CLASSIFICATION OF PHYSIOLOGICAL DISEASES USING EEG SIGNALS AND MACHINE LEARNING TECHNIQUES

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Abstract

In rural areas providing advanced diagnostics for various health disorders is not possible in countries like India. With latest technological breakthrough, brain signals (EEG signal) capturing devices are available at rate less 50$. If these brain signals can be used to predict any Physiological disorders like heart problem, kidney problems etc., then these EEG devices can be provided to rural health care centre for preliminary investigation and on diagnosis the patient can move to city hospitals for diagnostics and treatment. In this project, we provide a solution of identifying physiological problems using EEG signals and use machine learning techniques for diagnosis.

Keywords: *EEG Signals, EEG Frame, Feature Extraction*

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1. INTRODUCTION

The PC help is requested in restorative organizations because of the way that it could enhance the consequences of people in such a space where the false antagonistic cases must be at a low rate. It has been demonstrated that twofold perusing of therapeutic pictures could prompt better Tumor identification. In any case, the expense suggested in twofold perusing is high, that is the reason great programming to help people in restorative foundations is of incredible intrigue these days. Customary techniques for checking and diagnosing the infections depend on distinguishing the nearness of specific components by a human watch.

There are huge number of patients in serious consideration units and the requirement for persistent perception of such conditions;a few methods for mechanized analytic frameworks have been produced as of late to endeavor to take care of this issue. Such procedures work by changing the for the most part subjective demonstrative criteria into a more target quantitative element order issue. Robotized grouping of Brain signs by utilizing some earlier information like force and some anatomical components is proposed. At present there are no strategies broadly acknowledged along these lines programmed and dependable techniques for Tumor recognition are of awesome need and intrigue.

Brain–Computer Interfaces (BCI) is the best plausible method for giving the correspondence between the human and the framework by method for mind signals. Using this BCI the patients can put over their perspectives or necessities by method for their cerebrum flags just by deduction process. The sign characterization module is made out of the acquired EEG signal elements extraction and the change of these signs into gadget directions. The EEG order strategy relies on upon the affectation and, in this way, the response to identify engine symbolism, occasion related possibilities, moderate cortical possibilities, or relentless state evoked possibilities. The anticipated EEG drives the characterization to some exact component extraction strategies. Doing mind surgery is a confused undertaking keeping in mind the end goal to that they take MRI sweep and CT check yet at times the picture may give reciprocal data and make trouble in finding the tumor from the white matter of the cerebrum the most recent advances in PC innovation and diminished expenses have made it conceivable to grow such frameworks.

Train a machine learning classifier to identify physiological diseases using EEG signals and measure the accuracy of this in terms of classification accuracy.

2. RELATED WORK

We are extending the domain of EEG signal application to physiological disease diagnosis. EEG signals for unhealthy individuals are taken. From this elements are separated from signs utilizing PCA (Principal Component Analysis) system and after that these elements and elements from solid subjects are utilized to prepare a Neural Network. In light of the preparation, the neural system will have the capacity to anticipate any new flag test components to infected or sound subject.

Approach

1. First EEG signals for unhealthy and solid subjects are gained from doctor's facilities and web.
2. PCA examination is done on the signs and components are extricated.
3. Features are utilized to prepare a neural system.
4. Once neural system preparing is finished, it can be used for arrangement.
5. To analyze a man for issue, his EEG sign is gathered.
6. PCA is done on gathered sign to concentrate highlights.

7. Neural Network is utilized order the component to be ailing or ordinary.

Advantage of our Solution

1. The solution cost is very less and can be used in rural health centers for preliminary investigation.
2. Very little trained man power is only needed as the system is very easy to use.

3. ARCHITECTURE

Framework engineering describes applied configuration which categorizes the conduct and structure of a framework. A design rendering is a formal depiction of a framework, arranged in a way that assists thinking about the fundamental features of a framework. It categorizes the product structure segments and generates an order out of which items can be procuredand frameworks built up, that will help in executing general framework.

