Thermal Tracking of Sports Players

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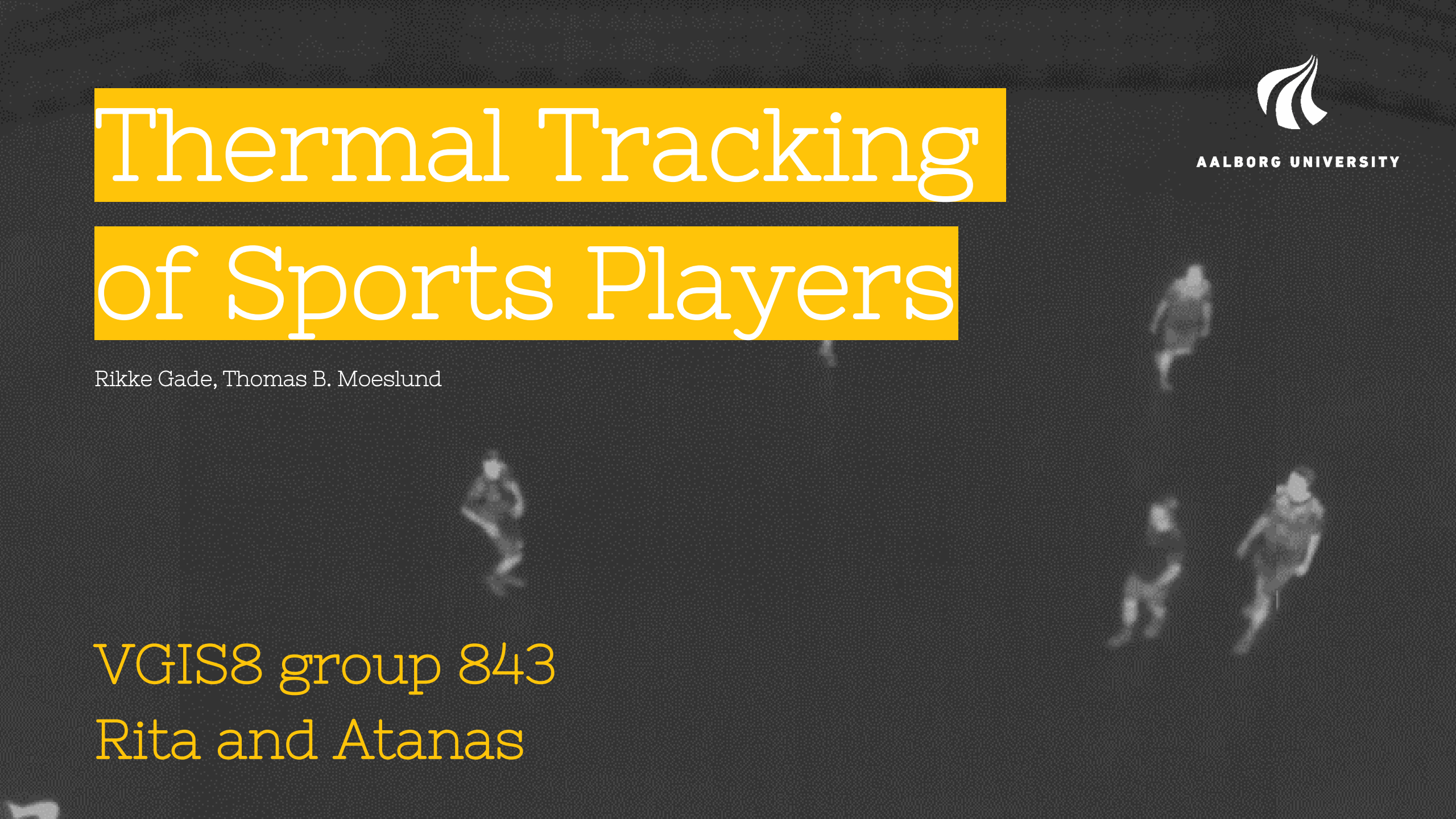


AALBORG UNIVERSITY

VGIS8 group 843
Rita and Atanas

Thermal camera

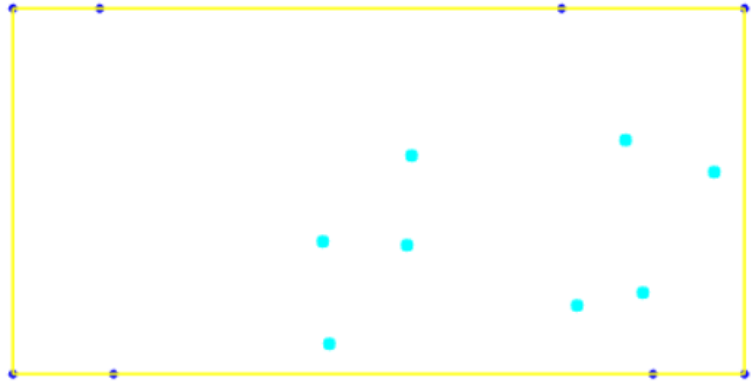
- Light independent sensor
- Preserves privacy

