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ARTIFICIAL INTELLIGENCE; THE HIGH INTELLECTUAL TOOL FOR MODERN SCIENCE

Preface

Artificial intelligence (AI) applications are software programs that use AI techniques to perform specific tasks. These tasks can range from simple, repetitive tasks to complex, cognitive tasks that require human-like intelligence. AI applications are becoming increasingly common in a wide variety of industries, including healthcare, finance, retail, and manufacturing. As AI technology continues to develop, we can expect to see even more innovative and ground-breaking AI applications in the future.

Applications of artificial intelligence (AI)

There are many different applications of AI, including:

- Natural language processing **(NLP)**: NLP allows computers to understand and generate human language. This technology is used in a variety of applications, such as machine translation, spam filtering, and sentiment analysis.
- **Computer vision**: Computer vision allows computers to identify and interpret visual content. This technology is used in a variety of applications, such as self-driving cars, facial recognition, and object detection.
- **Machine learning (ML)**: ML allows computers to learn from data and improve their performance over time. This technology is used in a variety of applications, such as predictive analytics, fraud detection, and recommendation systems.
- **Robotics**: Robotics is the branch of AI that deals with the design, construction, and operation of robots. Robots are used in a variety of applications, such as manufacturing, healthcare, and space exploration.

AI in business intelligence

AI is playing an increasingly important role in business intelligence (BI). AI-powered BI tools can help businesses collect, analyze, and visualize data more efficiently and effectively. This can lead to improved decision-making, increased productivity, and reduced costs.

Some of the ways that AI is being used in BI include:

- **Data collection**: Collecting data from a variety of sources, including structured data (for example, databases) and unstructured data (for example, text documents, images, and videos)
- **Data analysis**: To analyze data and identify patterns, trends, and relationships
- **Data visualization**: AI can help create visualizations that make it easier to understand data
- **Decision-making**: Insights and recommendations generated by AI models can help drive data-driven decision-making for businesses

AI in healthcare

AI is also playing an increasingly important role in healthcare. AI-powered tools can help doctors diagnose diseases, develop new treatments, and provide personalized care to patients. For example:

- **Disease diagnosis**: AI can be used to analyze patient data and identify patterns that may indicate a disease. This can help doctors diagnose diseases earlier and more accurately.
- **Treatment development**: By analyzing large datasets of patient data, AI can identify new patterns and relationships that can be used to develop new drugs and therapies.
- **Personalized care**: By analyzing a patient's data, AI can help doctors develop treatment plans that are tailored to the patient's specific needs.

AI in education

AI could be used in education to personalize learning, improve student engagement, and automate administrative tasks for schools and other organizations.

- **Personalized learning**: AI can be used to create personalized learning experiences for students. By tracking each student's progress, AI can identify areas where the student needs additional support and provide targeted instruction.
- **Improved student engagement**: AI can be used to improve student engagement by providing interactive and engaging learning experiences. For example, AI-powered applications can provide students with real-time feedback and support.
- **Automated administrative tasks**: Administrative tasks, such as grading papers and scheduling classes can be assisted by AI models, which will help free up teachers' time to focus on teaching.

AI in finance

AI can help financial services institutions in five general areas: personalize services and products, create opportunities, manage risk and fraud, enable transparency and compliance, and automate operations and reduce costs. For example:

- **Risk and fraud detection**: Detect suspicious, potential money laundering activity faster and more precisely with AI.

- **Personalized recommendations**: Deliver highly personalized recommendations for financial products and services, such as investment advice or banking offers, based on customer journeys, peer interactions, risk preferences, and financial goals.
- **Document processing**: Extract structured and unstructured data from documents and analyze, search and store this data for document-extensive processes, such as loan servicing, and investment opportunity discovery.

AI in manufacturing

Some ways that AI may be used in manufacturing include:

- **Improved efficiency**: Automating tasks, such as assembly and inspection
- **Increased productivity**: Optimizing production processes
- **Improved quality**: AI can be used to detect defects and improve quality control

Additional AI applications

In addition to the applications listed above, AI is also being used in a variety of other industries, including:

- **Retail**: AI is being used to personalize the shopping experience, recommend products, and manage inventory
- **Transportation:** AI is being used to develop self-driving cars and improve traffic management
- **Energy**: AI is being used to improve energy efficiency and predict energy demand
- **Government**: AI is being used to improve public safety, detect crime, and provide citizen services

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ARTIFICIAL INTELLIGENCE: A MODERN TOOL TO CONQUER OVER THE MEDICAL SCIENCES

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Abstract: Artificial intelligence in medicine is the use of machine learning models to help process medical data and give medical professionals important insights, improving health outcomes and patient experiences. Thanks to recent advances in computer science and informatics, artificial intelligence (AI) is quickly becoming an integral part of modern healthcare. AI algorithms and other applications powered by AI are being used to support medical professionals in clinical settings and in ongoing research. Currently, the most common roles for AI in medical settings are clinical decision support and imaging analysis. Clinical decision support tools help providers make decisions about treatments, medications, mental health and other patient needs by providing them with quick access to information or research that's relevant to their patient. In medical imaging, AI tools are being used to analyze CT scans, x-rays, MRIs and other images for lesions or other findings that a human radiologist might miss. The challenges that the COVID-19 pandemic created for many health systems also led many healthcare organizations around the world to start field-testing new AI-supported technologies, such as algorithms designed to help monitor patients and AI-powered tools to screen COVID-19 patients. The research and results of these tests are still being gathered, and the overall standards for the use AI in medicine are still being defined. Yet opportunities for AI to benefit clinicians, researchers and the patients they serve are steadily increasing. At this point, there is little doubt that AI will become a core part of the digital health systems that shape and support modern medicine.

Keywords: Artificial intelligence, deep convolutional neural network, medical use

Overview: Artificial intelligence in medicine is the use of machine learning models to help process medical data and give medical professionals important insights, improving health outcomes and patient experiences. The use of AI, inclusive of Generative AI, in healthcare is evolving rapidly and has the 'potential to enhance healthcare outcomes by improving clinical trials, medical diagnosis and treatment, self-management of care, and personalized care. Gen AI could help accelerate the process of identifying targets, developing validation assays to test compounds, singling out the most promising leads, and assisting in preclinical testing to determine their effectiveness. Pharmaceutical manufacturers are already using foundational models for these purposes.[1]

Figure-1: Artificial Intelligence in Medical Sciences

AI Doctor is the chatbot feature of Docus AI Health Assistant, designed to provide health-related information, recommendations, and support. It analyzes your medical history, symptoms, and other relevant factors to assist you with preliminary guidance through interactive communication. Artificial intelligence is shaping the future of healthcare technology by assisting clinicians with its advanced algorithms. From robotic surgery to highly accurate cancer detection, artificial intelligence is being threaded throughout a variety of vital procedures and shaping the future of surgery. However, integrating AI into medical education comes with advantages and obstacles. The advantages include objective student assessment, better clinical simulation organization, and enhanced education transparency. From conversational AI to clinical applications, Manipal Healthcare is also making strides. “We are using conversational AI to interact with our patients and families. In clinical areas, current applications include early alerts on patients who could require intensive care. Gen AI could help accelerate the process of identifying targets, developing validation assays to test compounds, singling out the most promising leads, and assisting in preclinical testing to determine their effectiveness. Pharmaceutical manufacturers are already using foundational models for these purposes. Recently, researchers from Tsinghua University have developed the AI hospital called "Agent Hospital." In this virtual world, all

doctors, nurses and patients are driven by large language model (LLM)-powered intelligent agents, capable of autonomous interaction. One of the key ways in which AI is used in robotics is through machine learning. This technique enables robots to learn and perform specific tasks through observing and mimicking human actions.

Figure-2: Robotics & Artificial Intelligence

AI gives robots a computer vision that enables them to navigate, detect and determine their reactions accordingly. There are many good uses for AI in the medical device industry, such as data management, remote surgery, diagnostic and procedural assisting, clinical trials, and more. AI can improve medical device manufacturing efficiency and reduce risk through. Drug Discovery and Development: AI accelerates the drug discovery process by analyzing vast datasets to identify potential drug candidates and predict their efficacy. Artificial intelligence (AI) affects 100% of physicians and other health care providers, but three out of four patients do not trust AI in a health care setting. AI has become ubiquitous in health care, but a new survey found nearly 80% of patients don't know if their doctor is using it or not. The scope of AI in healthcare amplifies diagnostic precision and expedites decision-making processes, facilitating a seamless workflow that ultimately enhances patient care outcomes. According to a Morgan Stanley report released in August, 94% of the health care companies surveyed said they are now employing artificial intelligence or machine learning in some capacity. Based on how they learn and how far they can apply their knowledge, all AI can be broken down into three capability types: Narrow AI, general AI and super AI.[2]

Figure-3: Artificial Narrow Intelligence

Artificial narrow intelligence (ANI) refers to the goal-oriented version of AI designed to better perform a single task such as tracking weather updates, generating data science reports by analyzing raw data, or playing games such as poker, chess, etc. Artificial general intelligence (AGI) is a field of theoretical AI research that attempts to create software with human-like intelligence and the ability to self-teach. The aim is for the software to be able to perform tasks that it is not necessarily trained or developed for. Artificial superintelligence (ASI) is a hypothetical software-based artificial intelligence (AI) system with an intellectual scope beyond human intelligence. At the most fundamental level, this superintelligent AI has cutting-edge cognitive functions and highly developed thinking skills more advanced than any human. AI modeling is allowing surgeons to have advanced intraoperative metrics such as force and tactile measurements, enhanced detection of positive surgical margins, and even allowing for the complete automation of certain steps in surgical procedures. AI is also Query revolutionizing the field of surgical education. One of the key ways in which AI is used in robotics is through machine learning. This technique enables robots to learn and perform specific tasks through observing and mimicking human actions. AI gives robots a computer vision that enables them to navigate, detect and determine their reactions accordingly. To operate using the Robotic system, your surgeon makes tiny incisions in your body and inserts miniaturized instruments and a high-definition three-dimensional camera, and sometimes skin incisions are not required at all. Then, from a nearby console, your surgeon manipulates those instruments to perform the operation. During the surgery, many surgical applications like ultrasound, NIRF (Near-

Infrared Fluorescence), OCT (Optical Coherence Tomography), probe-based confocal laser endomicroscopy, electromagnetic sensors, and many other devices use AI techniques to provide computer-assisted surgery. In sensitive surgical procedures, augmented reality integrated through an AI can overlay important information such as vitals and hemodynamic state of a patient in real time to the surgeons, which may help them optimize their techniques, as well as decision-making during the surgery. However, given that AI tools have the ability to improve patient safety, clinical outcomes, quality of care, and clinical documentation, according to AMA President Jesse Ehrenfeld, MD, "Physicians who use AI will replace those who don't." Da Vinci Software | Elevating the Possibilities for Robotic Surgery. One of the most significant developments in robotic surgery tools is the enhancement of robotic arms. These arms are now more dexterous, mimicking the movements of a human hand with greater precision. This advancement allows surgeons to perform intricate procedures in hard-to-reach areas with minimal incisions.

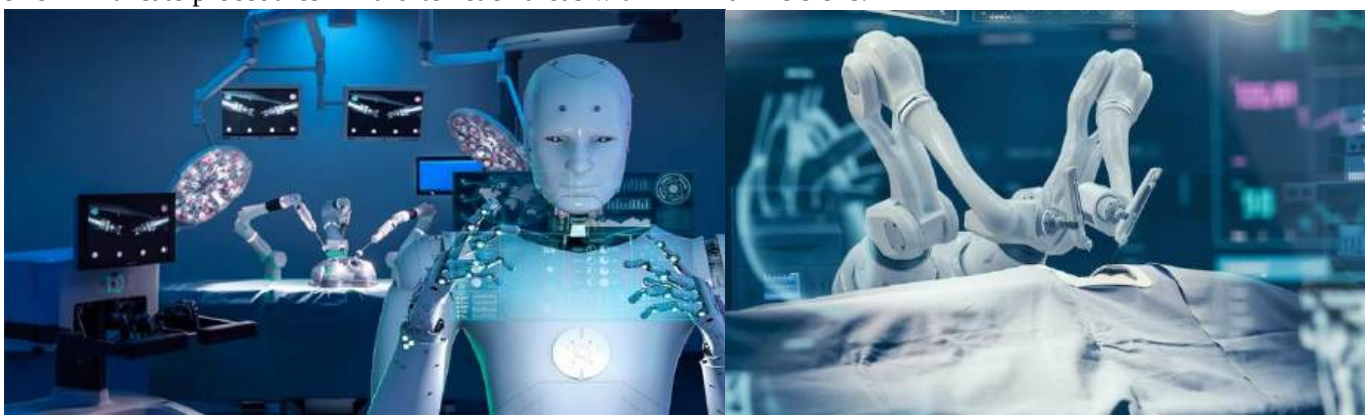

Figure-4: Artificial Intelligence in Robotic Surgery

AI applications in medicine: There are numerous ways AI can positively impact the practice of medicine, whether it's through speeding up the pace of research or helping clinicians make better decisions. AI in disease detection and diagnosis: Unlike humans, AI never needs to sleep. Machine learning models could be used to observe the vital signs of patients receiving critical care and alert clinicians if certain risk factors increase. While medical devices like heart monitors can track vital signs, AI can collect the data from those devices and look for more complex conditions, such as sepsis. One IBM client has developed a predictive AI model for premature babies that is 75% accurate in detecting severe sepsis. Personalized disease treatment: Precision medicine could become easier to support with virtual AI assistance. Because AI models can learn and retain preferences, AI has the potential to provide customized real-time recommendations to patients around the clock. Rather than having to repeat information with a new person each time, a healthcare system could offer patients around-the-clock access to an AI-powered virtual assistant that could answer questions based on the patient's medical history, preferences and personal needs. AI in medical imaging.

AI is already playing a prominent role in medical imaging. Research has indicated that AI powered by artificial neural networks can be just as effective as human radiologists at detecting signs of breast cancer as well as other conditions. In addition to helping clinicians spot early signs of disease, AI can also help make the staggering number of medical images that clinicians have to keep track of more manageable by detecting vital pieces of a patient's history and presenting the relevant images to them.

Clinical trial efficiency: A lot of time is spent during clinical trials assigning medical codes to patient outcomes and updating the relevant datasets. AI can help speed this process up by providing a quicker and more intelligent search for medical codes. Two IBM Watson Health clients recently found that with AI, they could reduce their number of medical code searches by more than 70%.

Accelerated drug development: Drug discovery is often one of the longest and most costly parts of drug development. AI could help reduce the costs of developing new medicines in primarily two ways: creating better drug designs and finding promising new drug combinations. With AI, many of the big data challenges facing the life sciences industry could be overcome.

Benefits of AI in medicine: Informed patient care. Integrating medical AI into clinician workflows can give providers valuable context while they're making care decisions. A trained machine learning algorithm can help cut down on research time by giving clinicians valuable search results with evidence-based insights about treatments and procedures while the patient is still in the room with them. Error reduction: There is some evidence that AI can help improve patient safety. A recent systemic review (link resides outside ibm.com) of 53 peer-reviewed studies examining the impact of AI on patient safety found that AI-powered decision support tools can help improve error detection and drug management.[3]

Reducing the costs of care: There are a lot of potential ways AI could reduce costs across the healthcare industry. Some of the most promising opportunities include reducing medication errors, customized virtual health assistance, fraud prevention, and supporting more efficient administrative and clinical workflows.

Increasing doctor-patient engagement. Many patients think of questions outside of typical business hours. AI can help provide around-the-clock support through chatbots that can answer basic questions and give patients resources when their provider's office isn't open. AI could also potentially be used to triage questions and flag information for further review, which could help alert providers to health changes that need additional attention.

Providing contextual relevance: One major advantage of deep learning is that AI algorithms can use context to distinguish between different types of information. For example, if a clinical note includes a list of a patient's current medications along with a new medication their provider recommends, a well-trained AI algorithm can use natural language processing to identify which medications belong in the patient's medical history.

Artificial intelligence in healthcare is the application of artificial intelligence (AI) to copy human cognition in the analysis, presentation, and understanding of complex medical and health care data, or to exceed human capabilities by providing new ways to diagnose, treat, or prevent disease. Specifically, AI is the ability of computer algorithms to arrive at approximate conclusions based solely on input data.

Figure-5: Artificial Intelligence in Neurology

The primary aim of health-related AI applications is to analyze relationships between clinical data and patient outcomes. AI programs are applied to practices such as diagnostics, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. What differentiates AI technology from traditional technologies in healthcare is the ability to gather larger and more diverse data, process it, and produce a well-defined output to the end-user. AI does this through machine learning algorithms and deep learning. Because radiographs are the most common imaging tests conducted in most radiology departments, the potential for AI to help with triage and interpretation of traditional radiographs (X-ray pictures) is particularly noteworthy. These processes can recognize patterns in behavior and create their own logic. To gain useful insights and predictions, machine learning models must be trained using extensive amounts of input data. AI algorithms behave differently from humans in two ways: (1) algorithms are literal: once a goal is set, the algorithm learns exclusively from the input data and can only understand what it has been programmed to do, (2) and some deep learning algorithms are black boxes; algorithms can predict with extreme precision, but offer little to no comprehensible explanation to the logic behind its decisions aside from the data and type of algorithm used.

