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THE USE OF ARTIFICIAL INTELLIGENCE AS A DIAGNOSTIC AND PREVENTIVE TOOL IN NEURODEGE-NERATIVE DISEASE

[1]NIKITA SHAHURAO UDHAN, [2]GOURI SUBHASH GAVHANE, [3]NEHA SANTOSH BHOITE

nsudhan2001@gmail.com , gavhaneanu1675@gmail.com , bhoiteneha19@gmail.com
DEPARTMENT OF PHARMACY , S.N.D COLLEGE OF PHARMACY , NASHIK

ABSTRACT :

Several studies have been carried out to predict there will be a global surge in the number of patients with neurological disorders by 2050.

Discussion -Many of neurological disease that is Alzheimer's diseases ,Parkinson's disease ,Prion disease ,Huntington's disease ,Acute spinal cord injury ,Ataxia ,bell's palsy ,epilepsy ,dementia and seizures are often diagnosed late that result causing the several complication and also cause of several irreversible effects .The recent advancement is physiological signals, patients data , artificial intelligence and machine learning techniques , biomarkers and medical images are being utilized for advanced signal processing and analysis in clinical decisions and diagnosis of neurological diseases. Several speech monitoring and recording devices are aimed at rapidly detecting and analyzing difficulties in speaking to enhance early diagnosis. These techniques are non-invasive. These are used for analysis and interpretation of complex pathways and biomarkers of neurological diseases. Therefore, application of smart algorithms could be utilized to diagnose, detect and analyze early dysfunctions in patients of neurological condition. Thus, Artificial intelligence based, non -invasive approaches to speech analysis could serve as inexpensive, easy, complicated and quick methods for overcoming the challenge of neurological diseases. This entire chapter describes the latest non-invasive technique that is contain emotion recognition, virtual environment, and behavioral analysis in the diagnosis, screening, evaluation and early detection of common neurological diseases.

KEYWORDS– Artificial intelligence, neurodegenerative diseases (Alzheimer, Parkinson's, prion disease, machine learning tool, deep learning, natural language processing).

INTRODUCTION :

In 1956, an *American scientist John McCarthy first introduced the term and principles of 'artificial intelligence (AI)'* [1,2]. the phenomenon AI is used to describe 'machines 'capable of demonstrating cognitive functions that human associated with other human minds that is contains 'learning 'and 'problem solving' [3].

Neurodegenerative disorder is more complex to understand and even more complicated to diagnose [6]. neurodegenerative diseases are class of progressive disorder that gradually lose the structure of neurons or dysfunction Ing of neurons resulting in impairment of different neurological process including movement, memory and cognition. most of neurodegenerative disease are characterized by the accumulation of misfolded protein aggregates that resulting neuronal dysfunction through various molecular pathways [4]. these diseases are clinically and physiologically diverse. reasons behind the diversity are the heterogenicity and complexity of genetic and environmental factors [5]. neuroadaptive disease are sometime difficult to diagnosis due to the overlapping symptoms.

Following are used to diagnose purpose that is *computational method* particularly machine learning help in diagnosis and monitoring and treatment. machine learning used in literature for several disease to identify the gap and potential future directions for the research of neurodegenerative disease [7]. The aim of this paper is to give a compressive, high-level review of benefits in diagnostics and management of neurological diseases.

ARTIFICIAL INTELLIGENCE :

According to father of AI, John McCarthy 'The science and engineering of making intelligent machines, especially intelligent computer program'. It also improve skills that important role in our evolution [8]. the ability to solve the problems.it is similar task using computers to understand human intelligence.

Goal of AI –

To create expert system.
To implement human intelligence
Develop problem solving ability .
To promote creativity .
Allow continuous learning .
Diagnosis ,prediction and treatment .