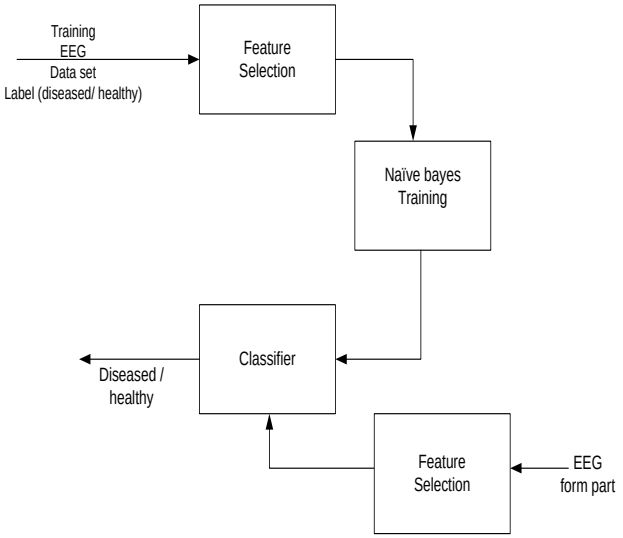

Fig-1: System architecture

Feature selection: This module takes training EEG data set as input. This training data set is helpful for training using naïve bayes classifier model. Based on the training, the neural network will be able to predict any new signal sample features to diseased or healthy subject.

Naïve Bayes classifier: It is a classifier based on Bayes probability theorem also known as probabilistic classifier. Naive Bayes classifier is very efficient since it requires a small amount of training data.

Classifier: Machine learning classifier is used to identify physiological diseases using EEG signals and measure the accuracy of this in terms of classification accuracy. The admin will be responsible for load train data set, train classifier and measure the accuracy.

Depiction of Classes for the System

Unified Modeling Language (UML) diagram's class chart is kind of static pattern graph. It uses framework's classes and their properties to depict the structure of a framework and connections between various classes. A class chart is depicted below:

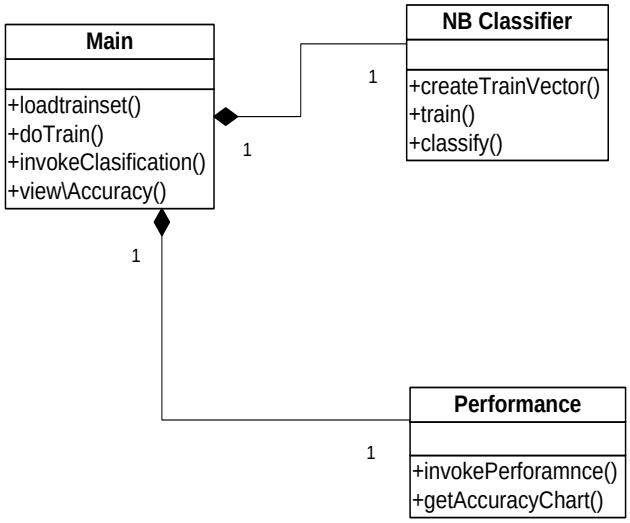

Fig-2: Class Diagram

The class diagram has the following classes:
Main class: This class has operations load trainset, do train, invoke classifier and view accuracy.

NB Classifier Class: This class has operations called create train vector, train and classify.

Performance class: This class has operations called invoke performance and get accuracy chart.

System's Operation Sequence Diagram

Unified Modeling Language's (UML's) sequence diagram is a kind of communication diagram which shows how processes work with each other and in which order. Sequence diagram is a form of a Message Sequence Chart.

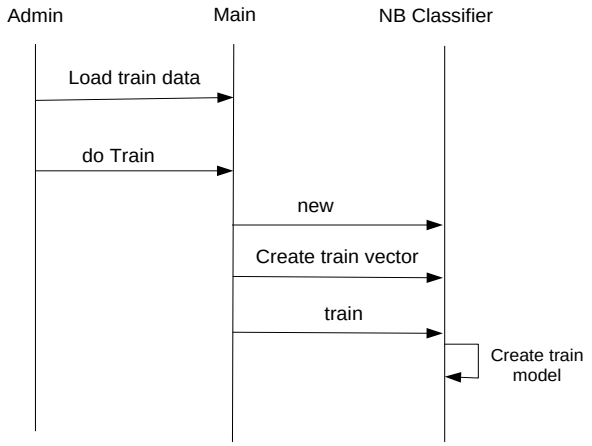

Fig-3: Sequence Diagram of Network Train Flow

Here admin, main, NB classifier are objects. Each object interacts with other objects in a sequential order through messages. As shown above.

