2D Object Detection and Tracking summary

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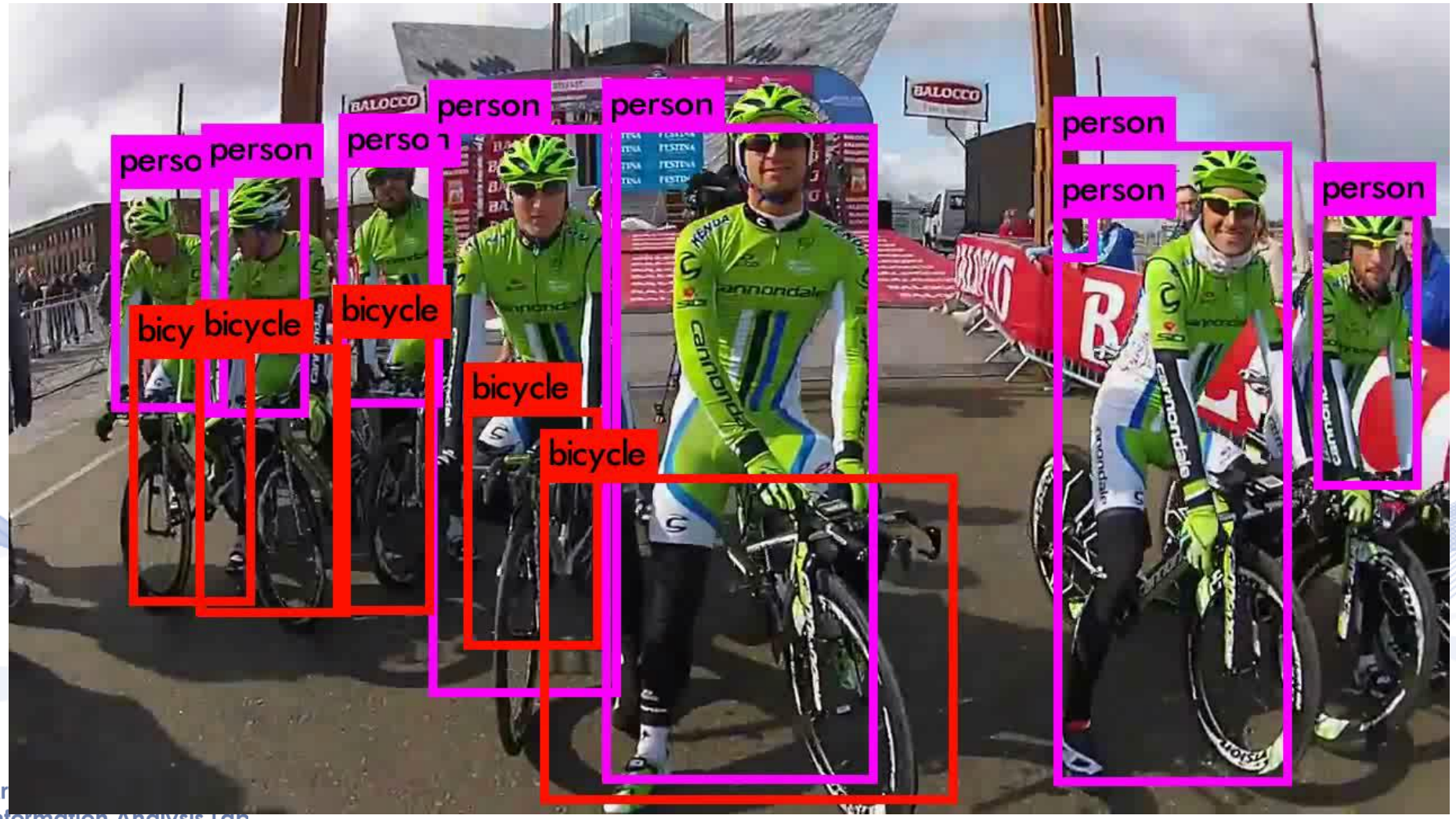
Artificial Intelligence & Information Analysis Lab

Object Detection

Object Detection



Object Tracking

2D Object detection and Tracking

- **Object Detection and Forward Tracking**
- Object Forward-Backward Tracking

2D Object detection and Tracking

- Video tracking is the process of locating a moving object (or multiple objects) over time using a camera.
- Variety of uses:
  - human-computer interaction
  - security and surveillance
  - video communication and compression
  - augmented reality and video editing
  - traffic control
  - medical imaging.
- Video tracking can be a time consuming process due to the amount of data that is contained in video.

