Analysis of 12 Lead ECG Signal for Diagnosis of Myocardial Infarction: Empirical Mode Decomposition and Machine Learning Application

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Abstract:

The characteristic changes in ECG signals can be complex and difficult to monitor. If these changes are recognized early, heart diseases such as myocardial infarction (MI) can be prevented. The development of artificial intelligence-based systems can provide early diagnosis of these diseases and help cardiologists in diagnosis. This paper presents an empirical mode decomposition (EMD)-machine learning-based approach for the early diagnosis and classification of STEMI and NSTEMI. The 12-lead ECG signals obtained from two different datasets with similar characteristics are analyzed and the signals are decomposed into their principal components using the EMD method. Features are extracted from the decomposed signals and the ones that are significant for the performance of the classifier model are determined by Least Absolute Shrinkage and Selection Operator (LASSO). Healthy controls (HC), NSTEMI, and STEMI groups were classified using SVM and ANN algorithms. The most successful results in the classification process were obtained with the SVM algorithm. The classification of the HC-NSTEMI group was 99.84%, the HC-STEMI group was 99.90%, and the HC-STEMI-NSTEMI group was 99.70% Area Under Curve (AUC). The findings obtained in the study may contribute to the development of systems to support the early diagnosis of cardiac abnormalities such as MI and may give cardiologists the opportunity for early intervention in heart diseases.

Keywords:

Electrocardiogram signal, Empirical mode decomposition, Machine learning, Myocardial infarction.