IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.6, Special Issue.11, Dec 2018 E-ISSN: 2347-2693

Analysis Of Diagnostic System For Alzheimer's Disease

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Available online at: www.ijcseonline.org

***Abstract*—** Alzheimer's disease was the leading cause of death. There is no cure and no effective treatment for Alzheimer's disease. The challenges will increase in intensity as demographic changes, particularly the aging of baby boomers, take hold. High prediction of Alzheimer's, developed in therapy, and appropriate care modalities that likely observe significant investment. The Alzheimer's disease Neuro Imaging Initiative (ADNI) is an ongoing, longitudinal study designed to develop clinical, imaging, genetic, and biochemical biomarkers for the early detection and tracking of Alzheimer's disease (AD). The required accomplishments of ADNI have been as follows: the development of standardized methods for clinical tests, magnetic resonance imaging (MRI), positron emission tomography (PET), and cerebrospinal fluid (CSF).In the recent system, a large number of people are suffering from brain related diseases. Studying and finding the solutions for those diseases is the requirement of our need. Dementia is one such disease of the brain. This is most reason for the loss of cognitive functions such as reasoning, memory and other mental abilities which may be due to trauma or normal ageing. Alzheimer's disease is one of the most dangerous mental disorders which accounts to 60-80% of mental disorders. Diagnosis of this disease at an early stage will help the patients to lead a quality life for the remaining tenure of their life. The focus of the work is to have a review on different neuro psychological tests, the various algorithms used for the purpose of diagnosis, and the tool that may be used for the analysis.

***Keywords*—** Alzheimer's disease, Diagnosis, MCI

I. INTRODUCTION

According to the report generated in 2013, by NCBI funded by US Government, an estimated 5.2 million Americans have AD. Approximately 2, 00,000 are below 65and 5 million are above 65. In America today some one develops AD once in 68 sec. By 2050 one new case of AD is expected to develop every 33secs. Between 2000 and 2010, the proportion of deaths resulting from heart disease, stroke, and prostate cancer has decreased to 16%, 23%, and 8%, respectively, whereas the proportion resulting from AD is increased 68% [1].

Diagnosis can be done at three different stages, namely consulting the G.P, Conducting Neuro Psychological tests and taking MRI or PET scans [2].In the Neuro psychological tests, there are different batteries like MMSE, BIMC, ADAS and SKT etc. The reliability, practicality and validity of these batteries are discussed by authors in their paper on An Approach in the Diagnosis of Alzheimer`s Disease - A Survey [3]. These metrics factors are well suited for people belonging to a particular community. A neuro psychological test is needed which can suit the person from any background. The 10/66 research group has suggested 10/66 CoG battery which may be used to conduct the neuro psychological test for subjects from any background, irrespective of their culture, religion and education.

II. RELATED WORK

In this section, Dementia is the disease of the brain, causing loss of cognitive functions like reasoning, memory and other mental abilities due to trauma or normal ageing. Dementia is classified into Alzheimer`s disease, Dementia with lewy bodies, Parkinson's disease, Creutzfeldt-Jakob disease, Normal Pressure Hydrocephalus, Vascular Dementia, Front temporal Dementia [4].Out of all the above mentioned diseases, 2/3 of the demented patients suffer from Alzheimer's disease.

Alzheimer's disease is listed as the leading cause of death in the United States. It is also the leading cause of death for those aged 65 and above. However, it may cause even more deaths than official sources recognize [5].An estimated 5.2 million Americans have AD. Approximately 200,000 people younger than 65 years with AD comprise the younger onset AD population; 5 million comprise the older onset AD population. A projected 450,000older Americans with AD will die in 2013, and a large proportion will die as a result of complications of AD [2].Though the mortality is high for the people aged above65, the number of people affected by the disease is more in the age group of 40-65. Thus early

diagnosis is needed to have quality life. There are various risk factors which contribute to the development of the disease namely age, genetics, smoking, consuming alcohol, cholesterol, Down syndrome [5].The symptoms of Alzheimer` diseases are decision making, poor judgment, misplacing things, impairment of movements, verbal communication, abnormal moods, complete loss of memory. From the literature survey, it is very much clear that there is a requirement for early diagnosis of the disease to ensure quality life to the diseased.