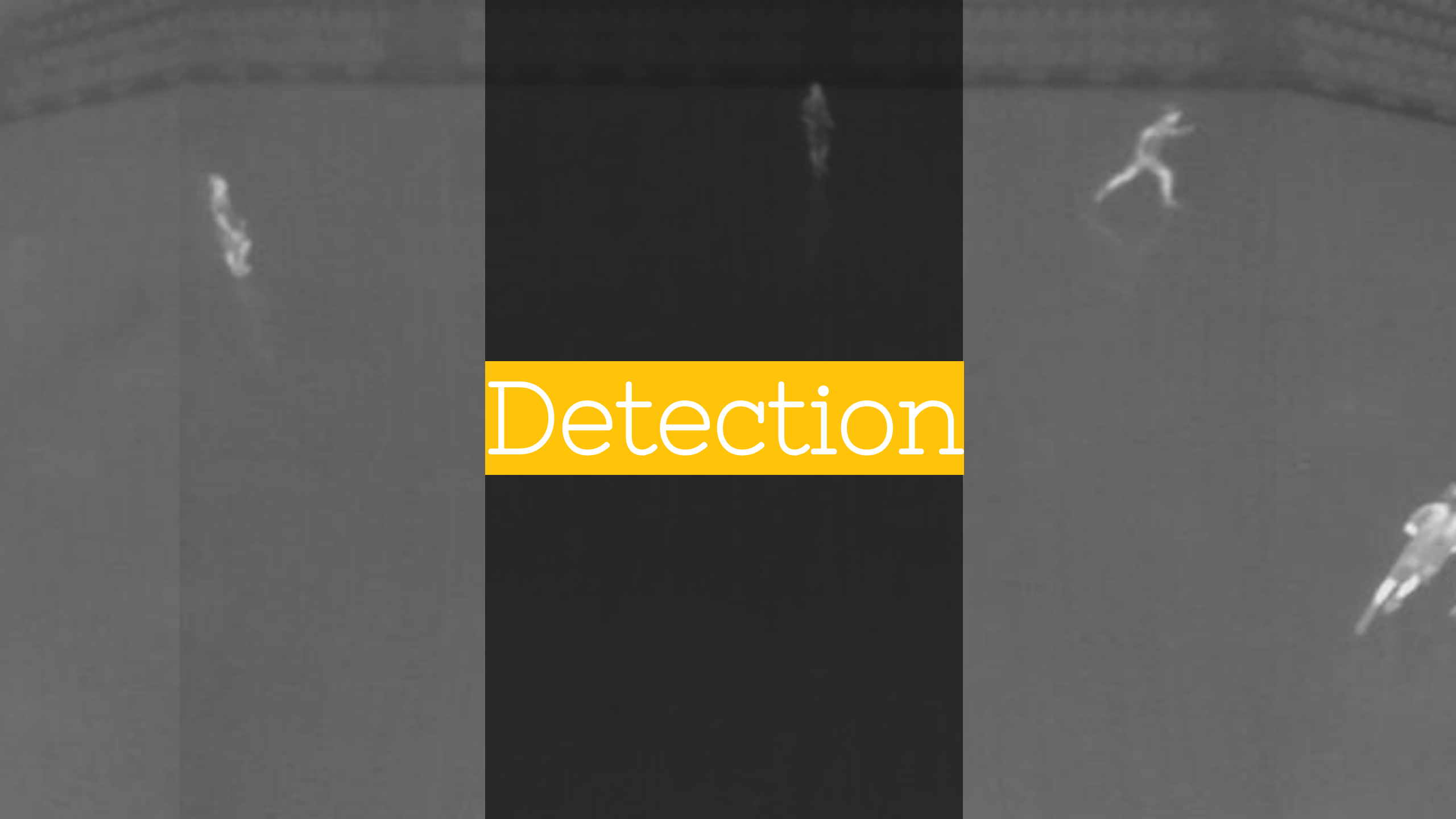
Data set

- Four 30 seconds videos of a soccer game on a public sports arena
- Videos from 3 cameras stitched together
- Challenge: unpredictable and erratic motion

Initialization

- To find peoples' locations in the court a mapping is done from video coordinates to court/world coordinates
- A homography matrix is calculated from the points in the images




Detection

Segmentation

- Thresholding
- Dilation and erosion

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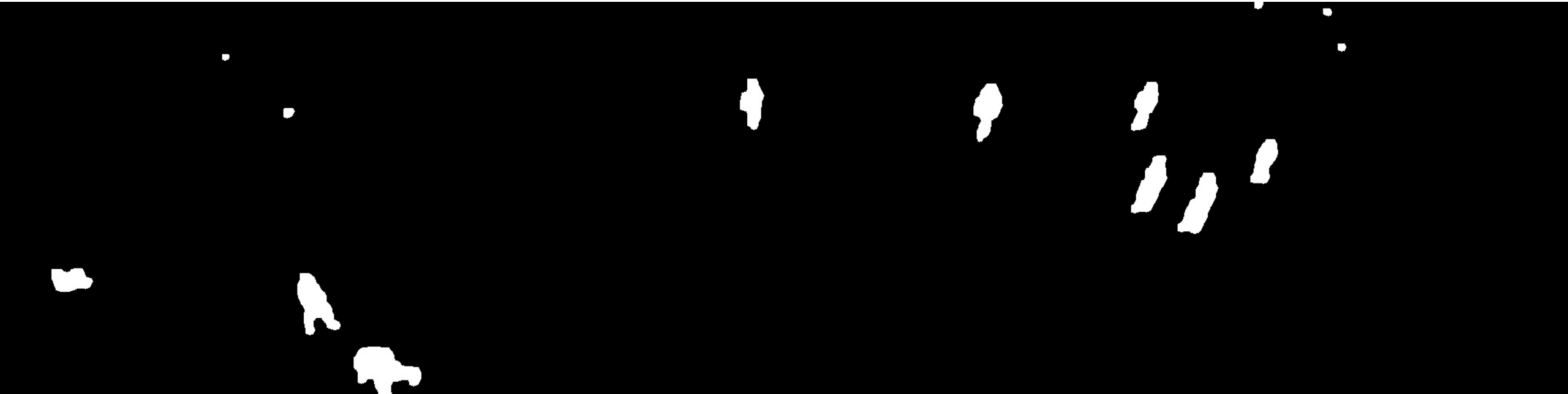
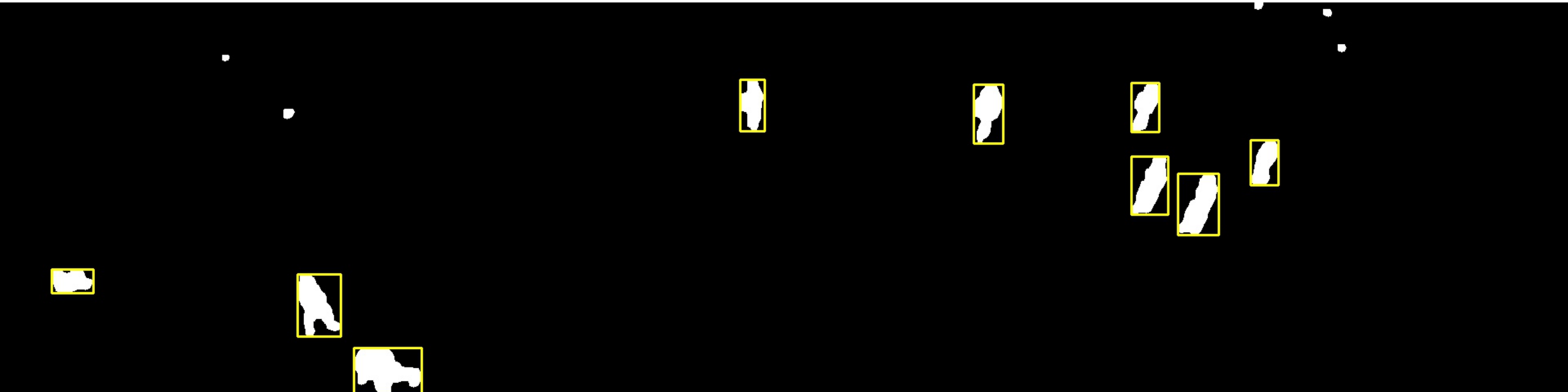
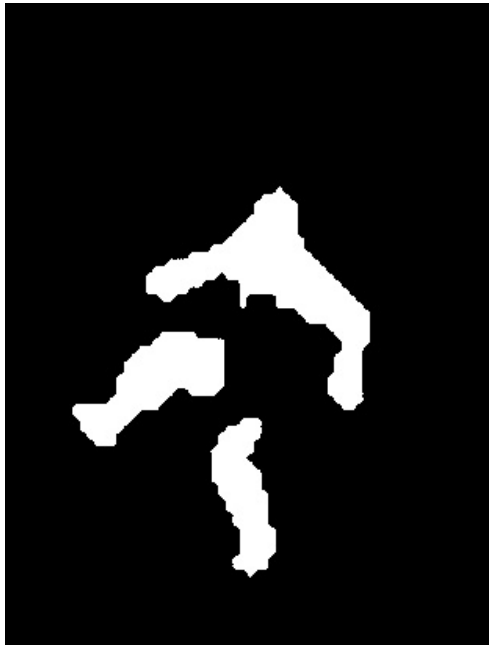


