WEARABLE SENSOR BASED ACTIVITY CLASSIFICATION DURING FAST BOWLING IN CRICKET

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Thesis submitted in partial fulfilment of the requirements for the degree of Master of Science in Electronics and Automation

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Name of Supervisor: Dr. Pujitha Silva

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ABSTRACT

Inertial Measurement Unit (IMU) data can depict three dimensional rotational angles specific to a motion. However, either to prevent injuries or to enhance performance based on IMU data, a specific segment of the total movement cycle needs to be analysed. This requires a process to segment the total motion into key phases during the complete movement cycle. The proposed method focuses on the major research question of developing a pattern recognition model to classify the three main phases (Run Up, Delivery Stride and Follow Through) of fast bowling action in cricket.

The research focuses on seven fast bowlers delivering a minimum of four deliveries in a training environment with IMU's to capture motion. Nine-axis IMU's are selected and quaternion based three-dimensional motion data are captured and stored. The research initially focuses on finding the most appropriate sensor position on body among calf, thigh, trunk and forearm to collect data for activity classification in fast bowling. The classification performance obtained by Support Vector Machines (SVM) indicate that overall, second and fourth quaternion on Forearm is the most suitable combination of quaternion and position for data collection.

Data collected from IMU's on forearm are used to develop a machine learning model to segment the three key phases of the fast bowling action. Video feedback is also obtained when defining initial classes for classification. A moving window collects time domain statistical features, Least Absolute Shrinkage and Selection Operator (LASSO) is used for feature selection and Principle Component Analysis (PCA) for dimensionality reduction. Synthetic Minority Over-Sampling Technique (SMOTE) is implemented to overcome class imbalances. K-Nearest Neighbour (k-NN), Random Forest (RF), Naïve Bayes (NB) and Support Vector Machines (SVM) are tested as supervised classification methods for activity classification. Cross validation determines classification model performance based on accuracy, precision, recall and F-measure values. The results indicate that k-Nearest Neighbour produces best overall classification accuracy of 82% among the tested supervised classifiers. Finally, the model is verified against a test sample from one of the bowlers.

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