ICS 117 Team Sport Player Tracking Evaluation

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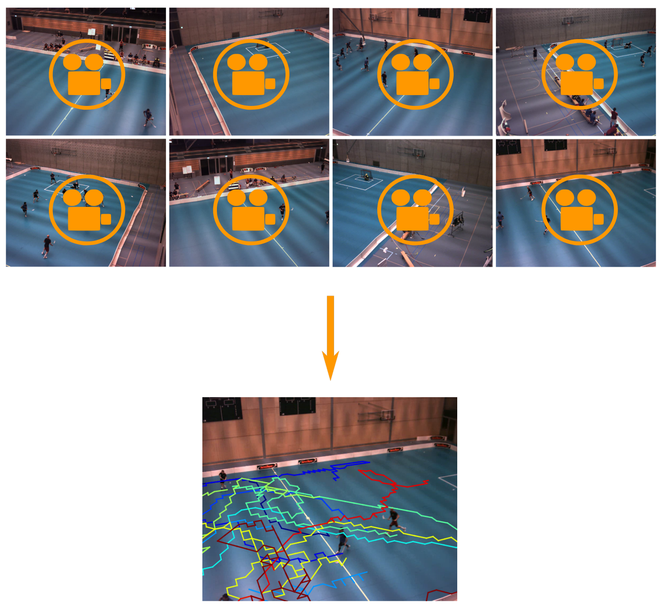
1 Goals

- Evaluate state of the art multi-target multi-view tracking algorithm with a publicly available implementation.
- Introduce a new team sport benchmark dataset.

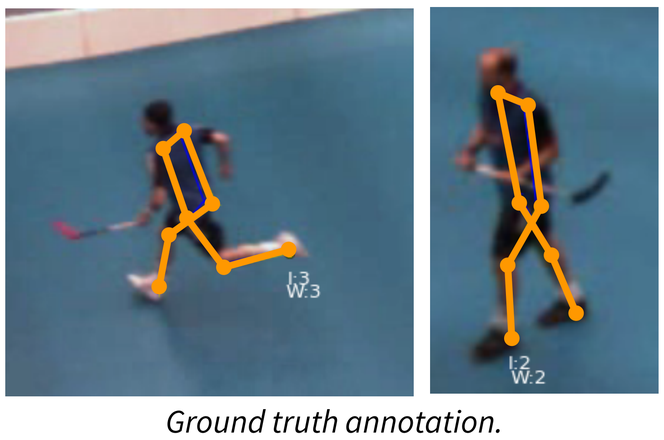


2 Conclusions

- The Probabilistic Occupancy Maps and K-Shortest Paths algorithms deliver good player tracking performance on a multi-camera team sport recording.
- The used implementation doesn‘t include appearance model and fails frequently on preserving person / player identity. Also most of the published appearance models can‘t distinguish between similar players of one team.
- Special attention should be payed to background subtraction of slowly moving objects.

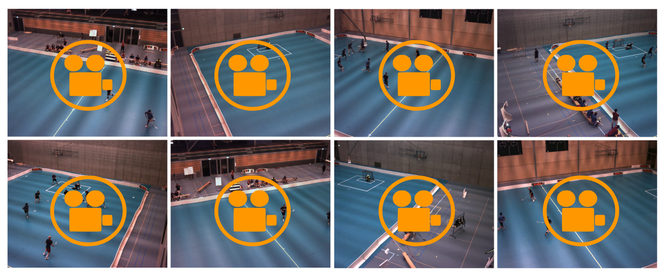
3 Dataset

- multi-camera floorball dataset with tracking ground truth
- acquired indoor with constant lighting
- 8 synchronized cameras
- 12 players of 2 teams
- 20 frames per second
- resolution 960 × 768 pixels
- camera calibration included
- groundtruth: player positions every 2 seconds or 40 frames until the first player switch in the 21st second, 3d player positions triangulated from multiple views

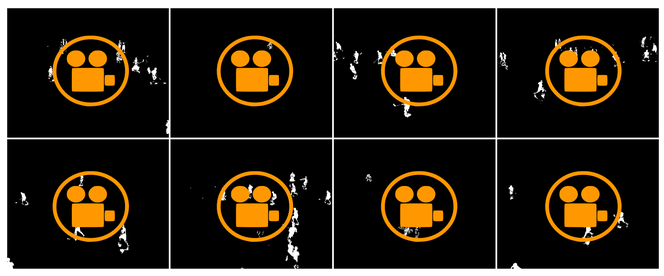


Ground truth annotation.