BRIEF HISTROY OF AI -

Year	**Development**
1941	First electronic computer.
1956	Artificial intelligence introduced.
1958	Frank Rosenblatt created neuronal network called perceptron's which transmit information in one direction.
1972	Frank Rosenblatt created neuronal network called perceptron's which transmit information in one direction
2000	First sophisticated walking robot.
2013	Google carried out efficient research on picture by utilizing the British technology.
2014	Google made first self-driving car. Amazon Alexa was released.
2016	The Go champion lee Sedol was defeated by google Deep mind, software, AlphaGo
2020	SARS CO 2 pandemic, Baidu made linear fold AI algorithm available to scientific and medical teams to create vaccine.
2021	DALL-E is a text to image model
2022	Chat GPT
2023	Milestone year in term of generative AI. Not only did open AI release GPT-4, which again built on its predecessor's power

HOW DOES AI WORK ? –

following domain are given [9,10,11]

- **Machine learning (ML)** – It is subset of AI. the ability to learn from experience, rather than just instructions .ML teaches a machine how to make decision based on experience .ML applies to study of neurodegenerative diseases and in early diagnosis and development of new therapies. neuroimaging was first area of neurology to benefit from ML method to motor function and language feature analysis .application of ML to longitudinal patient data collection and electronic health record has power or potential to inform prognosis prediction and patient satisfaction.
- **Deep learning** – It is subfield of machine learning .it used to teach machine what comes naturally to us humans. also, it helps in a computer model can be taught to run classification acts taking image, text or sound as an input.
- **Natural language processing (NLP)-** It helps in reading, understanding and interpreting a language by machine. once machine understand the what user's intention its respond accordingly.
- **Neural network** – It works like similar to human neural cell. they are series of algorithm that relationship between various underlying variables and process the data as a human brain does.
- **Computer vision** – Algorithm try to understand image by breaking down image and study in different part of the object. This helps the machine classify and learn from set of given images, to make better output decision based on previous data.

AI IN DIFFEERENT NEURODEGENERATIVE DISEASES –

Neurodegenerative diseases:

disorder of CENTRAL NERVOUS SYSTEM that affect to movement, talking, balance, breathing, heart function.

Degenerative nerve diseases including

- Parkinson's diseases
- Alzheimer diseases
- Prion disease
- Huntington's diseases

- 5.Lewy body diseases
- Spinal muscular atrophy
- 7.Stroke and dementia

Recent advances in AI great promise in diagnosis, prediction, treatment plans and monitoring of neurogenerative disorders [12].AI algorithm obtain large amount of data from various sources, including*(1) medical images (2)clinical records (3)genetic information to identify early disease markers and (4) development in personalized medicine treatment plans and prediction of diseases [13,14].*
Degenerative nerve disease cand be serious or life threating depends on type

ETIOLOGY OF NEURODEGENERATIVE DISEASES –

- Majority of neurodegenerative disorders are due to the combination of genetic and environmental factor.
- Caused due to inherited genetic changes. faulty gene transmitted from parents to their children. e.g., Huntington's diseases and are cases of motor neuron disease and Alzheimer's disease.
- Specific genetic changes cause chance of diseases has been identified in some extent. in most of cases genetic influence on environmental factor of neurodegenerative disorders. there is evidence linking Parkinson's disease with long term exhausted with pesticide, chemicals and toxins.
- Following are neurodegenerative disease -

1.Parkison's diseases (PD)–
It is second most common neurodegenerative disorder, it affecting in both men and women at an increasing rate, with currently less or no cure [15]. PD and other hypokinetic diseases are characterized by bradykinesia, muscle rigidity and freezing movement [16].
Causes – disruption of brain cells that produce substance dopamine or decreasing the level of dopamine. dopamine responsible for the control adaptation and movements [17].
In this paper machine learning based diagnosis of PD diseases presented. The proposed diagnosis method contains the feature selection and classification process [17].
Artificial intelligence model detects Parkinson's from breathing pattern: Researchers have developed an AI model that can help to detect PD and assessment of its severity by evaluating patients nocturnal breathing patterns .to measure breathing pattern, the researchers developed a device roughly size and shape of Wi-Fi router, which placed in patient's bedroom while they sleep. That device emits the radio signals and analyze reflections of these signals created by surrounding environment and breathing pattern. feedback given by neural network which analyze by each patient breathing pattern which helps to determine of diagnose the PD present [18,19,20].

