Segmentation and tracking in football

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Goals

- Detect objects on football field:
  - Players
  - Referees
- Track movement of objects
- Classify objects into groups
- Get knowledge about detected objects

Data

- **Typical football broadcast** (dynamic camera)
  - Unlimited availability
  - Not recording whole pitch

- **Static camera broadcast**
  - 3 static cameras
  - Recording whole pitch
  - Only 2 minute record

Data preprocessing

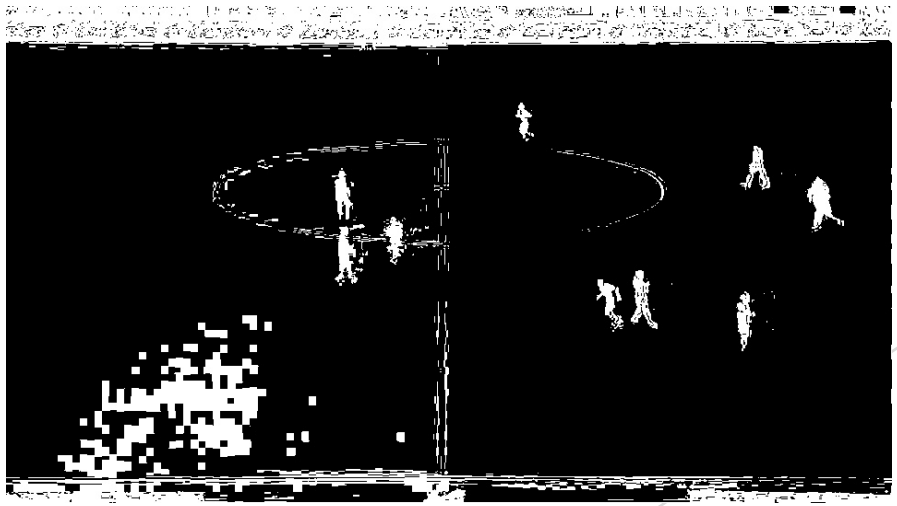
- Records after merge has
  - Duplicated areas
  - Blind areas

- Perspective transformation
  - Upper half of image

Segmentation of players

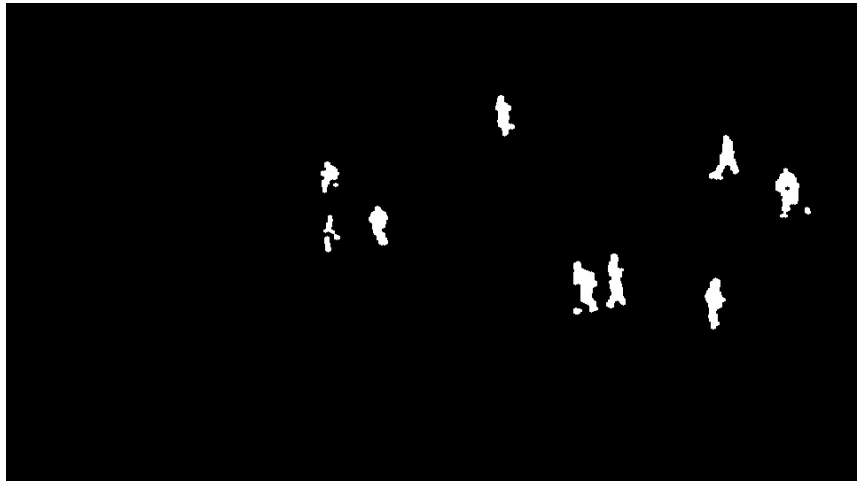
- **Background Substraction**
  - MOG2 Substractor
  - Object has to move

- **Color based extraction**
  - Take mask of green field
  - Difficult to find HSV range

