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BIPOLAR DISORDER DIAGNOSIS

BASED OF ARTIFICIAL INTELLIGENCE

Mr. E.Shravan Kumar(Assistant Professor) Department of Computer Science and Engineering
St. Peters Engineering College, Dullapally, Maisammaguda, Medchal,Hyderabad,Telangana 500043

D. Rohith Kumar
Department of Computer Science and Engineering
St. Peters Engineering College, Dullapally, Maisammaguda, Medchal,Hyderabad,Telangana 500043

P.Sai Surya Kumari
Department of Computer Science and Engineering
St. Peters Engineering College, Dullapally, Maisammaguda, Medchal,Hyderabad,Telangana 500043

B.Vara Prasad
Department of Computer Science and Engineering
St. Peters Engineering College, Dullapally, Maisammaguda, Medchal,Hyderabad,Telangana 500043

ABSTRACT:

Bipolar Disorder is a complex disorder that affects millions of people in the world.1in every 100 people are affected by bipolar disorder. One of the fields of work that could benefit from Machine Learning is, without doubt, the field of medicine. It is our belief that with the use of Machine Learning we can help both patients and doctors make a better diagnosis of this illness. The goal of this project is to apply different Machine Learning algorithms to symptoms based patient data in order to help create a prediction model. This model would make it easier for psychiatrists to decide whether their patients might be tending towards a depression or mania episode, or staying in a euthymic state.

KEYWORDS: Machine Learning, Python, Gitpod, Bipolar Disorder, Mental illness, Patient data, Episodes.

INTRODUCTION

Machine Learning is becoming increasingly present in all systems that gather and process huge amounts of data, being almost an essential requirement in the development of new software applications. One of the fields of work that could benefit from Machine Learning is, without doubt, the field of medicine.The use of Machine Learning algorithms allows the design of both classification and regression models that help with the diagnosis of different diseases, recommendation of drugs, automatic administration of drugs, etc. In the medical branch of psychiatry, in the area of brain disorders, one of the existing disorders is Bipolar Disorder. This particular disorder is characterized by the oscillation of the patient's mood between two states, mania and depression , which often come accompanied by different features, both physical and psychological.

Machine Learning is the process by which certain models are created, with the help of different algorithms, that predict values based on different features and become increasingly better in making these predictions the more data they train on. This is why Machine Learning could be a useful tool for trying to predict the episode in which a patient might be in or tend towards with the help of different Bipolar Disorder symptoms and patient dataThe first part of the project consists in the process of cleaning and visualizing data from patients with Bipolar Disorder. It includes an exploratory data analysis which helps in summarizing the data and various plots that help understand the data better and observe the possible relationships among parameters usedThe second part includes the predictive analysis of the data. In this part, different Machine Learning algorithms are analysed and applied to the patient data in order to compare prediction accuracies and select the algorithms that suit the problem the most.

LITERATURE REVIEW

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal.A subset of artificial intelligence is machine learning, which refers to the concept that computer programs can automatically learn from and adapt to new data without being assisted by humans. Deep learning techniques enable this automatic learning through the absorption of huge amounts of unstructured data such as text, images, or video.Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves.

Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks. A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics.The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers to learn automatically without human intervention or assistance and adjust actions accordingly.