2.Alzheimer diseases (AD):
it is progressive disease that destroy memory and other important mental function .
Causes – myeloid protein which deposit around the brain cell or plague formation and other is Tau protein deposits which form tangles within brain cells. low level of neurotransmitter that is acetylcholine.
Pathophysiology – plague made from small peptide typically contains 39-43 amino acids in length called amyloid beta. amyloid beta is fragments from larger protein known as amyloid precursor protein (APP) [21,22,23,24].APP is transmembrane protein that penetrate through neuron's membrane.
AI useful or predict cognitive impairment and anticipates how securely motor skills applied to decline over time period helping in patient diagnosis and prognosis in neurodegenerative diseases.

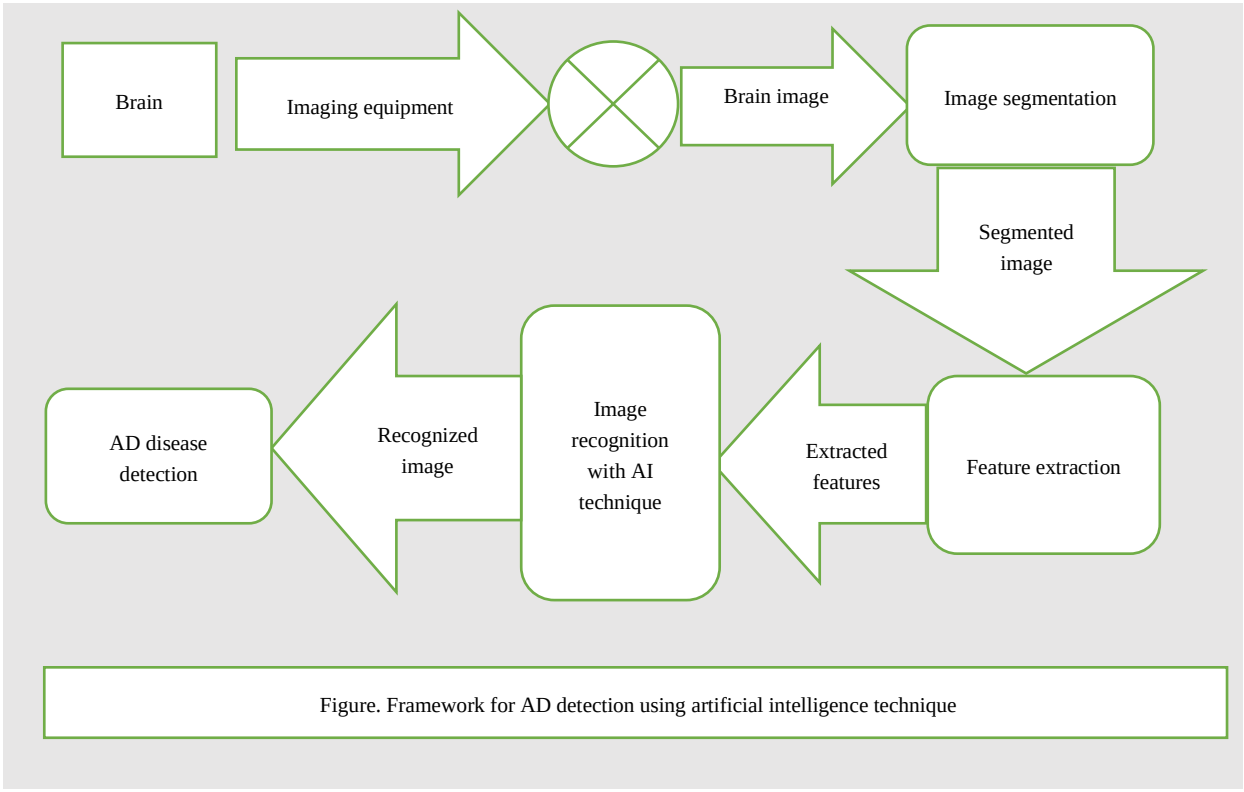

Figure. Framework for AD detection using artificial intelligence technique

3.Dementia – loss of memory

Frontotemporal dementia (FTD)is neurodegenerative disorder. that account has 20 percent young onset dementia and has high rate of misdiagnosis [25,26]. this leads to poor patient satisfaction and wellbeing, unwanted laboratory tests, clinic visit and in addition to healthcare cost [27,28]. A study in UK shown that deep learning algorithm can reduce unnecessary investigation and improve cost and patient satisfaction through better clinical practice guideline [29,30].

