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Artificial Intelligence in Diagnosis

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Abstract:-

Artificial intelligence (AI) has made significant progress in medicine in recent years. However, explanation issues make clinical AI applications challenging. To get around the drawback of AI techniques, some research has been done on explainable artificial intelligence. Artificial intelligence, mainly use in machine learning, has found various uses in computer-aided diagnosis, computer aided drug design, monitoring and management of neurological movement disorders of parkinsonian type, Diabetic Retinopathy, cardiovascular disease, and various type of cancerous disorder.AI used in Radiology, CT Scan, MRI, and RT-PCR.

Keywords:- Artificial Intelligence, Medical Diagnosis, Diabetic Retinopathy, CT Scan, Cardiovascular , Parkinson,etc.

Introduction :-

Artificial Intelligence:-

The simulation of human intelligence processes by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are a few specific uses of AI.[1]

Artificial intelligence (AI) is a branch of algorithm-based techniques that allow robots to solve issues using knowledge by simulating human thought processes and intellectual activities. AI is frequently employed in the medical industry in the information age and can help with the creation of new treatments. AI has the potential to improve chronic disease patients' care pathways, recommend precision medicines for difficult-to-treat conditions, and lower medical errors.[2]

AI refers to a machine's capacity to carry out operations that ordinarily require human intelligence." Many people are perplexed by this definition's clarity since it is so simple. However, this description is really extremely close to those offered by other top AI textbooks and eminent academics. The first thing to take away from this description is that AI is a very wide area that encompasses not just recent advances but also the accomplishments of the first electronic computers from the 1940s.[3]

The term "artificial intelligence" has a tendency to change over time. People have no problems about calling anything "artificial intelligence" when it is novel and amazing. However, once a specific AI approach's capabilities are known, they are frequently referred to as simply "software." Later in this article, we will discuss how contemporary AI techniques vary from previous ones and why this is a crucial time for AI technology. For now, simply be aware that AI may exist in even the oldest of technologies.[4]

AI has mainly two micro groups on the basis of axis –

I. AI Paradigms
II. AI Problem Domains

AI Paradigms :- The techniques developed by AI researchers to solve certain AI-related issues are represented by the AI Paradigms (X-axis) (including modern techniques).

Following the AI Paradigms –

- **Logic based tools -** This tools for problem-solving as well as knowledge expression.
- **Knowledge-based tools** – This tool developed on the basis of massive databases of ideas, facts, and rules.
- **Probabilistic methods –** This tool that enable agents to behave in settings with insufficient information.
- **Machine learning -** that enables computers collect information from data.
- **Embodied intelligence** - engineering toolbox, this holds that greater intelligence requires a body (or at least a partial set of abilities including movement, understanding, interaction, and visualization).
- **Search and optimization -** tools allowing intelligent search with a wide range of potential outcomes.

AI Problem Domains :- These are historically the type of problems AI can solve. In some sense, it also suggests the possible capabilities of an AI technology.[5]

A list of technologies that is used in AI –

- **Robotic Process Automation (RPA) -** technology that gathers the rules and actions to take by observing the user perform a task.
- **Expert Systems -** A computer programmed with pre-programmed rules that mimic how people make decisions. In contrast to conventional digital logic, which yields a 0/1 output, fuzzy systems are a special example of rule-based systems that translate variables into a continuum of values between 0 and 1.
- **Computer Vision (CV)** - Digital image collection and analysis techniques (often categorized as activity recognition, image recognition, and machine vision).
- **Natural Language Processing (NLP) -** A discipline that deals with natural language data and has three primary foundation blocks: machine translation, language production, and language understanding.
- **Ambient Intelligence (AmI) -** An approach that requires physical objects in digital settings to detect, perceive, and react to an external stimulus—typically one that is caused by human activity—with context awareness.
- **Probabilistic Programming** - A system that uses probabilistic models rather than requiring you to hardcode certain variables. A variant of probabilistic programming known as Bayesian Programmers Synthesis (BPS) uses Bayesian programmers to create new Bayesian programmers rather than humans as in the more general probabilistic programming model.
- **Distributed Artificial Intelligence (DAI)** - A group of technologies that work to solve issues by giving them to self-sufficient "agents" that communicate with one another. These three relevant descriptions of this subset, where collective behavior's emerge from the interaction of decentralized self-organized agents, are multi-agent systems (MAS), agent-based modeling (ABM), and swarm intelligence.
- **Affective Computing -** A area that deal with emotions recognition, interpretation, and simulation.
- **Autonomous Systems -** Intelligent perception, dexterous object handling, plan-based robot control, etc. are examples of a sub-field at the interface between robotics and intelligent systems.[6]

Medical Diagnosis:-

Diagnosis is a advance process for both disease (the probability and intensity of the disease) and diagnosis approaches is developed.[7] The care of any disease requires an accurate and immediate diagnostic with the lowest possible risk of incorrect diagnosis and delayed diagnosis then a proper mange of any disease.[8]

