

Corner line Technology: A Basic Approach using Tensor Flow

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Abstract:

Goal Line Technology in 2014, Virtual Assistant Referee (VAR) in 2016 followed by Semi-Automated Offside Technology in 2022 and many more. Such projects had brought Science into the sector of sports primarily Football. GoalVision wants to follow the same which wants to implement a similar prototype in the world of football by Analysing the pictures of the match if a corner kick is possible or not if a corner kick is allowed or not which brings a huge amount of help towards the referee just like VAR. which takes the photo of the on going game and later on assists the referee's on the line to say weather the corner kick should be awarded or not, referees consider majorly eye vision but integrating a human intelligence to keep an eye on lines weather a ball crossed the line or not is a great approach not directly replacing referee's but assisting them by what had actually happened which would require a loads of training data which is limited in our case because the amount of match's played by team in a year is maxxed up to 70-80 but this technology would limit down the mistakes made by referees on the line and would add a fair-play to the playing teams and also creating a new foundation of technologies like "tacticAI" developed by (google deepmind, 2024).

Keywords :- Geometric Deep Learning ,CNN's, Graph Theory, Machine Learning ,Object Tracking, Computer Vision, Tensor Flow & Open CV" - Tactic AI

Introduction

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A corner kick, awarded when the ball crosses the goal line last touched by a defending player without resulting in a goal, can be executed with various strategies such as inswingers, outswingers, targeting near or far posts, short corners, and set plays, each designed to exploit defensive weaknesses. Defensively, teams employ zonal marking, man-to-man marking, or a combination of both to counter these threats. To ensure accurate decisions regarding corner kick awards, implementing technology similar to goal line technology could be beneficial. Advanced ball tracking systems, enhanced VAR with additional cameras, sensor-embedded goalposts and corner flags, and automated decision systems could provide precise, consistent, and speedy decisions, reducing controversies and promoting fair play. Systems for tracking the ball better VAR with more cameras, goalposts and corner flags with built-in sensors, and systems that make decisions could lead to quick, reliable, and consistent calls. This would cut down on arguments and make the game fairer. Bringing in this tech wouldn't just make calls more accurate. It would also make sure all matches are judged the same way making the sport more honest overall.

Cutting-edge ball tracking tech would put sensors around the field and in the ball to pinpoint when it crosses the goal line or touchline much like goal line tech. This would make sure we know where the ball is at all times. Better VAR setups, with more cameras and views, would give refs

clearer info to make the right calls on corner kicks. Goalposts and corner flags with built-in sensors could spot the ball's exact spot near the lines leading to spot-on corner kick calls. Smart systems would tell refs right away when the ball goes out cutting down on mistakes and speeding things up. Using these new tools would help the game by getting rid of arguments about corner kicks making sure all teams get the same tech help, and keeping things fair.

Literature survey

Football is a rich sport when talk of fandom, money, investment etc. Fans spends good money either for club football or national teams, recently happening of FIFA World Cup 2022 at Qatar generated almost 7.5 Billion USD which is the vast amount so there's a lot of scope in football. In recent match the referee had a human error through which corner-kick was not awarded. Humans are meant to make errors but if the corner was given and the team scored it would have been a different scenario.

Just like goal-line technology, we thought of the same technology naming it GoalVision which currently focuses on corner-kick possibility of $x\%$ and $x - 1\%$ of if corner kicks are possible is possible or not for that we referenced the following research papers.

Game Plan:

We contoured how the integration of Artificial Intelligence and how much research had happen and still happening, recently the offside rule checking technology in the world cup surprised many but still people really had a mixed feeling about when you talk of machine learning and AI, the numbers should be discuss how accurate it the system do really matters this problem can be countered by continious development and high performing technologies (GPUs etc.)

Multiagent off screen behavior prediction in football:

Understanding high end multi-agents techniques is a difficult task but referring the research paper was merely overwhelming, but the motivation of GV and this research paper effect on the project is limited so as the data for cultivating the graph nodes straight out from the video's is challenging tasks even the next research paper had a issue regarding the same topic limited data which is reasonable coz in the whole year a team plays maximum of 70 match's and in a match 8-12 corner-kick's are possible

TacticAI:

This research paper have a large impact on our research which we can say has a direct connection with the paper, The research paper merely focuses on set-pieces Corner-kick's to be precise it predict's what is goal possibility also integrating the system of how to create those chances was a phenomenol research but it lacks in production we also plan to contribute to the project by integrating a LLM(Large Language Model) which can communicate with the TacticAI model and written back the result in the form of text or pictures which would be a challenging task yet intresting and needed but right now we focus on GoalVision .Our vision was to write the code of Tactic AI from scratch referring the researchers from this papers their past research would be a great choice of learning but those are plans for the future

Goal-line check technology is used in football to see if a ball has crossed the goal line. If an addition system of this nature was put into place for corners, as it has been with 'goal-line checks', game accuracy and fairness would be vastly improved. This would automatically avoid human errors in giving out corner kicks and thus, save games from turning on such blunders. Speedy decisions would preserve footballing impetus by

reducing the amount of time refs spend in conversation with or authority-checking their colleagues, and watching replays. It would also limit the number of on- the-field disputes, in turn leading to a more respectful and fair playing style.

Consistency in decision making is of utmost importance as they are always under the burden of heavy pressure during high scored matches. The practicalities of how to do this are another matter, with issues around cost or the technology simply not functioning as intended - especially for lower-tier leagues and smaller clubs. One of the key to its success is making sure that technology work well enough in various conditions (sunlight or a cloudy day).