Sequence Diagram for Test Flow

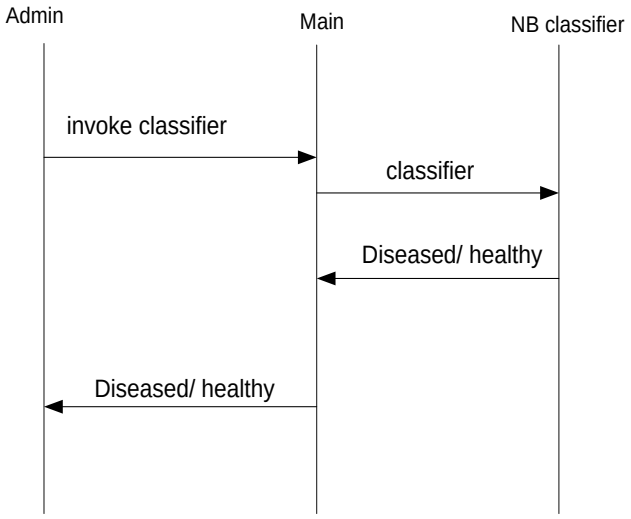

Fig-4: Sequence Diagram for Test Flow

Here admin, main, NB classifier are objects. Each object interacts with other objects in a sequential order through messages. As shown above.

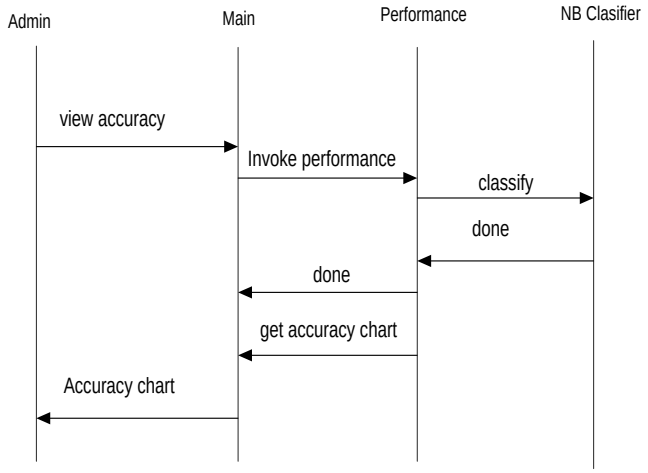

Fig-5: Sequence diagram for performance flow

Here, admin, main, performance and NB classifier are called objects. Each objects interacts with each other by exchanging the messages.

4. IMPLEMENTATION

4.1 EEG Framework

The primary reason for the EEG Frame structure is to concentrate highlight vectors from EEG records and store them for further information disclosure.