Diagnostic error: - Any mistake or failure in the diagnostic process that results in a misdiagnosis, a missed diagnosis, or a delayed diagnosis is referred to as a diagnostic error. This term can include any delay in providing care, failure to collect or understand

symptoms, signs, or test data, failure to formulate and consider a differential diagnosis, and failure to provide prompt follow-up, specialized referral, or evaluation.[9]

AI in Diagnosis:-

AI can change several parts of health care, including diagnosis. However, the elaborate nature of the various disease mechanisms and its symptoms makes diagnostic tools a constant struggle. Artificial intelligence (AI) that utilizes data as an input resource and whose effectiveness depends significantly on the volume and quality of the data it receives can overcome some of the difficulties and complexity of diagnosis.[10]

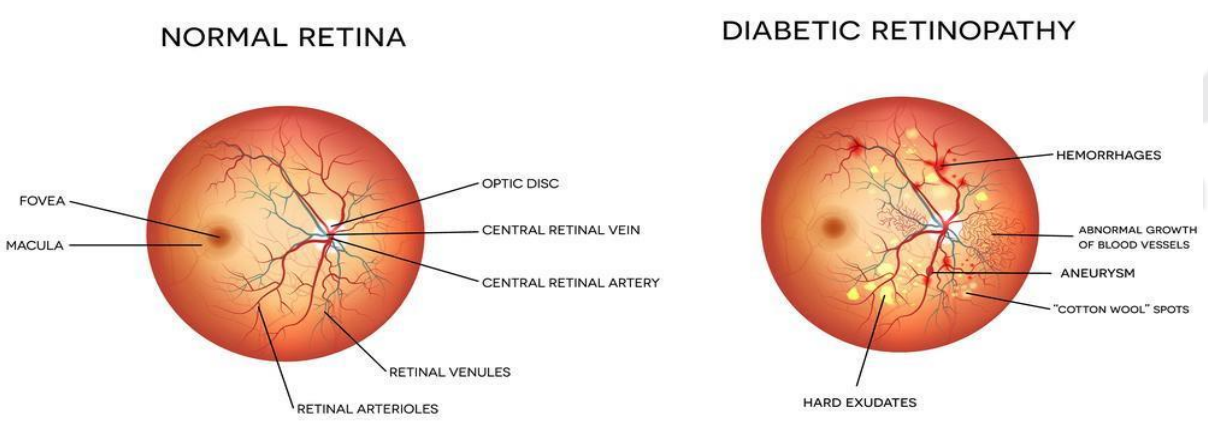
AI-powered diagnostic systems can analyze enormous volumes of data and uncover patterns that people may miss, resulting in more accurate diagnoses and more successful treatment options. Certain illnesses can be detected sooner with technology, leading to earlier diagnosis and treatment.[11]

AI-powered systems have the potential to reduce the need for human interpretation by accurately analyzing medical pictures, such as CT scans and X-rays. This may result in more efficient treatment programmers and quicker diagnosis.[12]

CT Scans –

AI-assisted computer tomography (CT) imaging has an opportunity to improve the utility of standard CT imaging by automatically detecting changes in organ characteristics as a sign of disease and using it as a genuine diagnostic tool to link features to particular diseases. Various AI assistants and algorithms are employed in the analysis of CT scan. This considerably facilitates picture interpretation for radiologists and other clinicians, allowing them to give more accurate and fast diagnoses and enhance the health of patients.[13]

Diabetic Retinopathy :- Diabetic retinopathy is an eye disease cause by diabetes, This is the period of time when hyperglycemia damages the retina's blood vessels, causing them to burst and leak, preventing the flow of blood. On the retina, aberrant new blood vessels can occasionally form. Your vision might be stolen by any of these alterations.[14] Diabetes can lead to several problems, one of which is diabetic retinopathy . Globally, it is expected that 34.6% of diabetes individuals have diabetic retinopathy, with 10.2% of them suffering blurred vision. In India and the US, 17.6% and 33.2% of diabetes Patient, respectively, suffered from Diabetic Retinopathy. Progressive in nature, Diabetic retinopathy carries a risk of visual loss up to and including blindness. It is the primary cause of blindness in adults in the working age population.[15]



Diabetic ocular disease has two primary phases.

1. NPDR (non-proliferative diabetic retinopathy)
2. PDR (proliferative diabetic retinopathy)

Non-proliferative diabetic retinopathy :-

The retina swells due to the leakage of tiny blood vessels. The term "macular edema" refers to swelling of the macula. This is the most typical cause of visual loss in diabetics. Diabetic ocular disease is now in its early stages. It is prevalent among diabetics.