4. Stroke and spinal cord injury (SCI) –

stroke is the rupture of blood vessel in the brain caused to hemorrhage. Treatment for this is time sensitive. Using AI, an individual's neurological function such as movement abnormalities are continuously monitored. ANN (artificial neural network) model used to construct receiver operating characteristic's (ROC) for better prediction and diagnosis. In SCI machine learning used to control, restore, replace and improve functioning of CNS [31].

5.Huntington's disease (HD)-

it is rare neurodegenerative diseases which cause persons ability to think, behave and movement .it has two subtype

1.Adult-onset Huntington's diseases and 2. Juvenile Huntington's diseases

Normal brain section (Normal frontal horns of the lateral ventricles) Huntington's disease (Enlargement of frontal horns)

AI used in Huntington's disease in brain at rest condition: using interpretable AI models we demonstrated how fast cognitive change take place. we applied simple logistic regression model, modified to select whole brain only the most relevant mode.AI model used to predict progression of HD.

6.prion disease – prion disease or transmissible encephalopathies (TSEs)are family of rare neurodegenerative disorders that affect both animal and human. Causative agent: TSFs or prion are abnormal, pathogenic agent that have ability to folding of specific normal cellular protein in the brain called prion protein. Abnormal folding of protein leads to brain damage and characteristics signs and symptoms of diseases.

AI have two option available to diagnosis and treated the prions that is 3D and 2D quantification in the brain.

WHAT IS OUR AIM OR SCOPE AND TARGET OF THIS REVIEW:

In this review, the given or present study proposes an in depth, analysis, predicting and diagnosing purpose existing artificial intelligence in neurodegenerative diseases, although the number of neurodegenerative diseases describe [32]

PURPOSE OF REVIEW :

main contribution of this study is following

1. 1.Computational approach in neurodegenerative disorder's
2. 2.To identify general taxonomy
3. 3.Detailed analysis of decision taking for each disease
4. 4.Identify and open questions to solved by upcoming development .

The future automated image analysis-

Neurodegenerative disease is substantial burden on pharmaceutical industry. millions of people affected worldwide. Common neurodegenerative disease that is AD, PD, motor neuron disease (MND) which impair physical movement or mental functioning and currently difficult to diagnosis, complicated to treated and not easy to cure .AI and machine learning helpful in this condition.

AI has potential to tackling neurodegenerative disease. It's faster in rate and accurate diagnosis and also helpful in drug discovery and development. It can target therapy. AI can be useful within scientific research and in development also .AI computer system it can store or sifting through vast amount of medical data than the human. That pattern helps to researchers re -purpose drug to treatment of another type of disease.

CONCLUSION AND FUTURE CHALLENGES –

In conclusion, AI in medical sciences and in healthcare also have beneficial in recent years. With ability to analyze vast amount of data from given sources including clinical records, EEG signals, blood and urine, genetic information, etc. AI has potential to revolutionize diagnosis and predication of neurological disorders.AI algorithms can helpful in healthcare professionals to reach early diagnosis, prediction and monitor neurodegenerative disease and find biomarkers and personalized treatment plan.

In this review, we give an overview on general trend applying computational approaches for diagnosis of neurodegenerative disease. We focus on how AI can helpful in preventing, diagnosis or treating neurodegenerative disease that is AD, PD, Prion, stroke and hunting's diseases. Neurodegenerative disease has been extensively studied in upcoming years with help of computational approaches specially including deep learning or machine learning networks.

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