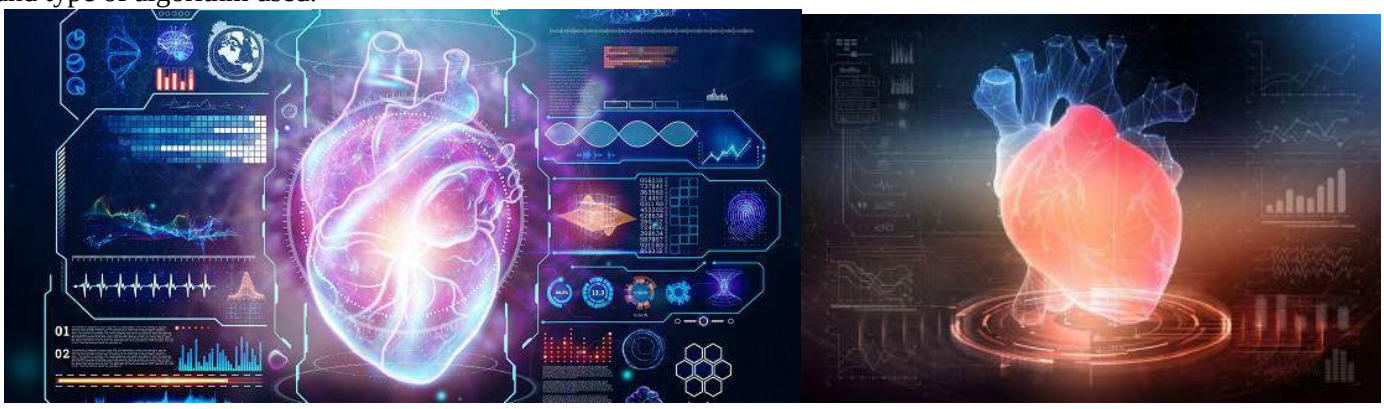

Figure-6: Artificial Intelligence in Cardiology

As widespread use of AI in healthcare is relatively new, research is ongoing into its application in various fields of medicine and industry. Additionally, greater consideration is being given to the unprecedented ethical concerns related

to its practice such as data privacy, automation of jobs, and representation biases. Furthermore, new technologies brought about by AI in healthcare are often resisted by healthcare leaders, leading to slow and erratic adoption.[4]

In recent years, AI has played a leading role in the use and valuation of extensive collections of data, Google and the Mayo Clinic, for example, have announced a partnership to solve complex medical problems using data-driven medical innovation, or a team from the University of California, San Diego was able to create a diagnostic program by training AI on medical records from 1.3 million patients under the age of 18.80.

Cardiovascular: Artificial intelligence algorithms have shown promising results in accurately diagnosing and risk stratifying patients with concern for coronary artery disease, showing potential as an initial triage tool. Other algorithms have been used in predicting patient mortality, medication effects, and adverse events following treatment for acute coronary syndrome. Wearables, smartphones, and internet-based technologies have also shown the ability to monitor patients' cardiac data points, expanding the amount of data and the various settings AI models can use and potentially enabling earlier detection of cardiac events occurring outside of the hospital. Another growing area of research is the utility of AI in classifying heart sounds and diagnosing valvular disease. Challenges of AI in cardiovascular medicine have included the limited data available to train machine learning models, such as limited data on social determinants of health as they pertain to cardiovascular disease.

Figure-7: Artificial Intelligence in Dermatology

A key limitation in early studies evaluating AI were omissions of data comparing algorithmic performance to humans. Examples of studies which assess AI performance relative to physicians includes how AI is noninferior to humans in interpretation of cardiac echocardiograms and that AI can diagnose heart attack better than human physicians in the emergency setting, reducing both low-value testing and missed diagnoses.

In cardiovascular tissue engineering and organoid studies, AI is increasingly used to analyze microscopy images, and integrate electrophysiological read outs.

Dermatology: Dermatology is an imaging abundant speciality and the development of deep learning has been strongly tied to image processing. Therefore, there is a natural fit between the dermatology and deep learning. There are three main imaging types in dermatology: contextual images, macro images, micro images. For each modality, deep learning showed great progress. Han et al. showed keratinocytic skin cancer detection from face photographs. Esteva et al. demonstrated dermatologist-level classification of skin cancer from lesion images. Noyan et al. demonstrated a convolutional neural network that achieved 94% accuracy at identifying skin cells from microscopic Tzanck smear images. A concern raised with this work is that it has not engaged with disparities related to skin color or differential treatment of patients with non-white skin tones.

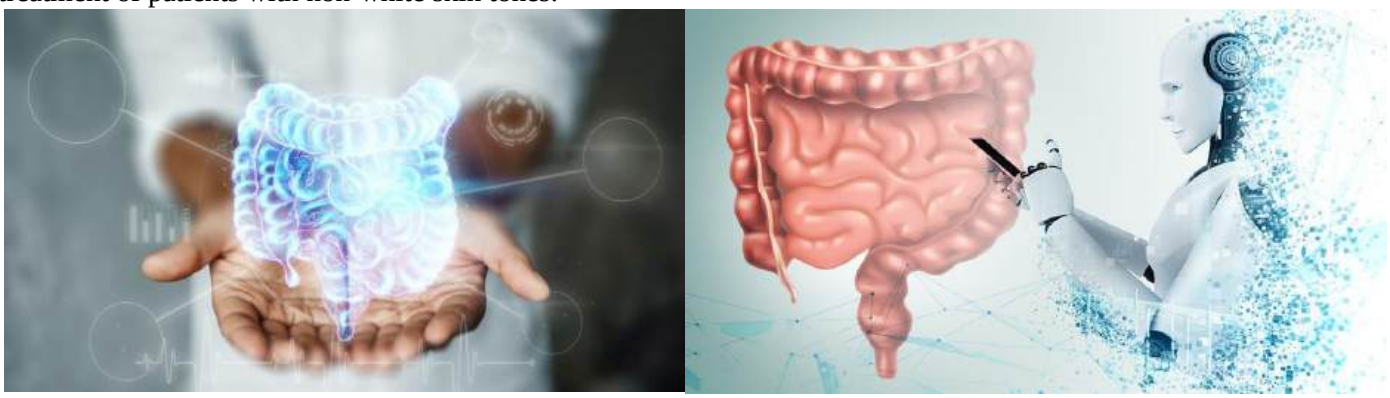

Figure-8: Artificial Intelligence in Gastroenterology

According to some researchers, AI algorithms have been shown to be more effective than dermatologists at identifying cancer. However, a 2021 review article found that a majority of papers analyzing the performance of AI algorithms designed for skin cancer classification failed to use external test sets. Only four research studies were found in which the AI algorithms were tested on clinics, regions, or populations distinct from those it was trained on, and in each of those four studies, the performance of dermatologists was found to be on par with that of the algorithm. Moreover, only one study was set in the context of a full clinical examination; others were based on interaction through web-apps or online questionnaires, with most based entirely on context-free images of lesions. In this study, it was found that dermatologists significantly outperformed the algorithms. Many articles claiming superior performance of AI algorithms also fail to distinguish between trainees and board-certified dermatologists in their analyses.

It has also been suggested that AI could be used to automatically evaluate the outcome of maxillo-facial surgery or cleft palate therapy in regard to facial attractiveness or age appearance.

Gastroenterology: AI can play a role in various facets of the field of gastroenterology. Endoscopic exams such as esophagogastroduodenoscopies (EGD) and colonoscopies rely on rapid detection of abnormal tissue. By enhancing these endoscopic procedures with AI, clinicians can more rapidly identify diseases, determine their severity, and visualize blind spots. Early trials in using AI detection systems of early gastric cancer have shown sensitivity close to expert endoscopists.[5]

Obstetrics and gynaecology: Artificial intelligence, or AI, utilises massive amounts of data to help with predicting illness, prevention, and diagnosis, as well as patient monitoring. In obstetrics, artificial intelligence is utilised in magnetic resonance imaging, ultrasound, and foetal cardiotocography. AI contributes in the resolution of a variety of obstetrical diagnostic issues.

Figure-9: Artificial Intelligence in Gynaecology

Infectious diseases: AI has shown potential in both the laboratory and clinical spheres of infectious disease medicine. As the novel coronavirus ravages through the globe, the United States is estimated to invest more than $2 billion in AI-related healthcare research by 2025, more than 4 times the amount spent in 2019 ($463 million). While neural networks have been developed to rapidly and accurately detect a host response to COVID-19 from mass spectrometry samples, a scoping review of the literature found few examples of AI being used directly in clinical practice during the COVID-19 pandemic itself. Other applications include support-vector machines identifying antimicrobial resistance, machine learning analysis of blood smears to detect malaria, and improved point-of-care testing of Lyme disease based on antigen detection. Additionally, AI has been investigated for improving diagnosis of meningitis, sepsis, and tuberculosis, as well as predicting treatment complications in hepatitis B and hepatitis C patients.[6]

Figure-10: Artificial Intelligence in Musculoskeletal

Musculoskeletal: AI has been used to identify causes of knee pain that doctors miss, that disproportionately affect Black patients. Underserved populations experience higher levels of pain. These disparities persist even after controlling for the objective severity of diseases like osteoarthritis, as graded by human physicians using medical images, raising the possibility that underserved patients' pain stems from factors external to the knee, such as stress. Researchers have conducted a study using a machine-learning algorithm to show that standard radiographic measures of severity overlook objective but undiagnosed features that disproportionately affect diagnosis and management of underserved populations with knee pain. They proposed that new algorithmic measure ALG-P could potentially enable expanded access to treatments for underserved patients.

Neurology: The use of AI technologies has been explored for use in the diagnosis and prognosis of Alzheimer's disease (AD). For diagnostic purposes, machine learning models have been developed that rely on structural MRI inputs. The input datasets for these models are drawn from databases such as the Alzheimer's Disease Neuroimaging Initiative. Researchers have developed models that rely on convolutional neural networks with the aim of improving early diagnostic accuracy. Generative adversarial networks are a form of deep learning that have also performed well in diagnosing AD. There have also been efforts to develop machine learning models into forecasting tools that can predict the prognosis of patients with AD. Forecasting patient outcomes through generative models has been proposed by researchers as a means of synthesizing training and validation sets. They suggest that generated patient forecasts could be used to provide future models larger training datasets than current open access databases.

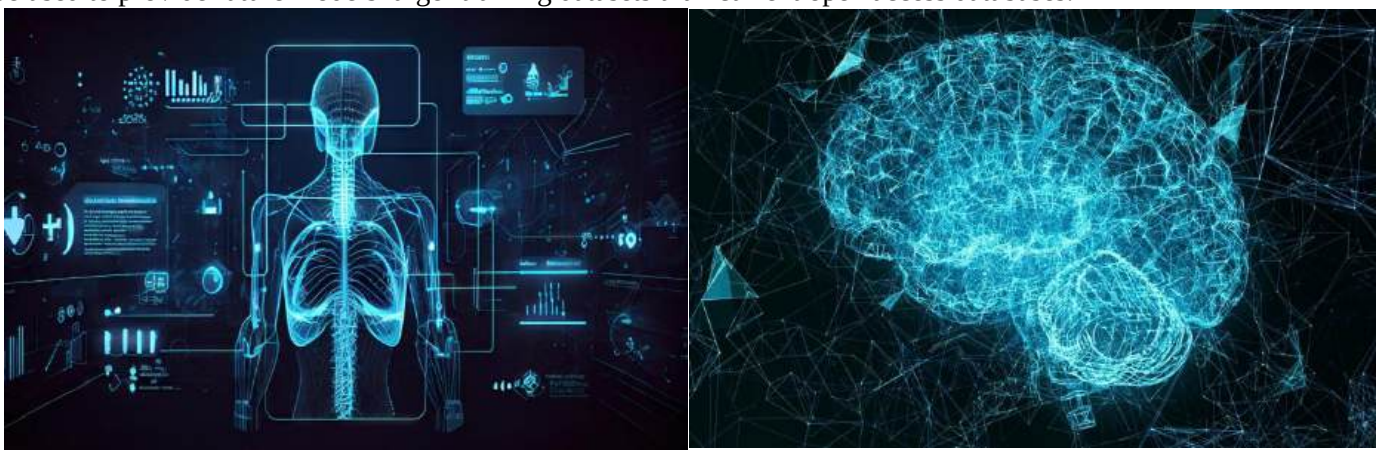

Figure-11: Artificial Intelligence in Neurology

Oncology: AI has been explored for use in cancer diagnosis, risk stratification, molecular characterization of tumors, and cancer drug discovery. A particular challenge in oncologic care that AI is being developed to address is the ability to accurately predict which treatment protocols will be best suited for each patient based on their individual genetic, molecular, and tumor-based characteristics. AI has been trialed in cancer diagnostics with the reading of imaging studies and pathology slides.

Ophthalmology: Artificial intelligence-enhanced technology is being used as an aid in the screening of eye disease and prevention of blindness. In 2018, the U.S. Food and Drug Administration authorized the marketing of the first medical device to diagnose a specific type of eye disease, diabetic retinopathy using an artificial intelligence algorithm. Moreover, AI technology may be used to further improve "diagnosis rates" because of the potential to decrease detection time.[7]

Primary care: Primary care has become one key development area for AI technologies. AI in primary care has been used for supporting decision making, predictive modelling, and business analytics. There are only a few examples of AI

decision support systems that were prospectively assessed on clinical efficacy when used in practice by physicians. But there are cases where the use of these systems yielded a positive effect on treatment choice by physicians.

Figure-12: Artificial Intelligence in Oncology

Pathology: Ki67 stain calculation by the open-source software QuPath in a pure seminoma, which gives a measure of the proliferation rate of the tumor. The colors represent the intensity of expression: blue-no expression, yellow-low, orange-moderate, and red-high expression. For many diseases, pathological analysis of cells and tissues is considered to be the gold standard of disease diagnosis. Methods of digital pathology allows microscopy slides to be scanned and digitally analyzed. AI-assisted pathology tools have been developed to assist with the diagnosis of a number of diseases, including breast cancer, hepatitis B, gastric cancer, and colorectal cancer. AI has also been used to predict genetic mutations and prognosticate disease outcomes. AI is well-suited for use in low-complexity pathological analysis of large-scale screening samples, such as colorectal or breast cancer screening, thus lessening the burden on pathologists and allowing for faster turnaround of sample analysis.

Figure-13: Artificial Intelligence in Pathology

Several deep learning and artificial neural network models have shown accuracy similar to that of human pathologists and a study of deep learning assistance in diagnosing metastatic breast cancer in lymph nodes showed that the accuracy of humans with the assistance of a deep learning program was higher than either the humans alone or the AI program alone. Additionally, implementation of digital pathology is predicted to save over $12 million for a university center over the course of five years, though savings attributed to AI specifically have not yet been widely researched.

Figure-14: Artificial Intelligence in Ophthalmology

The use of augmented and virtual reality could prove to be a stepping stone to wider implementation of AI-assisted pathology, as they can highlight areas of concern on a pathology sample and present them in real-time to a pathologist for more efficient review. AI also has the potential to identify histological findings at levels beyond what the human eye can see, and has shown the ability to use genotypic and phenotypic data to more accurately detect the tumor of origin for metastatic cancer. One of the major current barriers to widespread implementation of AI-assisted pathology tools is

the lack of prospective, randomized, multi-center controlled trials in determining the true clinical utility of AI for pathologists and patients, highlighting a current area of need in AI and healthcare research.[8]

Figure-15: Artificial Intelligence in Cell Culture

Psychiatry: In psychiatry, AI applications are still in a phase of proof-of-concept. Areas where the evidence is widening quickly include predictive modelling of diagnosis and treatment outcomes, chatbots, conversational agents that imitate human behaviour and which have been studied for anxiety and depression. Challenges include the fact that many applications in the field are developed and proposed by private corporations, such as the screening for suicidal ideation implemented by Facebook in 2017. Such applications outside the healthcare system raise various professional, ethical and regulatory questions. Another issue is often with the validity and interpretability of the models. Small training datasets contain bias that is inherited by the models, and compromises the generalizability and stability of these models. Such models may also have the potential to be discriminatory against minority groups that are underrepresented in samples.

Figure-16: Artificial Intelligence in Radiology

Radiology: AI is being studied within the field of radiology to detect and diagnose diseases through computerized tomography (CT) and magnetic resonance (MR) imaging. It may be particularly useful in settings where demand for human expertise exceeds supply, or where data is too complex to be efficiently interpreted by human readers. Several deep learning models have shown the capability to be roughly as accurate as healthcare professionals in identifying diseases through medical imaging, though few of the studies reporting these findings have been externally validated. AI can also provide non-interpretive benefit to radiologists, such as reducing noise in images, creating high-quality images from lower doses of radiation, enhancing MR image quality, and automatically assessing image quality. Further research investigating the use of AI in nuclear medicine focuses on image reconstruction, anatomical landmarking, and the enablement of lower doses in imaging studies. The analysis of images for supervised AI applications in radiology encompasses two primary techniques at present: (1) convolutional neural network-based analysis; and (2) utilization of radiomics.[9]

Pharmacy: Artificial intelligence in pharmacy is the application of artificial intelligence (AI) to the discovery, development, and the treatment of patients with medications. AI in pharmacy practices has the potential to revolutionize all aspects of pharmaceutical research as well as to improve the clinical application of pharmaceuticals to prevent, treat, or cure disease. AI, a technology that enables machines to simulate human intelligence, has found applications in

pharmaceutical research, drug manufacturing, drug delivery systems, clinical trial optimization, treatment plans, and patient-centered services.

Figure-17: Artificial Intelligence in Pharmacy

Disease diagnosis: To demonstrate some specifics for disease diagnosis/classification there are two different techniques used in the classification of these diseases including using artificial neural networks (ANN) and Bayesian networks (BN). It was found that ANN was better and could more accurately classify diabetes and cardiovascular disease. Through the use of machine learning classifiers (MLCs), artificial intelligence has been able to substantially aid doctors in patient diagnosis through the manipulation of mass electronic health records (EHRs). Medical conditions have grown more complex, and with a vast history of electronic medical records building, the likelihood of case duplication is high. Although someone today with a rare illness is less likely to be the only person to have had any given disease, the inability to access cases from similarly symptomatic origins is a major roadblock for physicians. The implementation of AI to not only help find similar cases and treatments, such as through early predictors of Alzheimer's disease and dementias, but also factor in chief symptoms and help the physicians ask the most appropriate questions helps the patient receive the most accurate diagnosis and treatment possible.[10]

Figure-18: Artificial Intelligence in Disease Diagnosis

Recent developments in statistical physics, machine learning, and inference algorithms are being explored for their potential in improving medical diagnostic approaches. Combining the skills of medical professionals and machines can help overcome decision-making weaknesses in medical practice. To do so, one needs precise disease definitions and a probabilistic analysis of symptoms and molecular profiles. Physicists have been studying similar problems for years, using microscopic elements and their interactions to extract macroscopic states of various physical systems. Physics inspired machine learning approaches can thus be applied to study disease processes and to perform biomarker analysis.