Detect contours



Challenges

- Connect blobs

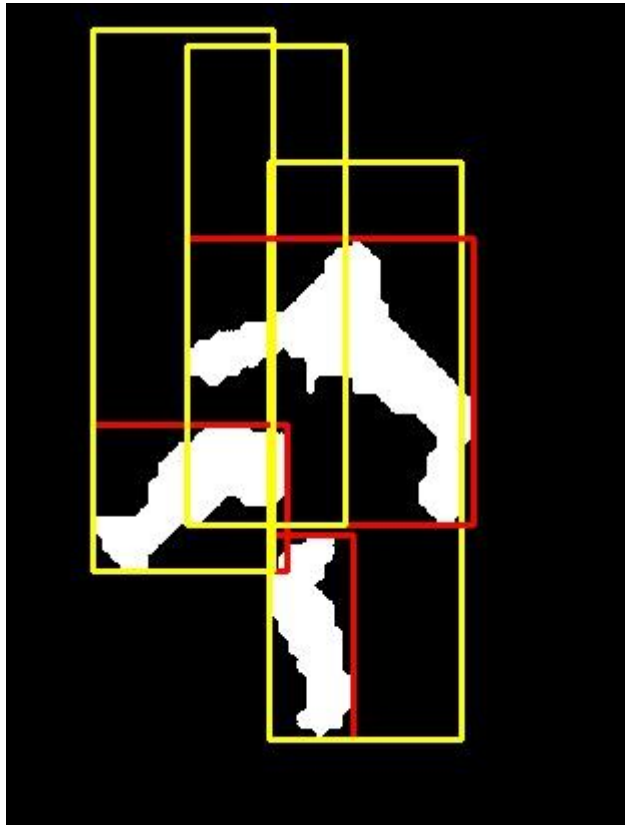


- Split tall blobs

- Split wide blobs

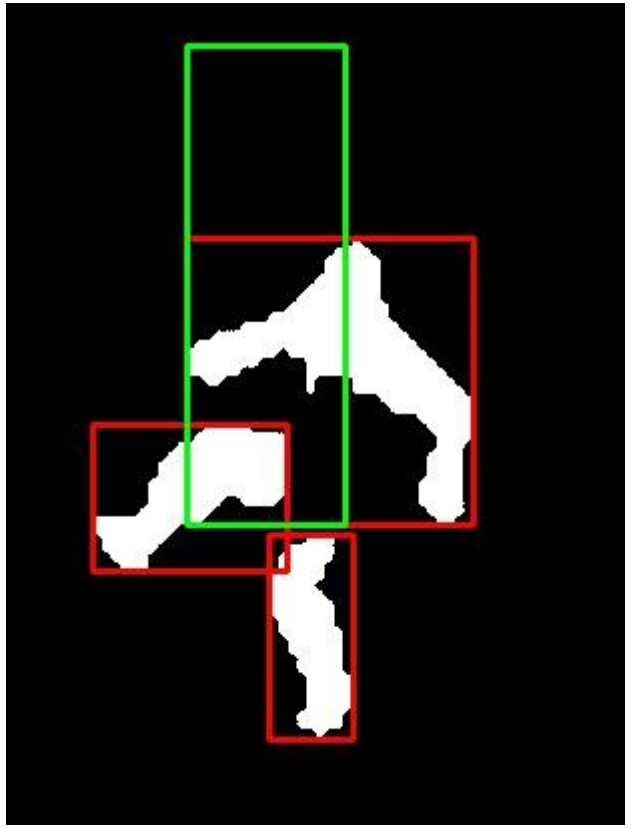
Connect Blobs

- Generate a rectangle of standard height at the location of each blob with the width being one third of the height
- For each rectangle, the ratio of white pixels is calculated
- If the ratio is below 15% the blob is discarded



