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A Video Processing System for Detection and Classification of Cricket Events

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Abstract - *The cricket events detection and classification is important for TV channels broadcasters. In this paper a new technique is described for detection and classification of cricket events from cricket video. The proposed methodology processed a cricket video, detecting the different events Pitch, Non-Pitch, Replay and Non-Replay and classifies the events. The Discrete Wavelet Transform (DWT) features and Probabilistic Neural Network (PNN) are employed for the task. In our work we tested four cricket videos with the proposed system. Considering overall obtained result the proposed system gives an average of 91.48% accuracy for input cricket videos.*

***Key Words*: DWT features, PNN, Cricket events.**

1. INTRODUCTION

The sports channels and other TV channels use the video processing system to broadcast the videos to viewers. The video processing is the part of signal processing, the video filtering is the software component, it encoding or decoding the video files. In video processing the input and outputs are video files. Now days we can see different videos such as news videos, sports videos and movie videos etc. The each type of videos has its own edition style, syntax, semantic and rules to generate the final sequence to present it to the final viewers.

In our work the cricket video is divided into Pitch, Non-Pitch, Replay and Non-Replay. The "Pitch" shots include stumps, creases, batting end and bowling end shots in the cricket video. The Non-pitch includes other things than pitch shots like outfield view and boundary view shots. The Replay shots are repeat the important moments sometimes by slow motion and Non-Replay shots are normal or real shots.

The DWT feature extraction techniques used to extract the features from given input video. When an image is fed to the Discrete Wavelet transform, it is divided it into four sub groups or sub bands like LL, HL, HH and LH. There, three sub groups HL, LH and HH are used to identify the key frame. In this work the probabilistic neural network (PNN) classifier used to classify the cricket events from the input video. The Probabilistic Neural Network (PNN) classifier consumes the four-layer architecture for classification. The PNN classifier consists of feed forward networks of neurons which are organized in layers. The given input layer is the first layer. This layer just passes the contribution to the pattern layer neurons. The gained output from the example layer is added and the middle value is found at the summation layer. The summation layer also measures the most extreme probability of an example being arranged. In this work train the PNN with number of training data to classify the cricket events.

1.1 Brief Survey

The literature survey has done which are related to DWT and PNN techniques and wavelet Features. M. H. Kolekar et.al [1], in this paper describes the solution for detect the events from cricket video using hierarchical tree method. The classification of video clips done at different levels. Using audio features extract the excitement clips from cricket video at level-1. The real-time and Replay clips are classified at level 2. Using color features classify the field view and non-field view at level 3. Using motion mask features classify the pitch-view, long-view, and boundary view at level 4a. Using edge density features classify the close-up and crowd view at level 4b. Using jersey color features classify the batsman, bowler/fielder, umpire clips at level 5a. Using color features classify the player's gathering at level 5b. At last cricket video clips classification is done with above features and techniques. Dr. P S Puttaswamy et.al [2] this work uses different techniques are used to extract the cricket events such as pitch, non-pitch Replay and non-Replay. The RGB histogram features are used to detect and pitch shots and non-pitch shots. There are three approaches Block matching analysis (BMA), Feature extraction and Kalman filters are used to motion estimation. Based on motion estimation extract Bowling, Batting shots using kalman filter technique. The Replay and Non Replay shots are extracted based on score card in cricket video using median filtering background modelling method. Gowri Srinivasa et.al [3] in this paper discussed about visual content based algorithms to extraction of cricket pitch frames from cricket video. In the algorithm the preprocessing step eliminate the frames such as audience, close-up shots, advertisements, etc. The cricket field frames are subject to statistical modeling of the grayscale (brightness) histogram (SMoG). Since SMoG does not use color or domain-specific information such as the region in the frame where the pitch is expected to be located, in this work the proposed an alternative

algorithm is component quantization based region of interest extraction (CQRE) for the extraction of pitch frames. P.Sangeetha et.al [4] in this paper discussed about the classification of different stages of brain Tumer cut levels such as Beginning or Normal. The 2D DWT is used to extract the features from Region of Interest (ROI) of image. Train the Probabilistic Neural Network (PNN) with data to classify the stages of brain Tumer. Stephen Gang Wu et.al [5] in this paper discussed about classification of plants based on plant leaf features. In this work 12 leaf features like Diameter, Physiological Length, Physiological Width, Leaf Area, Leaf Perimeter and others Digital Morphological features are extracted and orthogonalized into 5 principal variable which consist the input vector of the probabilistic neural network. The probabilistic neural network trained with set of data to classify the 32 kinds of plants.