Object Detection and Tracking

- Problem statement:
  - To detect a target/object (e.g. human face) that appear in each video frame and localize their **Region-Of-Interest (ROI)**.
  - To track the detected object over the video frames.

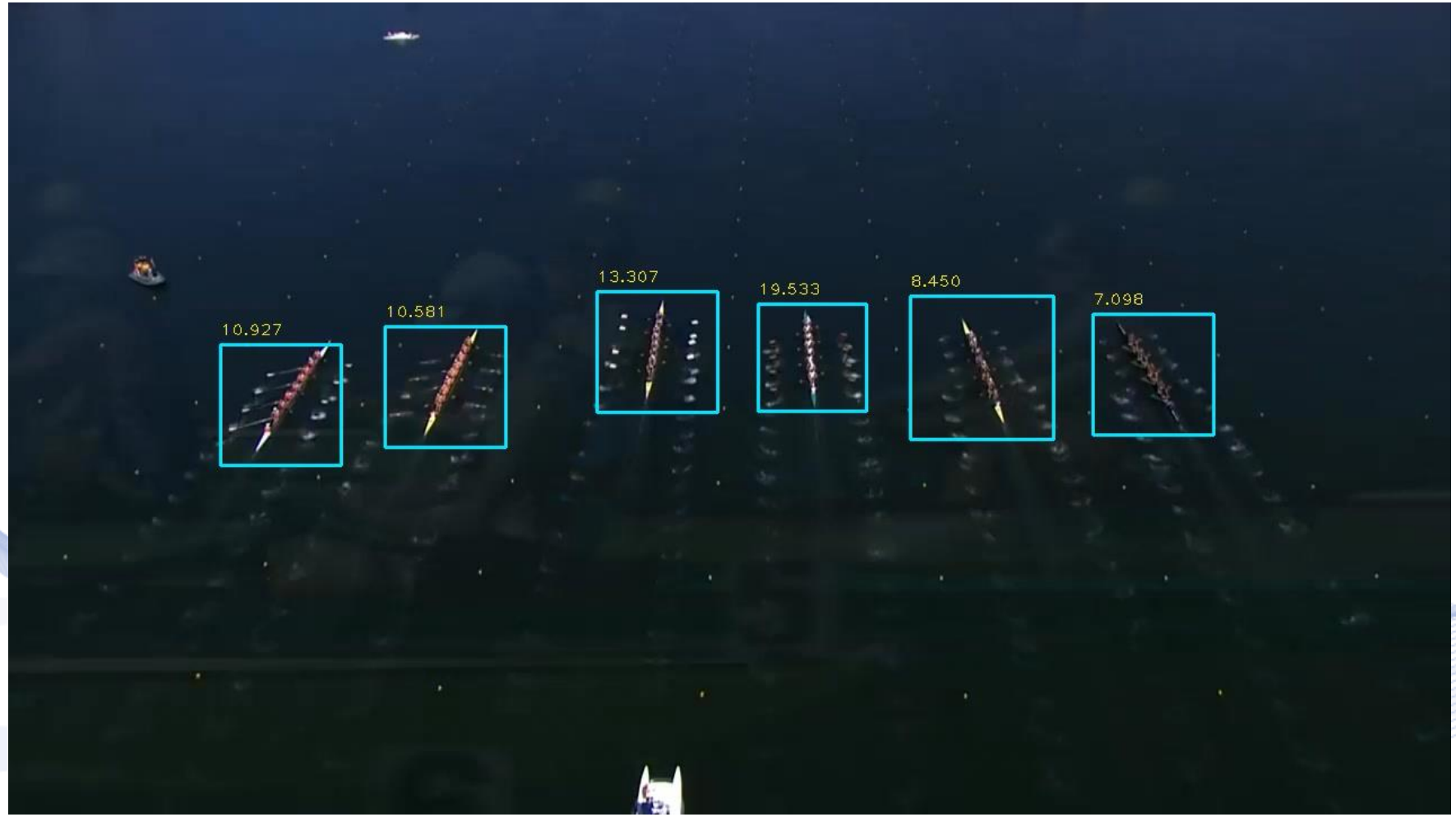
Object Detection and Tracking

- **Periodic object re-detection** can be applied to account for new objects entering the camera's field-of-view.

- **Forward and backward tracking**, when the entire video is available.