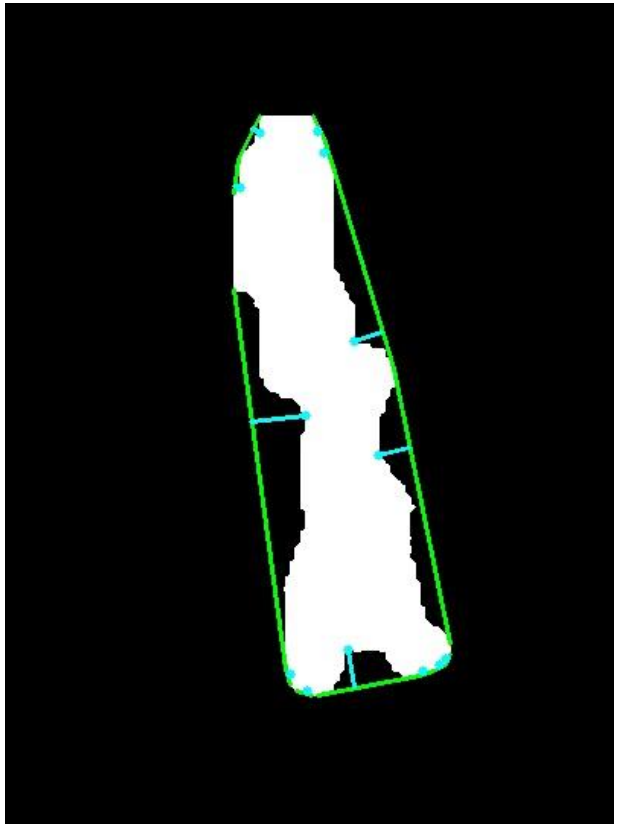
Connect Blobs

- If two rectangles overlap by more than 15%, the candidate with the highest ratio of white pixels is kept as the true detection



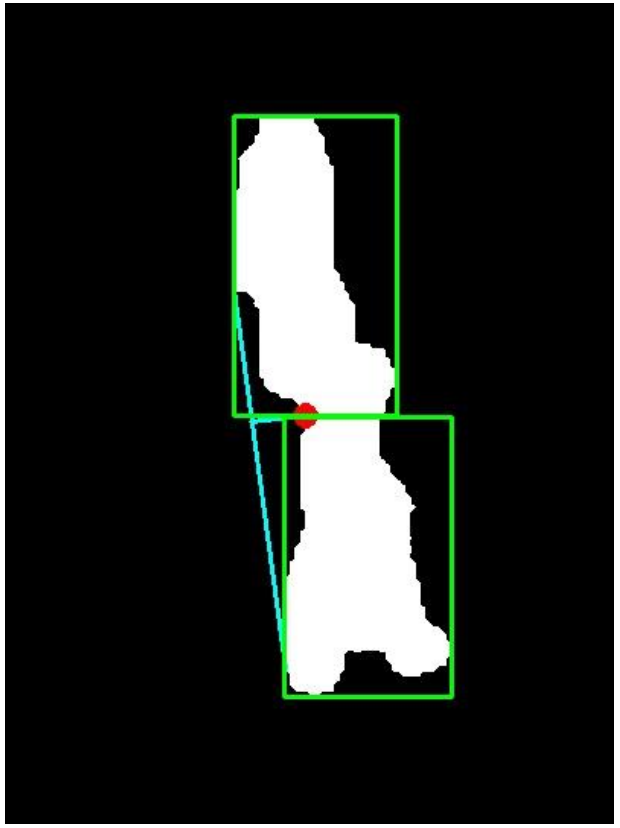
Split tall blobs

- If a blob has a height larger than a maximum height at the given position the algorithm tries to split the blob horizontally
- The convex hull and convexity defects of the contours are detected



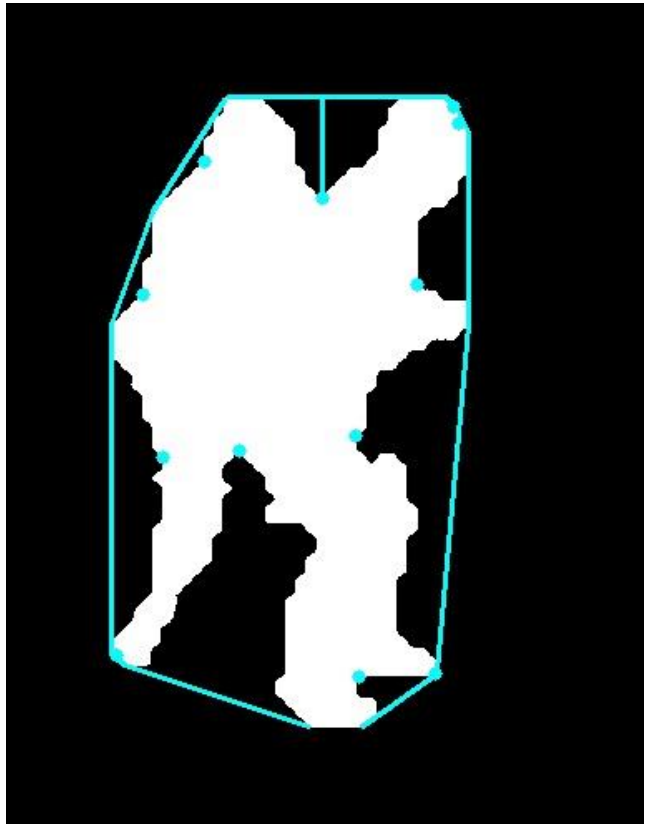
Split tall blobs

- The point selected to split from is the defect point with the largest depth and a maximum gradient of 1.5 (only defects from the side are considered)
- The defect point should not be in the top or bottom fourth of the region
- The region is split horizontally from the selected point



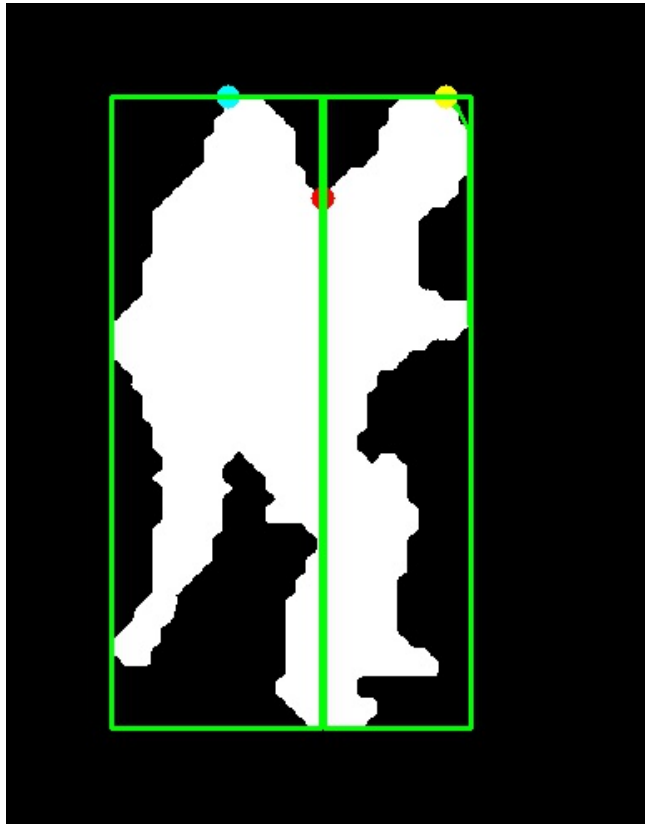
Split wide blobs

- The algorithm will try to split a blob vertically if a blob's bounding box height is less than five times the width and the contour of the region is larger than the bounding box perimeter
- The convex hull and convexity defects of the contours are detected



