

# Detection of Mental Illnesses Using Brain Scans

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## **Abstract:**

Brain scanners are used to detect brain activity with the help of neuro symptoms, which help to obtain specific functions or mental disorders. On top of for years doctors have used traditional questions and observation techniques to find out to diagnose individuals affected by mental illness, however, there is a long trial as well error process. With the introduction of MRI and other forms of brain scans, it became easier for doctors to monitor brain function and response to other stimuli and record responses. This paper aims to better understand and by using image processing techniques, you can see these problems and reactions to understand how the brain responds and allow doctors to act better and more accurately diagnose mental illness. Various classification algorithms like Logistic Regression (LR), Random Forest (RF), Decision Tree (TR), KNN, Super Vector Machine (SVM), and NAÏVE BAYES (NB) are used for bipolar disorder and evaluating accuracy.

**Keywords:** Brain Scanners, MRI, Image Processing

## I. INTRODUCTION

Mental health includes emotional, mental, and social health and it affects the quality of our lives in terms of how we act and build relationships with our people. There are various reasons why the state of our mental well-being is so affected, ranging from natural factors to previous life experiences as well even physical or biological reasons [1]. In recent years, the field of computer science plays an important role in the medical field to improve the quality of care provided to patients and assisted physicians and other medical professionals in the diagnosis of diseases, followed by better patient care. According to a study by the World Health Organization in 2017, psychological diseases affect about 11% of the world's population at some point in their area's lives [2]. Mental illnesses are health conditions that involve changes in mood, behaviour, or thinking, or a combination of them, that can cause problems, in general, the work of a person in their families or communities and hinders their well-being. In the current situation in the fields of psychology or psychology, most diagnoses systems involved in-depth behavioural analysis, followed by a complex process of testing and error, with various drug administration and practice different treatments. However, during the last twenty to thirty years, due to technological advances and the ability to perform neural scans and brain imaging, many patterns have been noted, not only in the patient's behaviour but also in their behaviour and the structure of the brain itself and there is a significant difference in the way their emotions methods are developed, which differ from healthy and normal working brains [3]. As the main objectives of various other research projects and studies mainly involve behavioural analysis and not the actual physiology involved, which we aim to do aimed at that research area for this project. The biggest problem involved is the diagnosis, as the process is long and tedious and involves many tests and errors.

## II. LITERATURE SURVEY

Diagnosis of mental health has often been defined as abnormal behaviour or behaviour, however, this definition continued to change as circumstances or places have changed

in a person. However, it was only in 1883 that the information was available about a system of psychological problems found near the pattern of symptoms, as well he suggested that there should be a basic cause for life. In 1952 when one shared program was designed, and that program is under review, the last update was done in 2013 [4]. It was first introduced in 1976 when psychiatrists discovered that in structural thinking, enlargement of certain brain structures was found in patients with multi-epitope schizophrenia. According to this study, a study was conducted to prove the effectiveness of the theory that brain scans can help with the diagnosis of brain diseases [5]. This study aimed to determine the level of ML use neuroanatomical data to allow for the diagnosis of the first episode of psychosis (FEP) while setting instead safety measures to avoid the consequences of overconfidence [6]. The system was tested by both traditional ML and the emerging method known as deep learning (DL) using factor 3 interest sets: (1) regional volumes based on column strength, (2) voxel-based Gray matter (GMV) volume, and (3) voxel-based cortical thick (VBCT) to test the reliability of the findings, we repeated all the analysis in

5 independent data sets, a total of 956 participants (514 FEP and similar 444 controls within the site). Performance was assessed using nested cross-validation (CV) and cross-site CV. Accuracy from 50% to 70% in top-notch features; from 50% to 63%. GMV; and from 51% to 68% in VBCT [7]. Four distinctive methods were used: neighborhoods close to k (KNN), logistic retreat (LR), support vector support (SVM), and deep neural networks (DNN) These methods were selected based on their increasing complexity structure (KNN is a straightforward algorithm, while DL can be very powerful at a cost of transparency), thunder (SVM and LR are among the most widely used ML methods previous studies), and adolescence (DL produced promising psychological results neuroimaging but to be used in FEP). The real challenge is not to distinguish between patients and people without the disease, but to develop biological testing that can be used to select among others to diagnose and extend treatment.