EXISTING SYSTEM

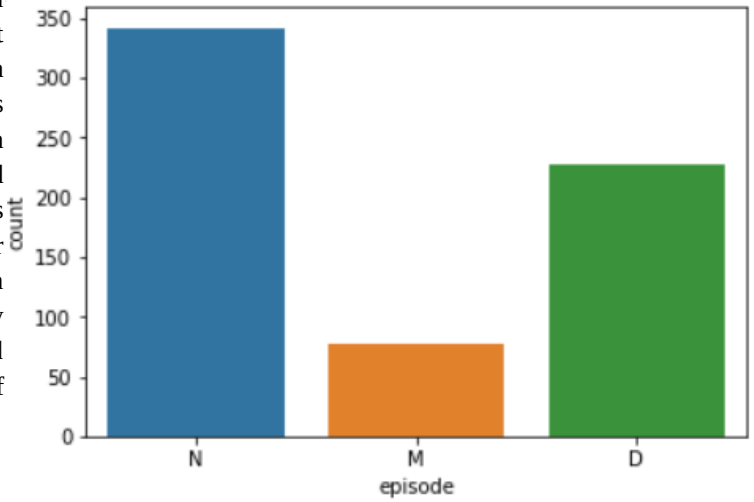
Bipolar disorder is a lifelong illness and there currently is no cure. Bipolar disorder can occur at any age, typically it's diagnosed in the teenage years or early 20s. Symptoms can vary from person to person, and symptoms may vary over time.However, it can be well-managed with medication and talk therapy, by avoiding stress, and maintaining regular patterns of sleeping, eating, and exerciseTo diagnose bipolar disorder, a doctor may perform a physical examination, conduct an interview.Mania-To be diagnosed with bipolar disorder, a person must have experienced at least one episode of mania or hypomania. Hypomania is a milder form of mania that doesn't include psychotic episodes. People with hypomania can often function well in social situations or at work. Some people with bipolar disorder will have episodes of mania or hypomania many times throughout their life.Depression-The lows of bipolar depression are often so debilitating that people may be unable to get out of bed. Typically, people experiencing a depressive episode have difficulty falling and staying asleep, while others sleep far more than usual. When people are depressed, even minor decisions such as what to eat for dinner can be overwhelming. They may become obsessed with feelings of loss, personal failure, guilt or helplessness; this negative thinking can lead to thoughts of suicide. Depression associated with bipolar disorder may be more difficult to treat and require a customized treatment plan.In existing system doctors need to analyse patient behavior patterns,medication,diet etc for each patient manually.There are no specific blood tests or brain scans to diagnose bipolar disorder. Even so, your doctor may perform a physical exam and order lab tests, including a thyroid function test and urine analyses. These tests can help determine if other conditions or factors could be causing your symptoms.

PROPOSED SYSTEM

Machine learning algorithms can detect patterns associated with diseases and health conditions by studying thousands of healthcare records and other patient data.Machine learning allows building models to quickly analyze data and deliver results, leveraging historical and real-time data. With machine learning, healthcare service providers can make better decisions on patient's diagnosis and treatment options, which lead to an overall improvement of healthcare services.It is our belief that with the use of Machine Learning and patient data we can help both patients and doctors make a better diagnosis of this illness. We have applied AI to create an app that can predict the mood swings in Bipolar disorder patients so they can be managed accordingly. This is possible because one of the signs of a future mood swing is a change in patient speech patterns.The first part of the project deals with the process of gathering, cleaning and visualizing data from patients with Bipolar Disorder.The second part includes the predictive analysis of the data. In this part, different Machine Learning algorithms are analysed and applied to the patient data .This model would make it easier for psychiatrists to decide whether their patients might be tending towards a depression or mania episode, or staying in a normal state.

DATASET DESCRIPTION:

The dataset parameters used to predict the crop name is as follows:
Mood: mood level of the patient, ranging from -3 to 3.
Motivation: motivation level of the patient, ranging from -3 to 3
Attention: level of attention of the patient, ranging from 0 to 4.
Irritability: irritability level of the patient, ranging from 0 to 4.
Anxiety: anxiety level of the patient, ranging from 0 to 4.
Sleep quality: quality level of the sleep, ranging from 0 to 4.
Caffeine: amount of caffeine ingested by the patient
Active_time : The total active time of a patient.