Telemedicine: An elderly man using a pulse oximeter to measure his blood oxygen levels. The increase of telemedicine, the treatment of patients remotely, has shown the rise of possible AI applications. AI can assist in caring for patients remotely by monitoring their information through sensors. A wearable device may allow for constant monitoring of a patient and the ability to notice changes that may be less distinguishable by humans. The information can be compared to other data that has already been collected using artificial intelligence algorithms that alert physicians if there are any issues to be aware of. Another application of artificial intelligence is chat-bot therapy. Some researchers charge that the reliance on chatbots for mental healthcare does not offer the reciprocity and accountability of care that should exist in the relationship between the consumer of mental healthcare and the care provider (be it a chat-bot or psychologist), though. Since the average age has risen due to a longer life expectancy, artificial intelligence could be useful in helping

take care of older populations. Tools such as environment and personal sensors can identify a person's regular activities and alert a caretaker if a behavior or a measured vital is abnormal. Although the technology is useful, there are also discussions about limitations of monitoring in order to respect a person's privacy since there are technologies that are designed to map out home layouts and detect human interactions.

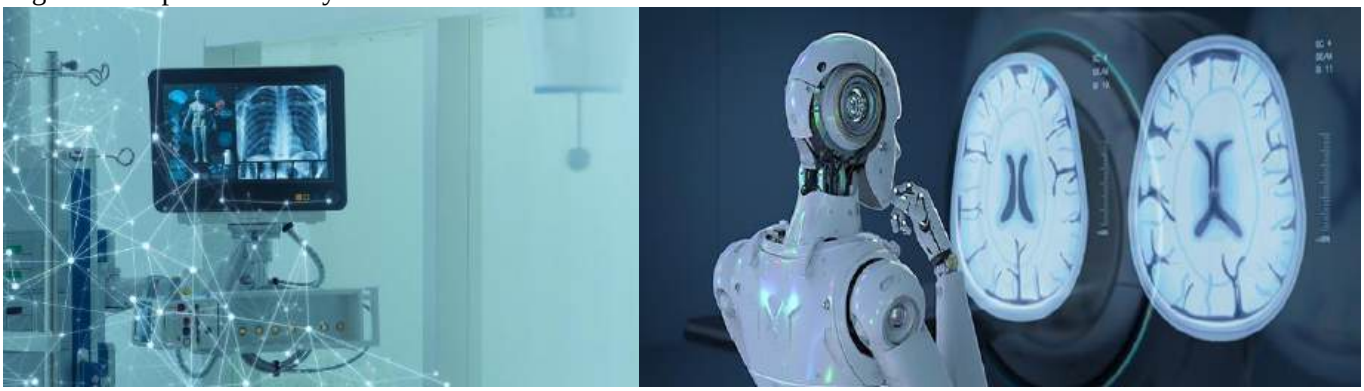

Figure-19: Artificial Intelligence in Telemedicine

Electronic health records: Electronic health records (EHR) are crucial to the digitalization and information spread of the healthcare industry. Now that around 80% of medical practices use EHR, the next step is to use artificial intelligence to interpret the records and provide new information to physicians. One application uses natural language processing (NLP) to make more succinct reports that limit the variation between medical terms by matching similar medical terms. For example, the term heart attack and myocardial infarction mean the same things, but physicians may use one over the over based on personal preferences. NLP algorithms consolidate these differences so that larger datasets can be analyzed. Another use of NLP identifies phrases that are redundant due to repetition in a physician's notes and keeps the relevant information to make it easier to read. Other applications use concept processing to analyze the information entered by the current patient's doctor to present similar cases and help the physician remember to include all relevant details. Beyond making content edits to an EHR, there are AI algorithms that evaluate an individual patient's record and predict a risk for a disease based on their previous information and family history.[11]

Figure-20: Artificial Intelligence in Electronic Health Records

One general algorithm is a rule-based system that makes decisions similarly to how humans use flow charts. This system takes in large amounts of data and creates a set of rules that connect specific observations to concluded diagnoses. Thus, the algorithm can take in a new patient's data and try to predict the likeliness that they will have a certain condition or disease. Since the algorithms can evaluate a patient's information based on collective data, they can find any outstanding issues to bring to a physician's attention and save time.

One study conducted by the Centerstone research institute found that predictive modelling of EHR data has achieved 70–72% accuracy in predicting individualized treatment response. These methods are helpful due to the fact that the amount of online health records doubles every five years. Physicians do not have the bandwidth to process all this data manually, and AI can leverage this data to assist physicians in treating their patients.

Artificial intelligence continues to expand in its abilities to diagnose more people accurately in nations where fewer doctors are accessible to the public. Many new technology companies such as SpaceX and the Raspberry Pi Foundation have enabled more developing countries to have access to computers and the internet than ever before. With the increasing capabilities of AI over the internet, advanced machine learning algorithms can allow patients to get accurately diagnosed when they would previously have no way of knowing if they had a life-threatening disease or not. Using AI in developing nations that do not have the resources will diminish the need for outsourcing and can improve patient

care. AI can allow for not only diagnosis of patient in areas where healthcare is scarce, but also allow for a good patient experience by resourcing files to find the best treatment for a patient. The ability of AI to adjust course as it goes also allows the patient to have their treatment modified based on what works for them; a level of individualized care that is nearly non-existent in developing countries.[12]

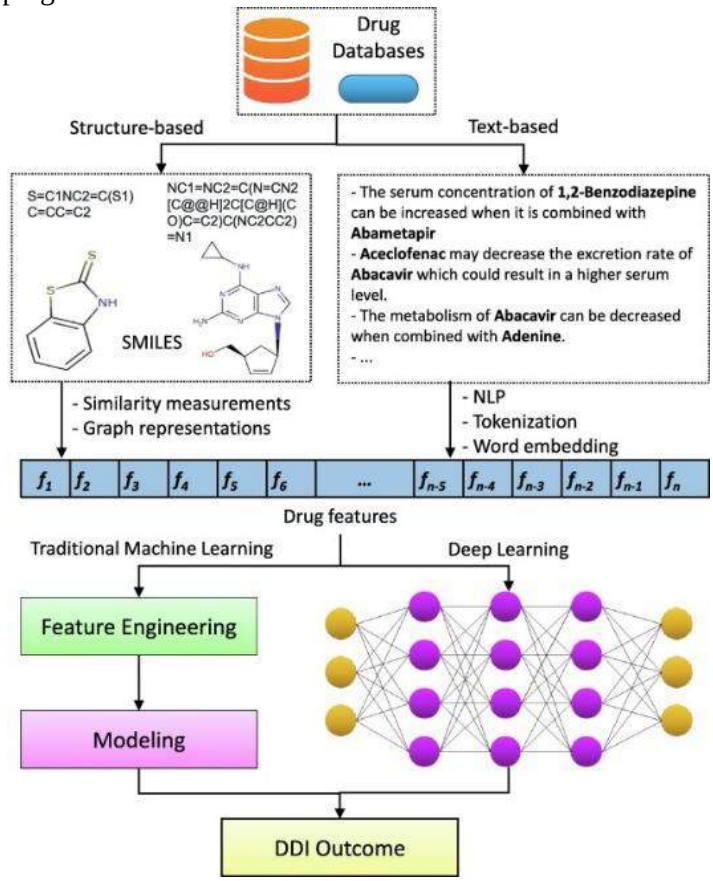

Figure-21: Artificial Intelligence in Drug-Drug Interaction

Regulation: While research on the use of AI in healthcare aims to validate its efficacy in improving patient outcomes before its broader adoption, its use may nonetheless introduce several new types of risk to patients and healthcare providers, such as algorithmic bias, Do not resuscitate implications, and other machine morality issues. AI may also compromise the protection of patients' rights, such as the right to informed consent and the right to medical data protection. These challenges of the clinical use of AI have brought about a potential need for regulations. AI studies need to be completely and transparently reported to have value to inform regulatory approval. Depending on the phase of study, international consensus-based reporting guidelines (TRIPOD+AI, DECIDE-AI, CONSORT-AI) have been developed to provide recommendations on the key details that need to be reported.

Conclusion: With the advent of the big data era, the interest of the international community is focusing on increasing the utilization of medical big data. Many hospitals are attempting to increase the efficiency of their operations and patient management by adopting artificial intelligence (AI) technology that enables the use of electronic medical record (EMR) data. EMR includes information about a patient's health history, such as diagnoses, medicines, tests, allergies, immunizations, treatment plans, personalized medical care, and improvement of medical quality and safety. EMR data can also be used for AI-based new drug development. In particular, it is effective to develop AI that can predict the occurrence of specific diseases or provide individualized customized treatments by classifying the individualized characteristics of patients. In order to improve performance of artificial intelligence research using EMR data, standardization and refinement of data are essential. In addition, since EMR data deal with sensitive personal information of patients, it is also vital to protect the patient's privacy. There are already various supports for the use of EMR data in the Korean government, and researchers are encouraged to be proactive. Various studies and projects have already been conducted to utilize EMR data. In recent years, EMR data have been used in various ways as a data source for AI, and several studies are being conducted on the methodology for additional multi-center expansion.40 However, in order to develop AI that can be used clinically, not only is the correct collection of data essential but also various efforts and policies for clinical use are required. Ultimately, to properly use EMR data for clinical research purposes, it is better to secure the data and check its characteristics in advance so that it can be used for new medical research. In addition, considering the characteristics of the medical field, while using medical data, research should be conducted

with a sense of legal and ethical responsibility of the researcher.36 Only when all of these things are well harmonized and operated, will the use of EMR data be valuable, and consequently, it will be able to contribute to improving the medical services and ultimately, the health of the patients.

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EMBRACE OF ARTIFICIAL INTELLIGENCE WITH MACHINE LEARNING OUTPUTS EXTRAVAGANZA OUTCOME

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Abstract: Artificial Intelligence (AI) is an umbrella term for computer software that mimics human cognition in order to perform complex tasks and learn from them. Machine learning (ML) is a subfield of AI that uses algorithms trained on data to produce adaptable models that can perform a variety of complex tasks.
Keywords: AI, ML

Introduction: Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, and speech recognition and machine vision.

Artificial intelligence (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks. Most AI examples that you hear about today – from chess-playing computers to self-driving cars – rely heavily on deep learning and natural language processing.

Figure-1: Cognition wave controlled by software

Machine learning (ML) is a branch of artificial intelligence research that deals with the development and research of statistical algorithms that can learn from data and generalize to unseen data, thus performing tasks without explicit instructions.[1] Recently, generative neural networks have been able to outperform many previous executions.(ML) approaches have been applied to many fields, including large language models, computer vision, speech recognition, email filtering, agriculture and medicine, where it is too expensive to develop the necessary algorithms to perform the required tasks. For all business problems, ML is known as predictive analytics. Although not all machine learning is based on statistical data, computational statistics is an important source of the field's methods. Some of these types of AI aren't even scientifically possible right now. According to the current system of classification, there are four primary AI types: reactive, limited memory, theory of mind, and self-aware. Artificial intelligence leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. Alan Turing was the first person to carry out substantial research in the field that he called Machine Intelligence. The field of AI research was founded at a workshop held on the campus of Dartmouth College, USA during the summer of 1956. Those who attended would become the leaders of AI research for decades. The history of artificial intelligence (AI) began in antiquity, with myths, stories and rumors of artificial beings endowed with intelligence or consciousness by master craftsmen. The seeds of modern AI were planted by philosophers who attempted to describe the process of human thinking as the mechanical manipulation of symbols. This work culminated in the invention of the programmable digital computer in the 1940s, a machine based on the abstract essence of mathematical reasoning.[2]

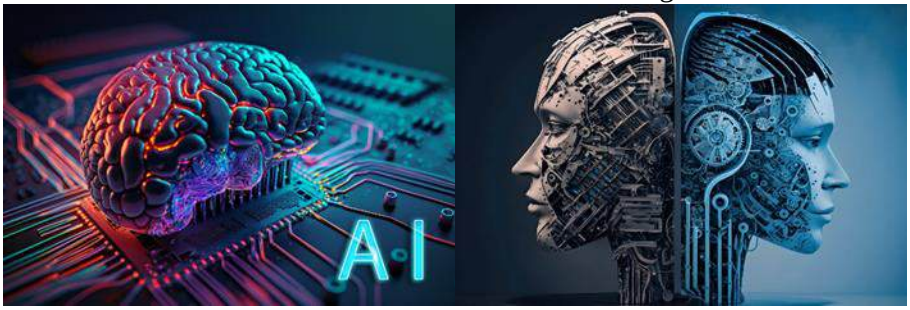

Figure-2: Artificial Intelligence and Machine learning as cognition dual nature

This device and the ideas behind it inspired a handful of scientists to begin seriously discussing the possibility of building an electronic brain. John McCarthy is considered as the Father of Artificial Intelligence. John McCarthy was an American computer scientist. The term "artificial intelligence" was coined by him. He is one of the founder of artificial intelligence, together with Alan Turing, Marvin Minsky, Allen Newell, and Herbert A. The term "AI" could be attributed to John McCarthy of MIT (Massachusetts Institute of Technology), which Marvin Minsky (Carnegie-Mellon University) defines as "the construction of computer programs that engage in tasks that are currently more satisfactorily performed by human beings because they require high-level. John McCarthy (September 4, 1927 – October 24, 2011) was an American computer scientist and cognitive scientist. He was one of the founders of the discipline of artificial intelligence. He co-authored the document that coined the term "artificial intelligence" (AI), developed the programming language family Lisp, significantly influenced the design of the language ALGOL, popularized time-sharing, and invented garbage collection. McCarthy spent most of his career at Stanford University. He received many accolades and honors, such as the 1971 Turing Award for his contributions to the topic of AI,[3] the United States National Medal of Science, and the Kyoto Prize.

Figure-3: John McCarthy, Ada Lovelace and Arthur Samuel [Inventors of AL & ML]

Birth of AI: 1950-1956. The term "mother of AI" is often used figuratively to refer to Ada Lovelace [Augusta Ada King, Countess of Lovelace (10 December 1815 – 27 November 1852) was an English mathematician and writer, chiefly known for her work on Charles Babbage's proposed mechanical general-purpose computer, the Analytical Engine. She was the first to recognize that the machine had applications beyond pure calculation.], an English mathematician and writer who lived in the 19th century. While she is not the literal mother of AI, she is considered the first computer programmer and made significant contributions to the concept of artificial intelligence. History and relationships to other fields.

Birth of ML: 1959. The term machine learning was coined in 1959 by Arthur Samuel, an IBM employee and pioneer in the field of computer gaming and artificial intelligence. The synonym self-teaching computers was also used in this time period. Arthur Lee Samuel (December 5, 1901 – July 29, 1990) was an American pioneer in the field of computer gaming and artificial intelligence. He popularized the term "machine learning" in 1959. The Samuel Checkers-playing Program was among the world's first successful self-learning programs, and as such a very early demonstration of the fundamental concept of artificial intelligence (AI).

Figure-4: AI in Biometrics and Robotics

AI is revolutionizing pharmacy practice by improving medication management, streamlining workflow, and enhancing patient safety and outcomes. Artificial intelligence (AI) is revolutionizing the field of health care and the practice of pharmacy is no exception. AI can also be used to predict a patient's prognosis by analyzing various data sources, including medical images, electronic health records, and genomic data. This can help doctors develop personalized treatment plans for their patients. In addition, AI can assist in drug development for cancer treatment. AI can assist pharmacists in managing their medication inventory, predict medication demand, and identify potential drug interactions and adverse reactions. This can help pharmacists make more informed decisions about prescribed medications and how to manage medication regimens. While AI can never replace pharmacists, it can certainly enhance their ability to deliver

care efficiently. Administrative tasks are an integral part of a pharmacist's responsibilities, and AI can automate these processes to free up more time for patient-centered care. AI-driven platforms streamline communication between pharmacists and clinicians by delivering real-time updates on patient medications, potential drug interactions, and dosage recommendations derived from integrated patient data.

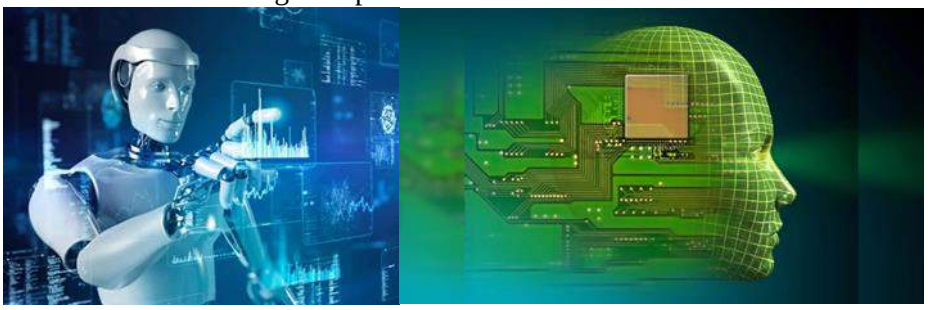

Figure-5: AI in robotics pharmacy

Examples of tasks that a robot could automate are packing drugs in pouches or boxes, loading products on trays or stacking boxes on pallets. Clearly, there are several options for implementing automation through robots within the pharmaceutical industry. Artificial Intelligence (AI) and big data technologies are transforming the pharmaceutical industry by enabling companies to restructure their business models, rationalize biopharma manufacturing, improve financial decisions, reduce human error, increase performance, and boost speed to market.

Disadvantages: Training complications. AI technology needs to be extensively trained with curated data sets in order to perform as expected. Change can be difficult. In any industry, change can prove challenging.

Figure-6: AI in banking & examination

Artificially intelligent computer systems are used extensively in medical sciences. Common applications include diagnosing patients, end-to-end drug discovery and development, improving communication between physician and patient, transcribing medical documents, such as prescriptions, and remotely treating patients. AI chatbots can be integrated with wearable devices such as smart watches to provide insights to both patients and caregivers in improving their behaviour, sleep and general wellness. The extensive application of AI-based technology in the defense sector covers many functions and possibilities such as training, surveillance, logistics, cybersecurity, UAV, advanced military weaponry like LAWS, autonomous combat vehicles & robots. Artificial intelligence (AI)-enabled smart watches continuously monitor the heart rate, which potentially helps to diagnose unwarranted rhythm and irregularity problems such as tachycardia, bradycardia, and fibrillation.