III. METHODOLOGY

Ferri et al. estimated a worldwide increase of 4.6million new dementia cases every year. Without changes in mortality and new effective prevention strategies or curative treatments, the numbers of affected people will double every20 years to 81.1 million by 2040[6].To do the neuro psychological tests MMSE,BDIMC, COG, BOMC, MOCA, AD8 and GP CoG are used. The disadvantage of MMSE is it`s insensitivity to the early changes of dementia. As the test relies on the verbal response, it`s difficult to use this for the patients with language problems like dysarthria, aphasia etc. [7]. In these screening tests the questionnaire is meant for a set of people. There is a requirement for a screening test which may be used to the subjects irrespective of gender, religion, culture and education. The 10/66 Dementia Research Group (10/66) founded in 1998 is a network of over 100 researchers from mainly developing countries. 10/66 is committed to encourage more good quality research in those regions, where an estimated two-thirds of all those with dementia live. It represents a collaboration of academics, clinicians, and an international non-governmental organization, Alzheimer's disease International (ADI).The 10/66 research group has suggested a battery which fulfills the above requirements [8].In this paper the author focuses on the new battery, suggested by the 10/66 research group. This battery is preferred compared to the most popular MMSE battery as it is applicable to anyone irrespective of gender, religion, culture and education [9]. In this battery a predefined questions will be asked to the subject. Each answer will be evaluated. Depending on the score, the subjects' will be classified as AD patient or not.

Analysis of data and decision making is a crucial step. Many a times the analysis and decision making depends on the mood of the Psychologist. In addition to that, the humane error cannot be avoided. Powerful and versatile tools are really needed to automatically uncover valuable information from the tremendous amount of data and transform such data into organized knowledge. This necessity has led birth to data mining. Many people treat data mining as the synonym for Knowledge Discovery from Data (KDD).The knowledge Discovery process is a procedure that comprises of Data Cleaning, Data integration, Data selection, Data Transformation, Data mining, Pattern evaluation, Knowledge presentations[10].Various techniques are used for discovering the knowledge, namely Association, Sequential pattern, Classifiers, Decision trees, Neural networks, Visualization, Clustering, Collaborative filtering, Data transformation and cleaning, Deviation and fraud detection, Estimation and forecasting, Bayesian and dependency networks, OLAP and dimensional analysis, Statistical analysis, Text analysis, Web mining etc. Of the all the above mentioned techniques, the most commonly used techniques are association, classifiers, visualization and clustering [11].
Data mining finds it`s applications in almost all the fields which include cattle farming, molecular biology, drug discovery, process based industries, Pharmacy, Astronomy, Medicine, geophysics, Fraud detection, Intrusion detection and many more. Data mining is very useful in diagnosing many of the life threatening diseases at early stage. Jyothi Sony has used supervised machine learning namely Naïve Bayes, K-NN, Decision List algorithm to analyze the datasets of heart disease patients [12]. Ruijuan Hu has suggested data mining algorithm in the diagnosis of breast cancer [13].Zheng and team have used data mining approach in the diagnosis of breast cancer [14].Amir Fallahi et.al have used Bayesian network for the detection of breast cancer [15].

