

Clinical Decision Support System for Psychiatric Disorders

Anshul Satsangi
Computer Engineering
MIT COE, Kothrud
Pune, India

Prof. Rekha Sugandhi
Associate Professor
MIT COE, Kothrud
Pune, India

Abstract—Psychiatric disorders are very common and causes social and economic burden. It is important to predict the treatment outcome prior to establishing treatment plan. Many studies have been done to create a predictive model of treatment outcome for different disorder using traditional regression techniques, which have low success rates and sometimes have inaccurate predictions. So there is need to create a better approach for treatment prediction with high accuracy. In this study, our main aim is to improve the Bayesian model and semantic network model for the better prediction treatment pattern for psychiatric disorders and improve the prognosis result which helps to know the future prediction of disease. There are various categories of psychiatric disorder i.e. dementia its early stage is Alzheimer's and progressive is mild cognitive impairment. Clustering techniques are used to extract Diagnosis categories from psychiatric report. Inputs are the description of historical as well as current factors and output will be the predicted treatment pattern for person affected with disorder.

Keywords— Regression, Bayesian Model, Semantic Network, Prognosis.

I. INTRODUCTION

Any illness which is experienced by a person which can affect their emotion, thoughts, behavior and personality Which is out of keeping their culture beliefs or personality and producing negative effect on their lives. Psychiatric disorder is also called as mental disorder or behavior pattern. A mental disorder generally defined by combination of how a person think, act feel and perceives. The acknowledgement and understanding of mental health conditions has changed over time passes and their different cultures, and there are still changes in the definition, categories, and treatment patterns of mental disorders.

There are various Categories of psychiatric disorder.

Anxiety Disorder: person with anxiety disorder response to a certain object or situation with fear or dread way as well as their physical signed are rapid heartbeat, sweating, worry, nervousness.

Mood Depression disorder: This disorder is also called as affective disorder. This involves persistence feeling of sadness or suddenly fluctuates from extreme happiness to extreme sadness. Person also feels like irritation, anger, feeling of guilty, also he/she may not able to concentrate on their work.

Schizophrenia disorder: A person with schizophrenia seems eccentric, unmotivated, emotional, and reclusive. They isolated themselves. They abandon their hobbies and activities and their performance at work deteriorates.

Alzheimer disorder: person with Alzheimer may get difficulty in remembering information, speaking, walking and there behaviors may changes with others.

Personality disorder: people with personality disorder may find that their beliefs and attitude are different from others. They are facing difficulty in maintaining the relationship and work with others. They always feel like hurt, disturbed and separated.

The specific causes of psychological disorders are not known, but involving factors may include imbalances in the brain, experiences of old ages, inheritance, illnesses, and stress. Some disorders, such as personality and depression, occur more common in women. Other disorders, like intermittent explosive disorder which is a behavioral disorder and abuse, are more common in men. Still other disorders, like bipolar disorder and schizophrenia, it can affect both men and women in equal proportions. Properly treated, improve the people condition have psychiatric disorder, however, recurrence are possible. Rest of people who have not treated, they can face psychological problems such as academic, legal, social and performance at work also deteriorates. Alcohol, drug overdose, suicide, and violent behavior are other potential involvements.

Mental illness is very common and causes social and economic burden. Schizophrenia is one such a form of chronic affective disorder where the person suffering from schizophrenia is unable to differentiate between what is real or unreal. It affects the way a person sees, hears, thinks and speaks. People with schizophrenia often seem eccentric, unmotivated, emotion-less and reclusive. At the Extreme cases of this psychiatric disorder person may lead to criminal tendencies. This is robust to finding. The correct treatment can help a person's condition to improve or help a person to live well, however the presence of running symptoms. Many people who have mental disorders, and are treated, they get well or even completely recovered. However, because there are many different factors involving in the development of every illness, it also becomes difficult to predict how, when, or to what level someone is going to get better. If the factors could be identified then management and treatment plans could be determine to prevent this behavior patterns. Most are based on the historical and current factors that play an

important role in case of patient have psychiatric disorder. Historical factors are associated with behavior of patient that includes antisocial behavior, substance misuse among parents, and conduct problem in childhood and early adolescence. Other current factors include substance misuse and inadequate community care [2].