Proliferative diabetic retinopathy:-

It occurs when new blood vessels begin to form in the retina. We refer to this as revascularization. Frequently, the vitreous is bled into by these delicate young veins. You may notice a few black floaters if they bleed very little. A lot of bleeding might completely obscure eyesight. Scar tissue may grow from these newly formed blood vessels. Scar tissue may result in ruptured retinas or macula issues.PDR is a dangerous condition that can impair both your peripheral (side) and central vision.[16]

AI in Diagnosis of Diabetic Retinopathy :-

Artificial Intelligence has been utilized in image-based medicine. In ophthalmology, artificial intelligence (AI) can help diagnose retinopathy of prematurity, age-related macular degeneration, glaucoma, and diabetic retinopathy. Specific visual characteristics were identified by early AI algorithms.[17] IDx-DR, the first AI software for DR, was authorized by the FDA. The doctor utilizes the Topcon NW400 to take fundus photos using IDx-DR (Digital Diagnostics Inc., Coralville, USA), then uploads the images to the cloud server.[18]

Cardiovascular System :-

Occasionally, the circulatory system or blood-vascular systems are used to refer to the cardiovascular system. The heart, a pumping mechanism made of muscles, and the arteries, veins, and capillaries, a network of closed vessels, make up the cardiovascular system. The term "circulation" refers to the repeated passage of blood through the body's numerous "circulations," which are caused by the heart pumping blood through a closed circle or circuit of vessels.[19]

AI in Diagnosis of Cardiovascular System :-

AI has the potential to improve diagnostic imaging skills, diagnose heart problems, and treat strokes more quickly. AI methods, for instance, were used in a Mayo Clinic study to develop a novel screening tool for patients with a particular kind of cardiac condition that lacks overt symptoms.AI-guided ECGs are also utilized for the early diagnosis of abnormal cardiac rhythms. Another name for an irregular heartbeat is atrial fibrillation. A low-cost diagnostic that may be commonly utilized to identify the existence of a weak cardiac pump has been developed by the application of AI to ECGs. If treatment for a weak heart pump is not received, heart failure may result. Mayo Clinic, with its database of over 7 million ECGs, is in a good position to drive this application of AI.[20]

AI systems have demonstrated the ability to detect left ventricular systolic dysfunction using single-lead ECG data from smart watches as well as 12-lead ECG data. The sensitivity, specificity, positive predictive value, and negative predictive value of an AI-enabled wristwatch two-lead ECG are 0.90, 0.86, 0.26, and 0.99, respectively, which is a satisfactory performance for detecting heart failure with decreased ejection fraction.[21]

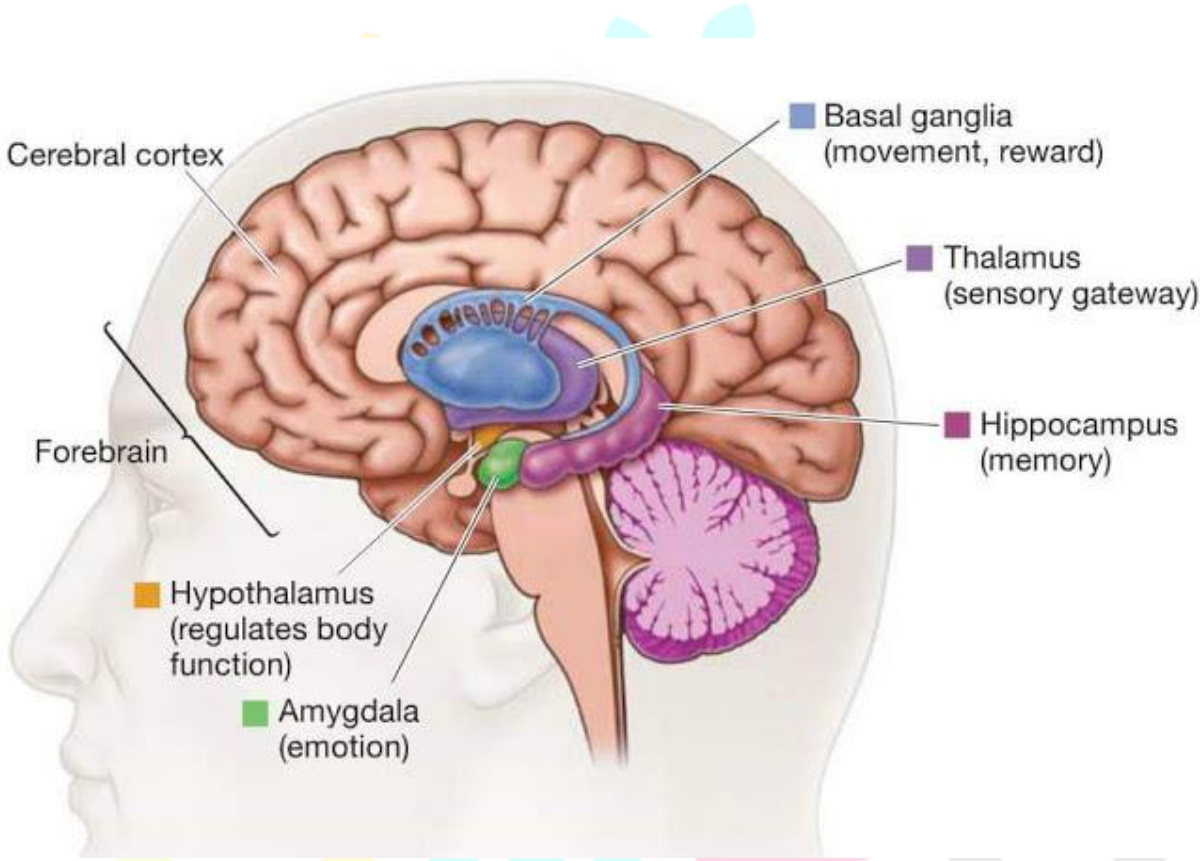
Deep Learning is utilized for automated segmentation of the right and left ventricular endo- and epicardium to determine cardiac mass and function parameters from several datasets. Artificial Intelligence has mostly been employed for segmentation of cardiac structures and infarct tissue.[22] AI was using 3-dimensional (3D) right ventricular cardiac motion as an input, principal component analysis was capable of to predict 4-year survival in pulmonary hypertension patients. When 3D-CMR characteristics were included to the algorithm with regular, functional, clinical, and CMR data as well as features obtained from right-sided cardiac catheterization, this technique demonstrated an AUC of 0.73.[23]

