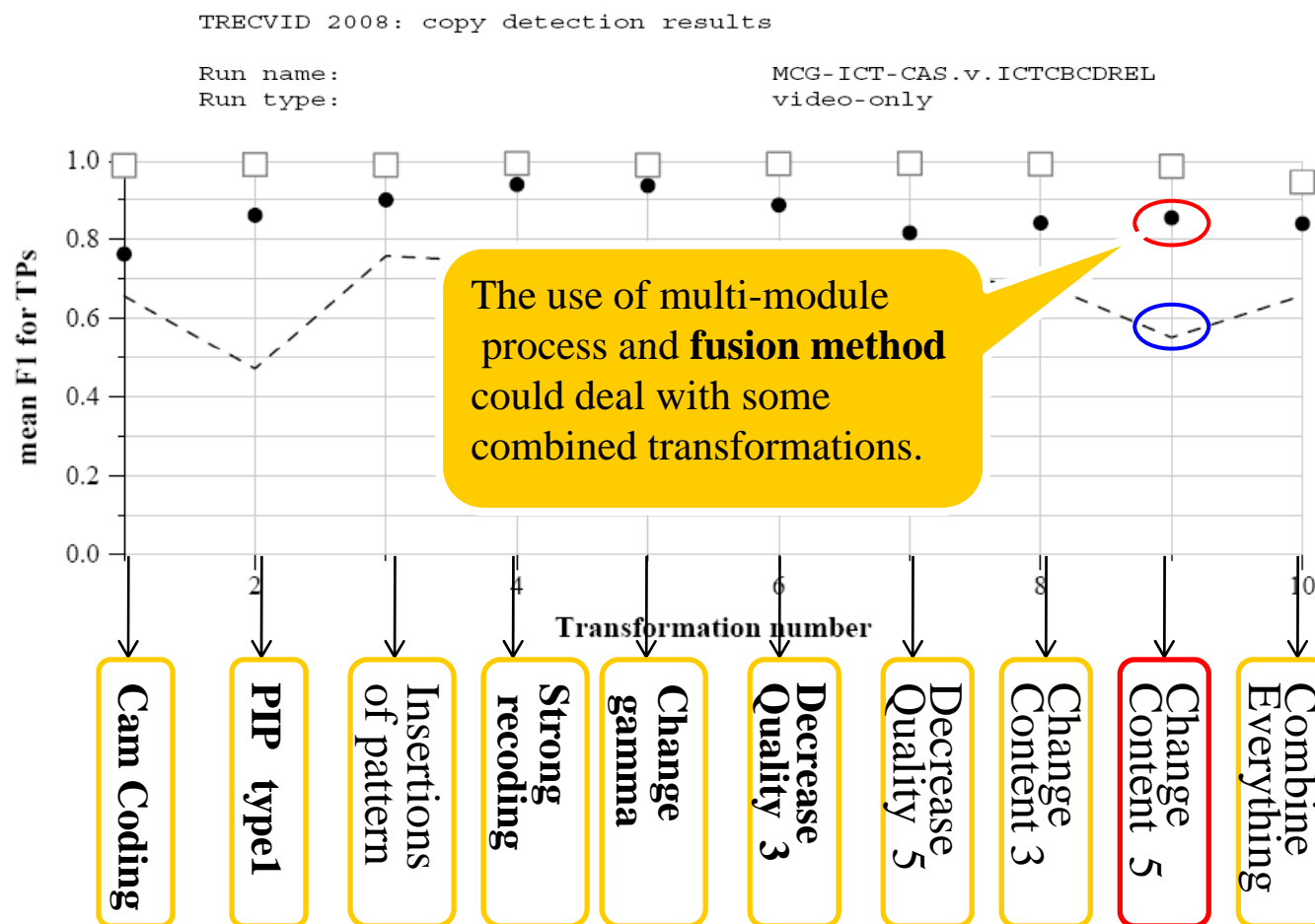
Result and Discussion



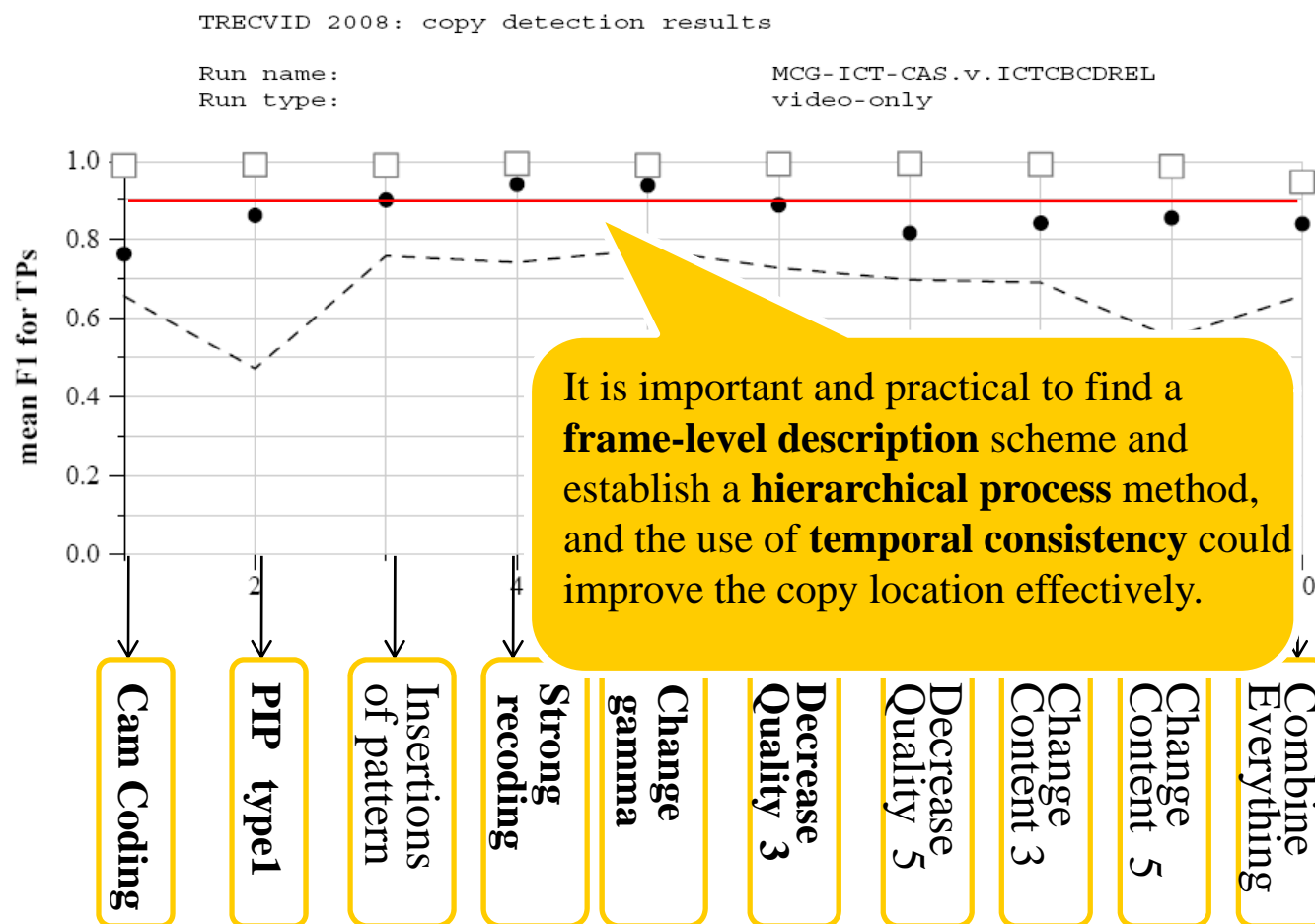
Result and Discussion



Result and Discussion



Result and Discussion



Result and Discussion

- Future work:
 - Introduce more features such as color, trajectory... etc;
 - Object-level copy detection;
 - Scalable mining of large video databases for practical application.



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Q&A

Thanks! 😊

Any further questions, please contact:

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