

Review Paper on Detection of Dementia related disorders Among Aged People

Harsimran Guram¹, Dr. Ashok Sharma²

^{1,2}Lovely Professional University

Abstract- Dementia is a neurological disorder which is defined as syndrome occurring worldwide in elderly people after the age of 60. 5.2% of the people over the age of 60 are living with dementia globally [11]. This paper reviews the work done on early detection of dementia among elderly people.

Keywords- Dementia, sensors, IoT, Machine learning, Behavioral issues, Cognitive impairment

I. INTRODUCTION

Dementia is a health issue which is coming up worldwide in the elderly people. Dementia is a neurological issue in which gradual and continuous loss of memory occurs. Dementia is a health issue which is seen in elderly people also as onset in young People. If detected at early stage, a person can be helped to slow down to certain extent. Most scientists seem to agree that there are two proteins in the brain that are heavily involved. One is beta-amyloid which reaches abnormal level and forms plaques that collect between neurons and disrupt cell function. The other is called tau which also reaches abnormal levels, and forms neurofibrillary tangles inside neurons which block the neuron's transport system[6]. It is indicated in researches that by year 2030, 19% of people will be aged 74 to 84 and nearly half of people who are older than 84 will have dementia [10]. It's been reported that Between the 2015 and 2050, the numbers of people living with dementia in low income countries will increase by 264%, by 227% in upper middle income countries, by 223% in lower middle income countries and by 116% in high income countries [11]. Dementia is divided into following types of Neurodegenerative and non-neurodegenerative [18]. Types of dementia is given in table I:-

TABLE I. TYPES OF DEMENTIA

Neurodegenerative	Non-neurodegenerative
Alzheimer's disease	Vascular dementia
Frontotemporal dementia	Normal pressure hydrocephalus
Dementia with lewy bodies	Autoimmune causes
Multiple system atrophy	Infectious causes
Alcoholic cognitive impairment	Toxic causes
Huntington disease	Vitamin deficiency

II. METHOD

This paper is basically a review of the already work done in early detection of dementia. In this extensive literature search is done from Elsevier (science direct), IEEE (Institute of Electrical and Electronics Engineers), Springer Link, Taylor &

Francis, Sage Journals. Then data extraction is done which will further lead to report writing about dementia. Various steps involved in writing the literature review:-



III. WORK DONE FOR DETECTION OF DEMENTIA AMONG AGED PEOPLE

Machine learning is a technique used by researchers to propose new models which will help clinician to diagnose the disease. Using Machine learning research work is as follows:

- Comparative analysis of various machine learning algorithm for detecting dementia[3]: In this brain MRI data set was collected from OASIS on which classifier techniques using WEKA tool was applied and then finally classification accuracy was calculated to detect dementia.
- An automatic Acoustic bathroom Monitoring system[4]: In this paper a bathroom activity report of elderly people is sent to doctor to analyze. A regular report is taken in this paper to check whether there is any change in the daily routine of the patient due to decline in cognitive skills
- Development of laughter motion on the cognitive robot "Bono-02" Assisting group Conversation [5]:- In this paper a robot with laughter motion is developed which will help aged people in conversation and will make them laugh with its laughter sounds. Laughter sounds were also divided into three types and degree of smile is calculated. As dementia is occurring in aged people because of their less interaction with other people and less conversation and laughter is further increasing the rate of dementia among people. So this robot has various motions which are a cause of laughter.
- Detection of Abnormal Behaviour for Dementia Sufferers using Convolutional Neural Networks[8]:- This paper explores the various behavioural difficulties of people with dementia also used Convolutional neural network by combining it with LSTM to detect their behavioural patterns which is differentiated on the basis of normal behaviour pattern of humans and then CNN was compared with other state of art models. Results from data sets shown a better behaviour pattern recognition using CNN than other models.

- Prospects of Statistical and Biostatistical Techniques in the Study of Diagnosis, Survival Analysis, and Disease Progression of Alzheimer's Disease[7]:-In this paper author has divided the paper into three areas i)diagnosis- Using statistical techniques biomarkers of the disease was taken out ii)Survival analysis- Using analytical techniques survival rate after onset of disease is analysed. Iii)Disease Progression- using estimation techniques transition state of patient is estimated.
- Activity Recognition and Abnormal Behaviour Detection with Recurrent Neural Networks[9]:In this paper author created a abnormal behaviour factors of a human like forgetting and repeating activities, Dehydration and disruption in sleep etc. Methods like RNN was used for activity detection in comparison to other models which showed that RNN outperformed all other models in detection of abnormal behaviour.
- Early detection system of senile dementia by behaviour sensing [12]:In this paper sensors were put at elderly person's place, which is then analysed on the basis of parameters. All parameters were predefined and on the basis of parameters elderly people were scored and then evaluated to reach the end result to ensure that they were demented or not.
- Comparison of Feature Selection Techniques in Machine Learning for Anatomical Brain MRI in Dementia[13]:- This paper compared various techniques in anatomical neuroimaging as machine learning detection is increasingly used. In this paper it is concluded that embedded feature gives greater performance than filter based methods.
- A study on the detection of wandering patterns in human trajectories[13]:-In this paper direction and movement of patient is analysed. As elderly people with dementia become disoriented. Trajectory feature is used to detect wandering among elderly people.
- Eyetracking metrics in young onset Alzheimer's disease: window into cognitive visual functions[14]:-In this paper three eyetracking techniques such as fixation stability, Pro-saccade and Smooth pursuit were applied on 36 participants with young onset Alzheimer disease(YOAD). Data retrieved from these techniques were statistically analyzed as well. After that machine learning classification model was also presented for pilot automatic classification on the basis of smooth pursuit. Paper was concluded that patients with YOAD has abnormal eye movement ie visual cognition than their age-matched healthy people
- The feasibility of a vision-based sensor for longitudinal monitoring of mobility in older adults with dementia[15]:- This paper monitored older adults with dementia using vision based sensor. Monitoring was based on two problems i.e gait and balance function which shows deterioration of cognitive skills in older adults. All the measurement were done on the basis of walking patterns of individual so that individual falls due to balance and

gait can be monitored using vision based sensors and informed in advance about decline in health.

