Automatic Scorecard updating based on Umpire gesture recognition using Machine Learning

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Abstract. Cricket is without a doubt one of the most popular sports in Asia's southern regions. With the growth of cricket, technology has allowed for the automation of many game-related tasks. The most popular method is unquestionably the use of computer vision to aid third umpire decisions. The length of the game is one of the most difficult topics that initially starts the conversation about its prosperity. Nearly every delivery requires the on field umpire to approve a judgment before making changes to the scorecard, which is a highly laborious process. In this study, a method for automating the umpire's judgment by reading his hand gesture is suggested, and a prototype is put into practice.

Introduction

The term "gesture" refers to an expressive, meaningful bodily movement that incorporates the physical movement of the fingers, hands, arms, head, face, or body with the intention of: 1) conveying meaningful information; or 2) engaging with the environment. Gesture is often used in video surveillance, image and video indexing, computer interfaces, and gesture detection in video, which is a key area of study for computer vision. Despite decades of study and several promising advancements, automating cricket scorecards based on umpire gesture detection has remained a difficult problem due to the huge diversity of gesture categories. Everyday gestures may be categorized into a variety of groups based on the purposes they are employed for, such as referee signals, diving signals, and deaf sign languages. We wanted to create a machine-learning-based visual system that could recognize a cricket umpire's hand movements. Our objective is to properly update the scoreboard for each gesture that an umpire makes throughout a game by recognizing the motions they make.

Literature Review

These days, updating the scorecard automatically is arguably the most popular concept. We are presently examining numerous papers and techniques in order to construct our "Automatic Scorecard Updating Based on Umpire Gesture Recognition using Machine Learning"

The papers mentioned in the literature review are as follows:

[1] **"Automation of Cricket Scoreboard by Recognizing Umpire Gesture"**
A logistic regression algorithm-based technique for recognizing a cricket umpire's gesture in real-time video. Throughout the learning process, they have offered a sizable quantity of gesture images as training data. The training image is scaled down and turned grayscale to improve efficiency. The recognition stage can produce results in a decent amount of time and functions in a real-time environment.

[2] "**To automate the scorecard in cricket with computer vision and machine learning"**
An extremely well-optimized cricket score prediction algorithm that accurately updates the scoreboard by spotting the umpires' hand motions. The algorithm's two steps, training and testing, can be separated.

[3] **"Hand gesture recognition using depth data"**
The method described here uses a collection of real-time depth image data gathered by active sensing equipment to identify hand motions. The hand posture and motion information that was extracted from a video is described using a gesture space, which has several elements such as hand shape, location, and motion information.

[4**] "A dataset and preliminary results for umpire pose detection using SVM classification of deep features"**
Based on the umpire's gesture, a novel dataset approach called SNOW is employed to automatically generate cricket updates. The umpire gesture, which comprises several signs including four, six, wide, and out, is seen on cricket videos.

[5] **"Deep Neural Network for image recognition based on the caffe framework"**
Deep learning is a technology that is in great demand nowadays. With the aid of this technology, we can recognize voices and images. The use of deep learning for picture recognition was discussed by the author.

Methodology

The proposed system interprets gestures made by the umpire, such as "six," "out," "no ball," and "four," and updates the scorecard appropriately. The block diagram of the system is shown in Fig. 1.