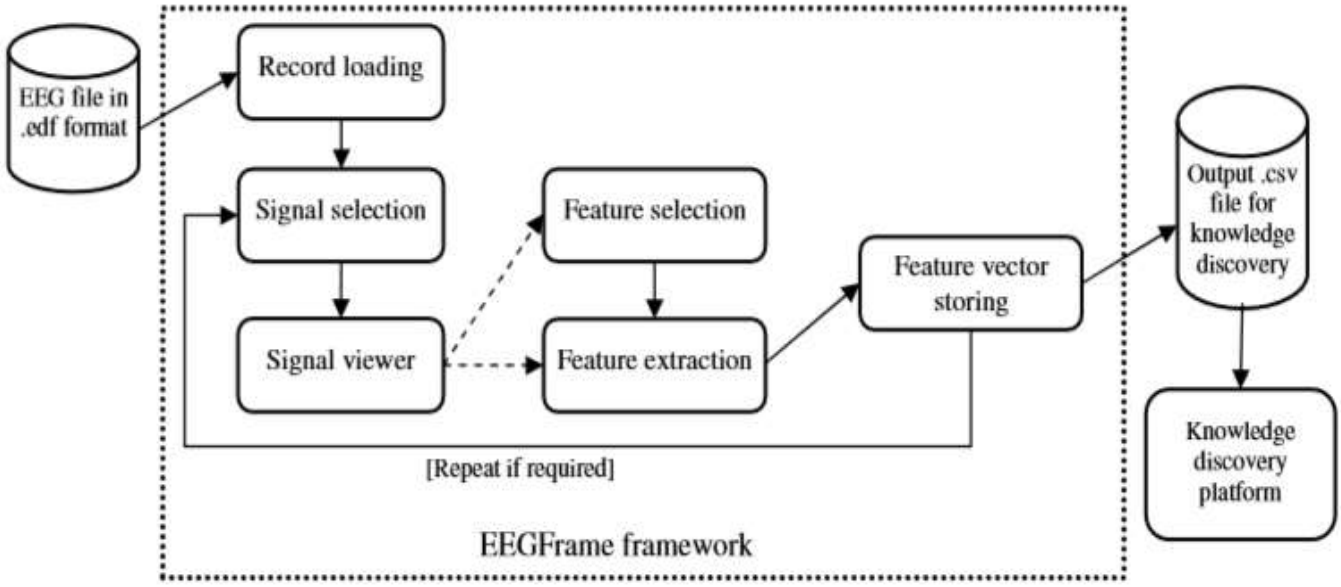

Fig-6: Overview of the EEG framework

The structure accepts that the information in EDF configuration is accessible, and that it has been separated (the system does exclude EEG pre-processing techniques. It then empowers visual review of a solitary record and highlight extraction from the record, by determining the extraction parameters.

The yield document is recorded in .csv position that can be perused by the greater part of the open-source information revelation stages, for example, Weka or Rapidminer.

4.2 Testing

Table-1: Module Testing

Classes Implemented	Functions used in classes	Tests Executed	Observation
Main	Load Train set() Do train() Invoke Classifier() view Accuracy()	Functionality is working correctly	Pass
Naïve Bayes Classifier	Train vector() Train() Classify()	Module are functioning properly	Pass
Performance	Invoke performance() get accuracy()	Measured Performance	Pass