There are many reasons why inconsistencies. Most studies used small samples ( $N \leq 50$ ) [8]. Schizophrenia is associated with a variety of clinical symptoms as well neuroanatomical mutations. In this work, we aim to differentiate the patterns of neuroanatomical mutations less than the number of different people using a slightly monitored integration method [9]. We use this strategy in a group of four patients with Schizophrenia of varying duration of illness, and we explain neuroanatomical features, and demographic and clinical features of the subtypes found. Neuropsychiatric disorders are diagnosed based on a behavioural process, which makes diagnosis a challenge. Objective biomarkers such as neuroimaging are needed, too when combined with machine learning, it can help diagnose and expand the decision honesty [10]. Free Surfer is used to retrieve data from participant brain tests. Six classifiers were used to separate the subjects [11]. Later, 26 very high-risk psychiatry (UHR) and 17 articles for the first episode of psychotherapy (FEP) were conducted with trained class dividers - All six dividers performed well compared to classify topic groups, especially support vector (SVM) support and Logistic regression (LR).

### III. PROPOSED METHODOLOGY

Current mental health diagnoses occur in one or more of the following ways as shown in figure 1. Where like a physical examination, the doctor will try to rule out any possible physical problems your symptoms, these may include abnormal growth,

physical/structural damage in any parts, etc. then later laboratory testing is done, and this may include, for example, a thyroid function or an alcohol and drug testing.

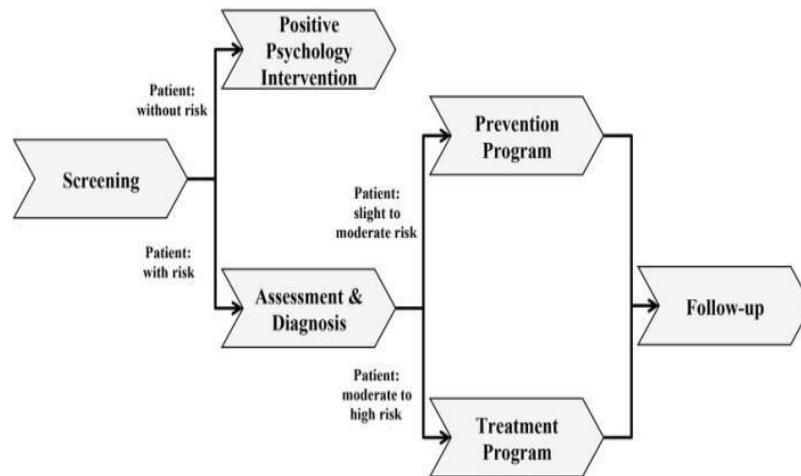


Figure 1: Depicts the traditional methods of diagnosis and treatment protocol

Later psychological testing in which a doctor or mental health professional talks to someone individuals about their characteristics, thoughts, feelings, and behaviours. She/he may be asked to complete a list of questions to answer these questions. As can be seen from the most widely used practices, many of them are inclusive behavioural testing and testing of chemical levels in the body. Using scanners is incorrect and common as alternatives, which may be easier to diagnose process. Although these behavioural tests and psychological tests are important factors diagnostic process, further testing in the form of thought can help this process in the testing platform itself. Doing so may increase the speed at which their diagnoses occur, or at least prevent delays and errors.

As shown in figure 2, the proposed methodology involves using algorithms to separate different machines for reading and seeing which method of separation is most useful for something structure. The detected data is called BiND or Bipolar Disorder Neuroimaging Website version contains an analysis of different brain structures for bipolar disorder and Schizophrenia. It is a complete database of 141 structural imaging studies in bipolar disorder listing medications, clinical data, and what brain structures were measured.

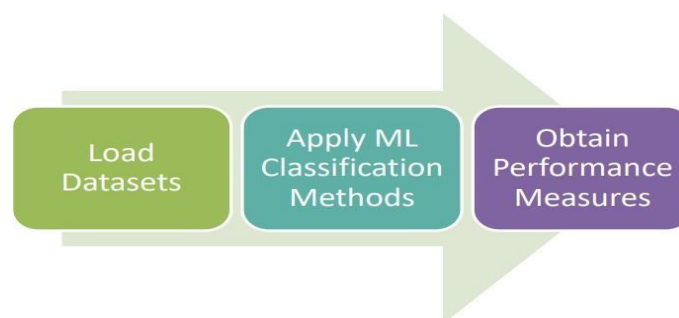


Figure 2: Basic system architecture

The summary of bipolar vs control metanalysis is presented as two tables and graphs presenting the result size and 95% confidence. Intervals of continuous variables and binary variables. Impact size values are derived from the single meta-analysis found in the following sheets. During the course of the project, research summaries are used from the website we were able to examine the studies and conclude that there is a certain brain formation in both the case of bipolar disorder and schizophrenia manifested significant change in size compared to hot brain. After this diagnosis is done, we were able to separate these records and patients from an individual database of each structure within a particular disease. Once these structures were identified, we were able to extract the records of 150 patients for each brain structure for each of the two selected disorders.