II. LITERATURE REVIEW

In Paper [1] proposes a Bayesian network decision model for supporting diagnosis of dementia, AD and Mild Cognitive Impairment (MCI). In a proposed Model that uses a combination of expert knowledge (expert reasoning) and data-oriented modeling (cognitive reasoning). The structure of network was built which is based on current diagnostic criteria and inputs are taken from physicians who are experts in this domain or historical factors. Supervised learning system is a novel approach to machine learning. It is a universal learning system. The network parameters were estimated by using a supervised learning algorithm from a dataset of real clinical cases. The dataset attributes consist of neuropsychological test results, patient demo graphic data, historical and current symptoms and signs. By using quantitative methods and a sensitivity analysis, a decision model can be evaluated. They have used Bayesian learning task that can be divided into subtasks such as structure learning and parameter learning. To estimate a BN from datasets numbers of method are proposed such methods are classified into two approaches are constraint based methods and scored-based methods. Constraint based method are used to find the structure of Bayesian network and scored-based method is a scoring metric that measures every candidate BN using a score function with respect to data sets. The performance measures they have used are based on the k-fold cross-validation method. Other performance measure they used for comparisons for BN is naive Bayes, logistic regression model, multilayer perceptron ANN, and decision table. These classifiers are available in WEKA (Waikato Environment for knowledge analysis) data mining tool. Sensitive analysis was used for testing robustness of result of proposed BN approach. The best result of AUP was obtained by multilayer perceptron ANN classifier In conclusion, the proposed Bayesian network decision model showed better results for diagnosis of dementia, Alzheimer's and Mild cognitive impairment, when they made comparison with other well-known classifiers. The proposed decision model uses probabilistic approach. BN has ability to deal with partial observation and uncertainty, which makes model suitable for clinical context [1].

In paper [2] the main contributions in this domain included the use of greedy Bayesian algorithm, country-independent factors, a merger model, and other measures of predictive performance including relative predictive value, and independent learning sets as well as test sets. In this paper they have collected datasets from different countries of patients. They constructed a robust model i.e. merger model which enable to merge datasets into it and performed external test for the model.

NBC method used in the study has outperformed, however predictive performance is depends on many different factors

and performance is changing from one prediction to another prediction. Thus they performed LR analysis form the country specific data and found somewhat weaker score from small datasets and little higher with the large datasets. but NBC performance works well with informative priors as well as increased the performance of LR method which is used for the variable selection.

AUC method is used to check the accuracy and Diagnostic odd ratio (DOR) is used for specificity and sensitivity. They have also introduced new method for data triangulation of qualitative and quantitative assessment through relative predictive value (RPV). The most important benefit of RPV is that it includes both statistical and clinical ones: it has possibility to understand qualitative and quantitative assessment for modeling and measures which are feasible for medical domain. The major drawback of this study is that data analyzed were matched between groups so from this perspective they had to explore new predictors for admission. Other drawback of this study is case-control settings. The study lacked the size of population at risk for studied groups and was also unable to determine the incidence of violence for the prediction [2].

In Paper [3] Machine learning techniques such as support vector machines are applied to a text classification task to determine mental health problems. They have performed experiments, first text classification of speech from patient with schizophrenia and normal controls. Second, they refined the broad categories such as schizophrenia and allow task-related diagnostic classes in future trials. Inputs are taken as speech samples from a "structured-narrative task" and outputs are psychiatric categories such as schizophrenia. Classification performance shows that this method is suitable for diagnostic purposes. The results improved further in experiments utilizing free-speech samples. There are various categories of psychiatric disorder e.g. schizophrenia, which also includes a range of very different symptoms. Clustering techniques are used to extract the diagnostic categories from psychiatric reports.