Parkinson's disease:-

Parkinson's disease is a neurological condition that results in unintentional or uncontrolled movements, including stiffness, shaking, and trouble balancing and coordinating. In Parkinson's disease People may experience trouble speaking and walking as the illness worsens. Along with these symptoms, they could have exhaustion, sadness, sleep issues, mental and behavioral disorders, and memory issues.

Reason for Parkinson Disease:-

Basal ganglia are a movement-controlling region of the brain might deteriorate or even die. Normally, these neurons—nerve cells—produce dopamine, a crucial brain neurotransmitter. The mobility issues linked to the condition originate from on by a decrease in dopamine production caused by dying or damaged neurons. Nor epinephrine, the primary chemical messenger of the sympathetic nervous system, which regulates several bodily processes including blood pressure and heart rate, is also produced by nerve endings that are lost in people with Parkinson's disease.[24]



AI in Parkinson's Disease:-

a novel AI-based system that uses nocturnal breathing to identify Parkinson's disease (PD), forecast the severity of the condition, and monitor its evolution over time. An individual can wear a breathing belt on their chest or belly to collect one night's worth of breathing signals, which the system uses as input.[25] Alternatively, by sending a low power radio signal and examining its reflections off the subject's body, the breathing impulses can be gathered without the need for wearable technology.[26] This model's ability to learn the auxiliary job of estimating an individual's quantitative electroencephalogram (qEEG) from their nocturnal breathing is a key feature that keeps the model from over fitting and aids in the interpretation of its output. Our approach seeks to provide a digital biomarker for progression and diagnosis that is objective, non-intrusive, affordable, and able to be tested regularly at the patient's home.[27]

Artificial intelligence is an advanced technical tool that can analyze massive quantities of data, identify patterns, forecast outcomes, and provide suggestions by simulating human thought processes. Using nocturnal breathing, researchers developed an AI-based

method to identify Parkinson's disease (PD), forecast its severity, and monitor the illness's development over time. There are two ways the system can receive the breathing input signals.

- Putting a breathing belt around the person's chest or belly,
- using a router similar to a Wi-Fi that is positioned someplace in the space and transmits a weak radio signal. The transmitted signals are reflected off the subject's body and subjected to further analysis.

The AI program is capable of -

- 90% accuracy in predicting the onset or course of Parkinson's disease.
- Monitor the course of Parkinson's disease and assess its severity using the MDS-UPDRS (the physician-rated Parkinson's disease).
- When a person is asleep, do an unbiased, non-invasive, at-home evaluation of Parkinson's disease (PD) without touching the body.
- Integrate readings from several nights to get the best test accuracy.
- Give measures at a person's house on a weekly and nightly basis that tests like the MDS-UPDRS would miss.
- Eventually be installed in the homes of people who are very susceptible to Parkinson's disease (such as those who have the LRKK2 gene mutation) in order to passively track their condition and report back to their provider. [28]

Conclusion:- AI plays a key role in future, It will help in incredible task, It is Playing an Incredible role in the field of diagnosis. It is Capable of giving correct and accurate information about diseases, as well as it is becoming easier to care and treat patients. If AI is used in the right direction then it will bring a revolution in diagnosis and Medical fields.

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