Computer Vision Approach to Football Player Mapping

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Abstract

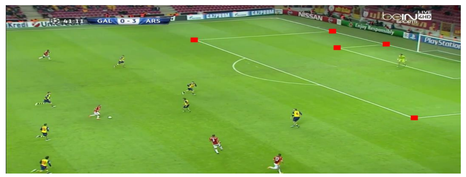
Professional sports industries continue to increase their reliance upon analytics, one of the primary being the tracking of player movement. In football (soccer) this is even more prioritized as the game relies upon player positioning and movement on a vast playing surface. Modern techniques utilize wearable technology to accomplish this. This project argues that through the adaptation of existing computer vision techniques the same results can be achieved and democratized. Utilizing image channel thresholding, Hough Transformations, algebra, linear algebra, and a deep neural network, our results illustrate the possibilities of transforming player and ball locations from broadcast images into a 2-dimensional overhead coordinate space.

Background

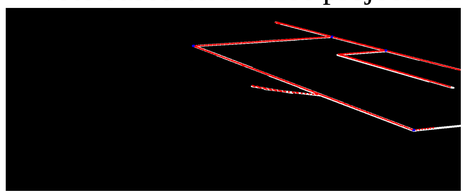
- A variety of computer vision techniques have been applied to applications ranging from tangential to highly relatable
- Line detection is a highly relatable application with lane detection for autonomous vehicles being a leading candidate
- Projection is a standard concept in the computer vision toolkit being applied for simple translations or as a piece of a broader application
- Object Detection has a myriad of fully researched applications, with applications in the sports industry being one of them

Methods

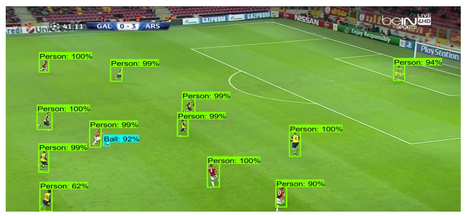
- Source Feature Point Detection
  - Filter Hue channel
  - Apply grayscale thresholding
  - Apply Hough Transformation
  - Solve for the valid intersections



- Solve Projection Matrix
  - Select 4 feature points
  - Test destination combinations
  - Vote based on inverse projection

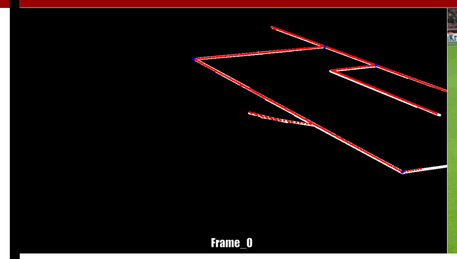


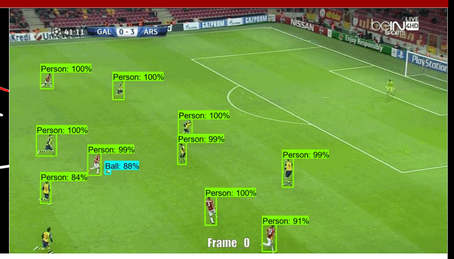
- Object Detection
  - Self-Labeled Image Dataset
  - TensorFlow 2 Object Detection API
  - Pre-Trained Model: Faster R-CNN with the COCO Dataset

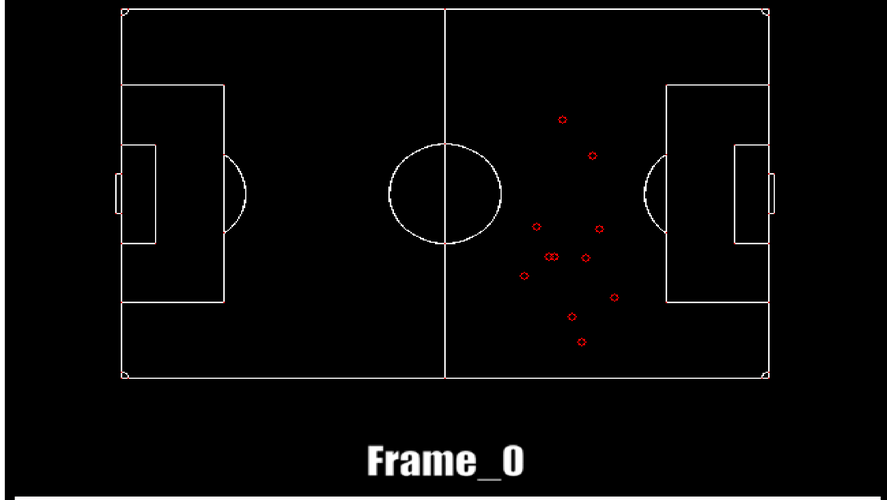


- Apply Projection
  - Ingest projection matrix and objects
  - Apply projection to object
  - Plot objects in destination

Results







Conclusion

In conclusion, we believe we have demonstrated a viable proof of concept for obtaining and mapping football player locations using computer vision techniques. We can inject an image from a broadcast angle of a football match, extract the pitch lines to identify feature points, solve for the projection matrix to the overhead space, identify objects in the original image, and project those objects into the overhead space.