Patient in this study comprised into three groups such as schizophrenia (31 patients) clinically diagnosed mania (16 patients) and controls (9 patients). Subjects are given to the patient for verbalize or to write a passage that utilized: 1) a particular topic 2) target word provided and required to construct story utilizing those words. Use of support vector machine data acquired at the accuracy of 77%. The accuracy increased slightly if the feature set limited to 100. SVM performs well for the fixed data sets. Decision tree learner performance is also closer to SVM. This approaches can be combine with the large other data sets such as video facial, radiological, FMRI data to develop mathematical algorithm and diagnostic classification. Some limitations are there in this studied that emotional classification with SVM had low success rates and also data represented by fewer clusters loses certain fine details [3].

In the paper [4] researchers have implemented a cost-effective medical diagnostic support for diseases where there are incomplete data sets available therefore common parameters are forced to be used for drawing a priori

inferences. They proposed a simple but powerful prediction model that combines the advantages of the Bayesian Approaches and Cognition-Driven Techniques such as Expert Reasoning (ER) and Cognitive Reasoning (CR) using Markov Chain analyses so that it is not necessary that large and complete data sets should be available. Then, they demonstrate the effectiveness of their approach in predicting Obstructive Sleep Apnea (OSA). The Bayesian approach they used is appropriate for new diseases and can work well with limited data sets. There are some limitations that Bayesian method does not result accurate predictions- The estimated probability of identified variables are based on heuristic so that it decreases the accuracy of the system. In the experiment at first stage prediction is based on the pure observation on collected datasets, in second stage their prediction was based on cross validation of hypothesis with Bayesian approach, at third stage prediction based on cognitive reasoning and expert reasoning which will be input to the Bayesian network. At fourth stage prediction is based on Expert and cognitive reasoning. And at fifth stage prediction is based on the Expert reasoning and cognitive reasoning with the Bayesian approach. So by above research finding shows that there was significant great improvement when they used Bayesian with cognitive and expert reasoning. In this result they also proved that markov chain analysis can be a good cognitive reasoning (CR) to augment Bayesian network because markov chain analysis can whether parameter can be sole immediate causal or effect variable to the phenomenon of interest [4].

In Paper [5] network includes HEPAR II, a sizeable Bayesian network model for diagnosis of liver disorder and six other medical diagnostic networks constructed from medical data sets available through the Irvine Machine Learning Repository. The original model parameters are perfectly accurate; we lower their precision by rounding them to progressively coarser scales and check the impact of this rounding on the models' accuracy. A Generic stationary rounding algorithm is used, the algorithm is based on a multiplier method, and the algorithm has three parameters: (1) stationary parameter (2) accuracy and (3) a global multiplier. In their studies their aim was to investigate the sensitivity of accuracy of diagnostic Bayesian network model to precision of their parameters in a context that is as close as possible the disease subtype are not known at the early stages, and also there is no information about how the seriousness is going to arise. There are different treatment patterns are available which depends on the progression of the disease; initial identification has become highly more convenient. Thus, it is given a patient, which is important to diagnose the disease subtypes. Related information to predict is the expected time to reach a progressive level indicating that assistance for walking is necessary. As two correlated class variables have to predict are: subtype of diseases and time taken to reach at the given severity level, they have used multidimensional Bayesian network classifiers because they can model and use the relations among both variables. The model that they obtained can be validated by the physicians by using their expert knowledge due to the interpretability of Bayesian networks. The result shows that imprecision in numerical parameters has minimal impact on the diagnostic

accuracy of models, and also they avoid zeroes among parameters [5].

III. PROPOSED SYSTEM

In the previous studies the estimated probability for identified variable are based on heuristic due this it limits to the accuracy. In our proposed model we are using Combination of Bayesian model and semantic Network Model for the better prediction of treatment patterns with high accuracy and also for the future prediction of disease occurrence.

