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Use Of Generative AI By 2047 In Healthcare

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Abstract
Introduction
Today's India is rapidly developing to become a superpower nation and making constant strides to achieve it. It is done in various ways, and artificial intelligence is one of them. With AI, we can have better medical outcomes and improvised public health.
Objective
This research has been done with an aim to find out the role of AI in the medical field in India by the year 2047. The year 2047 has been chosen because it would mark the 100th independence of India, aligning with the government mission to make India a developed country by then. AI, as it is booming now, would completely take over a large part of our profession, whether we talk about robotic surgery, precision medicine, or personalised medicine.
This paper and research are based on the identification of the most virulent and common diseases that a Viksit Bharat will have to face by the year 2047 and the use of artificial intelligence in the treatment and prophylaxis of those diseases. We have read and researched about 3 major diseases that will be most prevalent by the year 2047. These are ischemic heart disease, alzheimers and chronic obstructive pulmonary disease. The nature of the diseases show that it's going to be caused by the sedentary lifestyle and the environmental factors that are changing rapidly in India. Also giving us an insight that we need to tackle these changes to avoid these diseases as well. We have prepared our research on the use of artificial intelligence in the management of these diseases.
Conclusion
Thus, through this research, we would also look at the potential of AI in these areas, as well as how they can help in eradicating major diseases prevalent during that time in a new, modernized way.On the basis of this, we will be covering the insight of this topic in the paper.
Keywords: *AI, use of AI in healthcare, ischemic heart disease, COPD, alzheimers, depression, future development of AI, Diagnostics, drug development.*

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I. Introduction

"AI may well make care more efficient, more accurate, and, if properly deployed, more equitable", says Dhruv Kholat, MD, Physician, New York, Presbyterian Hospital.

India is a magnificent country and is also home to the world's largest population, with the world's largest workforce comprising of young people. Hence, having huge projects to make India a developed country, a Viksith Bharat by 2047.

One of the most important tool that is being used is Artificial Intelligence, that plays an important role in the development of a country for the near future. As it spreads its roots in every sector, India not only accepts it but is also making constant advancements with time to comprehend it in every sector.

Our tract, AI in healthcare, signifies the importance of artificial intelligence in the healthcare sector to help in various ways.

The paper includes research on how AI and its advancements will impact the healthcare sector. For that we first identified the most prevalent diseases that a Viksith Bharat will have to tackle by the year 2047.

This investigation examined the role of artificial intelligence (AI) in healthcare through an extensive review of relevant English-language literature indexed in databases such as PubMed/Medline, Scopus, and EMBASE, without imposing any time restrictions. The primary objective was to evaluate the effects and potential outcomes of integrating AI into healthcare environments. AI encompasses a variety of technologies, including machine learning (ML), deep learning (DL), and natural language processing (NLP). One advanced form of AI, known as Large Language Models (LLMs), utilizes deep learning and vast datasets to interpret, summarize, generate, and predict text-based content.

The development of AI dates back to 1951, when Christopher Strachey created the first AI program. Initially, AI was a niche area of academic interest. However, in 1956, John McCarthy hosted the Dartmouth Conference and introduced the term "Artificial Intelligence," marking the official start of the modern AI era.

Large Language Models (LLMs) are a type of AI algorithm that uses deep learning techniques and massively large data sets to understand, summarize, generate, and predict new text-based content[13]. AI has evolved since the first AI program was developed in 1951 by Christopher Strachey. At that time, AI was in its infancy and was primarily an academic research topic. In 1956, John McCarthy organized the Dartmouth Conference, where he coined the term “Artificial Intelligence.“ This event marked the beginning of the modern AI era.

In the following review paper, we will be looking at how AI will impact healthcare in the future and how it can be optimized to be used to treat the major diseases that will be in India by the year 2047. There are 4 major diseases that have been identified via references that will be on the top list of most fatal diseases. These include COPD, Alzhimers, Ischemic Heart disease and also depression[14,15].

II. Discussion

The first disease which we will discuss is ischemic heart disease. Ischemic heart disease, or IHD, arise from imbalance between the supply of blood to the myocardium and the demand of myocardium for oxygenated blood.

Ischemic heart disease is the single largest cause of mortality worldwide, accounting for 12% of global deaths. It is more commonly in male more than in females and usually manifests after the age of 50 years.

The risk factors for ischemic heart disease include traditional ones such as cigarette smoking, hypertension, and diabetes mellitus. In addition, there are emerging risk factors—such as obesity, overweight, elevated BMI levels, and dietary habits including high consumption of saturated fats, sugar, and limited intake of meat and poultry.These factors are contributing significantly to the growth of ischemic heart disease.

COPD is also one of the emerging diseases that would take place due to the increasing climate changes and air pollution.Not only climate change, but the increase in the amount of smokers every year—it would probably be one of the most common diseases in coming years.For instance, a study says that there will be 23% rise in the global COPD cases from ages 25 and older between year 2025 to 2050.

