Player detection and action recognition

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Outline

1. Player detection
2. Action recognition
3. Transfer learning
4. Plan

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Detecting player foreground

Mosaic, built per shot

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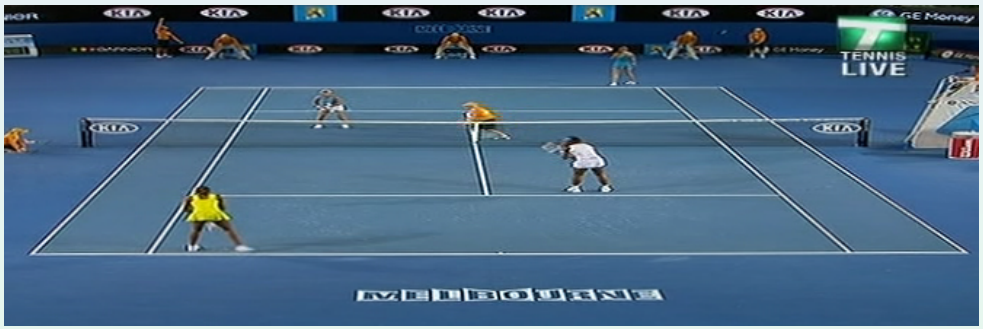

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Input image: de-interlaced field with radial distortion corrected, registered with the mosaic

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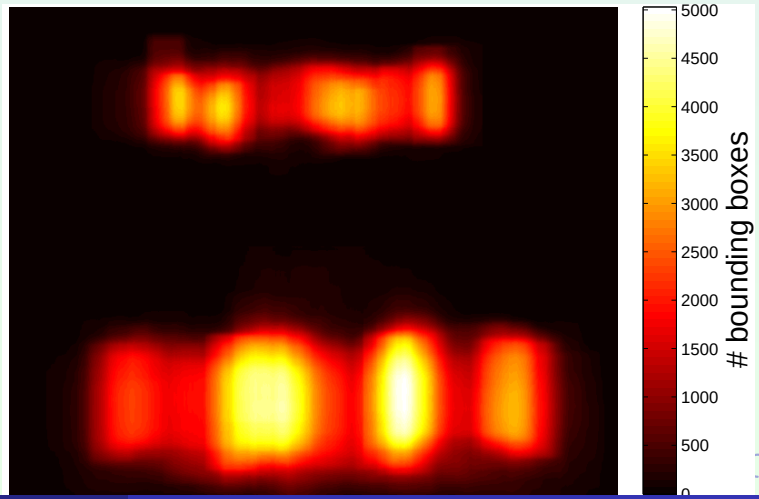
Moving blobs, filtered with a morphological opening operation (erosion $\rightarrow$ dilation)