IMPLEMENTATION

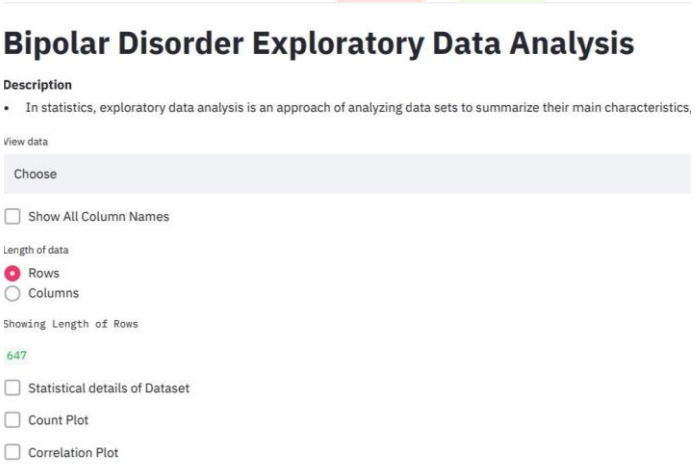
Sample patient data used is as shown below

nood	motivation	attention	irritability	anxiety	sleep_quality	caffeine	active_time	episode
0	1	1	1	1	2	90	1470	N
-1	-1	2	1	1	3	120	1790	N
0	-1	2	1	1	1	90	1545	N
2	2	3	3	3	3	150	1710	N
2	2	3	3	3	3	150	1770	N
2	1	3	3	3	3	120	1715	N
1	2	2	2	2	3	120	1830	N
1	1	3	2	2	2	150	1645	N
1	2	3	2	2	3	180	1715	N
-1	-1	4	2	3	2	180	1500	N
1	0	2	2	2	3	180	1710	N
0	0	2	3	2	2	0	1800	M
-1	2	4	3	3	2	180	1500	N
1	1	2	2	3	2	120	1645	N
1	0	3	3	3	4	180	1980	N
-1	1	2	2	2	2	120	1400	N
1	0	3	3	3	4	180	1980	N
-2	-1	1	1	2	2	120	370	N
-2	-2	1	3	3	2	120	1500	N
1	1	2	2	1	2	180	1645	N
-2	-2	2	3	3	1	0	1401	M
1	-2	3	4	1	4	90	1495	M
1	1	2	2	1	2	180	1645	N
0	-1	1	3	1	3	0	1430	M

EXPLORATORY DATA ANALYSIS

Exploratory Data Analysis(EDA) refers to the critical process of performing initial investigations on data so as to discover patterns,to spot anomalies,to test hypothesis and to check assumptions with the help of summary statistics and graphical representations.In statistics, exploratory data analysis is an approach of analyzing data sets to summarize their main characteristics, often using statistical graphics and other data visualization methods.EDA also helps stakeholders by confirming they are asking the right questions. EDA can help answer questions about standard deviations, categorical variables, and confidence intervals.

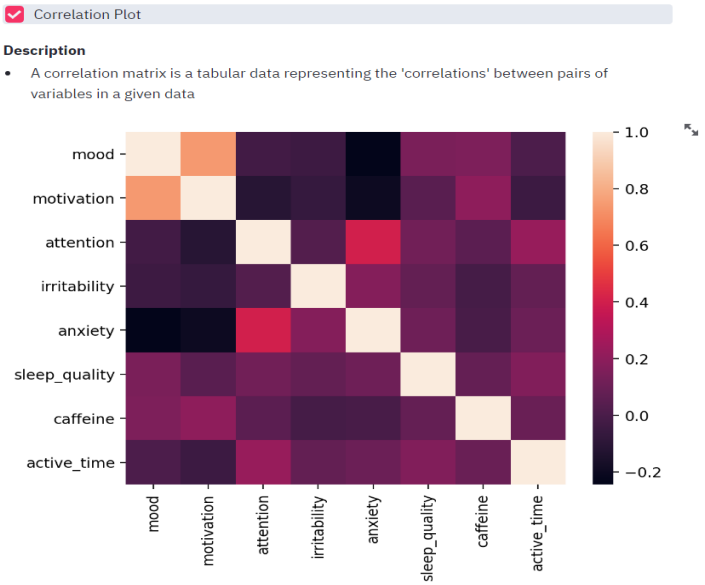
BIPOLAR DISORDER EDA WEB APP



Exploratory data analysis is a complement to inferential statistics, which tends to be fairly rigid with rules and formulas. At an advanced level, EDA involves looking at and describing the data set from different angles and then summarizing it.Once EDA is complete and insights are drawn, its features can then be used for more sophisticated data analysis or modeling, including machine learning.