To diagnose COPD, we have got new AI test sets that transform, in which they are pre-formed machines where one has to take two to three puffs and the AI will immediately diagnose whether you have COPD or not. , The machine takes five minutes, whereas a normal COPD diagnosis using Spirometry takes about 30 to 45 minutes.

In recent months, the parents of a boy child in Finland,the victim of a school massacre advocated for gun regulation by using artificial intelligence to mimic their son Joaquin Oliver's voice. A parent produced a video of his deceased daughter singing a birthday greeting for her mother using AI and recordings of her. Additionally, despite Carrie Fisher's death, Hollywood has digitally revived her to feature in films.Through these examples, we can see how AI is so useful in bringing back memories of loved ones, and at the same time, helping cure depression and loneliness by becoming a friend in need. Especially after COVID, people have witnessed the loss of many friendships and relationships. Due to increased time spent at home, many have adapted to living by themselves and not depending on others.Thus, AI becomes a very helpful tool for actually creating and impersonating someone, allowing individuals to have a heartfelt session without being judged or worrying that their conversations will be shared with the whole world.

Of course, data privacy is a con here, but if we have a more secure network and end-to-end encryption with AI Talk, one can easily chat and manage their depression and anxiety using scientific methods provided by AI.

Next disease which we want to discuss is Alzheimer's. Alzheimers is a neuro degenerative disorder. A progressive disorder that destroys memory and other important mental functions.

It is caused by the abnormal buildup of proteins in and around the brain cells. One of the protein is amyloid that deposits around the brain cells. It is one the the diseases that will be most fatal in india by 2047, hence we must develop ways to deal with it.

Following is an overview about the diseases which we will be discussing about. And discussion below shows ways how AI will actually effect healthcare.

Diagnostics

AI systems have demonstrated high performance in analysing the medical images and reports and making the most probably diagnosis that too in a less time. They also aid in identifying the electrocardiogram patterns

Administrative efficiency

AI helps in the administration routine tasks, hence reducing the burden on the healthcare professionals and helping them give more time on the treatment and better care of the patient

Global health equity

AI could help bridge health disparities by providing low costs diagnosis and also providing low cost treatment options in under developed areas.

Comprehensive mental health support

There are various AI tools that are available for people to talk and communicate, specially those who are struggling to share with others. AI will provide real time health mental health monitoring intervention, supporting individuals through personalised, on demand resources

Seamless integration of AI and human intelligence

Combination of human intelligence and artificial intelligence will help in the decision making process in diagnosis and various things. While the human judgement always remains central to care, AI intervention will aid via offering evidence based options.

We further discuss below detailed use of AI in Healthcare

A. Alzheimers

Origin

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that was first identified by Dr. Alois Alzheimer in 1906. It mainly affects memory, thinking, and behavior, and is the most common cause of dementia. As neurons in the brain begin to die, cognitive functions decline, leading to complete dependency and eventually death. As of 2024, over 55 million people globally live with dementia, with Alzheimer's making up 60–70% of these cases. According to the World Health Organization (WHO), this number is projected to triple to 152 million by 2050 due to the aging population. The increasing burden on caregivers, healthcare systems, and society demands more efficient diagnostic and treatment strategies.

Epidemiology

Alzheimer's is characterized by the buildup of amyloid-beta plaques and tau protein tangles in the brain. These abnormal protein accumulations disrupt communication between neurons and trigger inflammation and cell death.

The exact cause is still unclear, but it is believed to be a mix of genetic, environmental, and lifestyle factors. Genetic mutations such as those in the APP, PSEN1, and PSEN2 genes can lead to early-onset AD. The APOE-e4 gene increases the risk of late-onset AD.

Epidemiologically, Alzheimer's mainly affects older adults above 65, but early-onset forms can occur as early as 30–40 years of age.

Global epidemiological studies show a higher incidence in women, likely due to longer life expectancy. Additionally, comorbidities like hypertension, diabetes, and obesity contribute to higher risk. Socioeconomic factors, education level, and access to healthcare also influence prevalence.

In India, there are about 8.5-9 million people living with alzheimers and this set is to triple by the year 2050. Hence, it requires our attention to tackle this disease via the help of AI

Use of AI in alzheimer's disease

Diagnosis:

In early diagnosis, there are AI-enhanced neuroimaging techniques, including MRI, PET, and CT scans, enable precise detection of AD biomarkers that can be employed[1]. Machine learning models examine these images to detect patterns that suggest early stages of cognitive decline. AI has also improved cognitive and behavioral assessments by increasing the precision of neuropsychological tests and evaluating speech and language patterns to identify early indicators of dementia and help us to draw a prognosis for the disease.