This paper is organized in to 4 sections. Section II presents the proposed methodology. Experiment results are discussed in section III. Section IV presents the conclusion.

2. PROPOSED METHODOLOGY

The proposed video processing system is shown in figure 1. This proposed methodology consists the two phases, namely training phase and testing phase. In training phase the cricket video frames are processed to extract the DWT features and these features are used to train the probabilistic neural network for detect and classify the cricket Pitch, Non-Pitch, Replay and Non-Replay events. In the testing phase the cricket video is input to proposed system. The input video is converts to frames, Extract the DWT features from each frame and fed to probabilistic neural network (PNN) to detect and classify the cricket Pitch, Non-Pitch, Replay and Non-Replay events and display the result.

The video processing system for detecting and classification of cricket events consist three modules:

Module 1: Pre-processing the frames.
Module 2: DWT feature extraction.
Module 3: Probabilistic Neural Network training method.

2.1 PRE-PROCESSING

In pre-processing first step is to convert the video to number of frames and resizes the frames.

2.2 DWT FEATURE EXTRACTION

The 2D DWT is fragmented into two 1D DWTs such as horizontal and vertical filterings. The rows of the original image are processed by the horizontal filtering and the wavelet coefficients are stored in an auxiliary matrix. Then, the columns of the auxiliary matrix are processed by vertical filtering and the results are stored back in the original matrix.

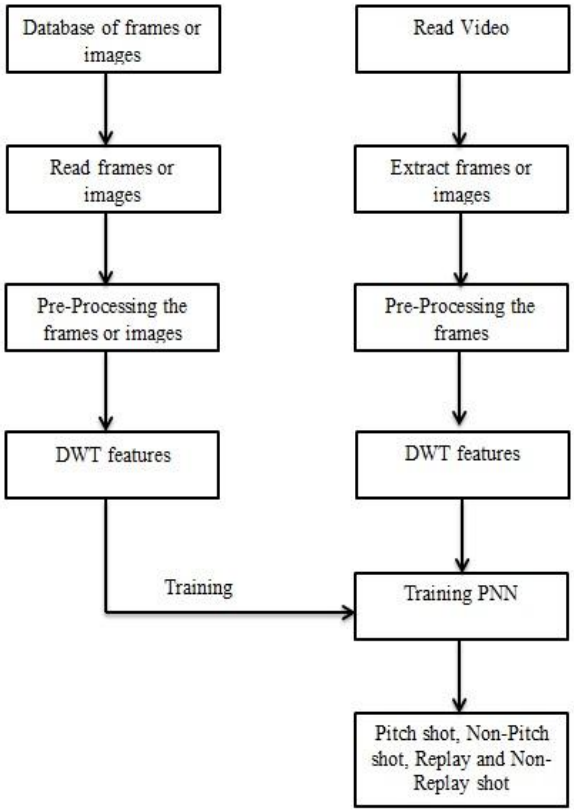

Fig -1: Block diagram of Cricket event detection and classification.

2.3 PROBABILSISTIC NEURAL NETWORK TRAINING METHOD

Probabilistic Neural Network (PNN) classifier consumes the four-layer architecture for classification. The PNN classifier consists of feed forward networks of neurons which are organized in layers. The given input layer is the first layer. This layer just passes the contribution to the pattern layer neurons. The gained output from the example layer is added and the middle value is found at the summation layer. The summation layer also measures the most extreme probability of an example being arranged.

Finally, based on Bayer's choice principle, the choice of the class is settled on at the choice layer. The determination of smoothing parameter denoted by σ1 is needed to carry out classification using PNN classifier. The figure 2 shows the architecture of probabilistic neural network.

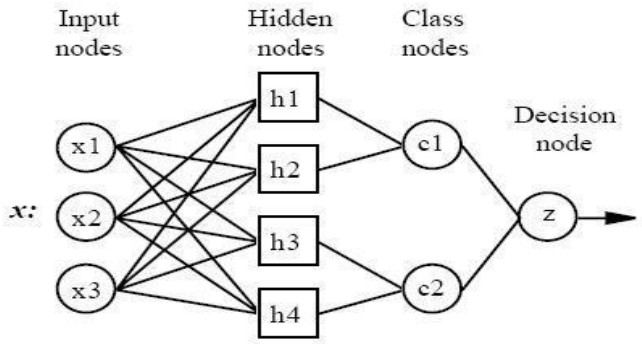

Fig -2: Architecture of PNN

The proposed system consists of nine input nodes, five hidden nodes and two output nodes of probabilistic neural network.

3. EXPERIMENTATION

Various tests carried out on video processing system and their results are discussed in this section.