5. RESULTS

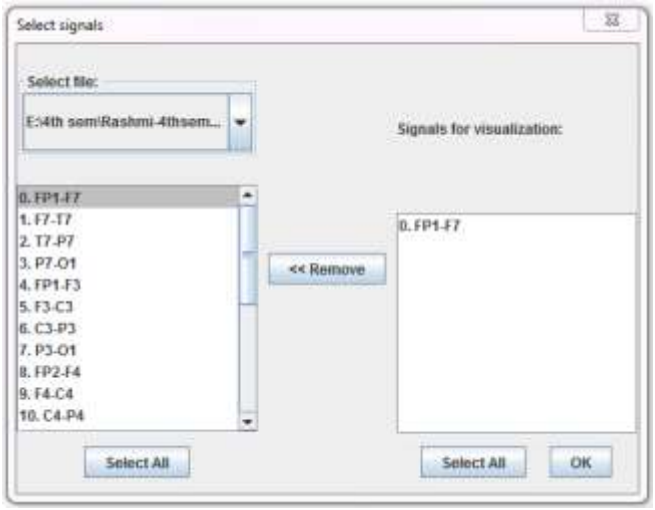

Fig-7: Selecting Signals for Feature Extraction

Fig-8: Feature Extraction

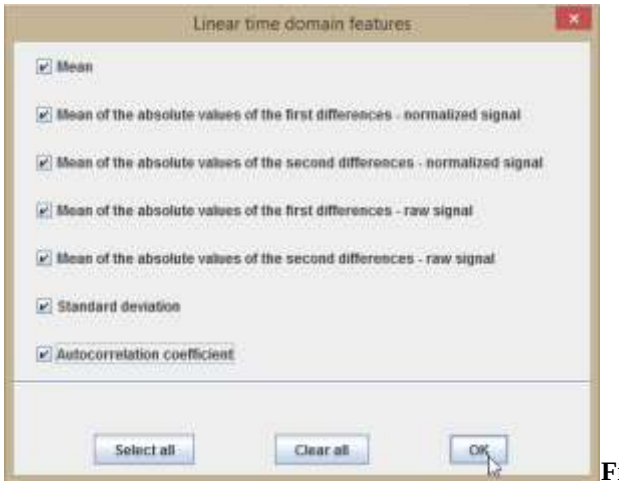

Fig-9: Selection of Linear Time Domain Features

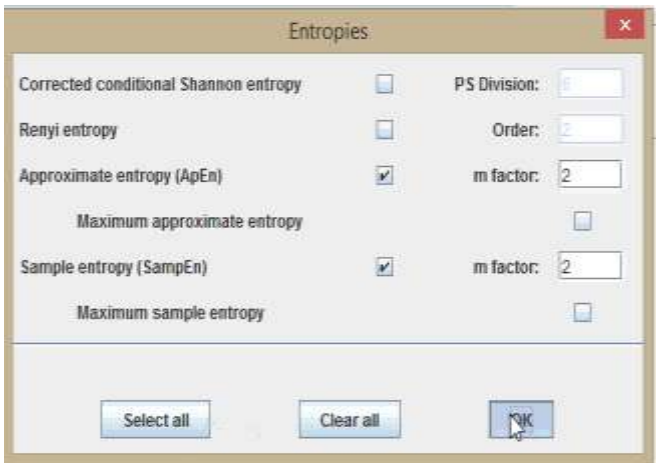

Fig-10: Selection of Approximate Entropy and Sample Entropy

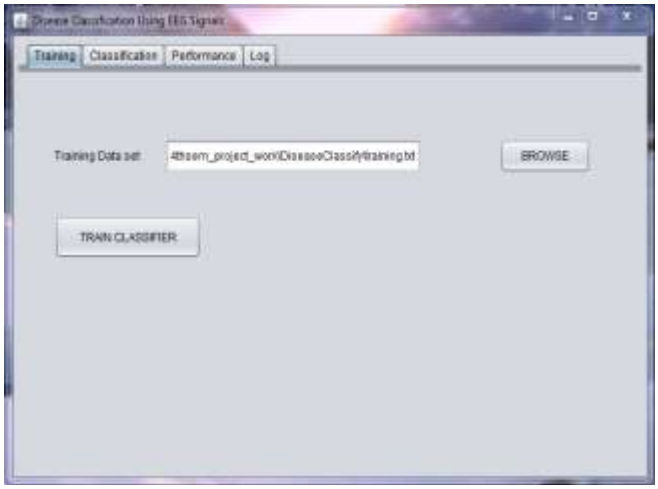

Fig-11: Train the Classifier by Browsing the Training Data Set Text File

Fig-12: Training Completed

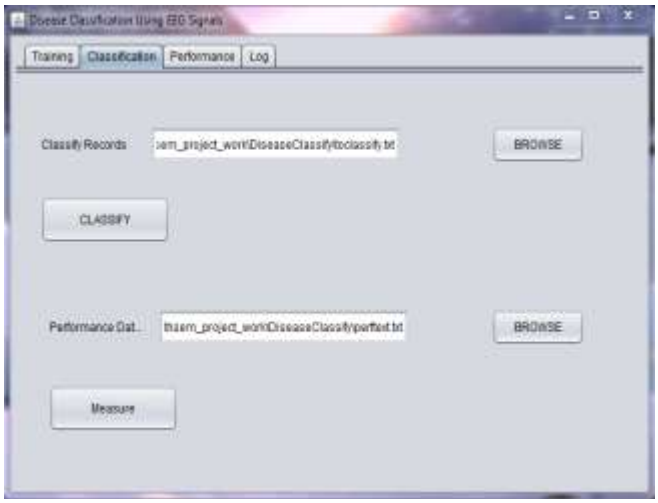

Fig-13: Classification

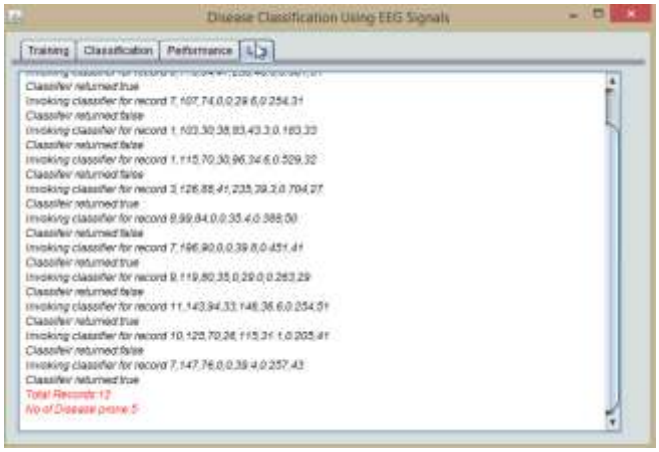

Fig-14: Log Information about Records and no. of Disease Prone

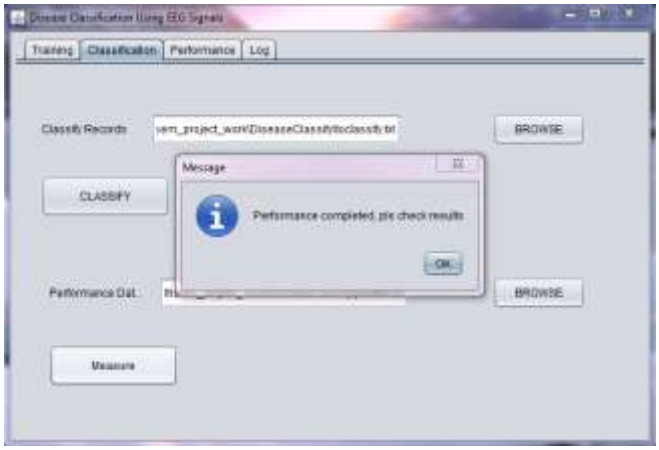

Fig-15: Performance Measurement Process

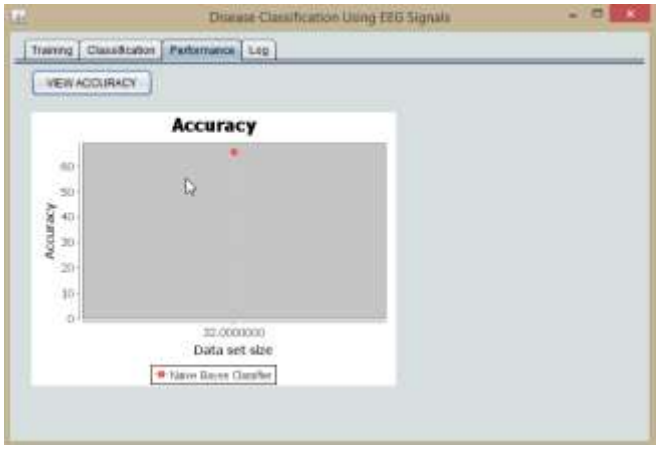

Fig-16: Accuracy Graph for Data Set

6. CONCLUSION

In order to improve the system performance, the classifier has trained with the features of principal components. The reproduced framework gave that the better order exactness of information tests and similarity in this determination. Robotized cerebrum ailments determination framework with directed back engendering with food forward neural system to distinguish variation from the norm, for example, tumor and epileptic case.

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned my effort with success.

I extend my deep sense of sincere gratitude to **Dr. MOHAN BABU. G N, Principal,BMS Institute of Technology & Management** for providing me an opportunity to continue my higher studies.

I express my sincere gratitude to **Dr. THIPPESWAMY. G, HOD, Dept. of Computer ScienceandEngineering, BMS Institute of Technology & Management** for his valuable suggestions and expert advice.

I deeply express my sincere gratitude to my internal guide**, Mrs. Veena N., Assistant Professor, Department ofComputer Science and Engineering,** for her encouragement and advice throughout this Project work.

Special thanks to all the staff members of Computer Science Department for their help and kind co-operation.

Last, but not least, I would like to thank my parents and friends for their encouragement and support given to me in order to finish this precious work.

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