Drug discovery

In this part we will see how AI can impact to the formation of new drugs for alzheimer's.Emerging methodologies in artificial intelligence (AI) hold potential to revolutionize the drug discovery and development from basic findings to pre-clinical and clinical stages [2]. The AI models include machine learning (ML)-based and network-based algorithms. AI-based models have demonstrated faster and more effective by leveraging large-scale biomedical data compared to traditional biological experiment. Specifically, recent AlphaFold2 technology offers emerging opportunities for structure-based drug discovery, in particular for proteins without known structures.

Phospholipase C gamma 2 (PLCG2):

The intracellular enzyme PLCG2 is mostly expressed in the brain's microglia cells. While p.Met28Leu has recently been discovered as an AD risk mutation, p.Pro522Arg, a genetic variant of PLCG2, is linked to a lower risk of AD. Microglia phagocytosis and lipid sensing are supported by PLCG2/TREM2 signalling.

Only a domain of PLCG2 co-crystallized with Rac2 (PDB: 2W2X) has been determined, despite the fact that PLCG2 is composed of 1265 amino acids. There are currently no known small compounds that effectively target PLCG2. However, if the variations can interconvert, there may be improvements in the future to lower the risk of AD.

Beta-site amyloid precursor protein cleaving enzyme 1(BACE1)

One of the most promising treatment targets for AD that facilitated the production of Aβ is BACE1. An elevated risk of AD has been linked to one BACE1 rs638405. Despite extensive research, the majority of BACE1 inhibitors were discontinued during clinical trials. There have been numerous reports on the crystal structures of BACE1 complexed with inhibitors. Targeting BACE1, a typical complex is shown in, highlighting the possibility of structure-based drug design.

Predictive analysis

AI is and can be employed to know about the complications or development of AD [3] .This can be done via identifying various symptoms; that now are not just the normal symptoms that are to be seen.There are various biochemical mechanisms that can be studied.To further explore the biological mechanisms underlying the prediction capabilities of their model, the researchers used SPOKE (Scalable Precision Medicine Oriented Knowledge Engine), a potent tool created at UCSF, in conjunction with public molecular databases.

The "database of databases" known as SPOKE was developed in the laboratory of Sergio Baranzini, a professor of neurology and member of the UCSF Institute for Neuroscience. SPOKE determined that the link between excessive cholesterol and Alzheimer's disease is caused by the APOE4 variation of the apolipoprotein E gene. Scientists are aware of this association. But when SPOKE was combined with genetic databases, a link between osteoporosis and Alzheimer's disease—especially in women—was found. This association was found because of a variation in the MS4A6A gene, which is less well-known in the context of Alzheimer's research. The discovery of this correlation demonstrates the effectiveness of combining extensive genetic data with advanced computational methods like SPOKE to allow for targeted research into the molecular pathways behind Alzheimer's disease.

Future AI development:

CRISPR Gene Editing in Alzheimer’s Disease (In-Depth)

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a greatly discovered gene-editing tool that can precisely alter DNA. In Alzheimer’s research,CRISPR [4,5] offers hope to edit or silence genes that contribute to the disease.

Targeting APOE-e4 Gene:

One of the strongest risk factors for Alzheimer’s is the APOE-e4 allele. In 2021, researchers at MIT used CRISPR to convert APOE-e4 into the neutral APOE-e3 variant in stem cells. This reduced toxic tau protein accumulation in lab-grown neurons.

Silencing Amyloid Precursor Protein (APP):

CRISPR has been used to cut out mutations in the APP gene, which is responsible for amyloid-beta plaque formation. A study from the University of California (2020) showed that editing the APP gene in mice prevented plaque formation and improved memory.

Reducing Inflammation and Oxidative Stress:

Genes involved in immune response (like TREM2) can also be modified using CRISPR. TREM2 variants are associated with increased neuroinflammation in Alzheimer’s. Editing these genes may regulate immune activity and reduce brain inflammation.

Ethical and Delivery Challenges:

While CRISPR shows promise, challenges remain. Delivering CRISPR safely into human brain cells is complex. There are also concerns about off-target effects and long-term safety. Nevertheless, with the development of more precise CRISPR variants like CRISPR-Cas9 Prime and base editors, clinical applications are becoming more realistic

Alzhimers is a disease that we should need to eye on as its increasing trends are not a good news for

the country. Further more we should initiate the researches in these sectors with the help of AI to boost and explore the possible ways of help preventing this disease.