Processing foreground blobs for player detection

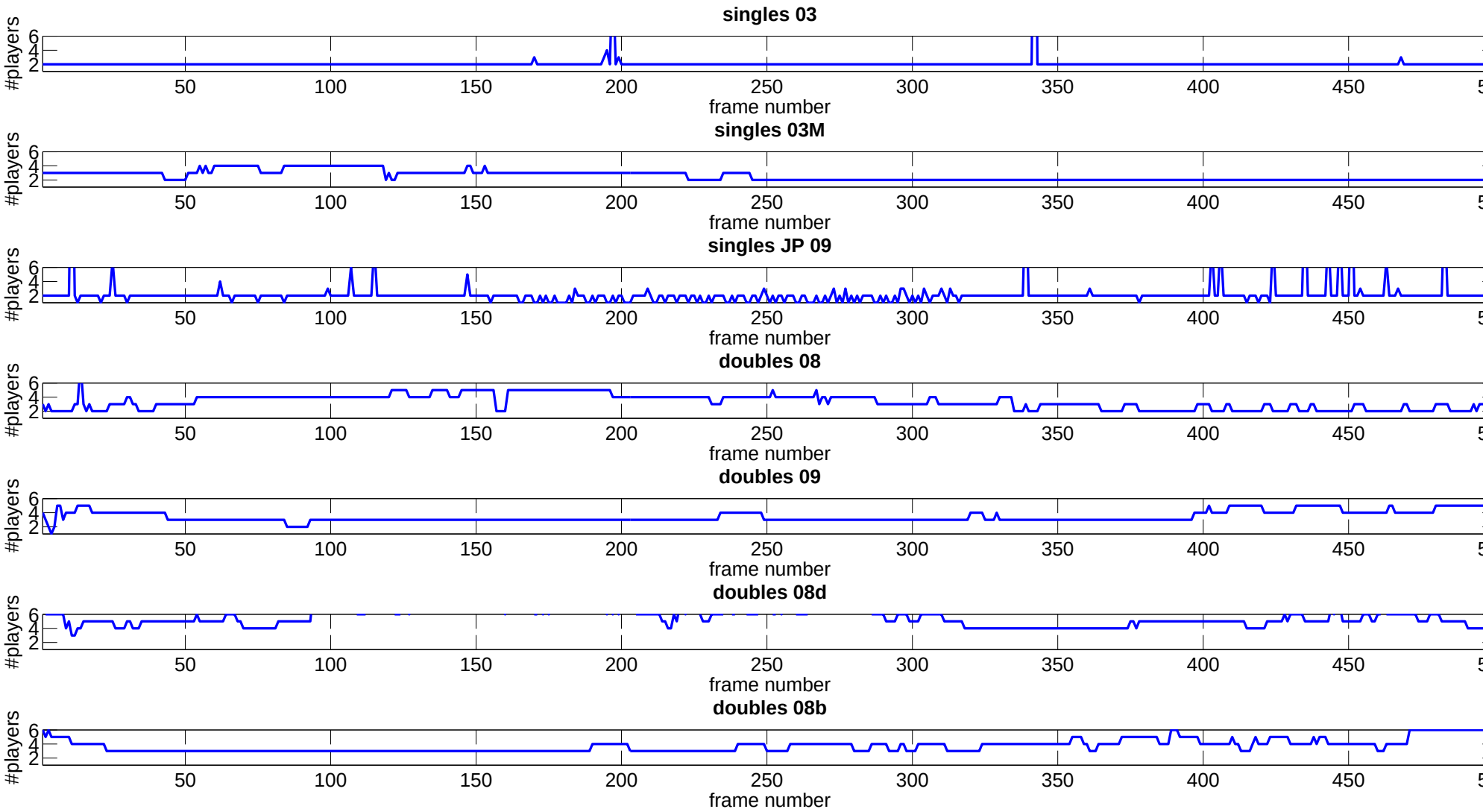
Algorithm

1. Background subtraction
2. Morphological opening
3. Fit bounding boxes to all continuous blobs: 119 red boxes
4. Merge nearby boxes: 32 cyan boxes
5. Apply geometric constraints: area, aspect ratio, ratio area/BB_area: 8 dashed magenta boxes
6. Apply temporal constraint: 7 dashed green boxes
7. Apply foreground mask: 5 dotted yellow boxes

Player location pdf computed from a 35 minutes footage of singles



Player detections over time



Player count anomaly measures

Plan: compute a player count histogram per shot and compare with a "normal" histogram using these measures:

- City block (l_1)
- $\chi^2(\mathbf{x}, \hat{\mathbf{x}}) = \frac{1}{2} \sum_{k=1}^{K} \frac{[x_k - \hat{x}_k]^2}{x_k + \hat{x}_k}$
- Kolmogorov-Smirnov test
- Difference of modes: found anomaly in 34 shots out of 49 (Australia2008a video, $|d| > 1$)