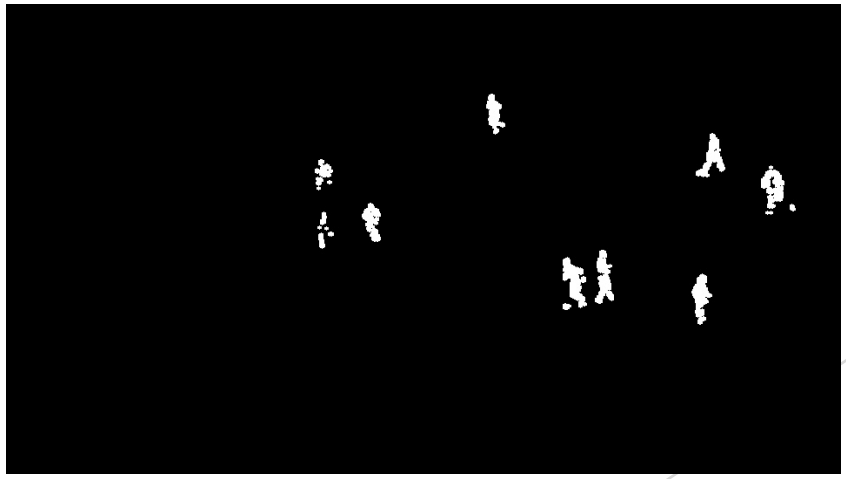


Morphological operations

- **Opening**
  - Removing small objects
  - 5x5 Ellipse Kernel



- **Closing**
  - Removing small holes
  - 5x5 Ellipse Kernel



Get objects from foreground

- Pedestrian detection
  - Implementation not working – small objects
- Obtain contours from post-processed foreground
- Filter contours
  - Based on regular size of player – contour bounding box

Dividing to groups – mean color

- Label on Treshold
  - Treshdold for color channel
  - More successful
- Label by K-means
  - More automated
  - Less succesful – labels switching
- Problem - connected objects are merged

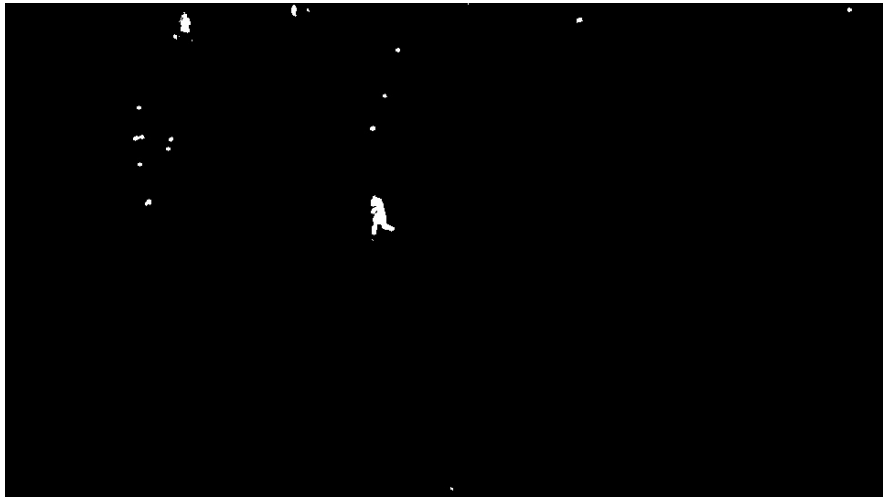
Mean color

Labelled objects

Dividing to groups – mask of label

- Mask of color
  - HSV range for color label (blue, white)
  - Bitwise AND with Foreground mask

- Connected objects are merged if they are same label (color)

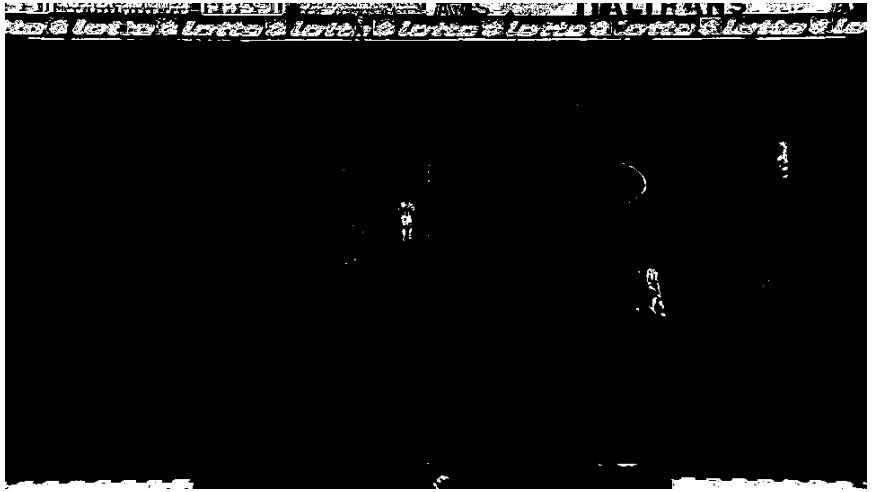


Referee's label mask

Labelled referee

Tracking of object

- MeanShift tracking alghoritm
  - Compute histogram of window
  - MeanShift tracks movement of object histogram in next frame
- Compute mask for object label (kit color)
  - Problems if 2 objects of same label(color) overlap



White mask

Mean Shift window

Segmentation sample

Tracking sample

Summary

- **Segmantation of objects**
  - Background substraction AND Field mask
  - Filtering of detected objects
  - Labelled objects
    - K-means, threshold
    - Mask for labelled group(HSV in-range)
- **Tracking of objects**
  - MeanShift alghoritm
    - Applicable to labelled object