B. ISCHEMIC HEART DISEASE

Origin

Ischemia is defined as inadequate blood supply (circulation) to a local area due to blockage of the blood vessels supplying the area [6] Ischemic means that an organ (e.g., the heart) is not getting enough blood and oxygen. Heart issues brought on by constricted heart (coronary) arteries that feed blood to the heart muscle are referred to as ischaemic heart disease, coronary heart disease (CHD), or coronary artery disease. Atherosclerosis, or plaque accumulation, is the most common cause of the narrowing, though blood clots and blood vessel constriction can also be the reason. A heart attack, also known as a myocardial infarction (MI), occurs when the heart muscle's cells die due to a complete blockage of blood flow to the heart muscle. The majority of patients with early-stage CHD (less than 50% constriction) do not have any symptoms or blood flow restriction. However, symptoms could appear if the atherosclerosis worsens, particularly if treatment is not received. Undiagnosed angina can also occur in people. Silent ischaemia episodes in angina patients may also go undetected. Moreover, people with diabetes or those who have experienced a heart attack are susceptible to silent ischaemia. With special focus to its temporal changes and associated risk factors, the current study offered a current summary of the global burden of IHD from 1990 to 2017.

Epidemiology

According to the Global Burden of Disease study age-standardized estimates (2010), nearly a quarter (24.8%) of all deaths in India are attributable to IHD. However, there is a major gap in knowledge, especially regarding the causes of death in rural India; Global Burden of Disease estimates are based on smaller community-based studies [7]. Although verbal autopsy data from India were collected after 2004, they have not been analyzed or released for public access, and they were not included in the burden estimation.Currently, there are no nationally representative surveillance data on the prevalence of IHD and the secular trends of IHD mortality in India. However, recent reports of 3 large prospective studies from India suggest a higher proportion of mortality an age-standardized India reports an age-standardized ischemic heart disease (IHD) mortality rate ranging from 255 to 525 per 100,000 men and 225 to 299 per 100,000 women, as compared to figures from the Global Burden of Disease study. Ischemic heart disease and stroke account for 83% of cardiovascular disease (CVD) deaths in the country, with IHD being the most prevalent. The mortality ratio of IHD to stroke in India is notably higher than the global average and aligns more closely with that observed in Western industrialized nations. Combined, IHD and stroke are responsible for over 21.1% of all deaths in India and contribute to around 10% of the total years of life lost (YLL)—a measure that emphasizes the impact of premature mortality by giving more weight to deaths at younger ages. From 1990 to 2010, the YLL due to CVD in India rose by 59%, increasing from 23.2 million to 37 million.

Use of AI in ischemic heart disease

Diagnosis

AI are used to ECG analysis , echocardiography , Cardiac CT / angiography and other imaging modalities AI algorithms can analyze ECGs to detect subtle patterns [8] indicative of IHD, potentially enabling early detection and intervention .AI can automate echocardiogram analysis, improving the accuracy and efficiency of assessing heart function and detecting IHD.AI can automate the quantification of coronary artery plaques and blood flow, aiding in risk assessment and treatment planning. AI is also being used to enhance the accuracy and speed of diagnosing IHD using MRI and other cardiac imaging techniques

Drug discovery

AI offers a wide range of applications in the medical field. Firstly, it assists clinicians in diagnosing diseases and streamlining treatment processes. When integrated into traditional medical practices, AI can lower the chances of misdiagnosis and enhance diagnostic accuracy. With the emergence of deep learning, AI has become capable of interpreting medical images, offering more dependable imaging insights to healthcare professionals. Additionally, through big data analysis—where AI processes vast datasets that traditional methods struggle with—it can generate more precise predictions for patient outcomes. AI also contributes to drug discovery, boosting the efficiency of developing new medications.

Moreover, the integration of AI with surgical robotics enhances precision in performing complex surgeries. As AI continues to evolve alongside big data and cloud computing, it is set to deliver high-quality medical care. Furthermore, AI will drive progress in smart healthcare and precision medicine, reducing both patient wait times and healthcare costs, while ensuring safer and more efficient treatment. These advancements, particularly in deep learning, are expected to greatly benefit cardiovascular medicine.

Predictive analysis
Multimodal Data Analysis

AI can integrate data from various sources, including patient history, lab results, imaging, and patient-generated data, to create more accurate risk models for IHD[9].

Predictive Modeling:
AI can identify individuals at higher risk of developing IHD and can also predict future heart failure risk

Future AI Development
Enhanced Imaging and Diagnosis: AI-enhanced imaging[10]

AI algorithms can be used to improve image quality, reduce noise, and automate analysis of imaging data (CT, MRI). This can lead to more accurate diagnosis and characterization of coronary artery disease (CAD)

Automated analysis:

AI can automate the quantification of coronary artery calcification, detection of myocardial perfusion defects, and analysis of complex flow patterns in 4D flow MRI.Nanotechnology-based imaging:

Nanoparticles can be used to target specific molecular markers of IHD, enabling more precise and early diagnosis.

Early detection:

AI can identify subtle changes in cardiac function and pulmonary circulation, enabling early intervention and improved patient management for conditions like PAH.