#### IV. RESULTS & DISCUSSIONS

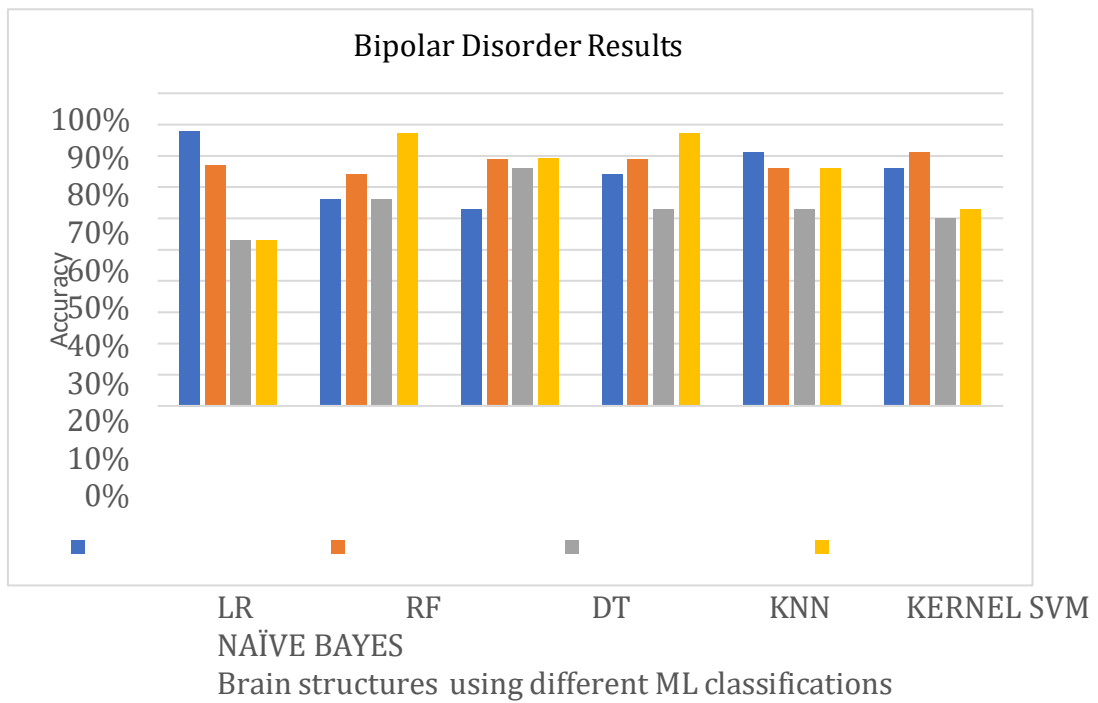
We have used differentiation methods in different brain structures. The effects of each brain structure are similar to those of the brain ventricles in a network of complete cavities Cerebrospinal fluid (CSF) is also found within the brain parenchyma. Ventricular the system is made up of 2 rear ventricles, a third ventricle, and a cerebral aqueduct. The choroid plexuses are internal ventricles that produce CSF, filling the ventricles and subarachnoid space, the next cycle of continuous production and re-absorption. Table 1 depicts the accuracy of the different data sets used for brain structures using various classification algorithms like Logistic Regression (LR), Random Forest (RF), Decision Tree (TR), KNN, Super Vector Machine (SVM), and NAÏVE BAYES (NB) for bipolar disorder and Table 2 used for Schizophrenia results. In the case of the Lateral Ventricle, Logistic Regression provided the best accuracy points than other algorithms. Three Ventricle, Random Forest, and KNN both provided the same and better accuracy than other classification algorithms. The graphical representation of the bipolar disorder results using various classifications for brain structure is shown in figure 3 and figure 4 depicts a graphical representation of Schizophrenia results.