- Neuropsychological test selection for cognitive impairment classification: A machine learning approach[16]:-In this paper various machine learning techniques are used to take input to diagnose the cognitive impairment with very less numbers of clinical measures. After analyzing the results got from machine learning techniques, participants will be divided as healthy older adults, mild cognitive impairment or dementia.

Work done using IOT based computer assisted devices as follows: Sensors help to predict the day to day behavior of patients and also these are helpful for caregivers and clinician as well. It gives a report to clinician whether the condition of patient has become or better which is shown in table II

Table II. Research work

Ref	Year	Name of the Paper	Devices used	Work done	Datas	No of Attributes	Accurac y
		RECEIVED VOL. 7 ISSUE 3 JULY.-SEPT 2019		ISSN: 2393-9028 (PRINT) ISSN: 2348-2281 (ONLINE)			
[1]	2016	Early Detection System for Dementia using the M2M/IoT Platform	IOT(Sensors, actuators, the M2M device engine, gateway and server/cloud)	Haruka ishii et.al proposed a system using sensors which detect the behavior of a person which is passed on to M2M device perform simple processing and sends to M2M gateway for further feature extraction from data and that data is stored by M2M server/Cloud which derives the suspicion of dementia.	-	13	80%-100%
[25]	2017	Smart Home Assistant for Ambient Assisted Living of Elderly People with Dementia	Intel Galileo Gen1 Card, XbeeS2B 63mW wireless communication, simple off shelf sensors, Pushbullet	Eren Demir et.al proposed an ambient Assisted Living system design in which collection of data through sensors, recording and transmitting that data through cloud application to either patient/caregiver for living a comfortable life.	-	18	-
[22]	2017	Front-Door Event Classification Algorithm for Elderly People Living Alone in Smart House Using Wireless Binary Sensors	wireless binary sensors	Tan –Hsu Tan et.al proposed a novel front event classification algorithm which classifier the person’s number of times entry, exit and again brief return and exit from front door which can be a symptom of dementia	14	5	-
[24]	2017	Detecting Dementia Through Interactive Computer Avatars	Laptop, Software for recording audio-visual features	Hiroki Tanaka proposed an approach which automatically detects dementia using audio-visual features recorded during interaction with user and Computer avatar	29	15	83%
[2]	2018	Dementia detection using automatic analysis of conversations	Software, Laptop, Microphone	Bahman Mirheidaria et.al proposed an automatic dementia classification between Neurodegenerative and functional memory disorder patients on the basis of conversation with patients using intelligent virtual agent(IVA).Classification accuracy rates are higher with IVA than with neurologist led conversation	30	44	90.9%
[23]	2018	Early Detection of Mild Cognitive Impairment in Elderly through IoT: Preliminary Findings	Passive Infra – Red motion sensors, Wearable device, Gateway device, Backend Server	Hwee-Xian Tan and Hwee-Pink Tan Proposed early detection of dementia among elderly people by putting sensors at their residence to monitor day –to day activities.	17	4	-
[26]	2018	Fuzzy adaptive cognitive stimulation therapy generation for Alzheimer’s sufferers: Towards a pervasive dementia care monitoring platform	IBM’s TJBot, Mente active software, IOT device	Javier Navarro et.al proposed a game based therapy to keep a check on patient’s health. At the same time using certain simulation games which helps to slow down the disease as well as shows decline in cognitive impairment as well	39	7	

IV. USE OF TECHNOLOGY IN VARIOUS EXPERIMENTS

Research work done in the field of diagnosing dementia using IOT based, machine learning has been listed in table III

Table III

Goals	Technology used	Report on
Prediction of Early Dementia [1]	Machine-machine(M2M)/Internet of things(IOT)	Behaviour
Dementia Detection accuracy [2]	Automatic analysis of conversation using intelligent virtual agent	Acoustic feature
To generate bathroom activity report of dementia patient for care.[4]	Sensors, Amplified circuit	Activity of daily living(ADL)
Prediction of Abnormal Behaviour for Dementia Sufferers[6]	Convolutional Neural Networks	Behaviour pattern

V. FUTURE WORK IN DEMENTIA DETECTION

Lot of research is going on in the field of dementia .As per[13]future work to be done is to compare the performance of machine learning methods in prognosis of dementia and limitation in the performance comparison.As per [3] future work is Extraction of features for early detection of dementia and enhance the performance of detection techniques.As per[14] future work to be done is Development of more machine learning methods in neuroimaging require much greater interdisciplinary. As per [15] work done is Research in improving classification for diagnosing dementia is required

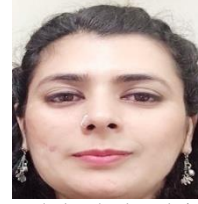
VI. CONCLUSION

In this review paper various research papers are discussed which have used different ways to detect dementia at early stage. Many have used sensors, neural networks and biostatistical methods for diagnosing and detecting daily behavior of elderly people which signifies whether they fall in the category of demented or not. In this paper literature review done till now in various research papers are discussed and majorly the future aspects lies in finalizing the exact symptoms or attributes are not yet predicted. Extraction of right attributes needs to be done from the already available data..

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Ms. Harsimran Guram, Phd scholar doing research on dementia related problems using neural networks.