Figure-7: AI Smart watches

AI can be used to verify the identity of students and to detect if they are using unauthorized materials. AI can also be used to detect patterns of cheating, such as groups of students giving the same answers to questions. Overall, AI has the potential to make online exams more efficient, secure, and fair. AI can be used in proctoring software to track eye movements, facial expressions, and keyboard strokes to detect anomalies during online exams. Moreover, AI-based text analysis tools can identify subtle changes in a student's writing style, indicating potential AI-assisted cheating.

Figure-8: AI in drug store and microbiology lab

Machine learning (ML) is a field of study in artificial intelligence concerned with the development and study of statistical algorithms that can learn from data and generalize to unseen data, and thus perform tasks without explicit instructions. Recently, generative artificial neural networks have been able to surpass many previous approaches in performance.

Figure-9: AI in ANN and Gaming

Figure-10: AI in Agriculture & Oceanography

Machine learning approaches have been applied to many fields including large language models, computer vision, speech recognition, email filtering, agriculture, and medicine, where it is too costly to develop algorithms to perform the needed tasks. ML is known in its application across business problems under the name predictive analytics.

Figure-11: AI with ML in Banking & Transaction

Although not all machine learning is statistically based, computational statistics is an important source of the field's methods. There are four basic types of machine learning: supervised learning, unsupervised learning, semi supervised learning and reinforcement learning. The type of algorithm data scientists choose depends on the nature of the data. Machine learning is used in internet search engines, email filters to sort out spam, websites to make personalized recommendations, banking software to detect unusual transactions, and lots of apps on our phones such as voice recognition.

Figure-12: AI in Robotic Surgery

Machine learning involves showing a large volume of data to a machine so that it can learn and make predictions, find patterns, or classify data. The three machine learning types are supervised, unsupervised, and reinforcement learning. The term machine learning was coined in 1959 by Arthur Samuel, an IBM employee and pioneer in the field of computer gaming and artificial intelligence. The father of machine learning is Geoffrey Everest Hinton.

Figure-13: AI in DNA Fingerprinting & Engineering

Geoffrey Everest Hinton CC FRS FRSC (born 6 December 1947) is a British-Canadian computer scientist and cognitive psychologist, most noted for his work on artificial neural networks. From 2013 to 2023, he divided his time working for Google (Google Brain) and the University of Toronto, before publicly announcing his departure from Google in May 2023, citing concerns about the risks of artificial intelligence (AI) technology. In 2017, he co-founded and became the chief scientific advisor of the Vector Institute in Toronto.

Figure-14: Geoffrey Everest Hinton

The simplest way to understand how AI and ML relate to each other is: AI is the broader concept of enabling a machine or system to sense, reason, act, or adapt like a human. ML is an application of AI that allows machines to extract knowledge from data and learn from it autonomously. Correlation, in the context of AI, refers to the statistical relationship between two or more variables. It helps us understand how changes in one variable relate to changes in another. This relationship allows AI systems to make accurate predictions and decisions based on available data.

Conclusion: Advancements in AI for applications like natural language processing (NLP) and computer vision (CV) are helping industries like financial services, healthcare, and automotive accelerate innovation, improve customer experience, and reduce costs. A correlation is the statistical summary of the relationship between two sets of variables. It is a core part of data exploratory analysis, and is a critical aspect of numerous advanced machine learning techniques. Machine learning is an application of AI. It's the process of using mathematical models of data to help a computer learn without direct instruction. This enables a computer system to continue learning and improving on its own, based on experience.

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FOCUS OF ARTIFICIAL INTELLIGENCE ON DRONE AS UNMANNED AERIAL VEHICLE FOR MANKIND

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Abstract: There are two meanings for drone then: a "male bee," or a "monotonous, sustained sound." The aircraft's function can clue you in: it's an extension of the "bee" meaning. Drones are bigger and heavier than worker bees, and they leave the hive and swarm in the fall. These can be used to transfer organs from donor to patient, often between 4 to 36 hours depending on the type of organ. These could make organ delivery faster, safer and more cost-effective. Drones can be used to deliver medical supplies cost-effectively to people residing in remote areas and those affected by natural disasters or emergencies. Drones can also be used inside hospitals for delivering biological samples or medicines from floor to floor or from building to building. Potential applications of UAVs in healthcare are broad based.

Keywords: UAV, Prehospital Emergency Care, Laboratory Diagnostic Testing, Surveillance, Vaccines, Haematological products, External defibrillators, Cloud computing.

Introduction: Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems. Drone technology has evolved and thrived in recent years, from technically staffing critical military regions to enticing enthusiasts all over the world. Individuals, businesses, and governments have realized that drones have a variety of valuable qualities, including:

- Aerial photography for journalism and film
- Express shipping and delivery
- Gathering information or supplying essentials for disaster management
- Thermal sensor drones for search and rescue operations
- Geographic mapping of inaccessible terrain and locations
- Building safety inspections
- Precision crop monitoring
- Unmanned cargo transport
- Law enforcement and border control surveillance
- Storm tracking and forecasting hurricanes and tornadoes

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without any human pilot, crew, or passengers on board. One of the primary roles of AI in drone technology is autonomous flight. AI algorithms can enable drones to fly autonomously without the need for human intervention. Autonomous flight enables drones to cover larger areas and perform tasks more efficiently.[1]

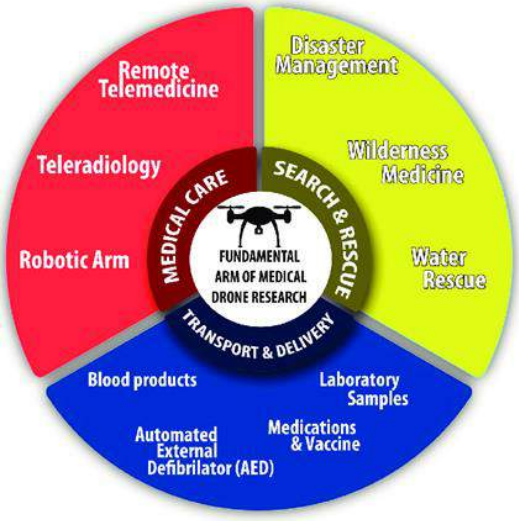

Figure-1: Drones

Drones are small or medium-sized unmanned aerial vehicles (UAVs). They're unique in that they can drive remotely and autonomously, and they're capable of maintaining a controlled, sustained level of flight.[2]
The first unmanned aircraft was created 16 years after the flight of the Wright's brothers. The drone, called Ruston Proctor Aerial Target. There are few prototypes that were developed through World War I, World War II and Cold War. Drones then evolved via military applications. DJI currently dominates more than 70% of the global drone market. According to a report by Drone Industry Insights, the market is expected to grow from $30.6 billion in 2022 to $55.8 billion by 2030. The Shenzhen-based company was formed in 2006 out of a college dorm room by its founder Frank Wang. Drones have been successfully used for the rapid and safe transportation of organs. They provide an advantage over traditional methods by avoiding traffic, reducing transportation time, and thus increasing the viability of the organ for transplant. Medical drones can deliver items such as drugs, serum and small medical devices quickly and to remote areas. Where retailers are still testing drones for the delivery of large packages to their customers, medical drones are already being used in developing countries.
They include (1) Prehospital Emergency Care, (2) Expediting Laboratory Diagnostic Testing and (3) Surveillance. Currently, UAVs have been shown to deliver vaccines, haematological products and automated external defibrillators. These are fixed-wing drones have rigid wings and can carry high-density payloads and data link equipment. Based on utility and size, these are further categorized as large, medium and small fixed-wing drones. Drone delivery of medical supplies, Meghalaya. Conducted its drone delivery trial in November 2021. From Nongstoin to Maweit PHC and is the first State in. The country to set up a functioning drone station that. **Keller Rinaudo** is the CEO and co-founder of Zipline, a drone delivery company that delivers life-saving medicine to remote places. The company began by focusing on delivering blood for urgent medical situations. **Keller Rinaudo Cliffton** is an American robotics and autonomous airplane entrepreneur and the CEO and a co-founder of Zipline.[3]

Figure-2: Keller Rinaudo [CEO]

Report Overview: The global commercial drone market size was estimated at USD 19.89 billion in 2022 and is expected to grow at a compound annual growth rate (CAGR) of 13.9% from 2023 to 2030. The market growth is attributed to the increasing enterprise application of drones across various industry verticals.
Here's a rundown of the four main types of drones, their uses, their strengths and weaknesses:

- **Multi-Rotor Drones.**
- **Fixed-Wing Drones.**
- **Single-Rotor Drones.**
- **Fixed-Wing Hybrid VTOL.**

Drone swarms and indoor operations are only permitted with drones in the Nano and Micro categories. Only approved regions and conditions approved by the DGCA [Directorate General of Civil Aviation] are permitted for swarm operations. Drones in the small, medium and large categories should not be flown in enclosed spaces.[4]
Organ delivery drones are able to carry freight up to 180kg. These drones are designed to transport vital organs such as hearts, kidneys, and livers from one location to another in a safe and efficient manner. Drones are able to transport objects on relatively short distances. Drone delivery will increase in 2023. Drones will be altering the way goods and services are delivered across a variety of industries. Drone technology improvements have made it possible for businesses to benefit from this new method of transportation to enhance operations and maximize productivity. The Meghalaya government in partnership with Startup Tech.

Figure-3: Drone controller

Eagle has unveiled Asia's first drone delivery hub and network Meghalaya Drone Delivery Network (MDDN), which is aimed at providing universal access to healthcare for the people in the state. Early last year, Bengaluru-based food delivery firm Swiggy called for bids in the drone-as-a-service (DaaS) market for its grocery service - Instamart. It selected Garuda Aerospace, Marut Dronetech and Skye Air Mobility for running pilots.[5]

Drone Operating System: Drone System is also called as UAV (Unmanned aerial Vehicle). Mainly drone is a flying robot that can be remotely configured or run on the basis via the software application controlled flight plans in their embedded system working in conjunction with onboard sensors & GPS. A real-time operating system (RTOS) is an operating system that provides precise time constraints for the execution of tasks, enabling it to be much more predictable than general-purpose operating systems. RTOSes are divided into two general categories – soft and hard. Software is used to analyze, process and enhance images captured by drone and unmanned vehicle camera payloads. Image processing software can be used to extract features from images for intelligence, or to create geospatial and photogrammetry products such as maps and 3D models. Drones, UGVs and unmanned marine vessels may make use of AI (artificial intelligence) software such as deep learning algorithms, either via onboard computing platforms or cloud services. This may be used to carry out functions such as autonomous navigation, obstacle avoidance and image recognition. Drone is an Embedded Operating System for writing real-time applications in Rust. It aims to bring modern development approaches without compromising performance into the world of embedded programming. By far, the most popular software platform for drone mapping that you can download and use for free is WebODM. This is open-source software that has been around for a few years and has been improved vastly by its active user community. Drones rely on a combination of hardware and software components to achieve successful takeoff, flight and landing. Drones are often equipped with rotors or fixed wings, sensors, navigation systems and gyroscopes (for stability), and are operated by ground control stations. The code for drone programming is written in both C and C++. C is strongly associated with UNIX, as it was developed to write the UNIX operating system. C is a function-driven language because C is a procedural programming language. Therefore, for advancement, when required, C++ programming language is used. In python, the pymavlink library defines the MAVLink messages in python form. The dronekit python library uses pymavlink and establishes a connection with the drone. This allows direct control of the drone right from a python script, so any MAVLink drone is therefore a programmable drone. One of the primary roles of AI in drone technology is autonomous flight. AI algorithms can enable drones to fly autonomously without the need for human intervention. Autonomous flight enables drones to cover larger areas and perform tasks more efficiently. Drone APIs let you write code to control and integrate with PX4-powered vehicles, without having to understand intimate details of the vehicle and flight stack, or having to think about safety-critical behaviour.

Drone type	Advantage
Multi-rotor drones	Easy to control and maneuver VTOL [vertical take-off and landing (VTOL) aircraft] and hover flight Often lower price Portability. They are called multi-rotor because they have more than one motor, more commonly tricopters (3 rotors), quadcopters (4 rotors), hexacopters (6 rotors) and octocopters (8 rotors), among others. By far, quadcopters are the most popular multi-rotor drones. Two multi-rotor drones flying at height.
Fixed-wing drones	Longer flight time Can carry a heavier payload Greater stability in the wind Higher flight speeds. A fixed-wing drone has one rigid wing that is designed to look and work like an aeroplane, providing the lift rather than vertical lift rotors. Hence, this drone type only needs the energy to move forward and not to hold itself in the air. This makes them energy-efficient.

Single-rotor drones	Single-rotor drones are very durable and robust and have a long flight time. If a gas engine is used, the flight time can be extended. Due to their construction they can transport heavy loads. The rotating rotors allow the machine to stay in the air and make various manoeuvres.
Fixed-Wing Hybrid VTOL	Hybrid VTOL Fixed-Wing UAVs combine the benefits of multirotor platforms with fixed-wing drones and transition between the two modes during flight. VTOL fixed-wing drones are a versatile choice for a wide range of commercial and military aerial applications.

Table-1: Drone classification

The flight controller is the brain of a drone. A small box filled with intelligent electronics and software, which monitors and controls everything the drone does. And just like the brains of different organisms, flight controllers also vary in sizes and complexity. Drone controllers work by sending commands or instructions to the drone. The controller sends these commands via a radio signal, which is then received by the drone's receiver. The receiver then converts the signal into the appropriate commands to control the drone's movements. Drones work much like other modes of air transportation, such as helicopters and airplanes: the engine is turned on, it starts up, and the propellers rotate to enable flight. Then, the pilot uses the remote control to direct its flight from the ground. Many drones have the option to set a course automatically. Photogrammetry software uses images captured by a drone to create 2D and 3D maps, models, and orthomosaics. Photogrammetry software creates realistic 3D depictions of topographic surfaces by merging geotagged images of the same features from multiple perspectives. Sky-Drones Cloud is tightly integrated with all hardware and software products including autopilots and SmartLinks. The data transmitted from drone to ground station is also available in the cloud. Data can be synced either post flight or during the flight with LTE connectivity.

Use: It is directly benefiting over 5.19 lakh people by improving healthcare accessibility and creating local employment in the drone delivery ecosystem. Drones have also significantly reduced delivery times and improved the quality of medical care in remote areas. The top industries using drones include real estate, agriculture, construction, law enforcement, shipping and logistics, and security. The industry using drones the most out of all of these might surprise you. Beyond surveillance and delivery applications, UAVs are used for drone journalism, search and rescue, disaster response, asset protection, wildlife monitoring, firefighting, communications relay, healthcare and agriculture. An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without any human pilot, crew, or passengers on board. UAVs were originally developed through the twentieth century for military missions too "dull, dirty or dangerous" for humans, and by the twenty-first, they had become essential assets to most militaries. As control technologies improved and costs fell, their use expanded to many non-military applications. These include aerial photography, precision agriculture, forest fire monitoring, river monitoring, environmental monitoring, policing and surveillance, infrastructure inspections, smuggling, product deliveries, entertainment, and drone racing.[6]

Group	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Size	Small	Medium	Large	Larger	Largest
Max take-off weight	< 20 lb	> 20 & < 55	> 55 & < 1320 lb	>1,320 lb	>1,320 lb
Operating altitude	< 1,200 ft	< 3,500 ft	< 18,000 ft	< 18,000 ft	> 18,000 ft
Speed	45mph	70mph	100mph	135mph	179mph

Table-2: Capacity of drones

UAVs may be classified like any other aircraft, according to design configuration such as weight or engine type, maximum flight altitude, degree of operational autonomy, operational role, etc. According to the USDD [United States Department of Defense], UAVs are classified into five categories below:

Group-5: These UAS weigh more than 1320 pounds; normally. Operate higher than 18,000 feet MSL at any speed (Reaper, Global. Hawk/Triton, UCLASS) Groups 4 and 5 are the largest of DoD UAS, weighing over 1,320 pounds, and operating at all speeds and altitudes.[7]

Group-4: These aircraft operate at all altitudes, usually below 18,000 feet MSL.

Group-3: The growing interest in UAVs in recent years has led to the strong emergence of various types of aircraft with varying configurations and components in terms of shape and size. UAVs are divided into four types: single-rotor, multi-rotor, fixed-wing, and hybrid. These UAS weigh more than 55 pounds, but less than 1320 pounds.

Group-2: UAS typically are in the 21 – 55 pound weight class; normally operate below 3500 feet AGL at speed less than 250 knots.

Group-1: UAS typically less than 20 pounds in weight; normally. Operate below 1200 feet above ground level (AGL) at speeds less than. 250 knots (Raven).

Future: The Indian drone industry, valued at Rs 2,900 crore in 2022, is projected to grow to Rs 81,600 crore by 2025 and Rs 2.95 lakh crore by 2030, with a 60% hardware indigenization (according to a FICCI-EY report in 2022). The global commercial drone market growth was valued at USD 8.77 billion in 2022 and is projected to grow from USD 10.98 billion in 2023 to USD 54.81 billion by 2030, exhibiting a CAGR of 25.82% during the forecast period.[8]

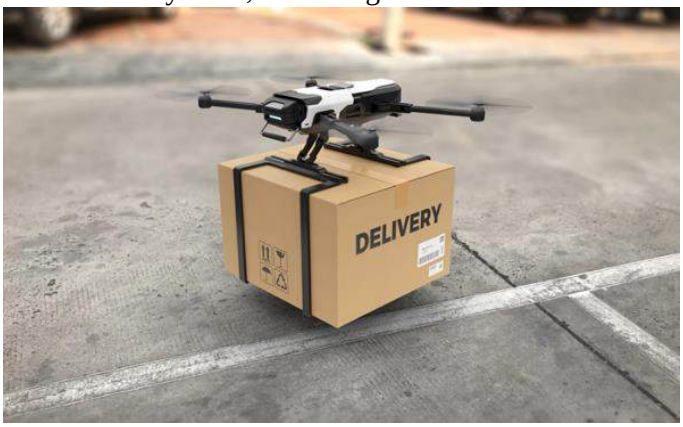

Figure-4: Domestic drone

Abraham Karem (Baghdad, Born 1937) is a designer of fixed and rotary-wing unmanned aircraft. He is regarded as the founding father of UAV (drone) technology. Abraham Karem (born 1937) is a designer of fixed and rotary-wing unmanned aircraft. He is regarded as the founding father of UAV (drone) technology.[9]

Nishant Unmanned Aerial Vehicle (UAV) developed by DRDO for Indian Army was successfully flight tested near Kolar on 20 June 2008. Nishant has completed development phase and user trials. The present flight tests are pre confirmatory trials before induction into services. The first pilotless vehicles were developed in Britain and the USA during the First World War. Britain's Aerial Target, a small radio-controlled aircraft, was first tested in March 1917 while the American aerial torpedo known as the Kettering Bug first flew in October 1918.