**Table 1: Bipolar disorder results using various classification algorithms for brain structure**

<b>METHOD/DATASET (ACCURACY)</b>	<b>Lateral Ventricle (Total)</b>	<b>Lateral Ventricle (CT)</b>	<b>Lateral Ventricle (MRI)</b>	<b>Third Ventricle</b>
LR	88%	77%	53%	53%
RF	66%	74%	66%	87%
DT	63%	79%	76%	79%
KNN	74%	79%	63%	87%
KERNEL SVM	81%	76%	63%	76%
NAÏVE BAYES	76%	81%	60%	63%

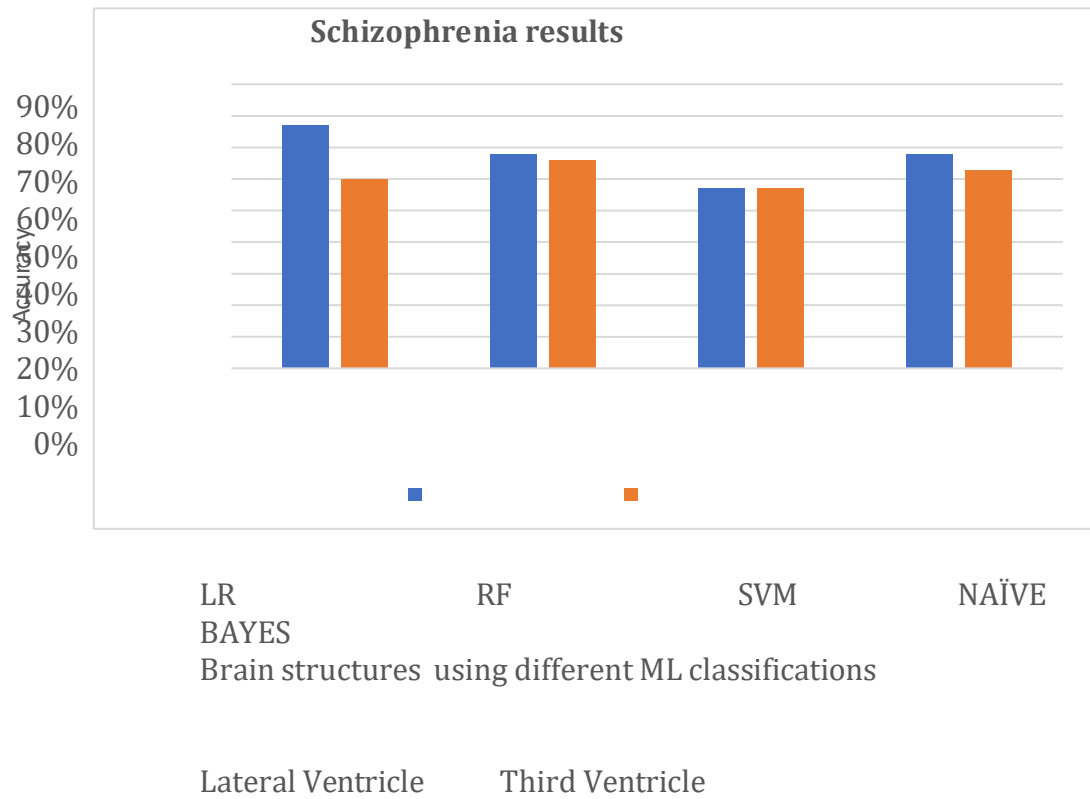
**Table 2: Schizophrenia results using various classification algorithms for brain structure**

THOD/DATASET (ACCURACY)	Lateral Ventricle	Third Ventricle
LR	77%	60%
RF	68%	66%
SVM	57%	57%
NAÏVE BAYES	68%	63%



Lateral Ventricle (Total)    Lateral Ventricle (CT)    Lateral Ventricle (MRI)    Third Ventricle

*Figure 3: Graphical Representation of bipolar disorder result*



*Figure 4: Graphical Representation of Schizophrenia results***V Conclusion**

Using classification reports of various machine learning algorithms, we were able to see that certain structural methods show different results and accuracy. During this project, we explored different ways in which machine learning algorithms can be used and how they can be used in the field of medical diagnostics. The positive results obtained from this study encouraged the authors to continue their studies. The scope of the future is shaped by the authors to incorporate the use of alternative solutions to see that results can be greatly improved and make more applications. In this context, it is intended to use a variety of machine learning techniques and algorithms to determine whether the performance and quality of the solution can be taken in certain future steps. Additionally, some medical information will also be used for alternative diagnostic procedures. By expanding this approach with more information on the various mental illnesses, better results can be obtained, as well as a greater list of patient records. In addition, by using more in-depth learning methods such as the convolutional neural network, the program can be expanded with real-time data as well.

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