Football player detection

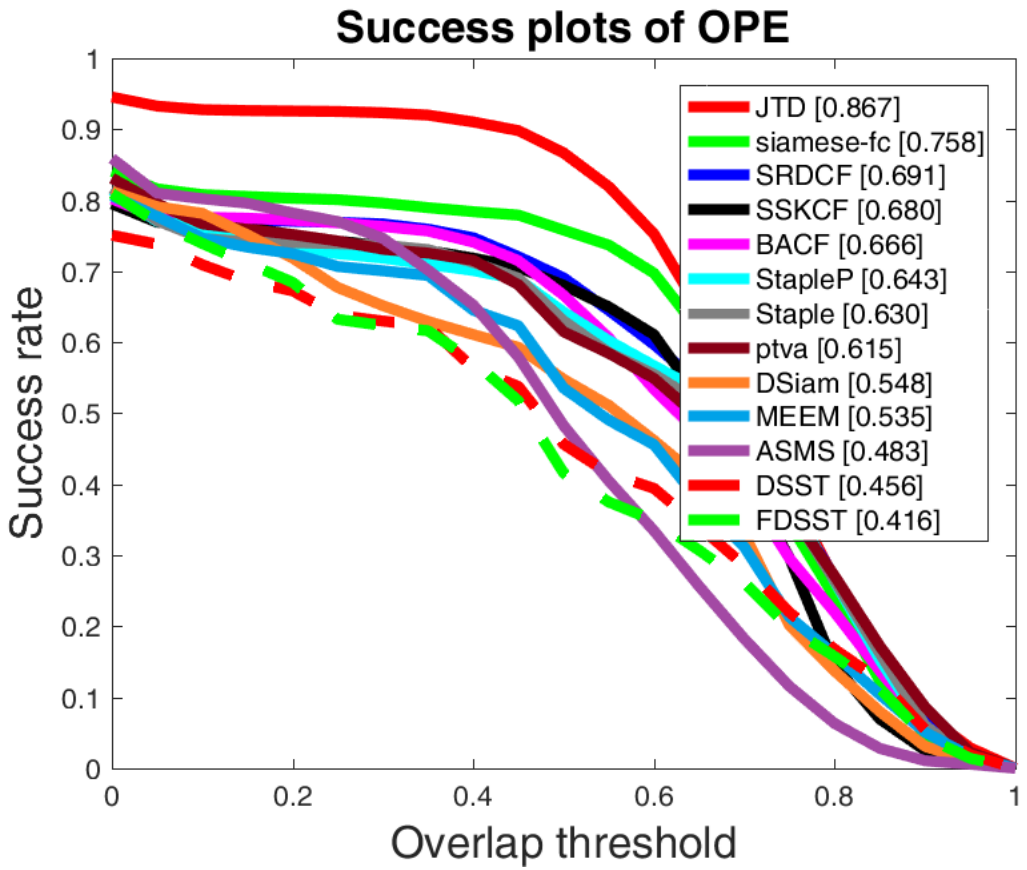
Boat detection



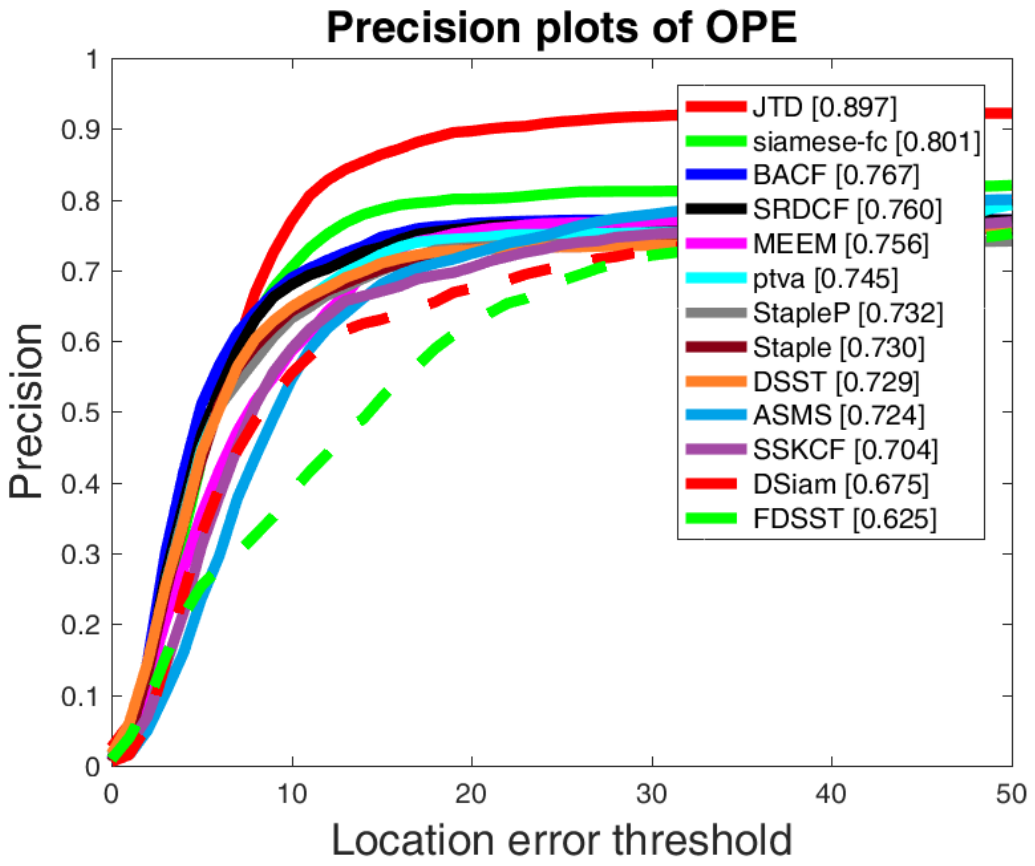
Joint Detection & Tracking

- **Tracker node**: Given the initialized position of a target, the tracker T is responsible for estimating the bounding box of the target in the subsequent frames.
- **Detector:** Given a bounding box defining the target in specific frame produced by the tracker, the detector D is responsible for verifying this result, and then provide the appropriate feedback to the system.
- **Master Visual Analysis:** If the verification from D fails, Master Visual Analysis is responsible for the re-initialization of the tracker T with the corrected bounding box.

Joint Detection & Tracking (JTD)

