Computer Vision System for Tracking Players in Sports Games Research Resource #2

<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5349633>

Overview

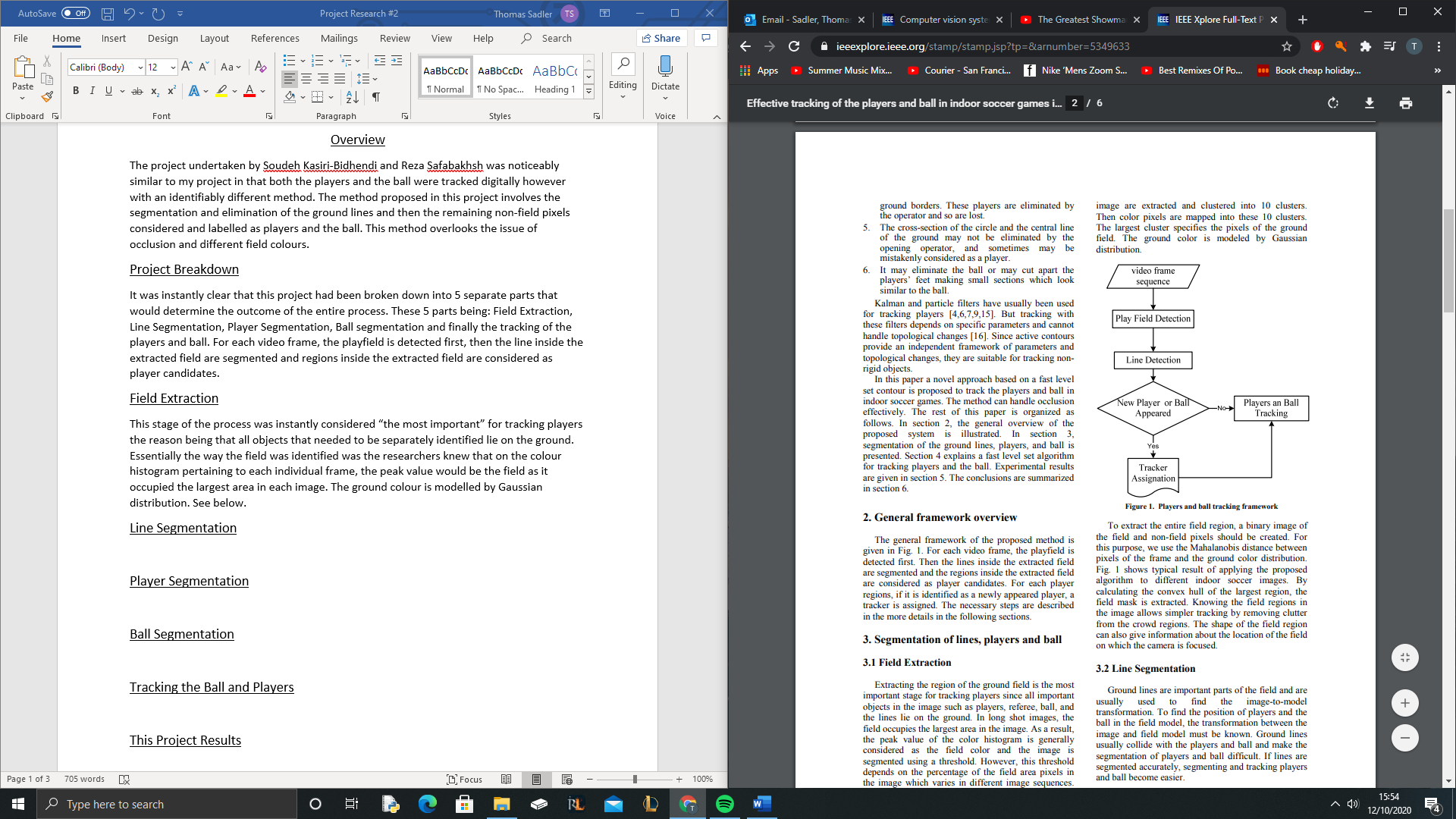
The project undertaken by Soudeh Kasiri-Bidhendi and Reza Safabakhsh was noticeably similar to my project in that both the players and the ball were tracked digitally however with an identifiably different method. The method proposed in this project involves the segmentation and elimination of the ground lines and then the remaining non-field pixels considered and labelled as players and the ball. This method overlooks the issue of occlusion and different field colours.

Project Breakdown

It was instantly clear that this project had been broken down into 5 separate parts that would determine the outcome of the entire process. These 5 parts being: Field Extraction, Line Segmentation, Player Segmentation, Ball segmentation and finally the tracking of the players and ball. For each video frame, the playfield is detected first, then the line inside the extracted field are segmented and regions inside the extracted field are considered as player candidates.

Field Extraction

This stage of the process was instantly considered “the most important” for tracking players the reason being that all objects that needed to be separately identified lie on the ground. Essentially the way the field was identified was the researchers knew that on the colour histogram pertaining to each individual frame, the peak value would be the field as it occupied the largest area in each image. The ground colour is modelled by Gaussian distribution. See below.