Normal myocardial function depends on the heart's blood flow adapting to various metabolic circumstances. It takes a complicated system of elements to accomplish this adaptive process. Myocardial flow regulation involves a number of mechanisms, including physical impacts like shear stress on the vessel wall or variations in intraluminal pressure, as well as metabolic and neurohumoral components. In this situation, cardiac ion channels play a critical role in regulating CBF in relation to metabolic demands. Variations in the expression or activity of ion channels frequently lead to alterations in vascular tone because of their function in repolarisation in coronary vascular cells (endothelial and smooth muscle). Therefore, vascular hyperactivity-causing pathophysiological diseases, such as arterial hypertension, dyslipidaemia, diabetes mellitus, and genetic variations, like mutations or polymorphisms , can result in changes to coronary ion channel expression or function. Additionally, during

diabetes-induced oxidative stress, abnormalities in these channels' activity brought on by ROS result in malfunction in the regulation of vascular resistance. This harms the regulatory system that is reliant on myocyte metabolism, which eventually results in the development of myocardial insufficiency and coronary artery microcirculation dysfunction. Current treatments for heart failure, including

beta-blockers, ACE inhibitors, and aldosterone antagonists, also lessen the oxygen demand on the heart and the dysfunctional effect of metabolic vasodilation. High amounts of cardiac effort make the imbalance between oxygen supply and demand—caused by changes in coronary ion channels and cardiac microcirculation—even more noticeable. Therefore, medications that might lower heart workload also diminish the effects of microcirculation dysfunction, and they most likely impede the disease's course. The study of coronary microcirculation and its regulators, such as ion channels, has gained more attention in scientific literature in recent years. This is due to the pathophysiological continuum that connects microcirculatory dysfunction to IHD and HF. However, more investigation is still required to clarify this fascinating but uncharted issue.

Chronic Obstructive Pulmonary Disease
Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a disease that worsens over time and causes breathing difficulties due to restricted airflow[11]. It includes chronic bronchitis and emphysema and is usually the result of sustained exposure to triggering factors like cigarette smoke, air pollution, or occupational dust and fumes. Symptoms often observed in Chronic Obstructive Pulmonary Disease patients include chronic cough, breathing difficulties, wheezing, and recurrent respiratory tract infections. Even though it is a progressive and incurable disease, COPD can be controlled with medication, lifestyle changes, and supportive care to manage symptoms, enhance quality of life, and slow the advancement of the disease.Each year, over 3 million lives are silently cut short by COPD, a non-communicable disease too often overlooked despite affecting over 380 million people globally.

Breathing becomes difficult with COPD,it is a progressive lung disease that causes symptoms like coughing, wheezing, and shortness of breath. Tobacco use and air pollution are the main causes of COPD.

Smoking causes inflammation and decreased airflow by harming the lung tissue and airways. In a similar way, long-term exposure to pollutants like industrial fumes and car emissions can deteriorate lung function. Living with COPD can be difficult for people, affecting their everyday routines and general well-being. However, many people can find comfort and improve their lung health with the right care and lifestyle adjustments.

Access to reasonably priced care is still scarce despite the high incidence of COPD, particularly in low- and middle-income nations where 85% of COPD-related deaths take place. This needs to be altered.

Epidemiology

Epidemiology refers to how a disease spreads in a particular geographical area and how it can be controlled in a population.[12] Below are the various countries' initiative on handling COPD

1. In the United states of America and Canada , there are guidelines and initiatives aim to improve COPD management and patient outcome.
2. Spain focus on early detection and reduction of risk factors like smoking.
3. India and Brazil facing a high disease burden are integrating COPD into broader public health strategies addressing environmental and lifestyle factors.

Annual deaths from COPD in India are estimated around a million per year in recent years, which means roughly one in every three COPD deaths worldwide happens in India.

Following is the list of some of the high burden states { These states exhibited the highest disability adjusted Life Years(DALY)}:

1. Rajasthan, Uttar Pradesh, Madhya Pradesh,Chhattisgarh,Odisha are high burden states.
2. Tripura, Meghalaya , Arunachal Pradesh, Nagaland are moderate burden states.
3. Delhi, Maharashtra , Andhra Pradesh Are low burden states.

Use Of AI In COPD

A. Diagnostics

USC Viterbi School of Engineering have discussed a groundbreaking development in Diagnosis of COPD using AI.[17] The research is led by professor Paul Bogdan and PHD student Chenszong Yin, have developed an AI powered wearable device that has the capability to diagnose COPD with 98.5% accuracy in under one minute.

The device has a small patch equipped with sensors that checks various signals such as Respiratory Inductance Plethysmography and Oxygen Saturation levels.The data collected is analyzed and then grouped under four categories that are considered as grade 1 to grade 4.

Respiratory Induced Plethysmography

Respiratory induced plethysmography is a noninvasive method to measure breathing patterns and volumes using inductance coils placed around chest and abdomen.

These inductance coils detect three types of movements:

1. Breathing Rate
2. Depth of Breathing
3. Pattern of breathing

There is no need of an invasive mouthpiece thus it is great for kids and infants or people with breathing issues. It gives a clearer picture about the movement of chest and breathing rate which was not possible with traditional spirometry.