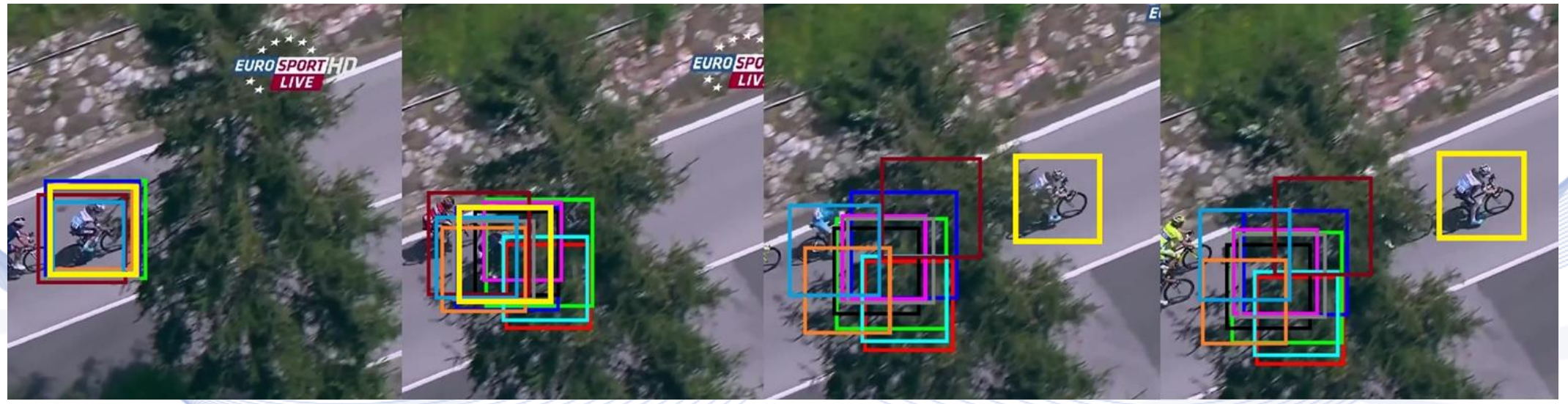


Joint Detection & Tracking (JTD)



Joint Detection & Tracking

- Target re-initialization by the detector in hard tracking cases when tracking algorithms fail.



Joint Detection & Tracking

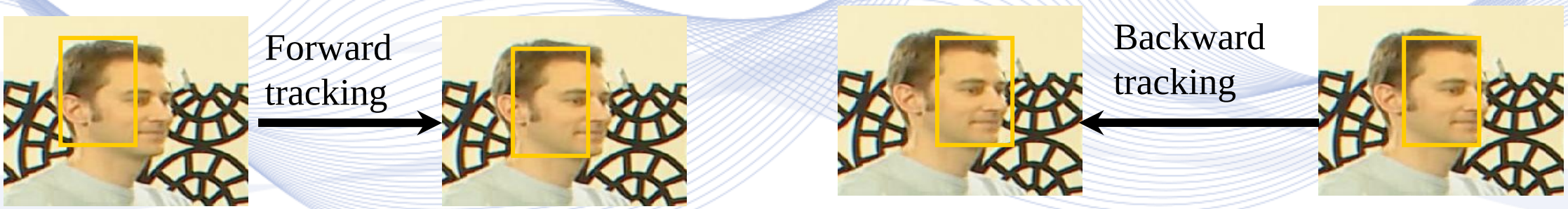
- Target reinitialization by the detector in hard tracking cases when tracking algorithms fail.