CORRELATION MATRIX:

A correlation matrix is simply a table which displays the correlation. The measure is best used in variables that demonstrate a linear relationship between each other.



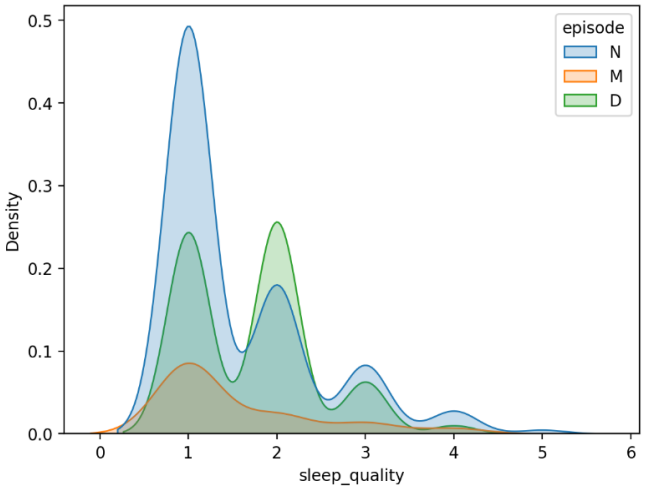
DENSITY PLOT:

Density Plot is a variation of the histogram that uses 'kernel smoothing' while plotting the values.

Description

- A density plot is a representation of the probability density function of the parameter

Sleep_quality

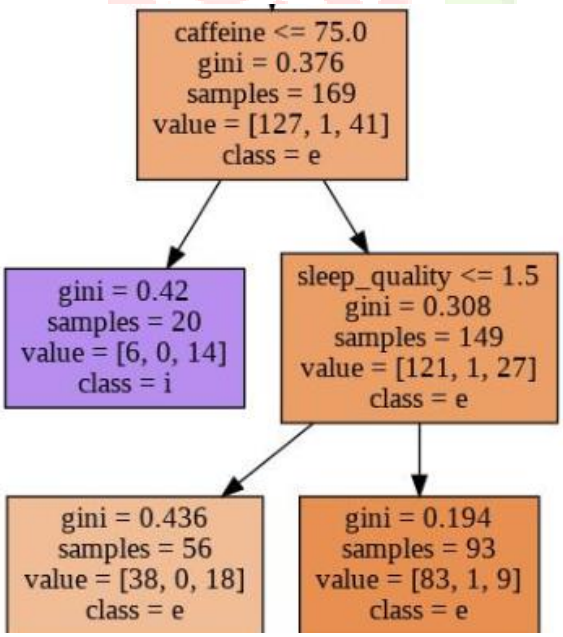


PREDICTIVE ANALYSIS

Machine learning is a form of predictive analytics that advances organizations up the business intelligence (BI) maturity curve, moving from exclusive reliance on descriptive analytics focused on the past to include forward-looking, autonomous decision support. Predictive analytics is the use of data, statistical algorithms and machine learning techniques to identify the likelihood of future outcomes based on historical data.Predictive analytics encompasses a variety of statistical techniques (including machine learning, predictive modelling and data mining) and uses statistics (both historical and current) to estimate, or 'predict', future outcomes.Predictive analytics involves certain manipulations on data from existing data sets with the goal of identifying some new trends and patterns.

DECISION TREE

The Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, the decision tree algorithm can be used for solving regression and classification problems too.The goal of using a Decision Tree is to create a training model that can be used to predict the class or value of the target variable by learning simple decision rules inferred from prior data.
n Decision Trees, for predicting a class label for a record we start from the root of the tree. We compare the values of the root attribute with the record's attribute. On the basis of comparison, we follow the branch corresponding to that value and jump to the next node.Decision Trees (DTs) are a non-parametric supervised learning method used for classification and regression. The goal is to create a model that predicts the value of a target variable by learning simple decision rules inferred from the data features.