Benefits: Let's take a closer look—here are the five biggest benefits construction operations are realizing from using drones in their work.[10]

Savings. Using drones in your construction work can help you save money.

Safety.

Improved Data = Improved Decision Making.

Better Planning.

Make Your Operations More Scalable and Repeatable.

Figure-5: Abraham Karem

Advantages: Drones can also be used to study and monitor protected species that are dangerous or inhabit hard-to-reach areas. Conservationists can more easily prevent poaching and deforestation. With drones, the cost of research and surveys can be cut, and areas can be covered quickly without hiring additional specialist teams. Drones, sometimes referred to as unmanned aerial vehicles (UAVs), carry out tasks that range from the mundane to the ultra-dangerous. These robot-like aircrafts can be found rescuing avalanche victims as well as dropping off groceries at your doorstep — and almost everywhere in between. Enhanced Efficiency and Cost Savings: One of the primary advantages of UAVs lies in their ability to complete tasks quickly and efficiently. Compared to traditional methods that often require manual labor or extensive resources, drones can accomplish the same tasks in a fraction of the time.[11]

The Pros and Cons of Drone Technology

PROS: Drones are fun to fly.

CONS: Not everyone takes kindly to seeing drones fly near or above them.

PROS: Drones are cheaper and easier to deploy than manned aircraft.

CONS: Drones can cause damage to property and injury to people.

Disadvantages: Drones can capture images, video, and other data from private property, potentially violating an individual's right to privacy. In some cases, drones may even be used to collect data on individuals without their knowledge or consent, leading to concerns about the potential misuse of this information.

Development of hundreds of more uses of drones are underway due to the multiple investments pouring into this promising industry everyday.[12]

Figure-6: Military drone & Agriculture drone

Military Drone Technology: The military is probably the oldest, most well-known, and most contentious application of drones. In the early 1940s, the British and American forces began utilizing extremely crude kinds of drones to spy on the Axis powers. Drones today are far more advanced than UAVs of the past, including thermal imaging, laser range finders, and even airstrike instruments. The MQ-9 Reaper is a well-known military drone. The aircraft is 36 feet long, can travel 50,000 feet in the air undetected, and is outfitted with a variety of missiles and intelligence gathering systems.[13]

Delivery Drone Technology: Delivery drones are typically unmanned aerial vehicles (UAVs) that bring meals, packages, or commodities to your front door. These flying vehicles are known as “last mile” delivery drones because they make deliveries from nearby retailers or warehouses. Instead of depending on delivery drivers with inefficient trucks, retailers and grocery chains throughout the country are turning to drones as a more effective delivery alternative. These drones can deliver 55 pounds of items to your front door without requiring you to leave the house. Amazon, Walmart, Google, FedEx, UPS, and many other major corporations are all testing various types of delivery drones.

Drone for Emergency Public Rescue: Due to the scale or severity of the disaster, it is not always safe to send humans into a rescue situation. This is where drones come into play. In the event of a capsized boat or a drowning person, officials can deploy an Autonomous Underwater Vehicle (AUV) to assist in the rescue.[14]

Drone for Agriculture: Drones have also shown to be advantageous to the agriculture business, providing farmers with a variety of options for optimizing their crops to maximize efficiency and minimize physical strain. UAVs make field surveys, sowing across fields, tracking livestock, and predicting crop yields easier while saving agriculture workers important time.[15]

Figure-7: Outer space drone & Wildlife conservation drone

Drone for Outer Space: NASA and the United States Air Force have been testing unmanned aircraft designed for space flight. The Air Force’s ultra-secretive X-37B UAV looks like a small space shuttle. It has been quietly circling the Earth for the past two years, setting a record for the longest unmanned aircraft flight (781 days and counting). Although the

Air Force has been ambiguous, it has stated that “the primary objectives of the X-37B are twofold: reusable spacecraft technologies for America’s future in space and operating experiments that can be returned to, and examined on Earth.” When it comes to the future of space exploration and innovation, it appears that drones have been prioritized.[16]

Drone for Wildlife and Historical Conservation: Drones are a less expensive and more efficient way to conserve wildlife. With humans on the ground, tracking wildlife populations is practically difficult. The ability to track travelling groups of animals, ranging from Orangutans in Borneo to Bison on the Great Plains, allows wildlife conservationists to gain a better understanding of the health of their species and ecosystems. Conservation drones are also useful in the fight against poaching in Asia and Africa.[17]

Drones are also being employed in global forestry projects. These drones scan the forest floors of burned-out forests, dropping seed vessels containing seeds, fertilizers, and nutrients that will help a tree rise from the ashes. Since the early 1990s, there has been around 300 million acres of deforested land. What would take humans approximately 300 years to reforest can be performed more efficiently with seed-planting drone technology.

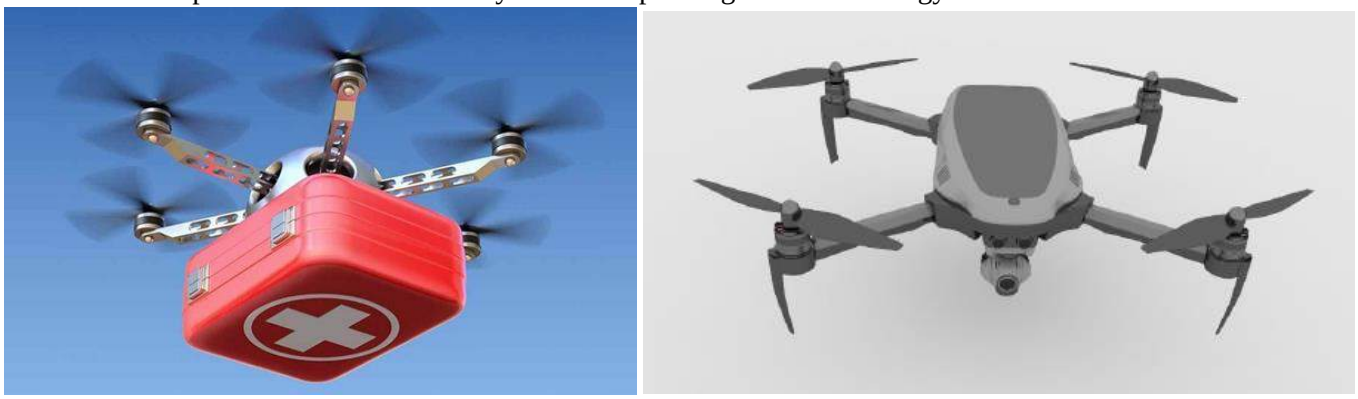

Figure-8: Medical & 3D modelling drone

Drone in Medicine: How do you get medical supplies to people who live in remote areas? What device could you utilize to transport organs to transplant patients? Drones can address both of those questions. Unmanned aerial vehicles are now being utilized to carry emergency medical supplies and goods to remote villages in Alaska. Instead of depending on dog sleds, snowmobiles, or ambulances that can’t manage the snow, Alaskans are turning to drones to get life-saving medical supplies delivered promptly.

Drones are also being used to transport donated organs to transplant recipients. A kidney was recently moved from one hospital in Maryland to another in under five minutes using a specially designed drone. This has the potential to reduce the painfully sluggish rate at which donations typically arrive (if they arrive at all). Organs are typically supplied through chartered or commercial flights. Delays and failures in judgement create dangerous two-hour or longer delays for 4% of all organ deliveries. Drones can significantly reduce time while also providing a safer and more secure means of organ transportation.[18]

Drone for 3D Modeling: LiDAR drones are equipped with LiDAR sensors, which survey landscapes and collect detailed data that can be used to create 3D models. Drones with LiDAR technology can provide significantly more accurate data than drones without the technology. Aside from making it easier for drones to navigate varied surfaces, LiDAR allows them to locate targets in search and rescue missions, evaluate crops in agriculture, and many other things.

Drone for Photography: Drones have been a benefit to aerial photographers who employ UAVs to get expansive shots. Have you ever wanted to have a bird’s-eye view of your favorited city, beach, or building? There are drones designed exclusively for photography that offer a different perspective on some of your favorite locations. For instance, an AI-powered drone can analyze data from its sensors, such as cameras and lidar, to identify objects and terrain features. It can then use this information to make decisions about where to fly, how to avoid obstacles, and how to complete its mission.[19]

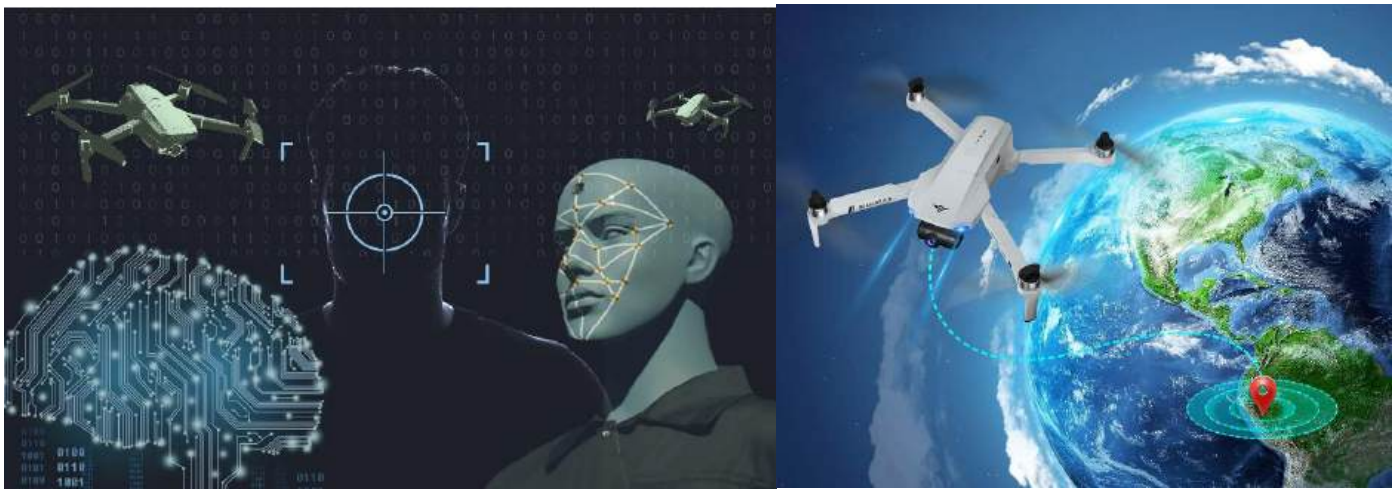

Figure-9: Drone with Artificial Intelligence

Artificial intelligence gives machines the ability to interact in an intelligent way. This is why the fusion between drones and artificial intelligence represents the response to many needs in aerial imagery and provides new headlines in the future of aerial technology for different sectors like Energy, Construction, Security, Agriculture. Thanks to its expertise in artificial intelligence, DRONE VOLT offers solutions based on drone, computer vision and neural networks, like:

- Object detection, counting, segmentation and tracking
- Person or animal detection and tracking
- Crowd counting
- Thermal detection
- Check compliance of the use of face masks in public spaces and in professional places
- Detection of the use of protective equipment (glasses and helmets)
- Face detection and recognition
- Fire and smoke detection
- License plate reading
- Crack damage detection on surfaces

Figure-10: Multifunctioning Drone

Drones with AI can also be used in the military. For example, they can monitor border regions, identify threats, and notify response teams. In addition, they can improve the security of military bases and the safety of soldiers during combat. AI plays a crucial role in enabling drones to make intelligent decisions in real-time. By leveraging advanced algorithms and machine learning techniques, drones equipped with AI can analyze their surroundings, detect obstacles, and autonomously plot the most efficient flight path to reach their destination. Autonomous drones are UAVs (unmanned aerial vehicles) that use AI-powered software for navigation and operations. AI enables drones to take auto Michigan Medicine recently announced its new partnership with Zipline, a San Francisco-based service that uses drones to deliver prescription drug orders to members' homes. The service is slated to begin in 2024.nomous flights and collect and analyze real-time high-quality visual information for many real-world tasks.[20]

Conclusion: Use of unmanned drones is feasible for delivery of life-saving medical supplies in austere environments. Drones repeatedly and accurately delivered medical supplies faster than other methods without additional risk to personnel or manned airframe. Drones and unmanned aircraft will be used by numerous enterprises and government

agencies. Complementary technologies such as 5G, augmented reality, and computer vision are likely to drive drone market growth and improve drone communication and intelligence. As the usage of personal and commercial drones grows, government agencies will refine their laws and restrictions. Drones will also provide new security flaws and attack vectors. With the integration of Artificial Intelligence (AI), drones have become even more versatile, efficient, and accurate in performing complex tasks. AI algorithms enable drones to perform tasks such as object recognition, navigation, and data analysis with greater speed and accuracy.

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ARTIFICIAL (A- ATTRACTIVE, R- READY FOR ANY TIME, T- THERAPEUTIC, I- INTELLIGENCE, F- FIGHTS FOR LIFE, I- INSIDE THE BODY, C- COMPUTING, I- INTERACTIVE, A- ALMOST THE GOD, L- LASTS LONG) INTELLIGENCE: READY FOR THE GREATER GOOD OF MEDICAL SCIENCE

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Abstract: ***Artificial intelligence in healthcare is an overarching term used to describe the use of machine-learning algorithms and software, or artificial intelligence (AI), to mimic human cognition in the analysis, presentation, and comprehension of complex medical and health care data. Specifically, AI is the ability of computer algorithms to approximate conclusions based solely on input data. What distinguishes AI technology from traditional technologies in health care is the ability to gather data, process it and give a well-defined output to the end-user. AI does this through machine learning algorithms and deep learning. These algorithms can recognize patterns in behavior and create their own logic. To gain useful insights and predictions, machine learning models must be trained using extensive amounts of input data. AI algorithms behave differently from humans in two ways: (1) algorithms are literal: once a goal is set, the algorithm learns exclusively from the input data and can only understand what it has been programmed to do, (2) and some deep learning algorithms are black boxes; algorithms can predict with extreme precision, but offer little to no comprehensible explanation to the logic behind its decisions aside from the data and type of algorithm used.***

Keywords: AI algorithm, Health application

Overview: The primary aim of health-related AI applications is to analyze relationships between prevention or treatment techniques and patient outcomes. AI programs are applied to practices such as diagnosis processes, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. AI algorithms can also be used to analyze large amounts of data through electronic health records for disease prevention and diagnosis. Medical institutions such as The Mayo Clinic, Memorial Sloan Kettering Cancer Center, and the British National Health Service, have developed AI algorithms for their departments. Large technology companies such as IBM and Google, have also developed AI algorithms for healthcare. Additionally, hospitals are looking to AI software to support operational initiatives that increase cost saving, improve patient satisfaction, and satisfy their staffing and workforce needs. Currently, the United States government is investing billions of dollars to progress the development of AI in healthcare. Companies are developing technologies that help healthcare managers improve business operations through increasing utilization, decreasing patient boarding, reducing length of stay and optimizing staffing levels.

As widespread use of AI in healthcare is relatively new, there are several unprecedented ethical concerns related to its practice such as data privacy, automation of jobs, and representation biases.

History

Research in the 1960s and 1970s produced the first problem-solving program, or expert system, known as Dendral. While it was designed for applications in organic chemistry, it provided the basis for a subsequent system MYCIN, considered one of the most significant early uses of artificial intelligence in medicine. MYCIN and other systems such as INTERNIST-1 and CASNET did not achieve routine use by practitioners, however.

Figure-1: Artificial Intelligence

The 1980s and 1990s brought the proliferation of the microcomputer and new levels of network connectivity. During this time, there was a recognition by researchers and developers that AI systems in healthcare must be designed to accommodate the absence of perfect data and build on the expertise of physicians. Approaches involving fuzzy set theory, Bayesian networks, and artificial neural networks, have been applied to intelligent computing systems in healthcare.

Medical and technological advancements occurring over this half-century period that have enabled the growth healthcare-related applications of AI include:

1. Improvements in computing power resulting in faster data collection and data processing
2. Growth of genomic sequencing databases
3. Widespread implementation of electronic health record systems
4. Improvements in natural language processing and computer vision, enabling machines to replicate human perceptual processes
5. Enhanced the precision of robot-assisted surgery
6. Improvements in deep learning techniques and data logs in rare diseases

Current research

Various specialties in medicine have shown an increase in research regarding AI. As the novel coronavirus ravages through the globe, the United States is estimated to invest more than $2 billion in AI related healthcare research over the next 5 years, more than 4 times the amount spent in 2019 ($463 million).