2D Object detection and Tracking

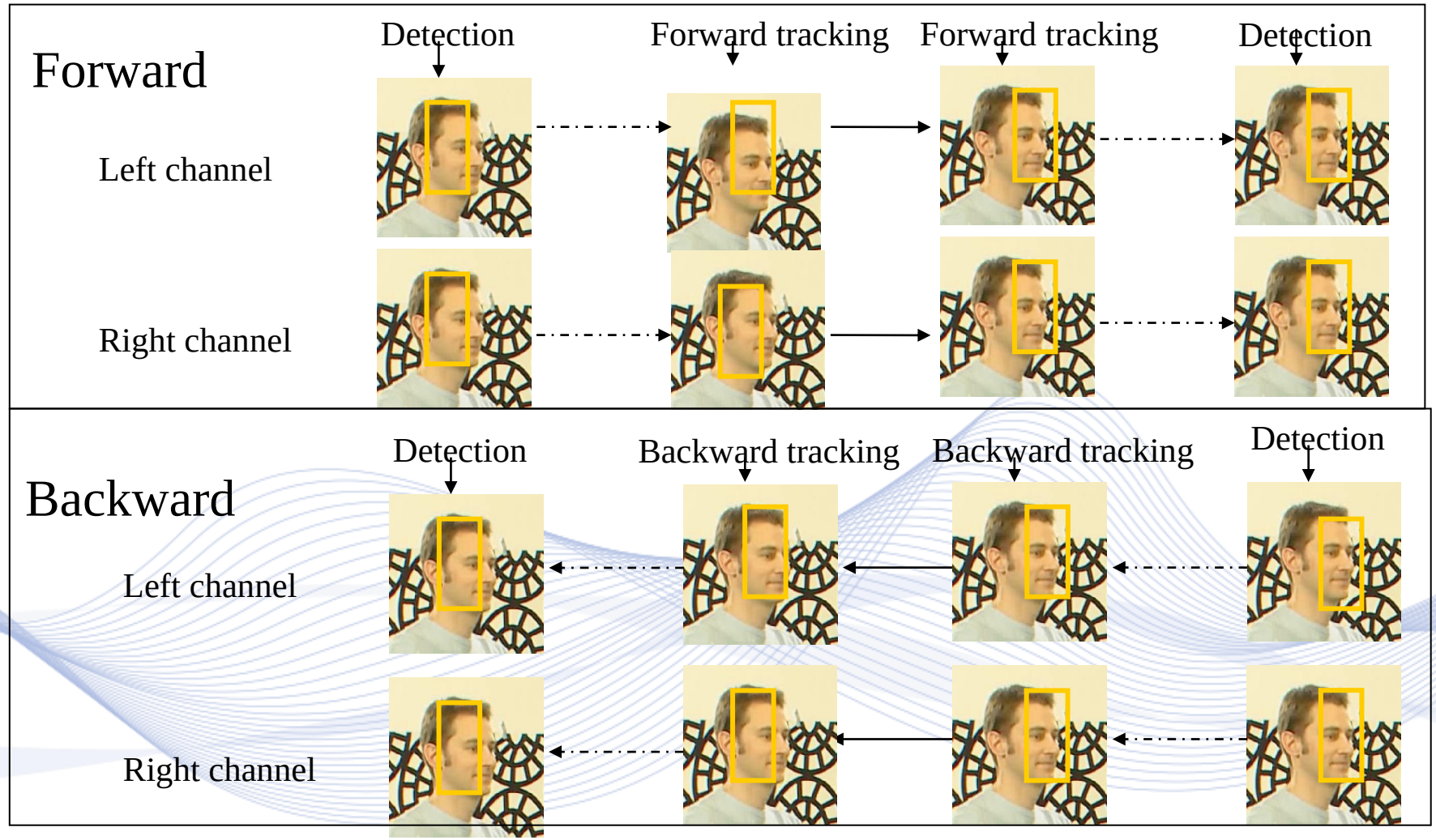
- Object Detection and Forward Tracking
- **Object Forward-Backward Tracking**

Forward-Backward Tracking Motivation

- Forward in time tracking: different results than backward in time tracking. One mode of tracking may succeed where the other fails
- The key point: post-process the results of a forward and a backward tracking jointly, in order to refine the tracking results
- Same reasoning for stereoscopic video: performing tracking on both channels of a video provides us with more information than using only one.