Role Of AI In Respiratory Induced Plethysmography

1. AI models can analyze the data to detect any anomaly in breathing during sleep and recognize the activities that are based on breathing patterns.
2. AI can help in noninvasive monitoring thus helping patients in stationary as well as moving conditions to detect their respiratory parameters
3. It increases the accuracy of the diagnosis.

Oxygen Saturation Monitoring

Oxygen saturation refers to the percentage of Hemoglobin binding site in blood stream occupied by Oxygen. Normal arterial oxygen saturation levels are 96% any number below 90% refers to as Hypoxia.Pulse oximeter is a small device that is used for monitoring the blood oxygen levels. It is usually clipped on fingers , toes or earlobes that measures oxygen saturation levels ie the SpO2 in blood. It works on the basis of light absorption. In brief if we explain the monitoring process

1. Two light waves of wavelength 660 nm and 940 nm are shined through your skin.

2. Oxyhemoglobin absorbs more of infrared rays whereas deoxyhemoglobin absorbs more of red light.
3. A photodetector on the other side measures how much of the light is absorbed on each side
4. Based on ratio it calculates the SpO2.

Role Of AI In Oxygen Saturation Monitoring
AI definitely can enhance the process of oxygen monitoring in the following way:
1. It can filter out the external noises to improve the accuracy of reading
2. It can help provide information from the preexisting data about the abnormal trends in the oxygen levels.
3. PREDICTIVE ANALYSIS: It can also predict if in future there is going to be any deterioration of the respiratory system of the patient using its algorithms. It is extensively being trialed on ICU patient
4. It can detect stages of COPD based on the pattern which it is given.

Machine Learning Algorithms

The article published by PMC tells us that machine learning is not something new rather it dates back to the 1950s when Alan Turning proposed that first machine can learn and become artificially intelligent. Since its beginning various machines used in biotechnology and healthcare have used machine learning. Current machine learning primarily served as a supportive role in physicians or analyst ability to fulfil their roles. They help in improving the accuracy, prediction and care quality. In COPD, machine learning can be used extensively for analysis of CT imaging in large population based cohort. It helps in analyzing CT imaging, demographic data and spirometry that predicts the future of the patient with COPD with a high accuracy. AI is currently being explored in diagnosing and phenotyping COPD through auscultation, pulmonary function testing and imaging lung scans.

A. Predictive Analysis
Wearables & mobile apps: Track symptoms, oxygen levels, heart rate, and physical activity.

Digital watches, which is quite common nowadays, is an AI tool very useful to detect early signs, it can detect the heart rate changes required and is helpful due to its other advancements as well. These devices nowadays are already so advanced that they are even capable of detecting how many steps to cover while walking to increase the heart rate by this much. This has been an extraordinary shift in recent years. People have been using these wrist bands a lot, in order to take care of their health, taking a small step towards their fitness journey, or out of self love or keeping up with the trending fashion.
AI models analyze this real-time data to predict flare-ups (exacerbations) before they become severe.
Personalized Treatment Plans

AI can segment COPD patients based on:
Lung function Symptom patterns
Comorbidities (like heart disease or diabetes).

Then it suggests customized medication, suggest different inhaler types, or rehabilitation programs. (For instance, someone with frequent exacerbations but mild airflow obstruction might benefit from anti-inflammatory therapy over bronchodilators.

2. Decision Making Support for the Doctor
AI can assist by becoming a co-pilot for the doctor:
Recommending evidence-based treatment guidelines. Highlighting possible drug interactions.
Alerting to missing tests or follow-ups.

C. Drug discovery
Moving Beyond Symptom Control
Traditional COPD treatments:
Bronchodilators (e.g., LABAs, LAMAs) Inhaled corticosteroids (ICS) Combination inhalers for better results.
These help open airways and reduce inflammation, but don't stop disease progression.

Focus on Disease Modification
Researchers are now trying to alter the course of the disease, not just manage symptoms. This includes:
Anti-inflammatory agents beyond steroids
PDE4 inhibitors (like roflumilast) – reduce exacerbations, especially in chronic bronchitis. Targeting IL-5, IL-13, IL-33 – similar to asthma therapies, but mixed success in COPD.

Mucus regulation
Drugs that reduce mucus hypersecretion, in order to clear the airway.

Tissue regeneration

Focused on repairing alveolar damage and reversing emphysema Includes stem cell therapy and elastin production enhancers (Elastin tissue is lost in COPD, i.e the tissue surrounding the alveolar walls vanishes causing the alveoli to fuse and hence the alveoli merge and become oversized, due to this air exchange becomes very difficult and the chest cavity size increases.)