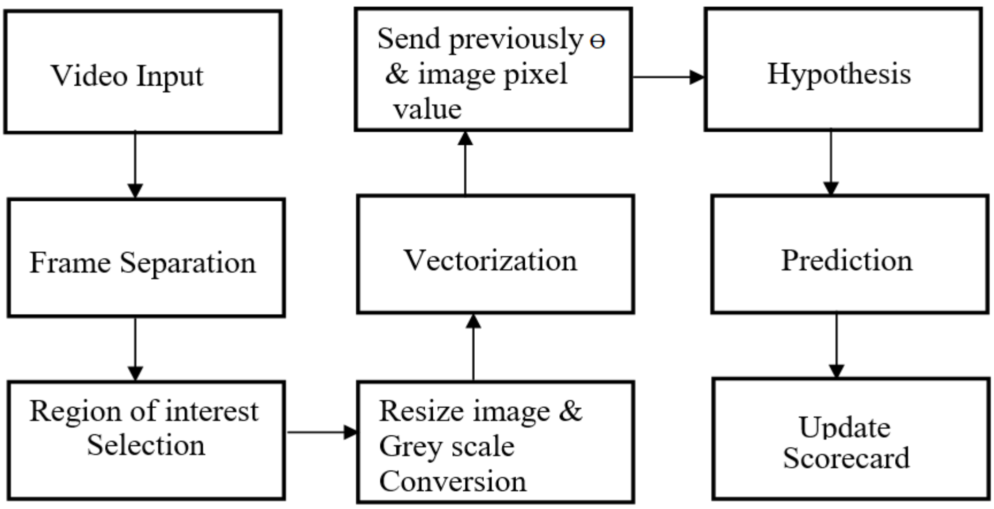


Fig. 1. Block Diagram

Working

We suggest using logistic regression to identify a cricket umpire's gesture from live video. Video is recorded from a stationary camera, and the video's frames are then separated. We employ the Haar-Cascade classifier after isolating the region of interest from the input photos. Once the area of interest has been chosen, it is converted to a 20x20 pixel image, vectorized, and sent together with the image feature value X and previously acquired weight to the logistic regression theory. The likelihood that a gesture is true or false is provided by the hypothesis. The recognition stage can produce results in a respectable period of time and operates in a real-time setting. The umpire used a variety of gestures to indicate how the delivery went. The gesture detections of the system are mentioned as below:

Four Runs: When the ball passes the boundary after at least one bounce, four runs are scored. The umpire gives the signal by tracing three or four passes with his or her right hand across the player's chest. The batting side's total will increase by four runs.

Six Runs: When a batsman drives the ball over the boundary without letting it bounce, he scores six runs. The umpire's uplifted arms lift their heads into the air. The batting side's total is then increased.

Out: The umpire upheld the fielding side's appeal, and the player was removed after receiving an Out ruling. The batter is deemed "out" and is compelled to leave the field of play when the technology identifies the umpire's raised index finger in the air.

No Ball: When a bowler throws down an illegal delivery that is considered a "no ball" according to the rules, he or she signals "no ball" when the programme notices that an umpire's arm is extended horizontally. As a result, the batting side's total is increased by one run (or two runs in some limited-overs cricket formats)