F-BTracking in Stereo Video

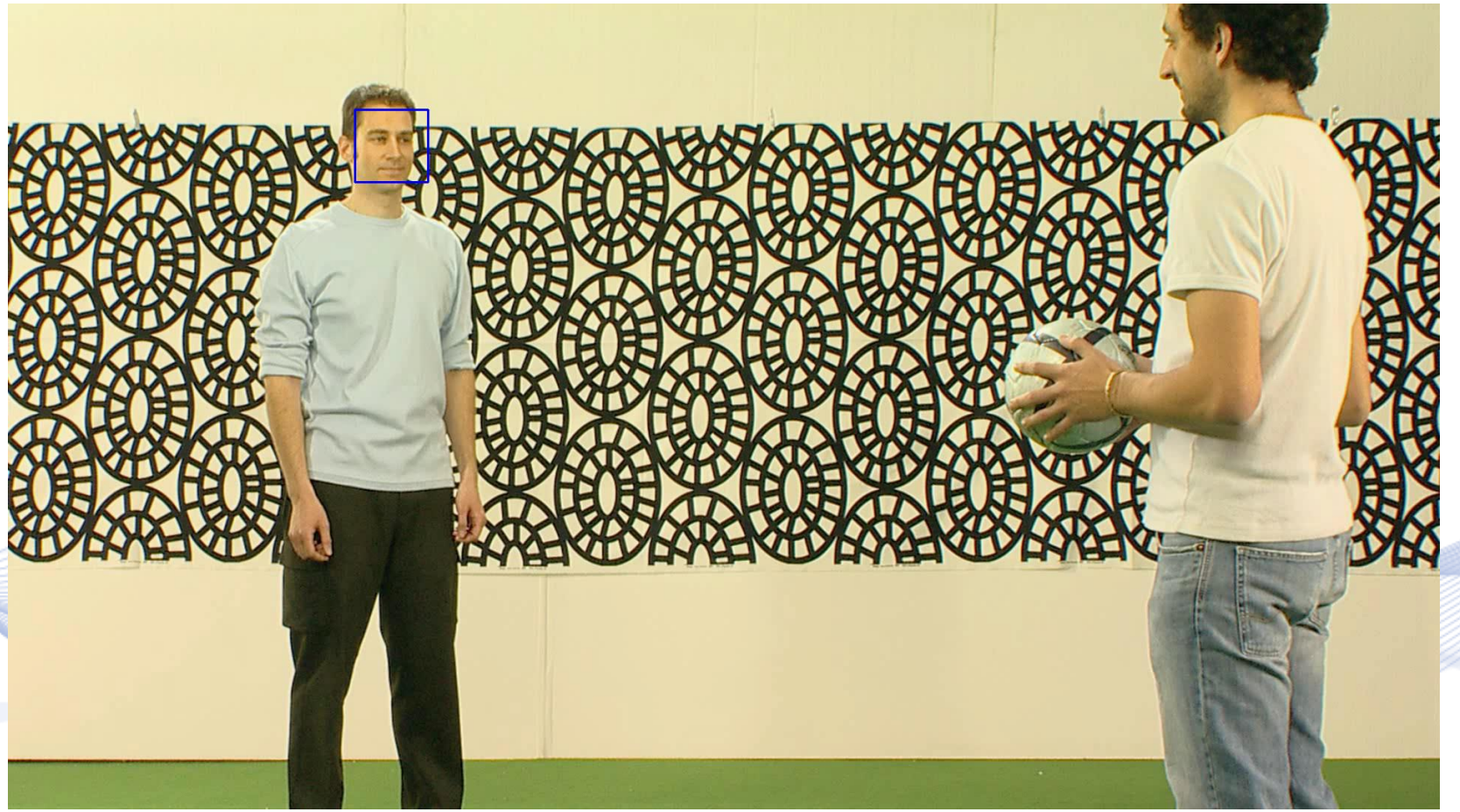


Quantitative Results

Algorithm performance (ATA) using stereo data						
Name	Detection period	Fowrard	FP	FBP	FBSP	
Badminton	20	0.614	0.620	0.625	**0.634**	
	30	0.604	0.612	0.624	**0.630**	
	40	0.580	0.589	0.594	**0.601**	

- Bayesian post-processing algorithms:
  - Forward tracking (FP)
  - Forward and backward tracking (FBP)
  - Forward and backward tracking in stereo sequence (FBSP)

Forward-Backward Stereo Tracking Results



F-B tracking conclusions

- Combining information from forward, backward tracking in a stereoscopic video, leads to more accurate tracking results.
- In terms of ATA, accuracy is increased proportionally to tracking failures of the standard single channel algorithm
- However, in tracking failures, it seems that the extra channel information from stereo is not fully exploited

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Q & A

Thank you very much for your attention!

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