Split wide blobs

- The idea is to separate the people based on their head position
- The defect must be on the upper edge of the region and have a y-value greater than both the convexity defect's start and end point to make it a minimum point

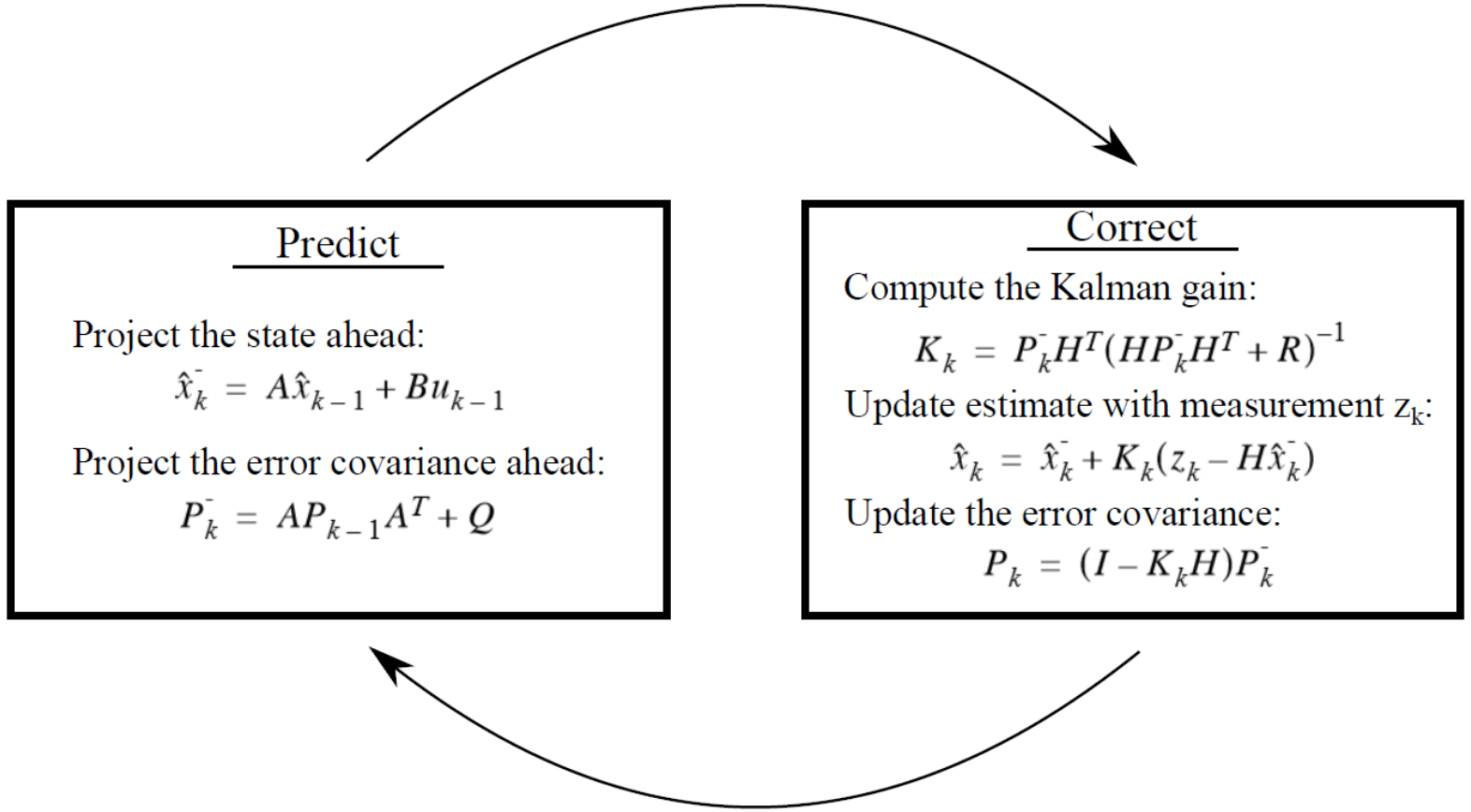



Tracking

Kalman filter

- Recursive algorithm that predicts the next step from the previous state, filtering noisy measurements, and uses the new measurement to update the estimate