Flowchart

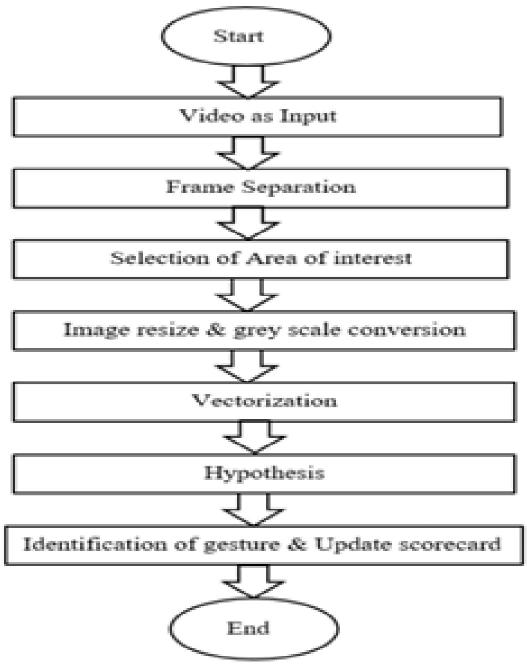


Fig. 2. Flow chart

a. Gesture for four runs

b. Gesture indicating six runs

c. Gesture indicating out

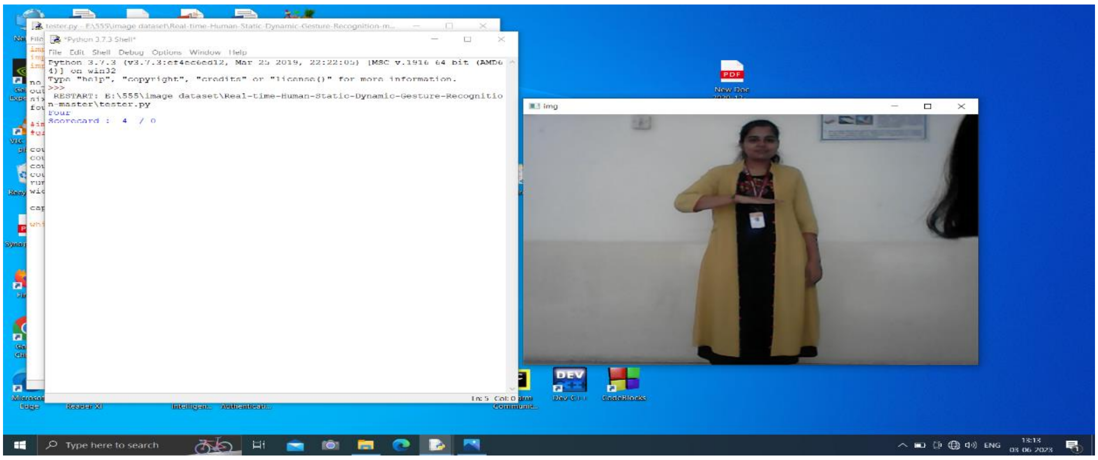
d. Gesture indicating no ball

Fig. 3. Sample input gestures

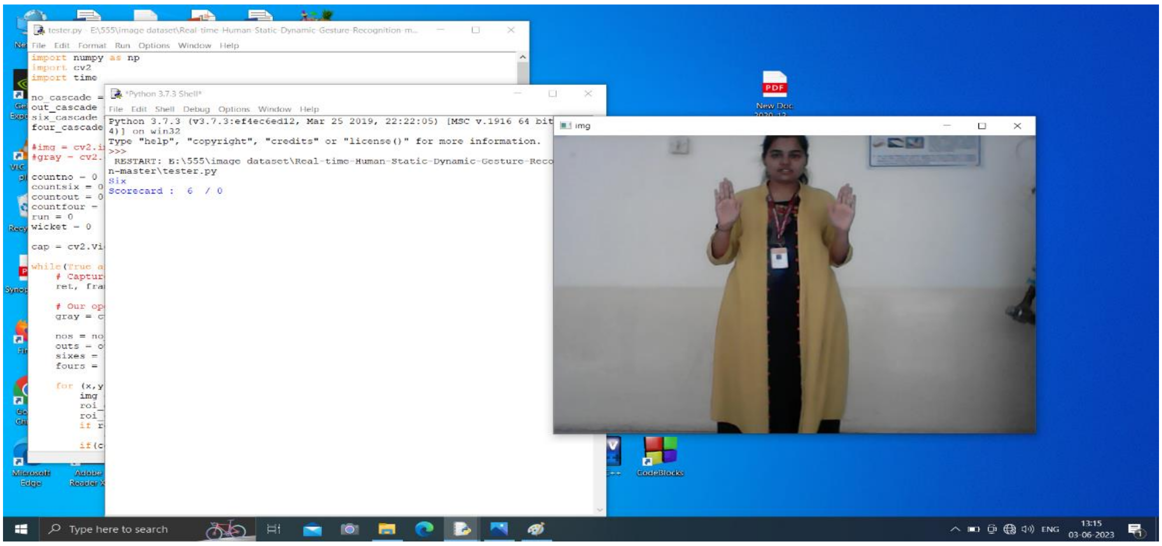
Above image shows sample input gestures for four, six, no-ball, out. The system receives the umpire's footage as input, which is then processed further with the aid of a machine learning algorithm. The scoreboard is then appropriately updated.