Targeted Biologics

Inspired by asthma treatment breakthroughs (like dupilumab), biologics are being tested for COPD patients with high eosinophil counts or other biomarkers.
Anti-IL-5 (mepolizumab): mixed results in COPD, but works in eosinophilic asthma-COPD overlap
Anti-TSLP (tezepelumab)
Mitochondrial dysfunction Mitochondrial biogenesis agents
Protease–antiprotease imbalance
Alpha-1 antitrypsin therapies

AI helping in Drug Discovery
Analyze huge patient datasets to identify subtypes. Predict drug responses
Find new drug targets by ANALYSIS, gene expression and protein interactions
FACT: “Deep learning models found connections between smoking, mitochondrial dysfunction, and COPD progression — leading to new drug targets.”

Repurposing Existing Drugs
Drug repurposing is big in COPD because it’s faster and cheaper than developing new molecules.
Metformin: being studied for anti-inflammatory and anti-aging effects in COPD
Statins: may reduce exacerbation risk via anti-inflammatory pathways
Macrolides (e.g., azithromycin): long-term use for reducing flares (already in practice)

Future AI Development In COPD

AI is one of the greatest innovations and has the ability to change the face of development in COPD. It can be [16] integrated in the following ways that would make it possible for early detection, diagnosis and management of COPD.

1. AI models can be used to analyze patients’ medical records and scans of lungs and identify the cause of COPD, stage of COPD and appropriate therapy plan based on the patient's age, lifestyle and complication which can often be missed with human intervention.
2. Here are some of the AI machines that are currently in trials and hopefully will be in extensive use by future.

SAMAY: a health technology company has developed an AI assisted wearable device called Sylvee that is being designed to monitor COPD patients, it has been used to track the breathing patterns and provide real time information to the doctors.

DEEPSPIRO: Researchers have developed this device that works on spirogram time series data to predict the progression of COPD by having highly sensitive sensors that detect the changes in respiratory data. It can tell us about the advancement of disease that help doctors in early intervention.

Thus AI can revolutionize the complete management of COPD and can really bring about changes that will make the life of a COPD patient much easier

From above discussion we conclude that:
AI in COPD Treatment by 2047

By 2047, artificial intelligence is expected to revolutionize the way COPD is diagnosed, managed, and treated, shifting care from reactive to predictive and personalized.

AI will enable:

Real-time disease monitoring through wearables and smart inhalers, Early diagnosis using AI-enhanced imaging and predictive models from electronic health records, Personalized treatment tailored to genetic, environmental, and phenotypic profiles, And accelerated drug discovery, using AI to identify novel

therapeutic targets and optimize clinical trials.

AI will help redefine COPD as not just a single disease, but a collection of treatable traits — each with a precise, data-driven intervention.

By 2047, with AI integrated deeply into public health systems and clinical workflows, COPD will likely be detected earlier, managed more effectively, and potentially even prevented in high-risk populations, especially in countries like India and Brazil where non-smoking-related COPD is prevalent.

AI will transform COPD care from managing decline to enabling longevity and quality of life.

D. Depression

Origin

As we have heard about this a thousand times by now, but thinking that what it actually is? Depression, is a mental state in which one does not feel satisfied or happy even after achieving anything in his life.The first recorded cass was recognised back in the ancient messapotenian civilization around 2000 BC, and at the time it was considered as a "curse of god" or possession of evil spirit; and the treatment involved religious sacrifice. Then came hippocrates who explained it clinically for the first time. The term depression was first used in 1856, France by a French psychiatrist Louis Delasiauve. Drugs for it was first used in 1950.

Epidemiology

Epidemiological studies show that depression affects people across all age groups, but it's particularly common among adolescents, women, and older adults. About 15% of people will experience major depressive disorder (MDD) at some point in their lives, making it a leading cause of disability worldwide. Depression often occurs alongside anxiety or substance abuse, which can make treatment even more challenging. Depression is a growing public health concern in India.The burden is particularly high among women, urban populations, the elderly, and people with chronic health conditions. Contributing factors include poverty, unemployment, academic pressure, family-related stress, and widespread stigma around mental health. Alarmingly, nearly 80% of people with mental health issues in India do not receive any form of treatment.As of recent estimates, India has over 45 million people living with depression, making it one of the most affected countries in the world.The prevalence rate stands at around 4.5% to 5% of the total population, with higher rates observed in urban areas.

Use of AI in depression

AI in Diagnosing Depression Using EEG and Audio Signals

To visualize and interpret the collected EEG and audio signals, the data was first converted into spectrograms. These spectrograms represented how the signals changed over time, with EEG showing patterns of brain activity and audio signals capturing shifts in frequency and intensity. To ensure clean and comparable results, specialized noise filters and pre-processing techniques were applied.

A modified DenseNet-121 deep learning model was then used to analyze these spectrogram images and detect signs of depression. This model featured a customized classification layer trained specifically to distinguish between individuals with depression and those without. The accuracy of the model's predictions was thoroughly evaluated.