Kalman filter



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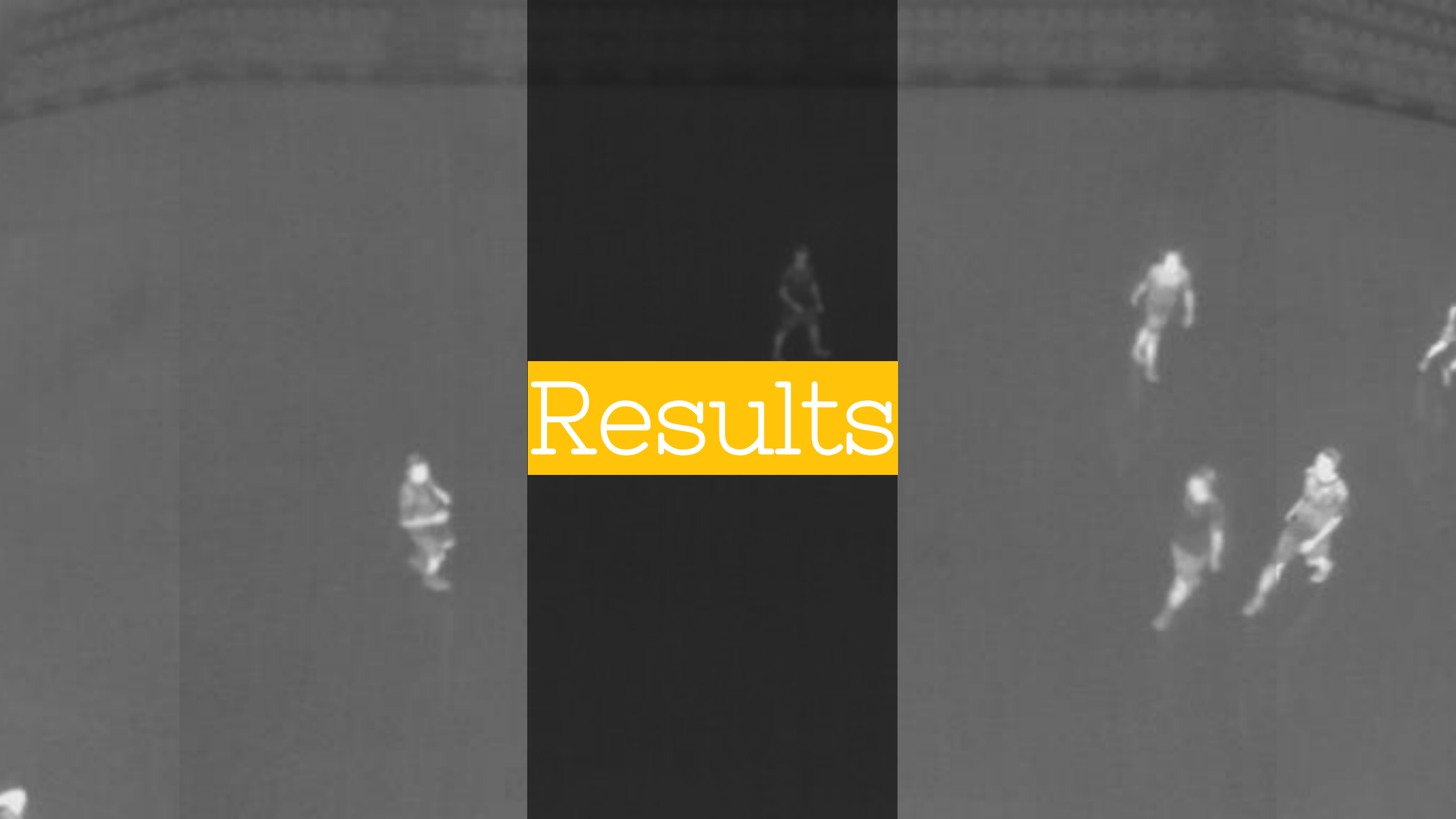
Tracking

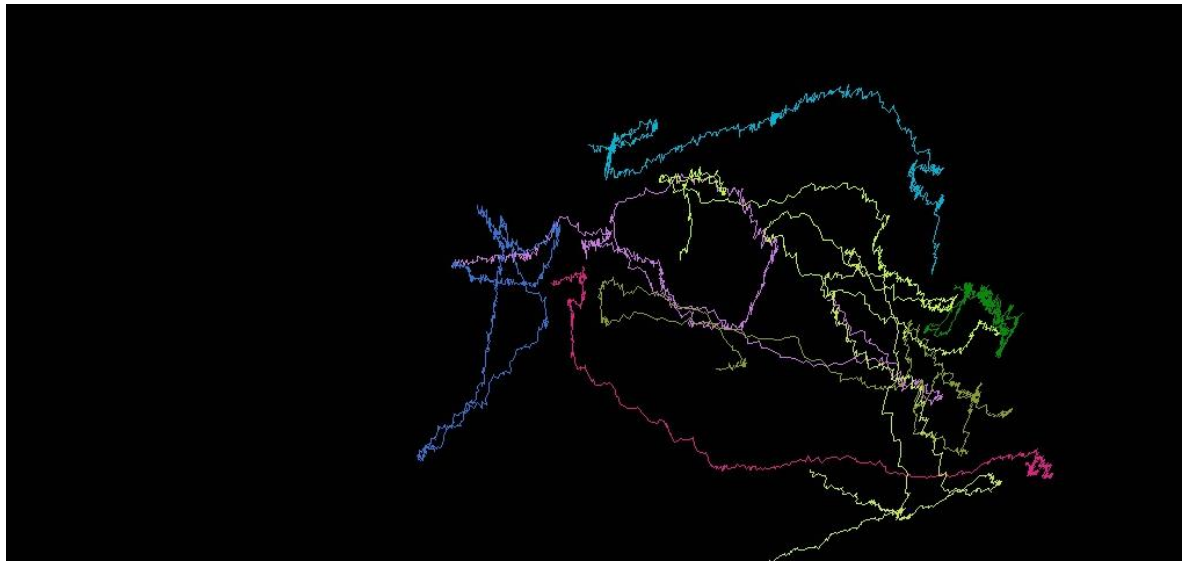
- For each detected person a new Kalman filter is created
- In each frame a Kalman filter is assigned the nearest detection (given a distance threshold)
- For each detection not assigned to a Kalman filter, a new one is created, thus beginning a new track
- Kalman filters with no assigned detections are still continued based on predictions for a maximum of 5 frames without detections