In this proposed system it includes use of Bayesian network model and semantic network model. In the system we are using clinical datasets as Inputs are the patient datasets such as historical and current symptoms and signs, Neurological test results. These factors are associated with the person with the psychiatric disorders. Historical factors are associated with behavior of patient that includes antisocial behavior, substance misuse among parents, and conduct problem in childhood and early adolescence. Other current factors include substance misuse and inadequate community care [2]. Later a medical exam will be conducted for the patients have psychiatric disorder and patient have to appear in this exam. The result of this exam will be input for the Bayesian network with semantic network. If the disorder is confirmed, then test will be done for the confirmation of the diagnosis of disorder. For example person with severe psychiatric disorder has certain disorder such as dementia, the early stage of dementia is AD and mild cognitive impairment is its progressive form so the test will find the level of diagnosis. After the confirmation of diagnosis of disorder there will be a treatment pattern for the particular patient which is better suitable for patient. So the output will be the treatment pattern for patient. According to the treatment pattern patient will be treated and can recover completely from particular disorder. This framework will also give the prognosis result i.e. prediction of future event before its possibilities of occurrence. It will also be beneficial for the patient so that patient can take precaution about it.

Bayesian network represent a domain in term of random variables and model interdependency between them. Whose nodes represent sets of the random variables that are clinical concepts and their conditional dependencies through edges represent causal relations. Bayesian model can deal with partial observation and uncertainty, which makes suitable model for clinical context. The semantic network that we are using with Bayesian model is use to represent semantic relations between the concepts and performs inference algorithm. It is often used for the knowledge representation. Clustering techniques are also used for the information extraction. As there are many different categories of psychiatric disorders such as dementia whose early stage is Alzheimer's and mild cognitive impairment is progressive form.

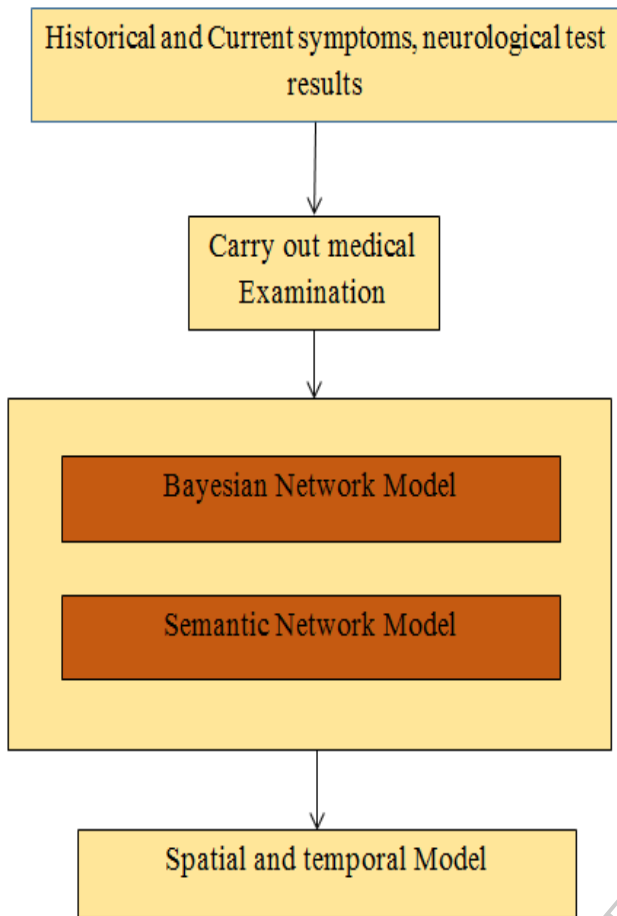


Fig. 1 Proposed System

Inputs: Historical and current Symptoms, Neurological test results.

Output: prediction of treatment Patterns and future prediction of disease occurrence.

IV. CONCLUSION

Our proposed model suggests that meaningful medical diagnostic support is possible through an algorithm that combines the merits of Bayesian techniques and Semantic network model to improve the medical diagnosis support and approach will be very useful when there is a new disease. We would like to assist a psycho analyst to identify the expected progression of the disease; therefore the most suitable treatment for each particular patient can be chosen. In order to develop the application, we set out a predictive model that, given genetic and surrounding factors as predictive variables, is supposed to predict some variables that define the progression of the disease. Bayesian model can deal with partial observation and uncertainty, which makes suitable model for clinical context.

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