Looking ahead, such AI-driven tools could significantly speed up the process of diagnosing depression, possibly even enabling remote assessments. This approach also reduces the reliance on subjective clinical evaluations. However, more clinical research and software refinement are essential before this technology can be widely adopted.

AI in Mental Health Drug Discovery

Artificial intelligence is also making strides in the discovery of new drugs for mental health conditions. Traditionally, drug development involves labor-intensive experimental methods to study how molecules interact with specific brain receptors. One major challenge is determining the complex three-dimensional structures of these receptors, which are crucial for designing effective drugs.

Thanks to recent advancements in AI, it's now possible to predict these structures with much greater accuracy. In a recent study, researchers used AI to model the 3D shape of a previously uncharacterized receptor known as Trace Amine-Associated Receptor 1 (TAAR1). TAAR1 is considered a promising target for developing treatments for conditions like depression and schizophrenia.

Using powerful supercomputers, scientists screened vast chemical libraries to identify molecules likely to bind effectively to the TAAR1 model. These candidate molecules were then tested experimentally by a team at Karolinska Institutet. Surprisingly, many of them successfully activated the receptor, with one compound showing particularly strong results in animal trials.

This breakthrough highlights how AI can revolutionize drug discovery by making it faster and more targeted. Continued research in this direction could pave the way for new and more effective treatments for

various mental health disorders.

Predictive analysis

Artificial intelligence can predict depression by analyzing a wide range of data that reflect a person's mental and emotional state. Machine learning models are trained on datasets including facial expressions, voice tone, social media language, typing behavior, and even physiological signals like heart rate variability or EEG

Speech and Text Analysis: Advanced models like Bidirectional Long Short-Term Memory (Bi-LSTM) networks and Time-Distributed Convolutional Neural Networks (CNNs) have shown high accuracy in predicting depression severity by analyzing speech and text features

Social Media Monitoring:[20] AI can analyze language patterns in social media posts and predict depression diagnoses up to 18 months before clinical confirmation, allowing for early intervention

Similarly, mobile phone usage patterns—like reduced movement, irregular sleep, and fewer social interactions—have been used to train AI models that can flag early signs of depressive behavior.

Future AI development

As AI technologies evolve, the landscape of depression diagnosis and treatment is set to undergo a major shift.Some innovative developments that can be developed in the near future are as follows: a Emotionally Intelligent AI Companions

Future AI models will be capable of understanding and responding to human emotions in real time. These virtual companions could provide empathetic interactions, detect subtle mood shifts through tone and facial analysis.

B. Brain-Computer Interfaces (BCIs) Integrated with AI:
BCIs paired with AI could decode neural activity to detect depressive patterns directly from brain signals.

C. AI-Driven Neurofeedback and Closed-Loop Therapy:

AI will power neurofeedback systems that adapt in real time. For example, if an EEG shows signs of emotional dysregulation, the system could trigger a relaxing video, guided meditation, or even targeted brain stimulation to stabilize mood—all autonomously.

There are development of various forms of AI that enables people to talk to when they feel lonely or think that they have no one to share to. As much as it may sound as a new concept, but the reality is these AI based applications that provide a real time interface via chat gives a good time to the person to talk to and also enables them to share their things. Not only that but also refer the people to suicide helplines or to reach out to help in case of severely remorse and people who are having suicidal thoughts just by analyzing and reading the chats.

The truth is that depression is increasing at a massive rate and the hard to accept part about it is that people are not ready to accept it. Many people and sometimes even the medical care professionals think that its not actually a disease or a condition that can cause major problems, however; once a person is in such a state then moving out from it requires sheer will and determination to save yourself from it. It can end up with people citing to suicides and they feel that it's not worth living in this life or they don't have anyone who care about them. AI makes a difference in this by providing basic mental and emotional support via its interfaces and applications. People who are not able to share their feelings are able to openly share themselves to the AI as they know that it does not judge rather it gives a beneficial output with its pros and cons. So one may feel safe to share their problems with it, and also release the burden that they carry inside of them and it actually helps them out.

By 2050, AI will have evolved from a supportive tool to an integral part of mental wellness ecosystems. Depression may never be entirely eliminated, but with AI's precision, scale, and empathy-driven interfaces, we can envision a world where it is no longer a silent epidemic—but a well-managed, deeply understood, and effectively treated condition.

III. Conclusion

AI is going to play a major role in various sectors of healthcare that we discussed. That's the main reason why we are ought to work better in this field so that India does not lag behind other countries. AI will not only be the key for future but also make a gateway of a developed country and how one operates, dealing with the major problems ; while having the right scientific temperament and promoting usage of the new tools for the society; at the same time educating the masses regarding the need of these futuristic tools in healthcare sector and other sectors that would not only promote the easiness of the patient's and the healthcare sector but also promote better treatment practices.

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