From here a binary image of the field and none field were created. By them calculating the convex hull of the largest region, the field mask is extracted. This meaning that tracking by removing clutter from crowd regions would make the goal of segmenting both the players and the ball much easier.

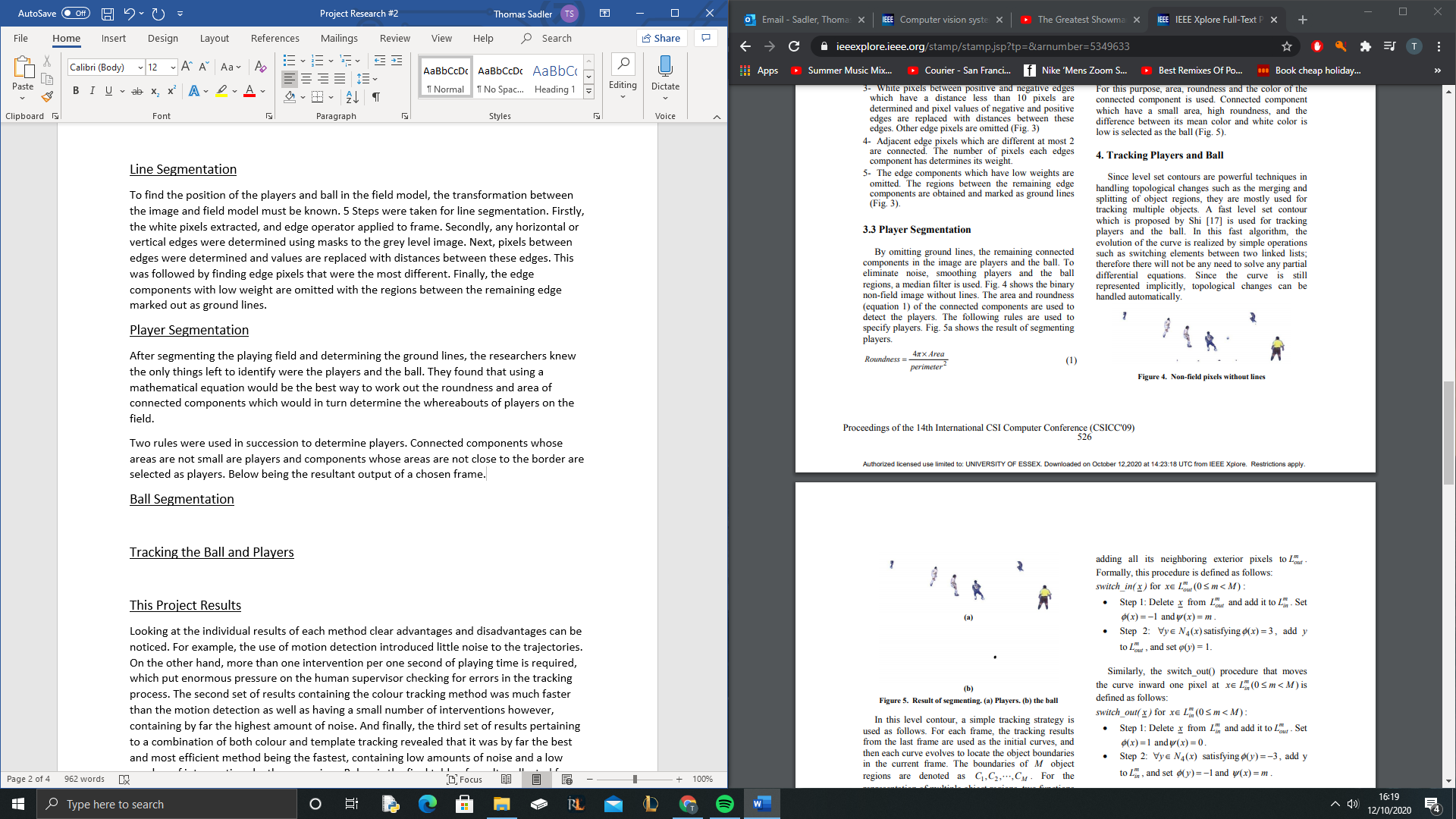
Line Segmentation

To find the position of the players and ball in the field model, the transformation between the image and field model must be known. 5 Steps were taken for line segmentation. Firstly, the white pixels extracted, and edge operator applied to frame. Secondly, any horizontal or vertical edges were determined using masks to the grey level image. Next, pixels between edges were determined and values are replaced with distances between these edges. This was followed by finding edge pixels that were the most different. Finally, the edge components with low weight are omitted with the regions between the remaining edge marked out as ground lines.

Player Segmentation

After segmenting the playing field and determining the ground lines, the researchers knew the only things left to identify were the players and the ball. They found that using a mathematical equation would be the best way to work out the roundness and area of connected components which would in turn determine the whereabouts of players on the field.

Two rules were used in succession to determine players. Connected components whose areas are not small are players and components whose areas are not close to the border are selected as players. Below being the resultant output of a chosen frame.



Ball Segmentation

By eliminating the field, ground lines and players, other connected components are detected for the ball. Area, roundness, and the colour of the component which have a small area and high roundness is selected as the ball.