Mirza Beg et.al has used artificial neural networks for the diagnosis of breast cancer [16]. Bor-Wen Cheng in their paper have discussed about using decision tree, Support vector Machine sequential minimal optimization in diagnosing breast cancer[17].Kavinila R have discussed about using hierarchical clustering in the diagnosis of cancer and classification of cancer [18].Rahman and Farhana Afroz have tested the various classification techniques using various tools like WEKA, Mat lab, Tanagra for the data sets of diabetes patients [19]. Abhishek [20] in his work has discussed about using data mining for the prediction of heart disease. Duarte Ferreira et.al has used decision trees, neural networks in the diagnosis of neonatal Jaundice [21]. Abhishek et al have discussed two different types of neural networks brain schema called Back Propagation Algorithm, Radial Basis Function and one non-linear classifier Support Vector Machine and comparison is made. Weka is used as a tool for diagnosis purpose [22]. Rajeswari in her work has used Naïve Bayes in the analysis of liver disorder and WEKA tool is used for analysis [23]. Sriram et.al has used classification algorithms to detect Parkinson's disease [24].From the above references it is evident that data mining maybe used for analyzing medical data of different diseases.
Data mining also finds applications in the diagnosis of Alzheimer`s disease in particular. Sandhya Joshi et.al have used the various machine learning methods such as neural networks, multilayer Perceptron, Bagging, Decision tree, CANFIS and Genetic algorithms for the classification of different stages of Alzheimer`s disease [25].Devi Parikh et.al

in their paper on early diagnosis of Alzheimer`s disease, have discussed about classifiers base data fusion approach to data from two different sources, containing complementary information [26]. Claudia Plant et.al in their paper on Automated detection of brain atrophy patterns based on MRI for the prediction of Alzheimer's disease have used combination of Support Vector Machine, Bayes statistics and voting feature Intervalto derive a quantitative index of pattern matching for the prediction of conversion from MCI to AD[27].Stefan Kloppel et.al in their paper on Automatic classification of MR scans in Alzheimer's disease have used linear support Vector achiness to classify the grey matter segment of TI weighed MR scans obtained from two different centers and two different equipment [28].

Ali Hamouet.al in their paper on cluster analysis of MRImaging in Alzheimer`s disease using decision tree refinement have used clustering algorithm to analyze the data and they have used decision tree algorithm to model the level of importance of variants influencing the decision [29].Kippenhan et.al and group in their paper on Neural-Network Classification of Normal and Alzheimer's disease Subjects Using High-Resolution and Low-Resolution PET Cameras have trained neural networks to distinguish between normal and abnormal subjects [30].Imainvan in their research work discussed about analyzing the traditional procedure employed by the physician in diagnosis of AD [31].Sandhya Joshi et.al in their paper have used data mining approach to classify various neuro degenerative disorders like Alzheimer's disease, vascular disease and Parkinson's disease by considering the common risk factors. In this paper they have used machine learning and neural networks. Under machine learning Decision tree, Bagging, BF tree, Random Forest tree, and RBF Networks are being used [32]. Javier Escudero et.al in their paper have discussed about detection of Alzheimer`s disease using machine learning [33].Filipovych et.al in their paper have discussed about using supervised classification approach for images using SVM technique [34].

In data mining there are various algorithms which may be used for extracting information. The award winners of IEEE International conference on data mining, XindongWu and team have identified the ten most popular algorithms used in data mining. They said C4.5, K-means, SVM, Apriori, EM, Page Rank, Ada Boost, KNN, Naïve Bayes and CART are the top ten, most popular data mining algorithms used in research. In this survey paper the authors have discussed about the description of the algorithm and the impact of the algorithm [35].In data mining a number of software like WEKA,See5 and Wiz Why are used for the purpose of analysis of data.

IV. CONCLUSION AND FUTURE SCOPE

The current study focuses on a new emerging approach in the diagnosis of AD. There are various neuropsychological tests that may be conducted for the diagnosis of AD. Though MMSE is a popular test of all, it too has a disadvantage. The disadvantage is that it cannot be used for the people who are having problem with verbal communication. The 10/66 battery designed by the research group of Alzheimer`s association will overcome this disadvantage. Though there are various ways to analyze the data, the application of data mining in the field of medicine makes, data mining as a more appropriate method of discovering the knowledge. There are various tools like Wiz why, See5, WEKA etc. The WEKA tool has an added feature to predict majority of the data and hence Weka tool may be used for the purpose of analysis.

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