Claims

1. A system for automatically detecting a front foot No-Ball through machine learning techniques comprising:

a data stream module (101) for providing raw data or sequence of frames from a live broadcast data or a recorded video file;

a line detection module (102) for detecting a popping crease comprising: an input model (701) that takes a RGB (Red, Green, Blue primary colours) image and adds a convolution layer (702), 17 bottleneck residual blocks (703) further adds a dropout layer (705) and two separable convolution layers (706), and an output model (707) to provide two ends of the popping crease and determining the popping crease on a frame;

a delivery detection module (103) for detecting every delivery of ball comprising:

a binary action detection module (801) that takes 40 consecutive frames and adds nine 3D convolution layers (802) and further adds a fully connected layer (804) with one neuron and sigmoid activation function as a binary classifier;

a Bowler detection Module (105) for detecting a bowler, when delivery of the ball is detected by the delivery detection module, by applying a deep neural network model comprising: an OpenCV (open computer version) pose estimation model (901) that detects body key points for every person in an image and passes to a Long Short-Term Memory (LSTM) model to detect the bowler in every frame, further adds two LSTM layers (902), and a bowler index model (903) that recognizes the bowler;

a front foot landing detection module (107) for detecting the bowler's front foot landing moment comprising: an input model (1001) that adds an LSTM layer (1002), three fully connected layers (1003) and a last layer (1004) that is fully connected layer with a softmax activation function and returns a bowler's front foot landing frame number, with the body key points of the bowler from the Bowler detection module as the input data in the input model;

a heel of the foot landing identifier module for identifying the bowler's front foot heel from the bowler's front foot landing frame number returned from the front foot landing detection module;

a determiner module to calculate a real-world distance between the front foot heel and the popping crease to determine if the bowler's front foot heel lands after the popping crease and is thus a No-Ball and to call a No-Ball call system;

and

the No-Ball call system (111) comprising: a notification message module (605) to send a message containing ball-by-ball information to the Umpire using regular widely used messaging applications when the No-Ball is determined by the determiner module, and an end of session module (606) to report a summary of a session containing a count of No-Balls and their corresponding Ball-by-Ball information.

2. The system as claimed in claim 1, wherein said data stream module (101) for providing a raw data or sequence of frames from a live broadcast data or a recorded video file is in any number of frame rate or resolution, or compressed in any form of compression.

3. The system as claimed in claim 1, wherein in the line detection module (102) the RGB image has a size of 224x224x3mm; the 17 bottleneck residual blocks (703) are constructed from a second convolution layer, a Dwise convolution and a residual connection; and the first separable convolution layer has a kernel size of 5 and an activation function of relu and the second separable convolution layer has a kernel size of 3 and activation function of sigmoid.

4. The system as claimed in claim 1, wherein each of the 40 consecutive frames is a second RGB image with a size of 224x224x3mm; and the nine 3D convolution layers are added (802) with max pooling, batch normalization, and dropout.

5. The system as claimed in claim 1, wherein the OpenCV (open computer version) pose estimation model (901) detects 17 body key points for every person in an image, wherein the key points of a maximum number of 10 persons for 40 frames are passed to the Long Short-Term Memory (LSTM) model to detect the bowler in the frame.

6. The system as claimed in claim 1, wherein the message further contains the exact frame that the No-Ball happens and a short clip containing the delivery, the message is sent using regular widely used messaging applications like WhatsApp/Telegram or messaging client installed on mobile/pc (personal computer) depending on the Umpire's choice.

7. A method for preparing the system as claimed in any one of claims 1 to 6.

8. A use of the system for automatically detecting No-Ball as claimed in any one of claims 1 to 6.