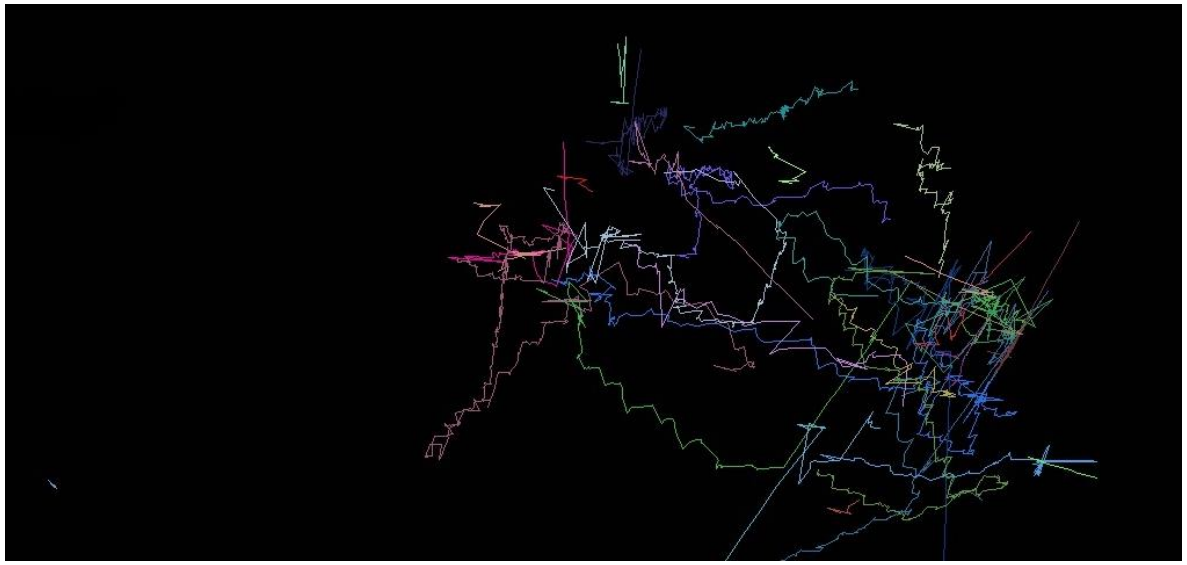
Results

Video 1

Ground truth

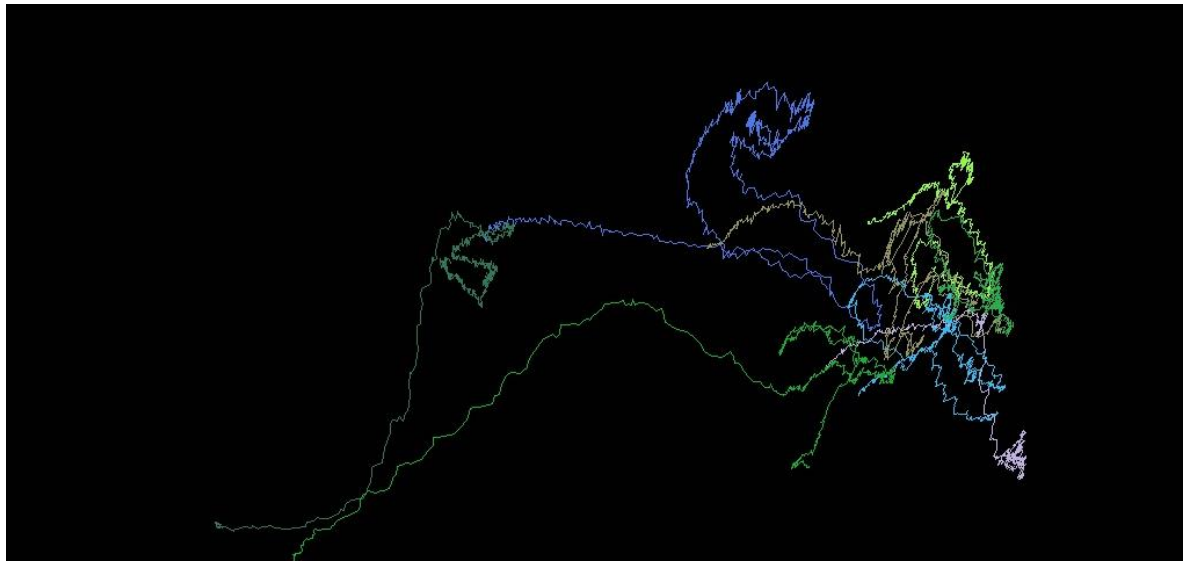


Result



Video 2

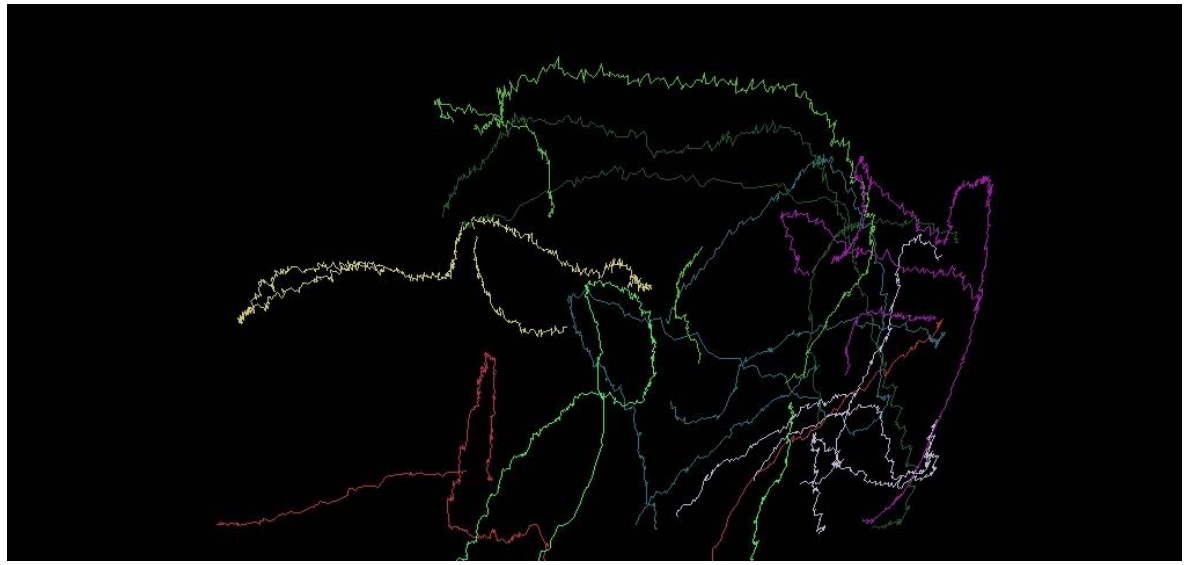
Ground truth