Here are some figures which depicts the step wise implementation:

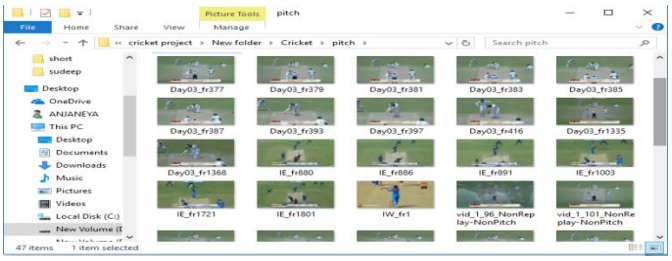

Fig -3: Pitch frames

The above figure 3 shows the pitch frames of cricket game to extract the features and train the probabilistic neural network.

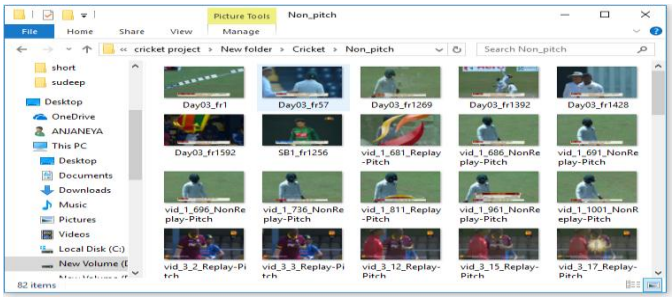

Fig -4: Non-Pitch frames

The above figure 4 shows the non-pitch frames of cricket game. These are used to extract DWT features and train the probabilistic network to detect and classify the events of cricket video.

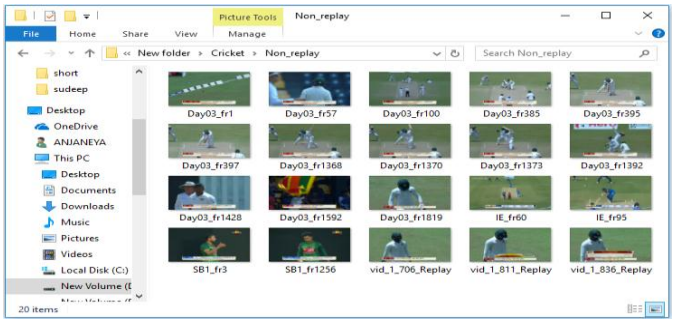

Fig -5: Non-Replay frames

The above figure 5 shows the non-Replay frames to extract the features and train the probabilistic neural network.

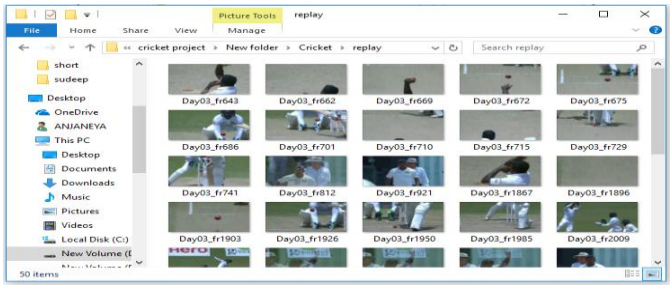

Fig -6: Replay frames

The above figure 6 shows the Replay frames to extract the features and train the probabilistic neural network.

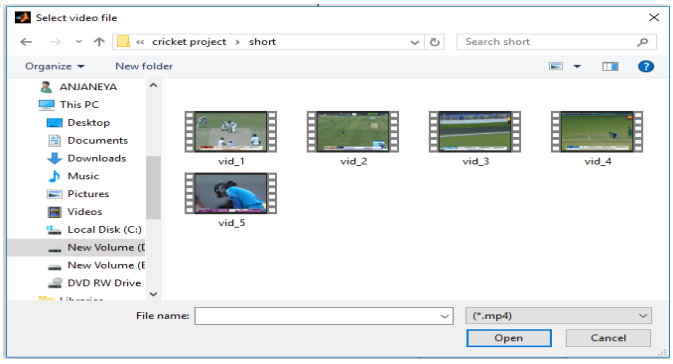

Fig -7: Videos for Testing

The above figure 7 shows the videos to test and classify the video shots.

RESULTS

The cricket videos are selected as input to the proposed cricket event detection system. The system process the input video and produce the results as pitch shot, non-pitch shot, Replay shot and non-Replay shot.

Fig -8: Replay-NonPitch

The figure 8 shows the output of Replay Non-pitch of the proposed system. There are total 1010 frames in input video and above figure shows the 590th frame and it is displayed as the output of reply non-pitch.