Methodology

The main idea of the project is to detect the corner kicks, we use various technologies in the project but the main segment includes javascript from the teachable machine of google deep mind ,the training of the machine is done by feeding the images of corner kick in the tactic board as the budget is not possible for us to implement camera (i.e. skycam) and the field this is just a basic model.

Coming to the teachable machine of the google deepmind A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required. Is used in this project to give basic idea of the major or main idea, the images of corner kick (in the tactic board) to the machine and the model is extracted from the site in the javascript language (we can see it in fig 1)

After the training we performed the testing which the further details are given in the further testing and results page.We minimised the whole project into a lite version so that everyone can access the model.

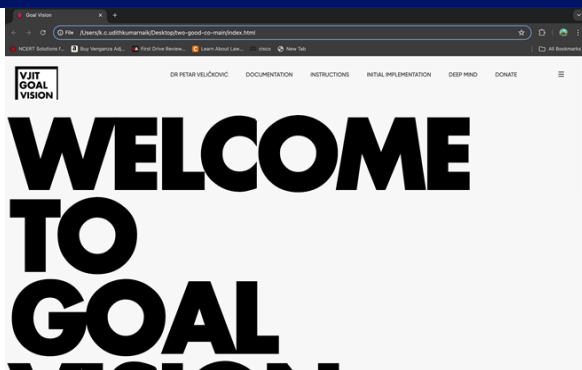


fig 2

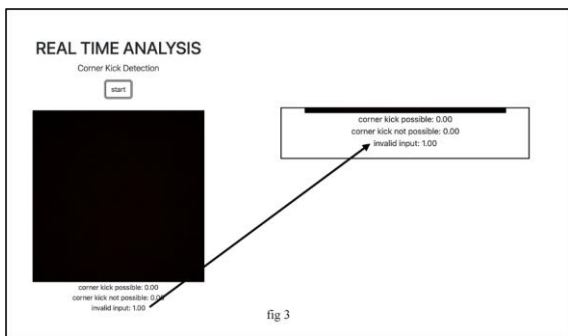
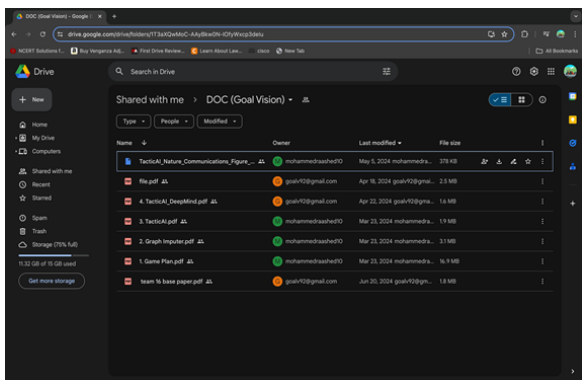


fig 3

As the webcam setup according to the instructions and complete setup of the apparatus is done then after the tactic field is shown to the phone (like skycam) the machine analyses the field and gives the output in the following probability values from 0.00 to 1.00 , the figures fig 4, fig 5, fig 6 shows the outputs or results.

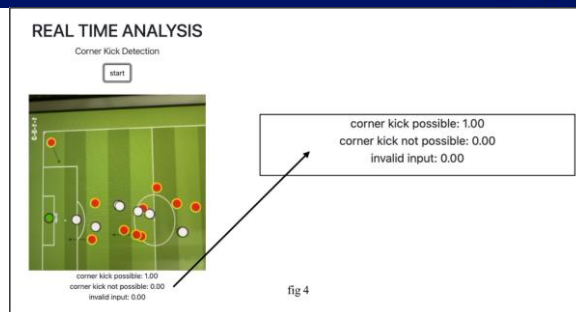


fig 4

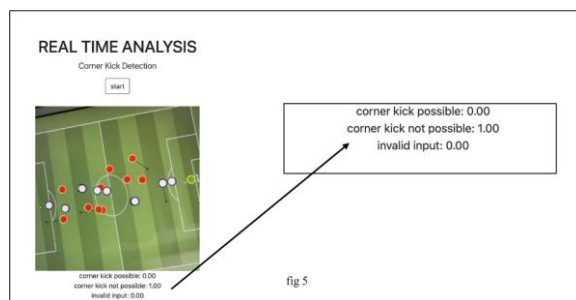


fig 5

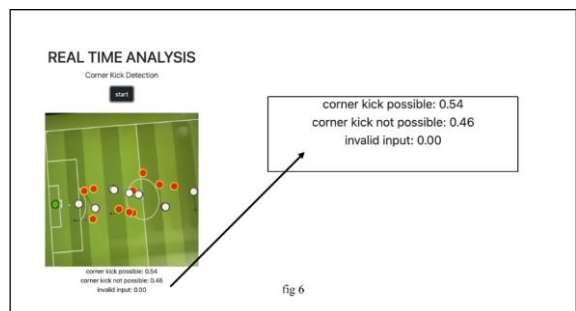


fig 6

Conclusion

To wrap up putting corner kick analysis tech into action, similar to goal line tech, marks a big step forward in today's football. This tech uses exact sensors and smart algorithms to boost the precision and fairness of corner kick calls. It gives real-time proof of whether the ball has gone past the goal line to a corner. This makes sure key decisions are right cutting down on human mistakes and making refereeing more trustworthy. On top of that, this breakthrough can give useful insights into corner kick plans and how players do adding to the game's analysis side. As football keeps changing with new tech, corner kick analysis tech stands out as a key advance. It aims to keep the game's honesty and thrill intact.

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