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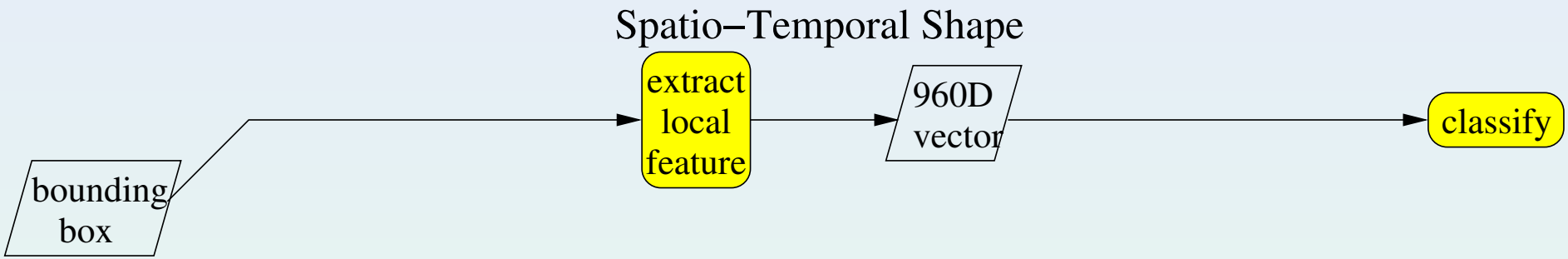
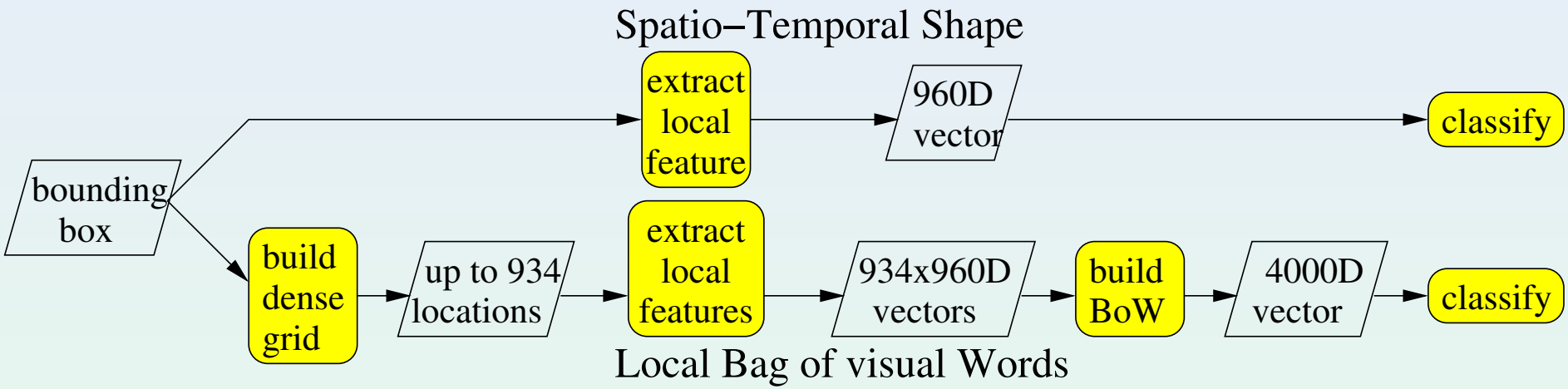
A comparison of two approaches for action recognition



A comparison of two approaches for action recognition



A comparison of two approaches for action recognition

- Although STS is more appropriated for actions that are well defined in time and space, it gives competitive results on non-local actions.
- We evaluated versions of BoW based on the use of constraints in space or time (SBoW and LBoW).
- We did experiments on 4 datasets: tennis, Weizmann, KTH, UCFsports.
  - STS outperformed BoW-based methods in all datasets where the background is not relevant.
  - In UCF sports, SBoW lead to the best result.

