Automatic Motion Artefacts Recognition in Resting ECG/EKG to Identify Failed Tests using Machine Learning

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Although an ECG is able to identify certain heart diseases, an uninterrupted and a clear signal is essential to accurately diagnose any abnormalities in the heart functions. Obtaining such a crisp ECG is a challenging task due to several artifacts such as motions because muscle movements are inevitable even in resting ECGs due to medical conditions such as anxiety, Parkinson's disease and body tremors. In addition, skin stretching too, produces electricity that disturbs the potentials involved in an ECG. There are numerous experiments have been conducted to find effective and efficient motion artifact removal methods from ECGs. In this study, we use cleaned and disturbed ECGs to implement more effective and efficient method to remove motion artifacts and evaluation mechanism for ECGs.

The first stage of the proposed technique involved gathering more than 500 ECGs having 12 leads data from public sources available on PhysioNet online database. These data contained cleaned ECGs and disturbed ECGs of healthy and unhealthy patients. The data set is cleaned to remove noise and undesirable effects such as baseline wander. A technique based on multi-resolution thresholding is used to recognize and remove motion artifacts and further, the Savitzky-Golay filter is used to reduce the mean squared error of this process.

In the second stage, a convolution neural network (CNN) is implemented on the cleaned ECG dataset. Initially, datasets of 12 leads are shuffled under two categories: with and without noise. These shuffled images, numbering more than 36,000, are then categorized for training, validation and testing of data with and without motion artifacts.

Results indicate a 98.7% accuracy in predicting whether a given ECG can be used or not by examining more than 500 cleaned ECGs.

Keywords: ECG signals, motion artifacts, heart rate, heart attack

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