Dermatology

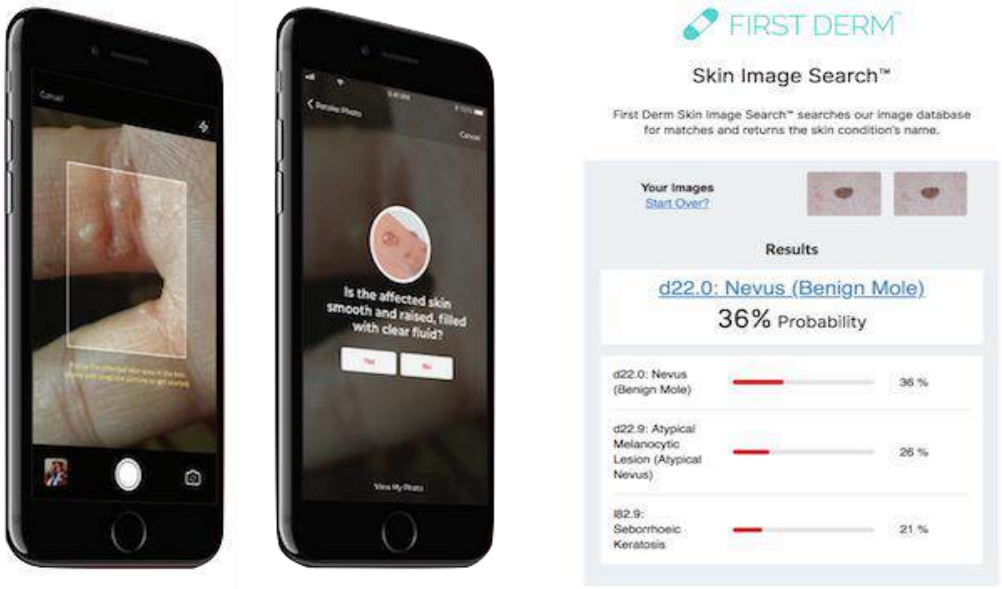

Figure-2: Artificial Intelligence In Dermatology

Dermatology is an imaging abundant speciality and the development of deep learning has been strongly tied to image processing. Therefore there is a natural fit between the dermatology and deep learning. There are 3 main imaging types in dermatology: contextual images, macro images, micro images. For each modality, deep learning showed great progress. Han et. al. showed keratinocytic skin cancer detection from face photographs. Esteva et al. demonstrated dermatologist-level classification of skin cancer from lesion images. Noyan et. al. demonstrated a convolutional neural network that achieved 94% accuracy at identifying skin cells from microscopic Tzanck smear images.

Radiology

AI is being studied within the radiology field to detect and diagnose diseases within patients through Computerized Tomography (CT) and Magnetic Resonance (MR) Imaging. The focus on Artificial Intelligence in radiology has rapidly increased in recent years according to the Radiology Society of North America, where they have seen growth from 0 to 3, 17, and overall 10% of total publications from 2015-2018 respectively. A study at Stanford created an algorithm that could detect pneumonia in patients with a better average F1 metric (a statistical metric based on accuracy and recall), than radiologists involved in the trial. Through imaging in oncology, AI has been able to serve well for detecting abnormalities and monitoring change over time; two key factors in oncological health. Many companies and vendor neutral systems such as icometrix, QUIBIM, Robovision, and UMC Utrecht's IMAGRT have become available to provide a trainable machine learning platform to detect a wide range of diseases. The Radiological Society of North

America has implemented presentations on AI in imaging during its annual conference. Many professionals are optimistic about the future of AI processing in radiology, as it will cut down on needed interaction time and allow doctors to see more patients. Although not always as good as a trained eye at deciphering malicious or benign growths, the history of medical imaging shows a trend toward rapid advancement in both capability and reliability of new systems.

Figure-3: Artificial Intelligence In Radiology

The emergence of AI technology in radiology is perceived as a threat by some specialists, as it can improve by certain statistical metrics in isolated cases, where specialists cannot.

Screening

Figure-4: Artificial Intelligence In Screening

Recent advances have suggested the use of AI to describe and evaluate the outcome of maxillo-facial surgery or the assessment of cleft palate therapy in regard to facial attractiveness or age appearance.

In 2018, a paper published in the journal Annals of Oncology mentioned that skin cancer could be detected more accurately by an artificial intelligence system (which used a deep learning convolutional neural network) than by dermatologists. On average, the human dermatologists accurately detected 86.6% of skin cancers from the images, compared to 95% for the CNN machine.

In January 2020 researchers demonstrate an AI system, based on a Google DeepMind algorithm, that is capable of surpassing human experts in breast cancer detection.

In July 2020 it was reported that an AI algorithm by the University of Pittsburgh achieves the highest accuracy to date in identifying prostate cancer, with 98% sensitivity and 97% specificity.

Psychiatry

Figure-5: AI In Psychiatry

In psychiatry, AI applications are still in a phase of proof-of-concept. Areas where the evidence is widening quickly include chatbots, conversational agents that imitate human behaviour and which have been studied for anxiety and depression.

Challenges include the fact that many applications in the field are developed and proposed by private corporations, such as the screening for suicidal ideation implemented by Facebook in 2017. Such applications outside the healthcare system raise various professional, ethical and regulatory questions.

Primary care

Primary care has become one key development area for AI technologies. AI in primary care has been used for supporting decision making, predictive modelling, and business analytics. Despite the rapid advances in AI technologies, general practitioners' view on the role of AI in primary care is very limited–mainly focused on administrative and routine documentation tasks.

Disease diagnosis

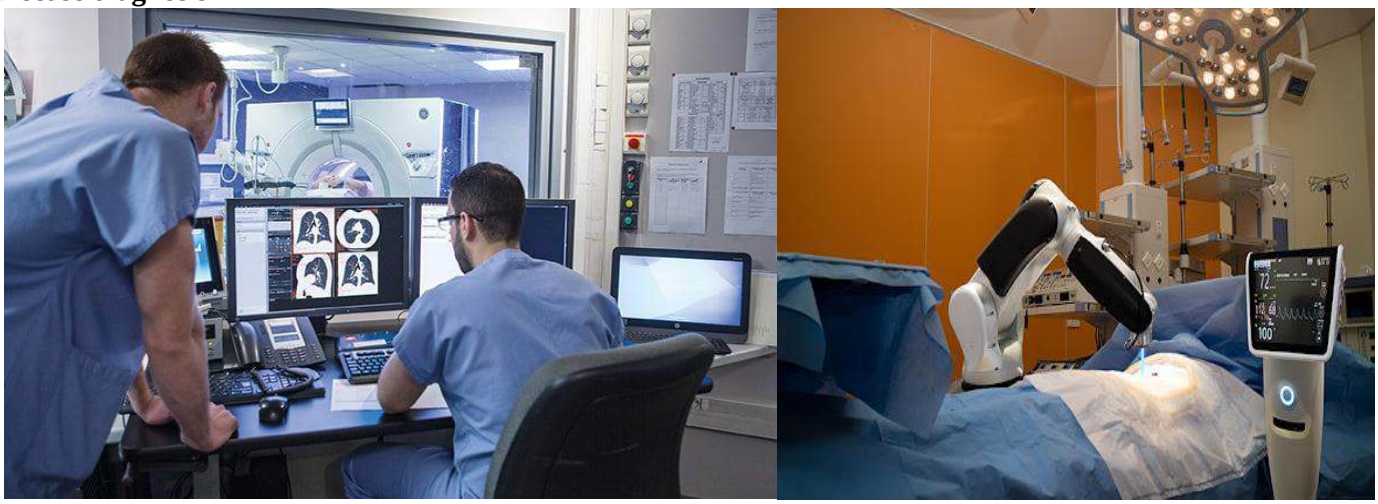

Figure-6: AI In Disease Diagnosis

An article by Jiang, et al. (2017) demonstrated that there are several types of AI techniques that have been used for a variety of different diseases, such as support vector machines, neural networks, and decision trees. Each of these techniques is described as having a "training goal" so "classifications agree with the outcomes as much as possible…". To demonstrate some specifics for disease diagnosis/classification there are two different techniques used in the classification of these diseases include using "Artificial Neural Networks (ANN) and Bayesian Networks (BN)". It was found that ANN was better and could more accurately classify diabetes and CVD.

Through the use of Medical Learning Classifiers (MLC's), Artificial Intelligence has been able to substantially aid doctors in patient diagnosis through the manipulation of mass Electronic Health Records (EHR's). Medical conditions have grown more complex, and with a vast history of electronic medical records building, the likelihood of case duplication is high. Although someone today with a rare illness is less likely to be the only person to have suffered from any given disease, the inability to access cases from similarly symptomatic origins is a major roadblock for physicians. The implementation of AI to not only help find similar cases and treatments, but also factor in chief symptoms and help the physicians ask the most appropriate questions helps the patient receive the most accurate diagnosis and treatment possible.

Telemedicine

Figure-7: AI In Telemedicine

The increase of telemedicine, the treatment of patients remotely, has shown the rise of possible AI applications. AI can assist in caring for patients remotely by monitoring their information through sensors. A wearable device may allow for constant monitoring of a patient and the ability to notice changes that may be less distinguishable by humans. The information can be compared to other data that has already been collected using artificial intelligence algorithms that alert physicians if there are any issues to be aware of.

Another application of artificial intelligence is in chat-bot therapy. Some researchers charge that the reliance on chat-bots for mental healthcare does not offer the reciprocity and accountability of care that should exist in the relationship between the consumer of mental healthcare and the care provider (be it a chat-bot or psychologist), though.

Since the average age has risen due to a longer life expectancy, artificial intelligence could be useful in helping take care of older populations. Tools such as environment and personal sensors can identify a person's regular activities and alert a caretaker if a behavior or a measured vital is abnormal. Although the technology is useful, there are also discussions about limitations of monitoring in order to respect a person's privacy since there are technologies that are designed to map out home layouts and detect human interactions.

Electronic health records

Electronic health records (EHR) are crucial to the digitalization and information spread of the healthcare industry. Now that around 80% of medical practices use EHR, the next step is to use artificial intelligence to interpret the records and provide new information to physicians. One application uses natural language processing (NLP) to make more succinct reports that limit the variation between medical terms by matching similar medical terms. For example, the term heart attack and myocardial infarction mean the same things, but physicians may use one over the over based on personal preferences. NLP algorithms consolidate these differences so that larger datasets can be analyzed. Another use of NLP identifies phrases that are redundant due to repetition in a physician's notes and keeps the relevant information to make it easier to read.

Figure-8: Electronic Health Record

Beyond making content edits to an EHR, there are AI algorithms that evaluate an individual patient's record and predict a risk for a disease based on their previous information and family history. One general algorithm is a rule-based system that makes decisions similarly to how humans use flow charts. This system takes in large amounts of data and creates a

set of rules that connect specific observations to concluded diagnoses. Thus, the algorithm can take in a new patient's data and try to predict the likeliness that they will have a certain condition or disease. Since the algorithms can evaluate a patient's information based on collective data, they can find any outstanding issues to bring to a physician's attention and save time. One study conducted by the Centerstone research institute found that predictive modeling of EHR data has achieved 70–72% accuracy in predicting individualized treatment response. These methods are helpful due to the fact that the amount of online health records doubles every five years. Physicians do not have the bandwidth to process all this data manually, and AI can leverage this data to assist physicians in treating their patients.

Drug Interactions

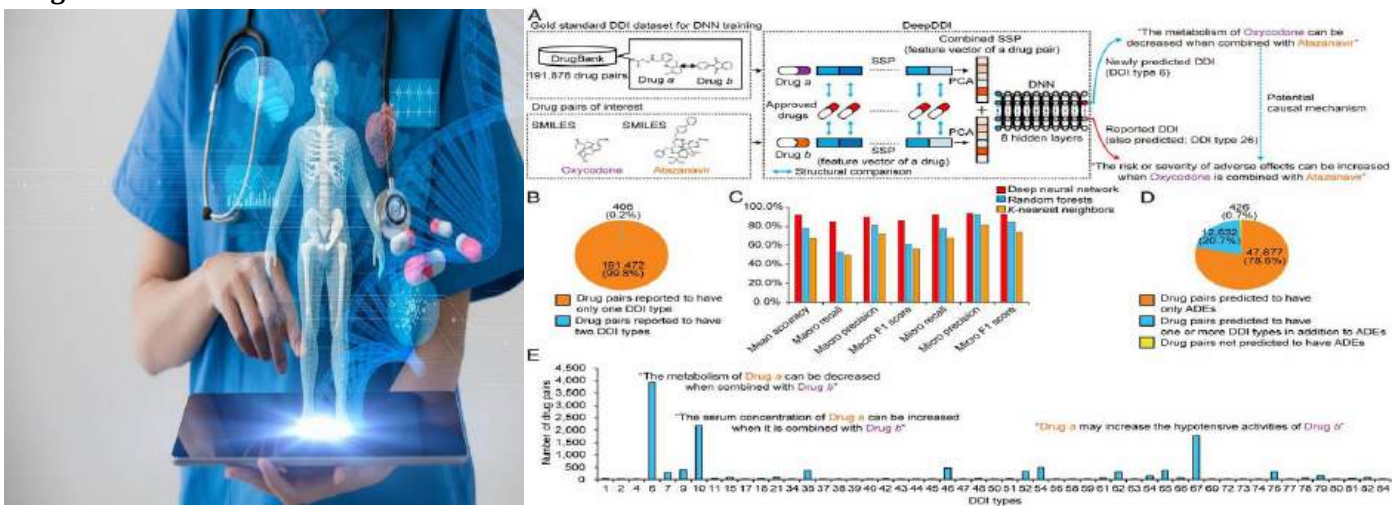

Figure-9: AI In Drug Interactions

Improvements in natural language processing led to the development of algorithms to identify drug-drug interactions in medical literature. Drug-drug interactions pose a threat to those taking multiple medications simultaneously, and the danger increases with the number of medications being taken. To address the difficulty of tracking all known or suspected drug-drug interactions, machine learning algorithms have been created to extract information on interacting drugs and their possible effects from medical literature. Efforts were consolidated in 2013 in the DDIExtraction Challenge, in which a team of researchers at Carlos III University assembled a corpus of literature on drug-drug interactions to form a standardized test for such algorithms. Competitors were tested on their ability to accurately determine, from the text, which drugs were shown to interact and what the characteristics of their interactions were. Researchers continue to use this corpus to standardize the measurement of the effectiveness of their algorithms. Other algorithms identify drug-drug interactions from patterns in user-generated content, especially electronic health records and/or adverse event reports. Organizations such as the FDA Adverse Event Reporting System (FAERS) and the World Health Organization's VigiBase allow doctors to submit reports of possible negative reactions to medications. Deep learning algorithms have been developed to parse these reports and detect patterns that imply drug-drug interactions.

Creation of new drugs

Figure-10: AI in Drug Discovery and Development

DSP-1181, a molecule of the drug for OCD (obsessive-compulsive disorder) treatment, was invented by artificial intelligence through joint efforts of Exscientia (British start-up) and Sumitomo Dainippon Pharma (Japanese pharmaceutical firm). The drug development took a single year, while pharmaceutical companies usually spend about five years on similar projects. DSP-1181 was accepted for a human trial.

In September 2019 Insilico Medicine reports the creation, via artificial intelligence, of six novel inhibitors of the DDR1 gene, a kinase target implicated in fibrosis and other diseases. The system, known as Generative Tensorial Reinforcement Learning (GENTRL), designed the new compounds in 21 days, with a lead candidate tested and showing positive results in mice.

The same month Canadian company Deep Genomics announces that its AI-based drug discovery platform has identified a target and drug candidate for Wilson's disease. The candidate, DG12P1, is designed to correct the exon-skipping effect of Met645Arg, a genetic mutation affecting the ATP7B copper-binding protein.

Industry

The trend of large health companies merging allows for greater health data accessibility. Greater health data lays the groundwork for implementation of AI algorithms.

A large part of industry focus of implementation of AI in the healthcare sector is in the clinical decision support systems. As more data is collected, machine learning algorithms adapt and allow for more robust responses and solutions. Numerous companies are exploring the possibilities of the incorporation of big data in the healthcare industry. Many companies investigate the market opportunities through the realms of "data assessment, storage, management, and analysis technologies" which are all crucial parts of the healthcare industry.

The following are examples of large companies that have contributed to AI algorithms for use in healthcare:

- IBM's Watson Oncology is in development at Memorial Sloan Kettering Cancer Center and Cleveland Clinic. IBM is also working with CVS Health on AI applications in chronic disease treatment and with Johnson & Johnson on analysis of scientific papers to find new connections for drug development. In May 2017, IBM and Rensselaer Polytechnic Institute began a joint project entitled Health Empowerment by Analytics, Learning and Semantics (HEALS), to explore using AI technology to enhance healthcare.
- Microsoft's Hanover project, in partnership with Oregon Health & Science University's Knight Cancer Institute, analyzes medical research to predict the most effective cancer drug treatment options for patients. Other projects include medical image analysis of tumor progression and the development of programmable cells.
- Google's DeepMind platform is being used by the UK National Health Service to detect certain health risks through data collected via a mobile app. A second project with the NHS involves analysis of medical images collected from NHS patients to develop computer vision algorithms to detect cancerous tissues.
- Tencent is working on several medical systems and services. These include AI Medical Innovation System (AIMIS), an AI-powered diagnostic medical imaging service; WeChat Intelligent Healthcare; and Tencent Doctorwork
- Intel's venture capital arm Intel Capital recently invested in startup Lumiata which uses AI to identify at-risk patients and develop care options.

- Kheiron Medical developed deep learning software to detect breast cancers in mammograms.
- Fractal Analytics has incubated Qure.ai which focuses on using deep learning and AI to improve radiology and speed up the analysis of diagnostic x-rays.
- Neuralink has come up with a next generation neuroprosthetic which intricately interfaces with thousands of neural pathways in the brain. Their process allows a chip, roughly the size of a quarter, to be inserted in place of a chunk of skull by a precision surgical robot to avoid accidental injury .

Figure-11: Surgical Robot

Digital consultant apps like Babylon Health's GP at Hand, Ada Health, AliHealth Doctor You, KareXpert and Your.MD use AI to give medical consultation based on personal medical history and common medical knowledge. Users report their symptoms into the app, which uses speech recognition to compare against a database of illnesses. Babylon then offers a recommended action, taking into account the user's medical history. Entrepreneurs in healthcare have been effectively using seven business model archetypes to take AI solution[buzzword] to the marketplace. These archetypes depend on the value generated for the target user (e.g. patient focus vs. healthcare provider and payer focus) and value capturing mechanisms (e.g. providing information or connecting stakeholders).

IFlytek launched a service robot "Xiao Man", which integrated artificial intelligence technology to identify the registered customer and provide personalized recommendations in medical areas. It also works in the field of medical imaging. Similar robots are also being made by companies such as UBTECH ("Cruzr") and Softbank Robotics ("Pepper").

The Indian startup Haptik recently developed a WhatsApp chatbot which answers questions associated with the deadly coronavirus in India.