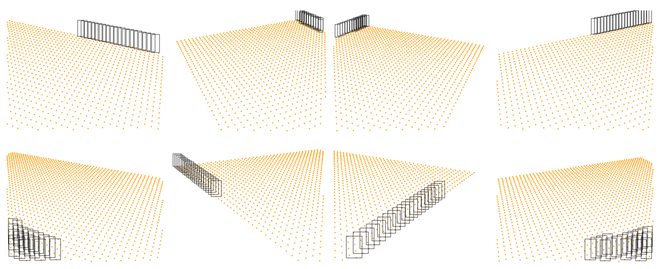
4 Methods



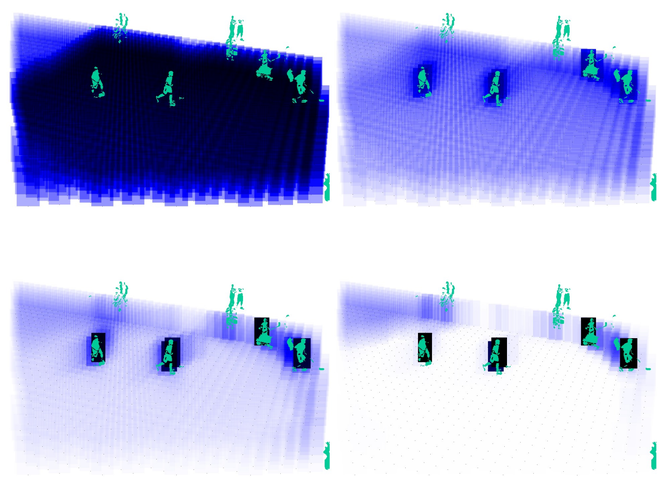
input: multi-view sequences of images



perform background subtraction to get sequences with foreground objects

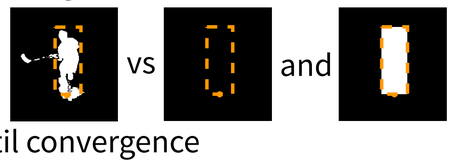


for every **camera view**:
  using camera calibration generate ground grid positions and player bounding boxes (only a few shown)



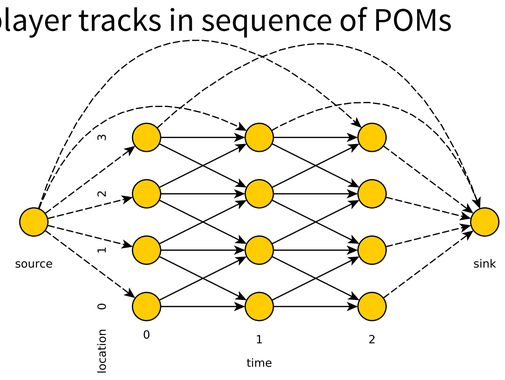
4 iterations of occupancy map estimation.

for every **time frame**:
  create probabilistic occupancy map:
    for every **position** repeat:
      for every **camera view**:
        update probability of a player on the position by comparing actual image with synthetic images

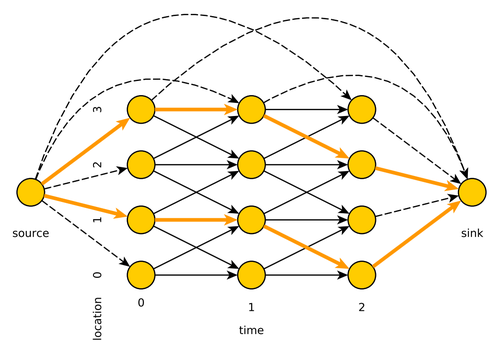


        until convergence

find player tracks in sequence of POMs



create graph where vertices have assigned occupancy probabilities and edges transition costs



run k-shortest disjoint paths algorithm to find k most probable player trajectories

5 Results

- evaluation of 10 players - without goalkeepers
- slowly moving goalkeepers are incorrectly segmented to backgroud
- identity is not preserved

false negatives

false positives

1.09 FP/frame

6 References

- J. Berclaz, A. Shahrokni, F. Fleuret, J. Ferryman, and P. Fua, “Evaluation of probabilistic occupancy map people detection for surveillance systems,” in IEEE International Workshop on Performance Evaluation of Tracking and Surveillance, 2009.
- F. Fleuret, J. Berclaz, R. Lengagne, and P. Fua, “Multicamera people tracking with a probabilistic occupancy map.,” PAMI, vol. 30, no. 2, pp. 267–82, Feb. 2008.
- J. Berclaz, F. Fleuret, P. Fua, and E. Turetken, “Multiple Object Tracking using K-Shortest Paths Optimization,” PAMI, vol. 33, no. 9, pp. 1806–1819, 2011.

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