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Classification of ECG signals for detection of arrhythmia and congestive heart failure based on continuous wavelet transform and deep neural networks

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Abstract
According to World Health Organization (WHO) report an estimated 17.9 million lives are being lost each year due to cardiovascular diseases (CVDs) and is the top contributor to the death causes. 80% of the cardiovascular cases include heart attacks and strokes. This work is an effort to accurately predict the common heart diseases such as arrhythmia (ARR) and congestive heart failure (CHF) along with the normal sinus rhythm (NSR) based on the integrated model developed using continuous wavelet transform (CWT) and deep neural networks. The proposed method used in this research analyses the time-frequency features of an electrocardiogram (ECG) signal by first converting the 1D ECG signals to the 2D Scalogram images and subsequently the 2D images are being used as an input to the 2D deep neural network model-AlexNet. The reason behind converting the ECG signals to 2D images is that it is easier to extract deep features from images rather than from the raw data for training purposes in AlexNet. The dataset used for this research was obtained from Massachusetts Institute of Technology-Boston's Beth Israel Hospital (MIT-BIH) arrhythmia database, MIT-BIH normal sinus rhythm database and Beth Israel Deaconess Medical Center (BIDMC) congestive heart failure database. In this work, we have identified the best fit parameters for the AlexNet model that could successfully predict the common heart diseases with an accuracy of 98.7%. This work is also being compared with the recent research done in the field of ECG Classification for detection of heart conditions and proves to be an effective technique for the classification.

Author Keywords
Convolution; Deep learning; Neural networks; Wavelet transform

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