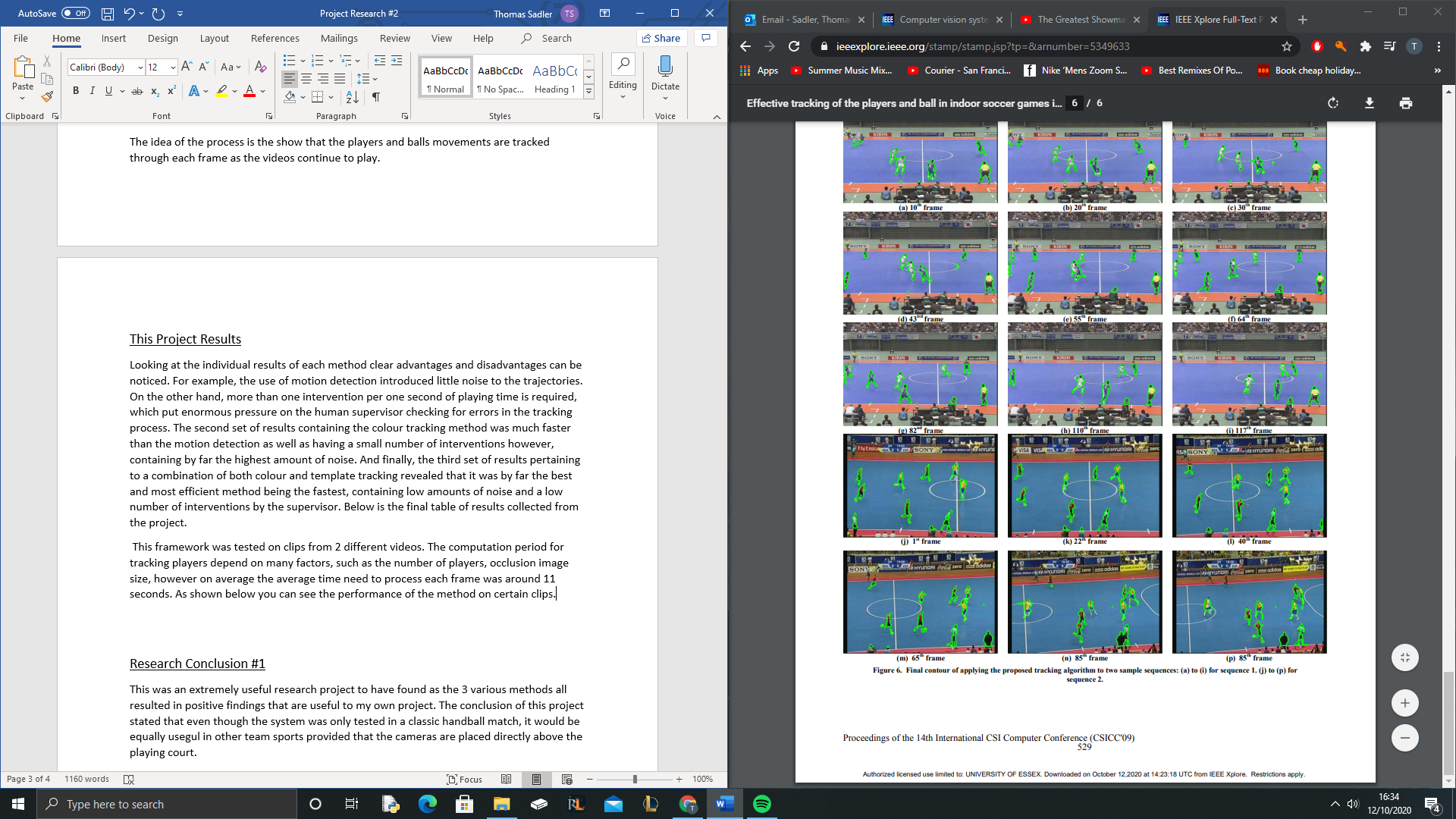
Tracking the Ball and Players

After multiple attempts at trying to understand the method used to track both the ball and players through each frame I have concluded that documenting it would be extremely counter productive as an extremely difficult and what seems to be overcomplicated mathematical process that spans over several pages is used. This does not in any way resemble the method that will be used in my project therefore I do not feel the need to try and understand it.

The idea of the process is the show that the players and balls movements are tracked through each frame as the videos continue to play.

This Project Results

This framework was tested on clips from 2 different videos. The computation period for tracking players depend on many factors, such as the number of players, occlusion image size, however on average the average time need to process each frame was around 11 seconds. As shown below you can see the performance of the method on certain clips.



Research Conclusion #1

Although I do believe this to be a useful research project to have found, I do belive it to differ in various ways to my own project. The goals of the project were extremely similar to mine in that the positions and movements of players were to be extracted with determining attributes to be found from these results and for the this reason the research was expectidly relevant to my current situation.

This being said, due to the age of the project being nearly 10 years old, there are extremely dated softwares used and overcomplicated methods of extracting certain data including the fact that my own project involves a static camera that does need to deal with occlusion or the quick movements each frame.

Overall this project was a success and I believe that I have extracted useful information that will ultimately help me in my own endeavours.

References

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