AI-DRS AND AUTOMATED THIRD UMPIRE

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Keywords:

Real time decision making, Algorithm (Convolution neural network), Impact analysis. Image recognition and video processing.

Introduction:

In cricket, an umpire is a person who has the authority to make judgements on the cricket field, according to the laws of cricket. Besides making decisions about legality of delivery, appeals for wickets and general conduct of the game in a legal manner.

Umpire may call, and signal, No Ball, for a ball which is illegally delivered (bowled). A Wide Ball is an illegal delivery in cricket, which is illegal due to it being “wide of the striker where he is standing and would also have passed wide of him standing in a normal guard position or the ball passing above a batsman’s head”. The umpire may rule a batsman out Leg before wicket if the ball would have struck the wicket, but was instead intercepted by any part of the batsman's body. The umpire's decision will depend on a number of criteria, including where the ball pitched, whether the ball hit in line with the wickets, and whether the batsman was attempting to hit the ball.

Objectives:

- Implementing computer vision algorithms such as contour detection, frame subtraction, minimum enclosing circle, thresholding for processing real-time images.
- Using machine learning to optimise the results and improve their

accuracy and correctness by implementing classification and regression techniques.

List the objectives 3 of project

- Visually representing the tracking results along with decisions based on the results, in accordance with the rules of cricket.
- To make precise decisions regarding LBW, catches ,run-outs ,and boundaries using AI-powered technologies like ball tracking ,ultra-edge and hawk-Eye.
- To eliminate human errors, personal bias, or pressure on umpires, ensuring fair decision for both teams.

Methodology:

The project the integration of technology in cricket has taken the game to a new level, and the AI Deck for Automating Third Umpire Decision Review System is no exception. By placing IP cameras in the all six stumps, the live video feed of the match can be continuously stored in the cloud, allowing for seamless access to footage when required. This enables a frame from the video to be captured, and the trajectory to be marked using advanced algorithms that have been trained for this purpose. Those algorithms will predict whether the batsman is out or not-out within a short time period. The AI system that is integrated with the deck can take a decision based on various scenarios that have been programmed into the AI model.

Result and Conclusion:

In conclusion, we say that the main goal of this thesis was to develop a product for assisting the umpire in the sport of cricket while making decisions, using a single camera. The thesis involved the development of algorithms using computer vision and machine learning techniques for ball detection and tracking, along with various cricket decision making rules.

In this thesis a thorough overview of the fundamentals of computer vision was presented, including the conclusions of historical research and newly proposed techniques. The thesis discusses the use of computer vision to detect, identify and track the cricket ball and machine learning techniques to optimize and further predict

various results and decisions.

Project Outcome & Industry Relevance:

The Videos section allows selection of a video to analyze and visualize.

The selected video's full name is displayed under the heading 'Selected Video'

The Select Bowling Action dropdown button is used to choose the action between fast slow and no-action for debugging purposes.

The Sliding Windows toggle button when toggled shows the sliding windows in progress during ball detection.

The Play Video button plays the selected video using a video player.

The Analyze button activates the script that analyzes the video and finds the image coordinates of the tracked ball and player across frames.

The Visualize button activates the script that visualizes the results of the analysis.

Working Model vs. Simulation/Study:

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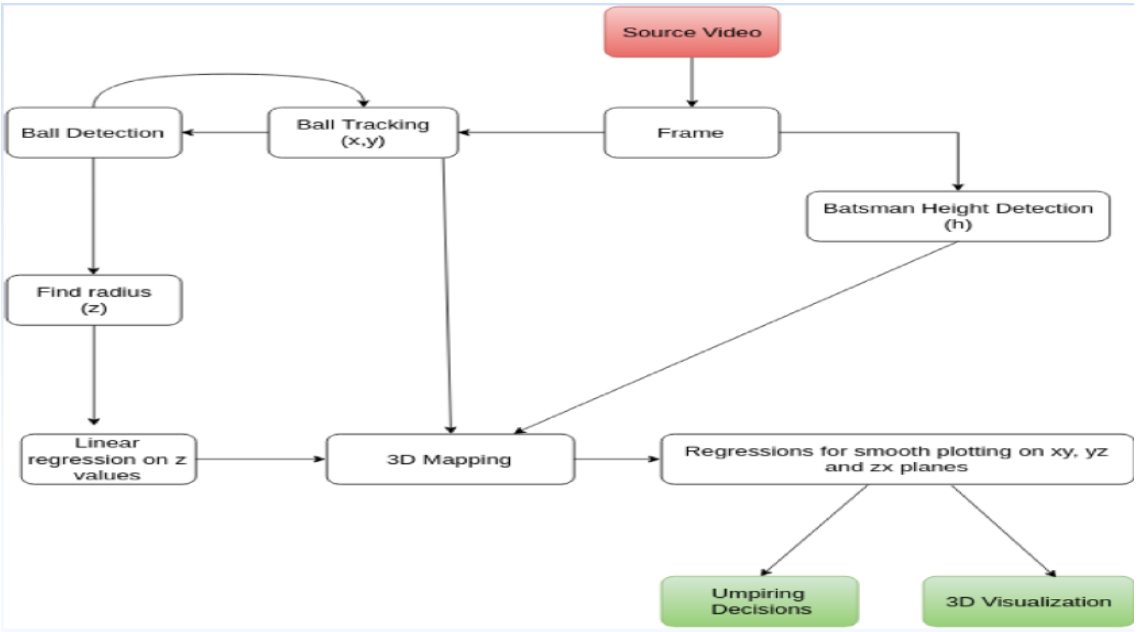
Project Outcomes and Learnings:



Ball Detection: The cricket ball is detected using Support Vector Machine (SVM) and Histogram of Oriented Gradient (HOG). Positive and negative data samples are collected and used for building the SVM models for HOG objects (ball, batsman).

Object Detection: Object Detection is the task of identifying an object and its location in an image. Object detection is similar to an image classification problem but with one additional task– identifying the location of an object as well– a concept known as Localization.

Linear Regression: Linear regression is a statistical method used to model the relationship between a dependent variable and one or more independent variables by fitting a straight line. The equation for simple linear regression is.

3DMapping:3D Mapping refers to the process of representing objects or movement in a three-dimensional space using mathematical techniques.

Future Scope:

The future scope of this project includes:

1. We have observed that the HOG based SVM classifier coupled with regression optimisations and computer vision techniques provide fairly

accurate results.

2. However, from a practical point of view perhaps a serious problem with the project is that the tracking results take a long time to compute. we can use better object detection algorithms and tools.
3. The capabilities of the project may be enhanced such that it may produce accurate results in environments. Depth analysis may also be done using stereo cameras, which will increase the functionality of the product and make it useful in real time cricket matches and practice sessions.
4. Another of our future objectives is to try to use multiple cameras and microphones to include decisions like ‘front foot no-ball’, ‘run out’, ‘edged and caught behind’, without increasing the computational and cost overheads significantly.
5. To improve the tracking prediction results,The calculation method of batsman’s height can be bettered and it can also be detected whether the batsman is right handed or left handed. Mapping of 2D image coordinates to real world 3D coordinates can be improved by using camera calibration methods.