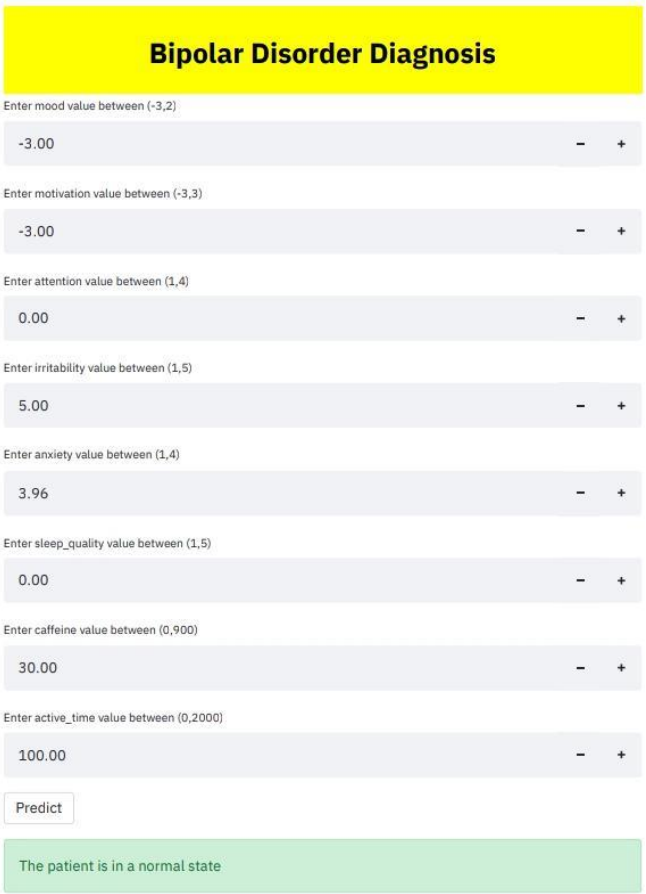


The default values for the parameters controlling the size of the trees (e.g. max_depth, min_samples_leaf, etc.) lead to fully grown and unpruned trees which can potentially be very large on some data sets. To reduce memory consumption, the complexity and size of the trees should be controlled by setting those parameter values.

A decision tree classifier.

`sklearn.tree.`**`DecisionTreeClassifier`**(*,
criterion='gini', splitter='best', max_depth=None, min_samples_split=2, min_samples_leaf=1, min_weight_fraction_leaf=0.0, max_features=None, random_state=None, max_leaf_nodes=None, min_impurity_decrease=0.0, min_impurity_split=None, class_weight=None, ccp_alpha=0.0)
criterion*{"gini", "entropy"}, default="gini"*
splitter*{"best", "random"}, default="best"*
max_depth*int, default=None*
min_samples_splitint or float, default=2
max_leaf_nodesint, default=None

BIPOLAR DISORDER DIAGNOSIS WEB APP



CONCLUSION

As a conclusion of this project we can state that having a deep understanding of the data we are working with is essential in any Machine Learning project focused on a branch of medical science like psychiatry, where knowing which behaviours are normal and abnormal in the patients can help us create much more precise prediction models. We can also affirm that the amount of data used in a project is a very important factor because with a larger amount of data we will be able to get prediction accuracies with a much higher level of confidence. In the same way that understanding the data is important, having a deep perception of the theory behind each algorithm used, as well as their different implementations, is crucial in order to get the models to perform in the best way possible.

FUTURE ENHANCEMENT

The most immediate use of the results obtained in this project would be to train the same algorithms used with larger amounts of data, in order to see if they perform in a similar way. Gathering objective data from devices like mobile phones or wristbands is something that can be accomplished quite easily. The goal of this would be to compare the performance of different algorithms on the objective data gathered from these devices with the performance results obtained on the subjective data used in this project. As for other more indirect applications of the results obtained during this project, the implementation of a drug recommending system for patients with Bipolar Disorder could be made by predicting the states in which the patients are in during a certain period of time. These predictions could be stored in a database which also contains the medicine that these patients have been prescribed with during the same period of time, thus providing the possibility of checking which drugs are better for the patient.

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