Report 2

Deep learning for EEG classification tasks: a review

This paper provides an overview of all the methods used in recent years used to classify EEGs and recommendations regarding which method to use for different classification tasks. The basic steps involved when classifying EEGs are: artifact removal, feature extraction, classification. Most relevant aspects were the implementation details of the most accurate CNN models. Recommendations for this model were: 4-5 convolutional layers followed by 1-2 classification layers.

Classification of EEG Signals Based on Pattern Recognition Approach

This paper deals in patter recognition in EEG's when subjects are performing cognitive tasks (multiplication, object rotation, mental letter composing, visual counting and Raven's Advance Progressive Matric Test (RAPM)). Multiple methods were used: support vector machines, multi-layer perceptron, naïve Bayes and K nearest neighbors. In order to accurately rank each method K-fold cross validation with K=10 was used.

An Automated System for Epilepsy Detection using EEG Brain Signals based on Deep Learning Approach

In this study a public dataset was used: University of Bonn, which is the dataset which I also used. The proposed architecture is made up of multiple models of type: pyramidal 1D CNN. After classifying the signal each of the models outputs their prediction and the result is decided by a majority vote. This method had great results on binary classification (seizure vs. Non-seizure) and ternary classification (normal vs ictal vs inter-ictal). Each model uses Adam optimizer with cross entropy loss function.

A Deep Learning Approach for Parkinson's Disease Diagnosis from EEG Signals

This paper proposes a CNN architecture in order to classify patients with Parkinson's disease. The model is composed of 4 1D convolutional layers each followed by a batch normalization layer and a max pooling layer, with ReLU as the activation function. The classifier is made of 3 dense layers with 50% dropout. High signal values which were over + or – 100 μV were dropped as they were considered artifacts. The dataset used is private and it only includes 20 patients.

Epilepsy EEG Signal Classification Algorithm Based on Improved RBF

In this paper a lot of features were extracted from the signals including: wave coefficients, approximate entropy, sample entropy and multiscale permutation entropy. The trained data is mapped to a new feature space through RBF (radial basis function, which is based on the number of neurons in the network). The binary classifier is a minmax probability machine which is trained with one against one strategy. Achieves an accuracy of 81% when classifying all classes in the University of Bonn dataset.

Plan

Besides these papers I've done more research regarding time series analysis from multiple sources and the plan is to use different machine learning architectures CNN, fully connected NN, RNN together with different filtering strategies on the input signal to classify the 5 classes of the University of Bonn dataset. The classes are as follows: normal with eyes open, normal with eyes closed, brain tumor and EEG was taken from healthy part of brain, brain tumor and EEG was taken from that part and seizure. Each method will be tested using 10-fold cross validation and