Result

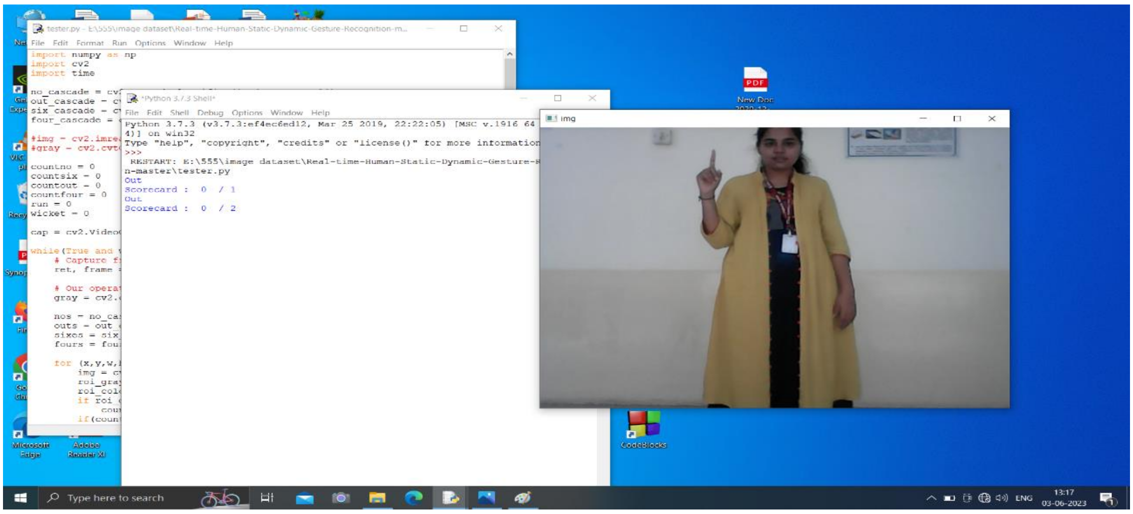
The Haar-cascade classifier selects the region of interest, and the logistic regression model predicts which gesture matches it best from the resized region of interest. The match determines how the score is updated. Fig. 4 presents some of the experiment's results.



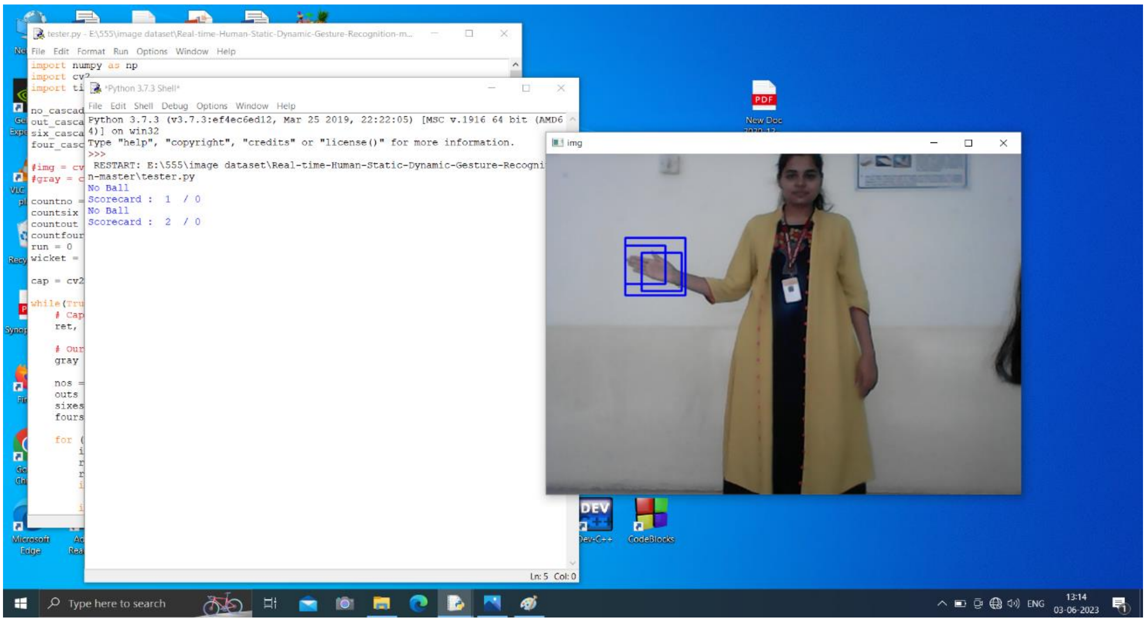
a. Obtained result for “Four runs” after detecting gesture



b. Obtained result for “Six runs” after detecting gesture



c. Obtained result for “Out” after detecting gesture



d. Obtained result for “no ball” after detecting gesture

Fig. 4. Score card Update

Conclusion

The peculiarity of our work is that it identifies proper cricket movements without the use of a specialised sensor or gloves. For the umpire, only a stationary camera is required. Background subtraction is fairly simple because the background is usually fixed. It required the training of many classifiers in order to function. Despite this, with static gestures like out, no, six, wide, etc., this method worked better. On the other hand, it was discovered that dynamic gestures like "four" had poor efficiency. Fortunately, there is a far simpler and quicker way to choose the area of interest, which will make the programme less complex and more effective.

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