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A Novel Approach for Improving Epileptic Seizure Prediction and Detection Using Deep Learning

A Dissertation by

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Abstract

Around 60 million people suffer from this chronic disorder, Epilepsy; out of them, around one-third have seizures, which cannot be contained by anti-epileptic drugs. Seizures are unpredictable and therefore, patients must live in constant fear of an onset of a seizure which can be led to both economic hardship and social isolation. The continuous mental strain on seizure patients could lead to depression, and studies have shown that there is a rise in death rates among seizure patients as they are more vulnerable to life-death situations.

Here the proposed solution looks for the possibility of identifying the current brain stage of the person as preictal, interictal and ictal with more accuracy. The models were built to classify the brain stage into preictal, interictal and ictal stages. Separate patient specific and generalized models were built using 2D CNN layer and 3D CNN layer and a hybrid model with SVM as the classifier. A simple 3-layer architecture was used for this. Convolutional layer, Max Pooling layer and a fully connected layer. This was selected due to limited ictal data.

The accuracy levels obtained was as follows: 2D CNN: 93.25% 3D CNN: 92.5625%, SVM (2D CNN feature extractor): 93.11%, SVM (3D CNN feature extractor): 92.37%, the generalized models obtained accuracy of 79% and 77% for multiclass classification using 2D CNN and 3D CNN respectively. The preictal classifier to early and late stage obtained an accuracy level of 91%. The overall results were promising and good except for the generalized models.

Key words: EEG, Spectrograms, CNN, Deep Learning, SVM, Machine Learning, Seizure detection, Epilepsy, Three-dimensional, Convolutional neural network