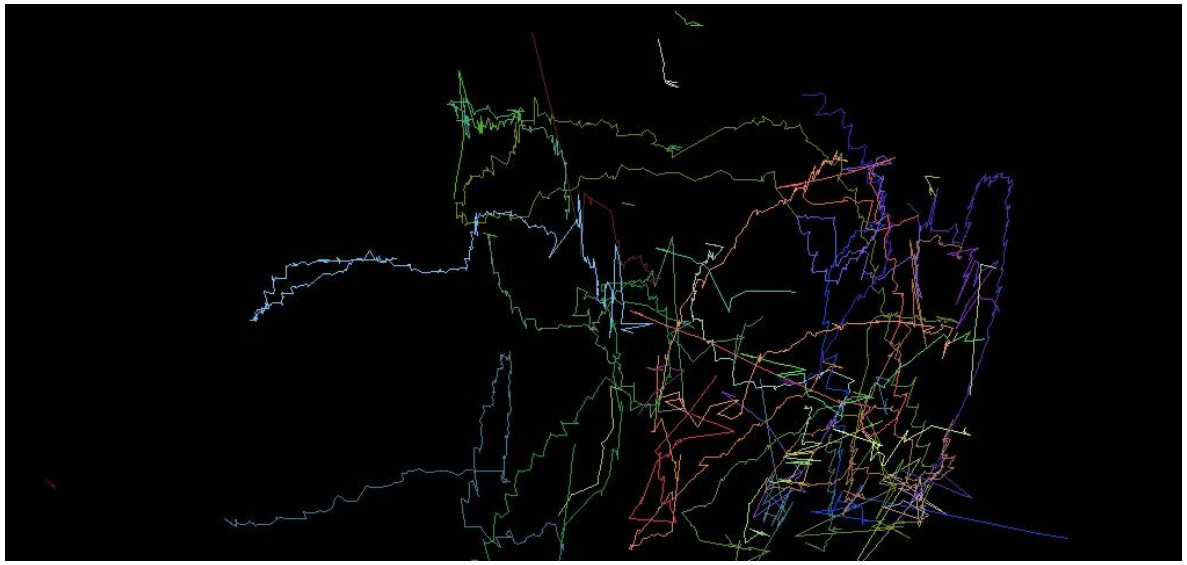
Result

Video 3

Ground truth

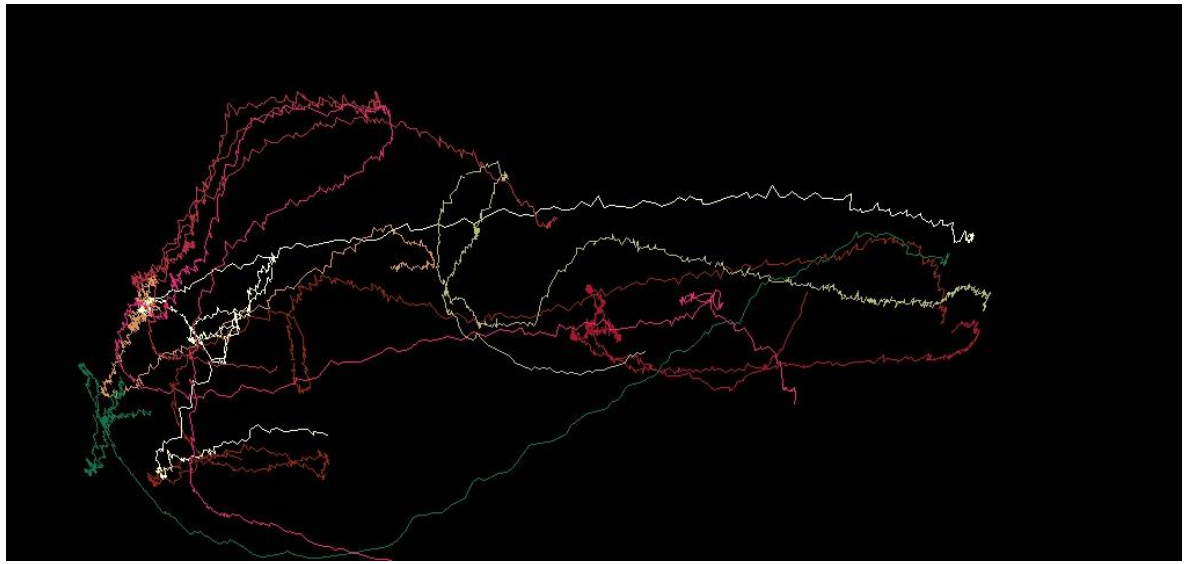


Result

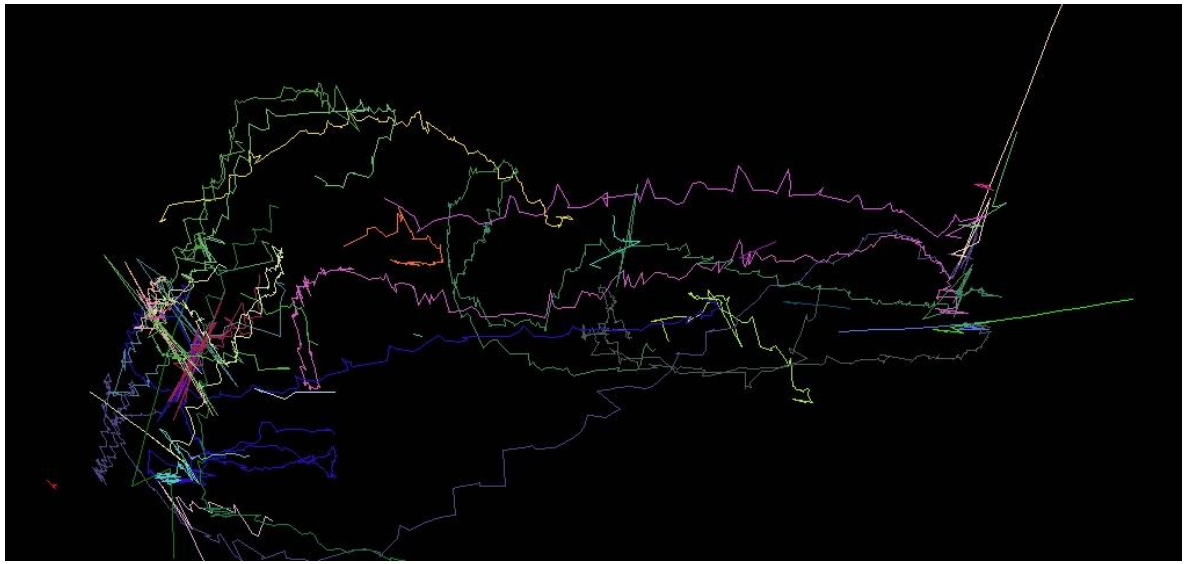


Video 4

Ground truth



Result



Thanks!

Any questions?