Fig -9: NonReplay-NonPitch

The figure 9 shows the NonReplay - Nonpitch as output of proposed system. There are total 1010 frames in input video and above figure shows the 205th frame and it is displayed as the output of Nonreply -Nonpitch.

Fig -10: NonReplay-Pitch

The figure 10 shows the NonReplay - Pitch as output of proposed system.

The table 1 shows the results of the proposed system. We tested the proposed system for four different videos. First we consider a video of 28 seconds. For this video there are totally 720 frames. In that 120 are Pitches, 525 are Non-Pitches. There are totally 305 reply frames and 415 Non-Reply frames. In that 720 frames 640 frames correctly retrieved.

Table-1: Results

Video	Total frames	Pitch frames	Pitch Accuracy	Non-pitch frames	Non-Pitch Accuracy	Replay frames	Replay Accuracy	Non-replay frames	Non-replay Accuracy	Over all Accuracy	Video Duration
Vid_1	720	120	75%	525	90.51%	305	100%	415	100%	93.53%	28 sec
vid_2	745	110	81.14%	535	87.7%	410	100%	335	100%	94.63%	29 sec
vid_3	975	80	87.5%	810	93.85%	325	100%	650	100%	89.74%	38 sec
vid_4	830	135	74.22%	615	85.92%	175	100%	655	100%	88.55%	33 sec

So there are 80 frames are not retrieved correctly. There is an accuracy of 93.05% for the input video.

Second we consider a video of 29 seconds. For this video there are totally 745 frames. In that 110 are Pitches, 535 are Non-Pitches. There are totally 410 reply frames and 335 Non-Reply frames. In that 745 frames 705 frames correctly retrieved. So there are 40 frames are not retrieved correctly. There is an accuracy of 94.63% for the input video.

Third we consider a video of 38 seconds. For this video there are totally 975 frames. In that 80 are Pitches, 810 are Non-Pitches. There are totally 325 Reply frames and 650 Non-Reply frames. In that 975 frames 875 frames correctly retrieved. So there are 100 frames are not retrieved correctly. There is an accuracy of 89.74% for the input video.

Fourth we consider a video of 28 seconds. For this video there are totally 830 frames. In that 135 are Pitches, 615 are Non-Pitches. There are totally 175 Reply frames and 655 Non-Reply frames. In that 830 frames 735 frames correctly retrieved. So there are 95 frames are not retrieved correctly. There is an accuracy of 88.55% for the input video.

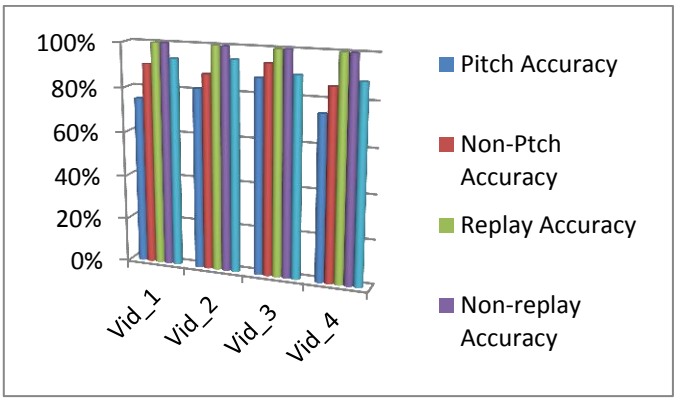

Fig -11: Bar chart for result table 1

The figure 10 shows the bar chart for result table 10, in this x-axis represents the video name and y-axis represents the accuracy of detected events result.

In our work we tested four cricket videos with the proposed system. Considering overall obtained result the proposed system gives an average of 91.48% accuracy for input cricket videos. Considering event wise obtained result the proposed system gives 79.47% accuracy for Pitch event, 89% accuracy for Non-Pitch event, 100% accuracy for Non-Replay event and 100% accuracy for Replay event.

4. CONCLUSION

In this work, we proposed a video processing system to detect and classify the Pitch, Non-Pitch, Replay and Non-Replay events in cricket video efficiently. The system trained with the obtained features to detect and classify the Pitch, Non-Pitch, Replay and Non-Replay events.

The DWT is used to extract the features and Probabilistic Neural Network is used to classify the Pitch, Non-Pitch, Replay and Non-Replay from given input cricket video. The experimental results show the accuracy of detecting and classification of cricket events.

Apart from the detection and classification of Pitch, Non-Pitch, Replay and Non-Replay events we can detect and classify the other cricket events such as detect and classify the umpire and players based on jersey color features and detect the excitement clips from cricket video using audio features.

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BIOGRAPHIES

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