With the market for AI expanding constantly, large tech companies such as Apple, Google, Amazon, and Baidu all have their own AI research divisions, as well as millions of dollars allocated for acquisition of smaller AI based companies. Many automobile manufacturers are beginning to use machine learning healthcare in their cars as well. Companies such as BMW, GE, Tesla, Toyota, and Volvo all have new research campaigns to find ways of learning a driver's vital statistics to ensure they are awake, paying attention to the road, and not under the influence of substances or in emotional distress.

Implications

The use of AI is predicted to decrease medical costs as there will be more accuracy in diagnosis and better predictions in the treatment plan as well as more prevention of disease.

Other future uses for AI include Brain-computer Interfaces (BCI) which are predicted to help those with trouble moving, speaking or with a spinal cord injury. The BCIs will use AI to help these patients move and communicate by decoding neural activates.

Artificial intelligence has led to significant improvements in areas of healthcare such as medical imaging, automated clinical decision-making, diagnosis, prognosis, and more. Although AI possesses the capability to revolutionize several fields of medicine, it still has limitations and cannot replace a bedside physician.

Healthcare is a complicated science that is bound by legal, ethical, regulatory, economical, and social constraints. In order to fully implement AI within healthcare, there must be "parallel changes in the global environment, with numerous stakeholders, including citizen and society."

Expanding care to developing nations

Artificial intelligence continues to expand in its abilities to diagnose more people accurately in nations where fewer doctors are accessible to the public. Many new technology companies such as SpaceX and the Raspberry Pi Foundation have enabled more developing countries to have access to computers and the internet than ever before. With the increasing capabilities of AI over the internet, advanced machine learning algorithms can allow patients to get accurately diagnosed when they would previously have no way of knowing if they had a life threatening disease or not.

Using AI in developing nations who do not have the resources will diminish the need for outsourcing and can improve patient care. AI can allow for not only diagnosis of patient is areas where healthcare is scarce, but also allow for a good patient experience by resourcing files to find the best treatment for a patient. The ability of AI to adjust course as it goes also allows the patient to have their treatment modified based on what works for them; a level of individualized care that is nearly non-existent in developing countries.

Regulation

While research on the use of AI in healthcare aims to validate its efficacy in improving patient outcomes before its broader adoption, its use may nonetheless introduce several new types of risk to patients and healthcare providers, such as algorithmic bias, Do not resuscitate implications, and other machine morality issues. These challenges of the clinical use of AI has brought upon potential need for regulations.

Figure-12: AI In Medical Seminar

Currently, there are regulations pertaining to the collection of patient data. This includes policies such as the Health Insurance Portability and Accountability Act (HIPPA) and the European General Data Protection Regulation (GDPR). The GDPR pertains to patients within the EU and details the consent requirements for patient data use when entities collect patient healthcare data. Similarly, HIPPA protects healthcare data from patient records in the United States. In May 2016, the White House announced its plan to host a series of workshops and formation of the National Science and Technology Council (NSTC) Subcommittee on Machine Learning and Artificial Intelligence. In October 2016, the group published The National Artificial Intelligence Research and Development Strategic Plan, outlining its proposed priorities for Federally-funded AI research and development (within government and academia). The report notes a strategic R&D plan for the subfield of health information technology is in development stages.

The only agency that has expressed concern is the FDA. Bakul Patel, the Associate Center Director for Digital Health of the FDA, is quoted saying in May 2017:

"We're trying to get people who have hands-on development experience with a product's full life cycle. We already have some scientists who know artificial intelligence and machine learning, but we want complementary people who can look forward and see how this technology will evolve."

The joint ITU-WHO Focus Group on Artificial Intelligence for Health (FG-AI4H) has built a platform for the testing and benchmarking of AI applications in health domain. As of November 2018, eight use cases are being benchmarked, including assessing breast cancer risk from histopathological imagery, guiding anti-venom selection from snake images, and diagnosing skin lesions.

Ethical concerns

Data collection

In order to effectively train Machine Learning and use AI in healthcare, massive amounts of data must be gathered. Acquiring this data, however, comes at the cost of patient privacy in most cases and is not well received publicly. For example, a survey conducted in the UK estimated that 63% of the population is uncomfortable with sharing their personal data in order to improve artificial intelligence technology. The scarcity of real, accessible patient data is a hindrance that deters the progress of developing and deploying more artificial intelligence in healthcare.

Automation

According to a recent study, AI can replace up to 35% of jobs in the UK within the next 10 to 20 years. However, of these jobs, it was concluded that AI has not eliminated any healthcare jobs so far. Though if AI were to automate healthcare related jobs, the jobs most susceptible to automation would be those dealing with digital information, radiology, and pathology, as opposed to those dealing with doctor to patient interaction.

Automation can provide benefits alongside doctors as well. It is expected that doctors who take advantage of AI in healthcare will provide greater quality healthcare than doctors and medical establishments who do not. AI will likely not completely replace healthcare workers but rather give them more time to attend to their patients. AI may avert healthcare worker burnout and cognitive overload

AI will ultimately help contribute to progression of societal goals which include better communication, improved quality of healthcare, and autonomy.

Conclusion:

Since AI makes decisions solely on the data it receives as input, it is important that this data represents accurate patient demographics. In a hospital setting, patients do not have full knowledge of how predictive algorithms are created or calibrated. Therefore, these medical establishments can unfairly code their algorithms to discriminate against minorities and prioritize profits rather than providing optimal care. There can also be unintended bias in these algorithms that can exacerbate social and healthcare inequities. Since AI's decisions are a direct reflection of its input data, the data it receives must have accurate representation of patient demographics. White males are overly represented in medical data sets. Therefore, having minimal patient data on minorities can lead to AI making more accurate predictions for majority populations, leading to unintended worse medical outcomes for minority populations. Collecting data from minority communities can also lead to medical discrimination. For instance, HIV is a prevalent virus among minority communities and HIV status can be used to discriminate against patients. However, these biases are able to be eliminated through careful implementation and a methodical collection of representative data.

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THREE MUSKETEERS IN TRIO COMBINATION MESMERISES THE WORLD BY ARTIFICIAL INTELLIGENCE, CHATGPT & CHATBOT

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Abstract: Using AI chatbots can be more cost-effective than hiring and training additional employees. Improved content quality. Writers can use ChatGPT. The primary characteristic of ChatGPT i.e Automation helps businesses slash their labor expenses at the same time increase accuracy and reduce. Businesses can save money on staffing costs by automating the customer service process. Handles many customer queries and issues, reducing the cost. Can be a cost-effective solution for businesses and organizations that want to automate certain tasks or processes without the need for cost. Intelligent automation and ChatGPT are formidable technologies capable of revolutionizing the manner in which businesses operate. Businesses that adopt and are smooth. You can get the same results from ChatGPT as you would with a commercial AI copywriter. Even experiments have shown it can compose music. ChatGPT offers several advantages for businesses when it comes to communication. For one thing, the system is trained on a vast amount of data points. Discover how ChatGPT, an AI-powered chatbot, is transforming the way students learn and study. Automating customer service: Businesses in a variety of industries depend heavily on customer assistance. With its rapid responses, round-the-clock. Undoubtedly, effective customer service is the main incentive for business growth and customer satisfaction, especially when it's available 24/7. More examples are: troubleshooting issues, handling complaints, or offering recommendations. Businesses can use it to reduce the workload of customer service.
Keywords: Open AI, ChatGPT, Chatbot, Quillbot

Introduction: OpenAI is a U.S. based artificial intelligence (AI) research organization founded in December 2015, researching artificial intelligence with the goal of developing "safe and beneficial" artificial gen eral intelligence, which it defines as "highly autonomous systems that outperform human's at most economically valuable work". As one of the leading organizations of the AI Spring, it has developed several large language models, advanced image generation models, and previously, released open-source models. Its release of ChatGPT has been credited with starting the artificial intelligence spring. OpenAI offers text embedding models that take as input a text string and produce as output an embedding vector. Embedding are useful for search, clustering, recommendations, anomaly detection, classification, and more. Today, the ownership pie is divided between Microsoft (49%), other stakeholders (49%), and the original OpenAI non-profit foundation, which staunchly preserves its autonomy as the leading firm continues to write OpenAI history.

Figure-1: Founder of trio artificial intelligence

In 1966, an MIT professor named **Joseph Weizenbaum** [Joseph Weizenbaum (8 January 1923 – 5 March 2008) was a German American computer scientist and a professor at MIT.] created the first chatbot. He cast it in the role of a psychotherapist. A user would type a message on an electric typewriter connected to a mainframe. After a moment, the "psychotherapist" would reply. **Sam Altman** [Samuel Harris Altman (Born April 22, 1985) is an American entrepreneur and investor best known as the CEO of OpenAI since 2019 (he was briefly fired and reinstated in November 2023).], the father of ChatGPT, has become the hottest face in the world of artificial intelligence, or AI. But his notoriety is nothing new: he has been in Silicon Valley's spotlight for nearly two decades already. Elon Musk cofounded OpenAI but left after his own failed coup. Now he has shared an unsigned letter containing unverified accusations against the recently fired CEO, Sam Altman. **Elon Reeve Musk** (Born June 28, 1971) is a businessman and investor. He is the founder, chairman, CEO, and CTO of SpaceX; angel investor, CEO, product architect, and former chairman of Tesla, Inc.; owner, chairman, and CTO of X Corp.; founder of the Boring Company and xAI; co-founder of Neuralink and OpenAI; and president of the Musk Foundation.[1]

The organization consists of the non-profit OpenAI, Inc. registered in Delaware and its for-profit subsidiary OpenAI Global, LLC. It was founded by Ilya Sutskever, Greg Brockman, Trevor Blackwell, Vicki Cheung, Andrej Karpathy, Durk Kingma, Jessica Livingston, John Schulman, Pamela Vagata, and Wojciech Zaremba, with Sam Altman and Elon Musk serving as the initial board members. Microsoft provided OpenAI Global LLC with a $1 billion investment in 2019 and a $10 billion investment in 2023, with a significant portion of the investment in the form of compute resources on Microsoft's Azure cloud service.

Figure-2: Software technologies in artificial intelligence

ChatGPT (Chat Generative Pre-trained Transformer) is a chatbot developed by OpenAI and launched on November 30, 2022. Based on a large language model, it enables users to refine and steer a conversation towards a desired length, format, style, level of detail, and language. ChatGPT release date is 30 November 2022. Successive prompts and replies, known as prompt engineering, are considered at each conversation stage as a context. ChatGPT is owned by OpenAI, the company that developed and released it. OpenAI is a company dedicated to AI research. It started as a nonprofit company in 2015 but transitioned to for-profit in 2019. ChatGPT is a natural language processing tool driven by AI technology that allows you to have human-like conversations and much more with the chatbot. The language model can answer questions and assist you with tasks, such as composing emails, essays, and code. It's currently open to use by the public for free. ChatGPT is generally safe to use for common questions and general needs. But, we do not recommend using it with personal or proprietary business information. Whether you are using ChatGPT-4, Bard, Perplexity AI, or any other ChatGPT alternative – you should be cautious of what data you are putting into your prompts.

By January 2023, it had become what was then the fastest-growing consumer software application in history, gaining over 100 million users and contributing to the growth of OpenAI's valuation to $29 billion. ChatGPT's release spurred the development of competing products, including Bard, Ernie Bot, LLaMA, Claude, and Grok. Microsoft launched its Copilot based on OpenAI's GPT-4. Some observers raised concern about the potential of ChatGPT and similar programs to displace or atrophy human intelligence, enable plagiarism, or fuel misinformation.

Figure-3: Three musketeers of modern generation

ChatGPT is built upon either GPT-3.5 or GPT-4, both of which are members of OpenAI's proprietary series of generative pre-trained transformer (GPT) models, based on the transformer architecture developed by Google—and is fine-tuned for conversational applications using a combination of supervised learning and reinforcement learning. ChatGPT was released as a freely available research preview, but due to its popularity, OpenAI now operates the service on a freemium model. It allows users on its free tier to access the GPT-3.5-based version, while the more advanced GPT-4-based version and priority access to newer features are provided to paid subscribers under the commercial name "ChatGPT Plus.

Importance: Imagine having a conversation with a chatbot that feels almost human. That's exactly what OpenAI ChatGPT brings to the table. The remarkable technology of Generative Pre-trained Transformer (GPT) powers it. AI ChatGPT utilizes Natural Language Processing (NLP) techniques. These help it to learn from past conversations and generate response options. It is trained on massive amounts of human interaction data. This results in an AI that can

understand and have conversations like humans. It was released as a free research preview/prototype in November 2022. It is powered by a machine learning model called GPT-3, developed by OpenAI.[2]

OpenAI: The adoption of AI is increasing across different domains by leaps and bounds. Entrepreneurs and professionals including app developers have started using various AI models for performing various tasks. One of the most advanced AI platforms available for them is OpenAI. As the most funded AI and ML (Machine Learning) platform in the world, OpenAI has started enhancing its scope across different sectors. One of these sectors is mobile app development. Though the usage of OpenAI is increasing in the mobile app development process, many developers ask a question- Is OpenAI the right model for the app development process? Let's go through the pros and cons of OpenAI from the perspective of mobile app development to get an answer to this question.

What is OpenAI and Its Significance in Development Process? Founded in 2015, OpenAI is an AI-based research organization consisting of highly skilled scientists, engineers, and research scholars dedicated to opening new horizons for AI technology that remain beneficial for people. It aims to create a world where AI-driven technologies are used ethically and in a transparent way. Be it Natural Language Processing (NLP), robotics, or computer vision, OpenAI ensures the safe and beneficial use of all advanced technologies. Deep learning, machine learning, and robotics are some of the core areas on which OpenAI focuses. It has developed several innovative models to serve this purpose to date. These models are GPT-3, DALL-E, and CLIP. Software developers and expert professionals can use these models in various applications including chatbots and virtual assistants for content creation and image recognition. Integrating the API of OpenAI into the app can enable you to offer advanced AI capabilities to users with a personalized approach. Also, It plays a vital role in increasing the scalability, efficiency, and productivity of the company by promoting automation. Also, OpenAI's API is open and collaborative in nature. As a result, developers can easily share and collaborate on their tasks with others. It further boosts innovation and digital transformation.

The following status show the importance and increasing scope of OpenAI.[3]

Interesting Stats of OpenAI

- The monthly number of active users stood at 21.1 million in 2022
- It is one of the most innovative AI concepts that has raised over $1 billion in funding
- Users of as many as 156 countries access the OpenAI platform
- Male users' percentage is over 65% which is two times that of female users
- The technical sector is the biggest user of OpenAI with over 251 companies using it followed by the education sector which has 209 institutions using it.

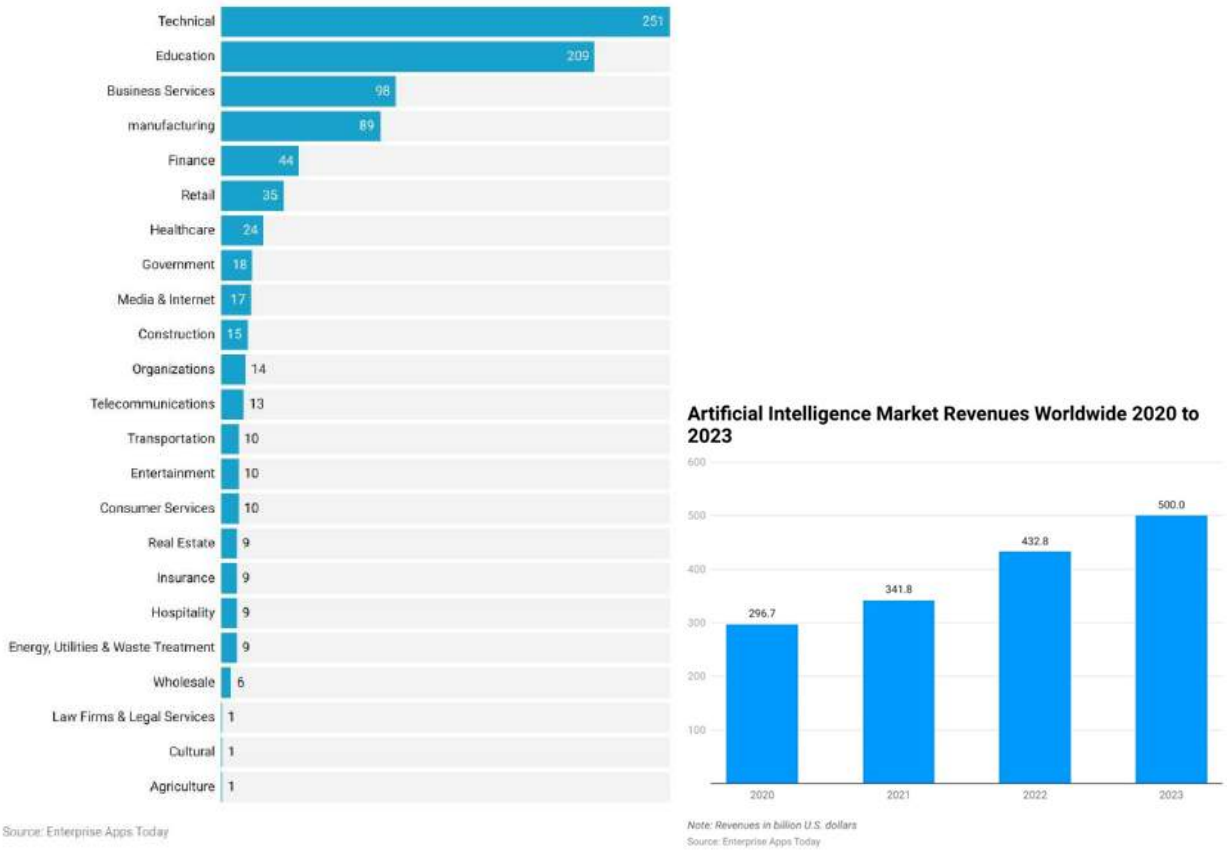

Figure-4: Histogram of AI survey

Open AI Survey: AI has the capability to perform anything as instructed by humans. As this concept evolves, its market revenue steadily increases. Alexa, Google now, Siri, and Cortana are some examples of AI. We can expect that AI technology will cross USD 500 billion in the year 2023.

