# Heart Arrhythmia Detection using Continuous Wavelet Transform and Principal Component Analysis with Neural Network Classifier

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An approach for automated heart arrhythmia detection is presented in this study. The specific aim of this study is to develop an algorithm to detect and classify six types of Electrocardiogram (ECG) signal beats including Normal (N), Atrial Premature (A), Right Bundle Branch Block (R), Left Bundle Branch Block (L), Paced (P), and Premature Ventricular Contraction (PVC or V) beat using a neural network classifier. To advance the accuracy of classification a hybrid method combining Continuous Wavelet Transform (CWT) and Principal Component Analysis (PCA) is applied. Several stages of pre-processing have been applied in order to prepare the most appropriate input vector for the neural classifier; first of all, since the collected ECG signals are so noisy, a mathematically based signal filtering method is used to remove the ECG signal baseline wandering in addition to noise. To select the suitable range of samples from the raw ECG signal, several methods have been tested and finally the best method was found to select 150 samples after R wave for all types of signals. These segments are found to be the most appropriate range of ECG signals which represent morphological differences between different types of ECG beats and include sufficient amount of data needed for accurate classification of heart arrhythmias. Continuous Wavelet Transform is then applied in order to extract features of ECG signal which are different for different types of arrhythmias. In the next step PCA method is used to reduce the size of the data. Finally, a well-known neural network architecture called Multi-Layered Perceptron Neural Network (MLPNN) is utilized as the final classifier to classify each ECG beat as one of six groups of signals under study. Finally, MIT-BIH database is used to evaluate the proposed algorithm, resulting in 99.5% Sensitivity (Se), 99.7% Positive Predictive Accuracy (PPA) and 99.2% Total Accuracy (TA).