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The Design of Algorithm for Analysis of EEG Datasets for Prediction of Epilepsy

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Abstract- *The study and analysis of sleep Electroencephalogram (EEG) data has long been done to understand the psychology and brain function among patients and individuals. The data collected from these studies have helped researchers in arriving at various well documented conclusions. In this work, the evaluation of EEG data on different perspectives shall be done so that the brain waves and EEG hypnograms can be evaluated with predictive mining. A unique model of Improved ANN shall be devised and trained from the dataset fetched. We have used epilepsy based data to work with the predictive model with Random Forest on EEG Data.*

Key Words: EEG(Electroencephalograph) ,Epilepsy, Machine Learning, Physionet, Polyman, Python, Random Forest, SVM(Support Vector Machine)

1. INTRODUCTION

The new age has provided mankind with a lot of technology to ease the life of an individual but this so called period of "Smart-products" has also made man more dependent on technology and has led to a rise in stress and anxiety. This stress and anxiety manifests itself as various brain disorders in humans. Our aim is to study the sleep EEG signals captured from patients' brain and study these to perform predictive analysis on them. We design ANN and train it with sample datasets captured from Physionet. The proposed technique is an improved hybrid approach for prediction called Random Forest Approach.

2. STEPS OF PROPOSED WORK

- Extraction of Live EEG Data from Bioinformatics Research Portals including Physionet.
- Transformation of EEG Data to ASCII Format using execution in Polyman and Python.
- Training of Soft Computing Model from ASCII data so that predictions can be done on testing data.
- Development and Execution of Python based Implementation on Pre-Processed EEG-ASCII Data on multiple algorithms
  - *Support Vector Machine (SVM)* : Traditional Approach
  - *Improved Hybrid Approach for Prediction using Random Forest Approach* : Proposed Approach
- Implementation of Algorithms and Fetching Results on Multiple Parameters
  - Execution Time
  - Cost Factor
  - Complexity
  - Performance

3. TOOLS AND TECHNOLOGIES USED FOR IMPLEMENTATION

- Python
- Notepad++
- Scikit-Learn
- Python Machine Learning Libraries
- SeaBorn
- Physionet Polyman EDF Browser

4. IMPORTANCE OF NOVEL APPROACH

- Deep Evaluation of the Architecture of EEG Data
- Predictive Mining based on the different parameters associated with EEG
- Evaluation and Analytics of EEG Aspects with Deep Signal Processing
- Analytics of EEG Signals and Waveforms for identification of disorders
- Evaluation of Sleep data for different applications
- Predictive Analysis from EDF files and association with frames
- Electroencephalography (EEG) signals characterization with respect to various states of human body.

- Experimental setup used in EEG analysis with the integration of deep analytics and predictive mining from hypnograms.
- Implementation of EEG Lab and related tools, the deep evaluation of the architecture and framework of EEG shall be done with the effectual predictive mining.

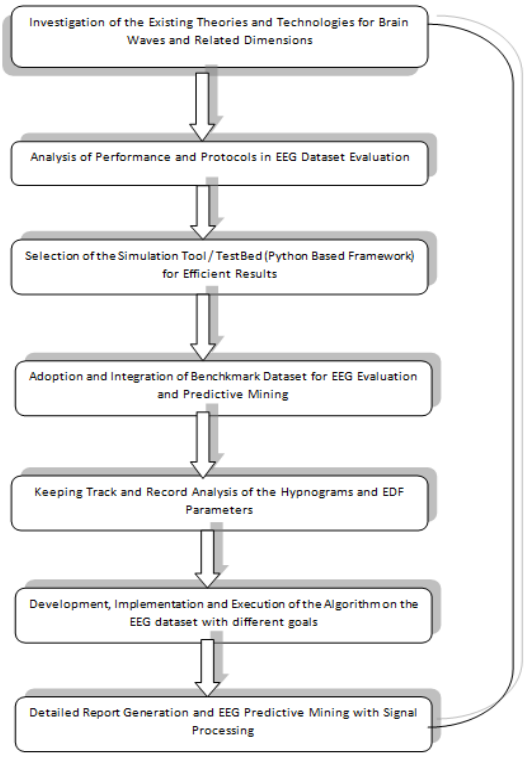

Fig- 1: Flow diagram of Methodology

5. MODULES INTEGRATED

- EEG Data Set Extraction from Assorted Sources
  - A number of data portals available including PHYSIONET from where the EEG Brain Wave dataset can be fetched. In addition, the dataset can be fetched and generated using live brain wave packet capturing tools.
- Implementation of EEG Analytics Tools in classical approach
  - The classical approach of frequency analysis can be worked out for the implementation of existing work.
- Features Extraction
  - The features or important aspects of the fetched dataset shall be investigated and then can be used for prediction.
- Development of a unique network for training
  - A unique model of Improved ANN shall be devised and trained from the dataset fetched.
- Training of Improved ANN Model
  - The training of Improved ANN model comprises of all the vulnerabilities which will generate the prediction on other datasets.
- Predictive Analysis from EEG on specific brain disorder including Epilepsy
  - The penetration analysis from the newly developed model is implemented and then analysis is performed.
- Deep Investigation and Predictive Analysis
  - The detailed comparative analysis between the classical and proposed approach shall be done on multiple parameters.

6. PROPOSED APPROACH WITH RANDOM FOREST ON EEG DATA

Random Forest algorithm is a supervised classification algorithm. This algorithm creates a forest with a number of trees and by some way makes it random towards the solution or optimization perspectives. The number of trees in the forest and the results it can get are directly related i.e.; the larger the number of trees, the more accurate the result. Random forest is, that it can be used for both classification and regression problems which is a big advantage. However, creating the forest using random forest technique is not the same as constructing the decision with information gain or gain index approach.

6.1 Properties of Random Forest Approach

- Large number of decision trees
- Every observation fit to every decision tree
- Most common outcome for each observation -> Final Output
- New Observation fit to all the trees and Majority Vote is taken

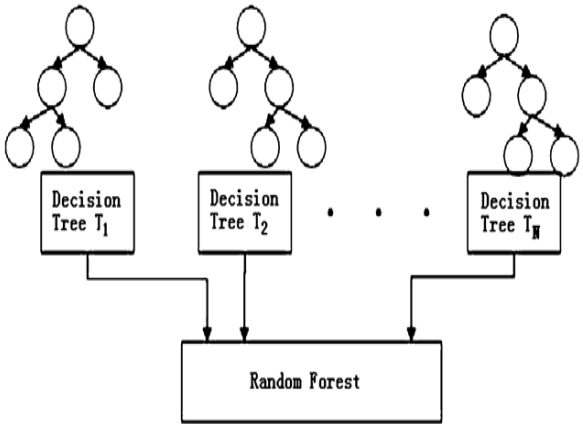

Fig -2 Random Forest algorithm

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