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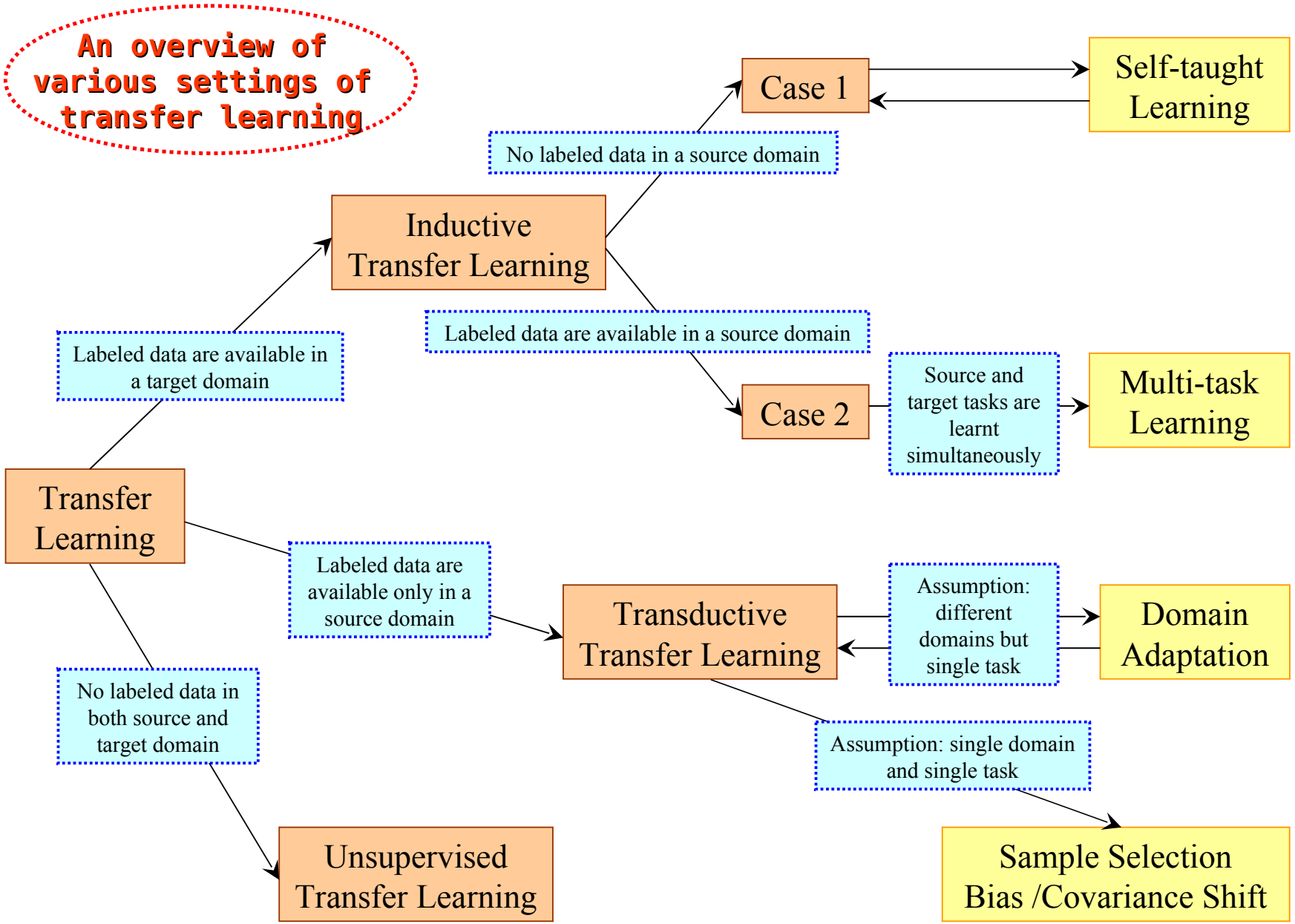
Transfer learning



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Plan

- Evaluate anomaly detection via player count
- Improve player detection and tracking using [Kalal et al CVPR2010]
- Apply transfer learning from one sport to another