

Automated Sports Analysis and Coaching

Development

The goal of this project is to create a pipeline which can analyze a game of football using the video captured by a camera of the playing field.

We can divide this into two major tasks - game state reconstruction and analysis of the game.

Game state reconstruction:

To analyse the game, we first need to extract data from the video. This can be done with the following subtasks:

- Track players (and goalkeepers) from both teams and the referees on the field
- Track the ball
- Track the boundaries of the field (by tracking a few important points on it)

Using these, we can construct a 2D map of the game which contains the location of all players and the ball at every frame of the video.

This is however a solved problem. Using YOLOv8, the above tasks have been performed with reasonable accuracy. However, they generally work on pre-recorded footage of the game. Our goal would be to make the pipeline fast enough that it can run in real time (24 frames per second).

Analysis of the game:

Once we have completely reconstructed the game, we can derive a lot of useful data from it. Some of these include:

- Overall formation of the team
- Player positions during critical moments
- Position and control of the ball
- Movement of a player throughout the game
- Successful and unsuccessful passes

We can draw heatmaps for the above to give a robust understanding of the game. We can also give live commentary using this information.

Deployment

The solution proposed here can be targeted towards both casual audiences and professional coaches. A product can be made as follows:

- For the casual audience who just want a more detailed viewing experience, the tracking and statistics can be displayed along with the live streaming of the game (by OTT platforms like Hotstar). It would be an optional toggle to enable annotations in the live footage itself.
- For professional coaches who want to use the statistics properly, an app or website can be made where they can feed in pre-recorded footage and obtain all the relevant data about that match. This can be used by them to study the strategies of their opponent and develop counterplays, without having to sit through multiple hours of recordings.

Providing a one stop solution and wrapping it up with good UI can convert this to a good product for both B2B and B2C applications.

Datasets

We would primarily be using the Soccer Net dataset (<https://www.soccer-net.org/>) for training. This dataset contains annotated data for all the tasks described above. Since this comes from an open challenge, there are multiple existing solutions which can be used as reference.

Alternatively, we can also use footage from the video game FIFA, which is similar to actual football games. The camera angles used are the same as actual matches. It also allows us to create hypothetical scenarios for testing with ease.