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Artificial Intelligence Market Revenues

Though OpenAI helps all the core industry sectors, here we will see its advantages and disadvantages from the mobile app development domain's perspective.

Pros of OpenAI in Mobile App Development: Mobile app development is thriving at a rapid pace and requires a touch of innovation while meeting the deadline. Here are some of the top benefits of OpenAI in mobile app development.

Increased Speed: Reduced development time is one of the major benefits of OpenAI-backed mobile app development. A custom software development company can automate certain tasks to increase the app development speed with the help of OpenAI. What's more, OpenAI also assists app developers in automating app testing.

Streamlined Operations: OpenAI has various pre-trained models and inbuilt ML algorithms that can automate certain tasks. For example, image recognition, sentiment analysis, and text summarisation are some of the activities that OpenAI can perform effectively. Let's take an example of GPT-3, an OpenAI feature based on NLP (Natural Language Processing), which can understand specific language patterns and answer customer queries automatically.

Enhanced Security: OpenAI has a machine-learning model that helps developers detect security threats like malware and unauthorized access to prevent applications from any damage. Also, OpenAI comes with advanced safety features like biometric authentication and data encryption that offer additional security to apps.

Predictive Analytics: AI has a revolutionary feature known as Predictive Analytics. OpenAI offers this feature to enable users to analyse data and make accurate predictions using their mobile apps. The predictive analytics feature is also useful in improving the performance of chatbots and voice assistants that work on AI. It is also useful in forecasting sales and the shopping behaviour of customers.

Improved Efficiency: AI is designed to automate several tasks and as a result, mobile apps with OpenAI API can work more efficiently while bringing automation to certain tasks. For example, it can automate the response to customer service inquiries. It can reduce the workload on the support staff while improving their efficiency.

Competitive Edge: Customized mobile apps with an integrated OpenAI API can give your company an edge over competitors who have not given the power of AI to their apps. Talking about developers, they can create more sophisticated and advanced apps than their competitors and thereby get a chance to stand out in a crowd.[4]

Cons of OpenAI in Mobile App Development:

More Complexity: The AI-powered mobile app development process is highly complicated. OpenAI API integration is also complex and time-consuming, particularly for mobile app developers who have no idea of AI technologies. AI models need specialized expertise in developing, training, and testing. Entry-level and at times, experienced app developers find it cumbersome.

Error in Predictions: OpenAI is based on AI and it is prone to make erroneous predictions sometimes. Also, as it is trained on large data sets or data pools, chances are high that it comes up with inaccurate and biased predictions. Moreover, OpenAI lacks interoperability and is run by humans, so there is a high chance of human errors also remaining in the process.

Higher Cost: It is the biggest disadvantage of using OpenAI in app development. Whether developers want to integrate OpenAI into the app during the development or customisation phase, it always increases the cost significantly. The reason is simple- OpenAI requires significant computational resources and users need to pay to use these resources which makes the maintenance of such mobile apps more difficult for developers.

Data Privacy-related Concerns: OpenAI has various privacy and security-related concerns because it is trained on large data sets that contain a lot of confidential and sensitive information. Also, APIs based on OpenAI can transmit sensitive data and as a result, the application remains vulnerable to a data breach. When you hire mobile app developers, they need to remain cautious and take precautionary measures to mitigate privacy and security concerns.

Limited Interpretability: OpenAI models can pose a challenge to interpret especially for end-users or developers who want to understand the underlying technology. Mobile app developers also find it challenging when it comes to explain the app's functionality with the OpenAI API or why the app has made certain decisions.[5]

Concluding Lines: OpenAI has taken our world by storm. It has started bringing revolutionary changes to various industry sectors, and mobile app development is no exception! However, you need to consider both pros and cons before integrating it into a customised enterprise application. How about consulting a reputed custom software development company to discuss the scope of OpenAI in your upcoming application?

Chatbot: A chatbot is a software or computer program that simulates human conversation or "chatter" through text or voice interactions. Users in both business-to-consumer (B2C) and business-to-business (B2B) environments increasingly use chatbot virtual assistants to handle simple tasks. Adding chatbot assistants reduces overhead costs, uses support staff time better and enables organizations to provide customer service during hours when live agents aren't available.

How do chatbots work? Chatbots have varying levels of complexity, being either stateless or stateful. Stateless chatbots approach each conversation as if interacting with a new user. In contrast, stateful chatbots can review past interactions and frame new responses in context. Adding a chatbot to a service or sales department requires low or no coding. Many chatbot service providers allow developers to build conversational user interfaces for third-party business applications. A critical aspect of chatbot implementation is selecting the right natural language processing (NLP) engine. If the user interacts with the bot through voice, for example, then the chatbot requires a speech recognition engine.

Business owners also must decide whether they want structured or unstructured conversations. Chatbots built for structured conversations are highly scripted, which simplifies programming but restricts what users can ask. In B2B environments, chatbots are commonly scripted to respond to frequently asked questions or perform simple, repetitive tasks. For example, chatbots can enable sales reps to get phone numbers quickly.

Why are chatbots important? Organizations looking to increase sales or service productivity may adopt chatbots for time savings and efficiency, as artificial intelligence (AI) chatbots can converse with users and answer recurring questions.

As consumers move away from traditional forms of communication, many experts expect chat-based communication methods to rise. Organizations increasingly use chatbot-based virtual assistants to handle simple tasks, allowing human agents to focus on other responsibilities.

How do businesses use chatbots? Chatbots have been used in instant messaging apps and online interactive games for many years and only recently segued into B2C and B2B sales and services. Organizations can use chatbots in the following ways:

Online shopping. In these environments, sales teams can use chatbots to answer noncomplex product questions or provide helpful information that consumers could search for later, including shipping price and availability.

Customer service. Service departments can also use chatbots to help service agents answer repetitive requests. For example, a service rep might give the chatbot an order number and ask when the order shipped. Generally, a chatbot transfers the call or text to a human service agent once a conversation gets too complex.

Virtual assistants. Chatbots can also act as virtual assistants. Apple, Amazon, Google and Microsoft all have forms of virtual assistants. Apps, such as Apple's Siri and Microsoft's Cortana, or products, like Amazon's Echo with Alexa or Google Home, all play the part of a personal chatbot.[6]

How are chatbots changing businesses and CX? The rapidly evolving digital world is altering and increasing customer expectations. Many consumers expect organizations to be available 24/7 and believe an organization's CX is as important as its product or service quality. Furthermore, buyers are more informed about the variety of products and services available and are less likely to remain loyal to a specific brand. Chatbots serve as a response to these changing needs and rising expectations. They can replace live chat and other forms of contact, such as emails and phone calls.

Chatbots can enhance CX in the following ways:

- reduce customer wait times and provide immediate answers;
- offer customers 24/7 support;
- remove the potential for unpleasant human-to-human interactions that moods and emotions of both the service or sales representative and the customer dictate;
- reduce wait times and streamline conversations to minimize the potential for customers' stress and annoyance;
- improve the redirection of customer queries;
- add customized elements to the chatbot to advance brand personality; and
- personalize CX with AI-enabled chatbots.

Additionally, major technology companies, such as Google, Apple and Facebook, have developed their messaging apps into chatbot platforms to handle services like orders, payments and bookings. When used with messaging apps, chatbots enable users to find answers regardless of location or the devices they use. The interaction is also easier because customers don't have to fill out forms or waste time searching for answers within the content.

What are the benefits of using chatbots? In addition to chatbots' benefits for CX, organizations also gain various advantages. For example, improved CX and more satisfied customers due to chatbots increase the likelihood that an organization will profit from loyal customers.[7]

Other benefits include the following:

- Can hold multiple conversations at once. Chatbots can converse simultaneously with thousands of buyers. This increases business productivity and eliminates wait times.
- Cost-effective. A chatbot is a faster and cheaper one-time investment than creating a dedicated, cross-platform app or hiring additional employees. In addition, chatbots can reduce costly problems caused by human error. User acquisition costs also decrease with a chatbot's ability to respond within seconds.
- Saves time. Chatbots can automate tasks performed frequently and at specific times. This gives employees time to focus on more important tasks and prevents customers from waiting to receive responses.
- Proactive customer interaction. In the past, organizations relied on passive customer interaction and waited for buyers to reach out first. With chatbots, organizations can interact proactively, as bots can initiate conversations and monitor how customers use the websites and landing pages. Organizations can then use the information gathered from monitoring to offer specific incentives to buyers, help users navigate the site and answer future questions.
- Monitors and analyzes consumer data. Chatbots collect feedback from each interaction to help businesses improve their services and products or optimize their websites. Bots can also record user data to track behaviors and purchasing patterns. This information can offer organizations insight into how to better market their products and services, as well as common obstacles that customers face during the buying process.
- Improves customer engagement. Most companies already engage their customers through social media. Chatbots can make this engagement more interactive. Buyers rarely talk to the people within businesses, so chatbots open a communication channel where customers can engage without the stress of interacting with another person.
- Eases scalability to global markets. Chatbots can solve customer concerns and queries in multiple languages. Their 24/7 access enables customers to use them regardless of time or time zone.
- Expands the customer base. Chatbots can improve lead generation, qualification and nurturing. Chatbots can ask questions throughout the buyer's journey and provide information that may persuade the user and create a lead. Chatbots can then provide potential customer information to the sales team, who can engage with the leads. The bots can improve conversion rates and ensure the lead's journey flows in the right direction -- toward a purchase.
- Measures lead qualifications. Chatbots can help sales teams determine a lead's qualifications using identified key performance indicators, such as budget, timeline and resources. This can prevent companies from wasting time on unqualified leads and time-consuming customers.

What are the challenges of using chatbots? While chatbots improve CX and benefit organizations, they also present various challenges.[8]

These challenges include the following:

- New technology, new obstacles. Chatbot technology is still new and faces obstacles that organizations may not know how to handle. While AI-enabled bots can learn from each interaction and improve their behaviors, this process can cost organizations a lot of money if the initial interactions cause customers to disengage and turn away.
- Security. Users must trust the chatbot enough to share personal data. Therefore, organizations must ensure they design their chatbots to only request relevant data and securely transmit that data over the internet. Chatbots should have secure designs and be able to prevent hackers from accessing chat interfaces.
- Varieties in how people type their messages. This can lead to misunderstood intentions. Chatbots must handle both long and short sentences, as well as chat bubbles with lengthy content versus multiple short submissions.
- The different ways in which humans talk. Chatbots can struggle to understand these variations. For example, the user may use slang, misspell words or use acronyms. Unfortunately, NLP is limited and cannot fully resolve this challenge.
- Unpredictable human behavior, moods and emotions. Humans are random and emotions and moods often control user behavior, so users may quickly change their minds. After initially asking for a suggestion, they might want to give a command instead. Chatbots must adapt to and understand this randomness and spontaneity.
- User satisfaction. Users always want the best experiences but are rarely satisfied. They always want the chatbot to be better than it currently is. This means organizations employing chatbots must consistently update and improve them to ensure users feel like they're talking to a reliable, smart source.

Future of chatbots: Many experts expect chatbots to continue growing in popularity. In the future, AI and ML will continue to evolve, offer new capabilities to chatbots and introduce new levels of text and voice-enabled user experiences

that will transform CX. These improvements may also affect data collection and offer deeper customer insights that lead to predictive buyer behaviours. Voice services have also become common and necessary parts of the IT ecosystem. Many developers place an increased focus on developing voice-based chatbots that can act as conversational agents, understand numerous languages and respond in those same languages.[9]

How have chatbots evolved? Chatbots such as ELIZA and PARRY were early attempts to create programs that could at least temporarily make a real person think they were conversing with another person. PARRY's effectiveness was benchmarked in the early 1970s using a version of a Turing test; testers only correctly identified a human vs. a chatbot at a level consistent with making random guesses. Chatbots have come a long way since then. Developers build modern chatbots on AI technologies, including deep learning, NLP and machine learning (ML) algorithms. These chatbots require massive amounts of data. The more an end user interacts with the bot, the better its voice recognition predicts appropriate responses. Chatbot use is on the rise in business and consumer markets. As chatbots improve, consumers have less to quarrel about while interacting with them. Between advanced technology and a societal transition to more passive, text-based communication, chatbots help fill a niche that phone calls used to fill.

Types of chatbots:

As chatbots are still a relatively new business technology, debate surrounds how many different types of chatbots exist and what the industry should call them.

Some common types of chatbots include the following:

- Scripted or quick reply chatbots. As the most basic chatbots, they act as a hierarchical decision tree. These bots interact with users through predefined questions that progress until the chatbot answers the user's question.
- Similar to this bot is the menu-based chatbot that requires users to make selections from a predefined list, or menu, to provide the bot with a deeper understanding of what the customer needs.
- Keyword recognition-based chatbots. These chatbots are a bit more complex; they attempt to listen to what the user types and respond accordingly using keywords from customer responses. This bot combines customizable keywords and AI to respond appropriately. Unfortunately, these chatbots struggle with repetitive keyword use or redundant questions.
- Hybrid chatbots. These chatbots combine elements of menu-based and keyword recognition-based bots. Users can choose to have their questions answered directly or use the chatbot's menu to make selections if keyword recognition is ineffective.
- Contextual chatbots. These chatbots are more complex than others and require a data-centric focus. They use AI and ML to remember user conversations and interactions, and use these memories to grow and improve over time. Instead of relying on keywords, these bots use what customers ask and how they ask it to provide answers and self-improve.
- Voice-enabled chatbots. This type of chatbot is the future of this technology. Voice-enabled chatbots use spoken dialogue from users as input that prompts responses or creative tasks. Developers can create these chatbots using text-to-speech and voice recognition APIs. Examples include Amazon Alexa and Apple's Siri.

ChatGPT is an AI tool powered by Reinforcement Learning from Human Feedback (RLHF). To ensure that the responses given by the chatbot are more accurate, data is collected through a supervised and fine-tuned method.

- AI trainers compose conversations. In these they act as both the user and the AI assistant. Model-written suggestions help them to craft their replies.
- This new dataset is combined with existing Instruct-GPT data to form a dialog format.
- Quality assessment of the dialogue is monitored. This is using comparison data collected from conversations between the AI.

ChatGPT offers several advantages for businesses when it comes to communication. For one thing, the system is trained on a vast amount of data points. So, it can provide near-instant responses to customer queries. This allows companies to offer a more responsive and personalized experience. Additionally, the technology works in real time. So, businesses no longer need to worry about responding to customer queries. This leaves them free to focus on other tasks.[10]

1. Multilingual translation: The chatbot GPT can eliminate language barriers by providing translation services for different languages.

2. Personalization of customer service: Using a GPT chatbot can help to make customer service more efficient and customizable. It can quickly answer commonly asked questions and provide personalized customer service. It can also act as a first line of support so that customers do not have to wait for a live representative. A GPT chatbot can provide personalized experiences to customers. This is by considering customer data, preferences, and interests.

3. Automation of customer support: A GPT chatbot can enable the automation of customer support functions. Picture logging in customers into their accounts or giving FAQs. More examples are: troubleshooting issues, handling complaints, or offering recommendations. Businesses can use it to reduce the workload of customer service representatives. It handles simple tasks so they can focus on more complex issues.

Business use:

1. Generating personalized responses to customer inquiries: Using a GPT chatbot can help to make customer service more efficient and customizable. It can quickly answer commonly asked questions and provide personalized customer service. It can also act as a first line of support so that customers do not have to wait for a live representative. Furthermore, businesses can use it to reduce the workload of customer service representatives.
2. Creating custom content: Businesses can use ChatGPT for dynamic marketing strategies and media campaigns. For example, they can generate custom content that's relevant to the customer's personal preferences. Through this approach, businesses can create more effective ads and ensure they reach the right customers at the right time. This way, they can get their message across in a more personalized manner. This increases the chances of conversion.

ChatGPT gives businesses the power to personalize ads and promotional material based on individual customer criteria. Through this approach, businesses can create hyper-targeted ads with greater accuracy. This is because they base them on the customer's specific interests or browsing history. This type of content creation can increase engagement and conversions. This makes it an effective marketing strategy. Additionally, through ChatGPT, businesses can easily track customer lifetime values. They can also monitor customer behavior in real-time. This gives them a better understanding of their audience.[11]

3. Writing code: The capabilities of ChatGPT can be useful to you, whether you are a coder or just learning. If you need help figuring out how to create the code, ask the AI chatbot for assistance. Additionally, if you tell it whatever programming language to use, it will write the code for you.
4. Integrating with other services: Things like booking appointments or making purchases can be simpler. ChatGPT-3 can be coupled with other services like calendars, payment processors, and databases.

Security Considerations for ChatGPT Solutions:

When it comes to using any type of AI-driven communication tool, security is always a top priority.

Encryption: User data should be encrypted and stored securely. This ensures protection both on the server side and during transit across networks.

- Suspicious Activity Detection: The ChatGPT solution should have mechanisms in place. These detect and identify any suspicious activity. Users should be notified promptly in case of any anomalies or unusual behavior.
- Regular Maintenance: Regular maintenance of the system is crucial. This is to identify and address any potential bugs or security vulnerabilities. This helps ensure a secure and reliable environment for users.
- Monitoring: Continuous monitoring of the ChatGPT solution is necessary. This is to proactively detect and mitigate any security risks. This includes monitoring access logs, user interactions, and system behavior for potential threats or breaches.
- Prompt Issue Resolution: Any identified security issues or vulnerabilities should be addressed promptly. You can achieve this through timely updates, patches, and fixes to maintain a secure environment.
- User Education: Educating users about best practices for security, is essential to enhance overall security posture. Examples are strong password management and awareness of potential phishing attempts. Regular training and awareness programs can help promote a security-conscious culture.
- Compliance: The ChatGPT solution should comply with relevant data protection and privacy regulations. This is to ensure the safeguarding of user data and privacy rights.
- Data Retention: Implementing appropriate data retention policies helps to minimize the risk of data exposure. It also ensures compliance with applicable regulations.
- Access Controls: Robust access controls, including authentication and authorization mechanisms, should be implemented. These are to restrict access to sensitive user data and system functionalities.
- Third-Party Audits: Regular audits and security assessments by independent third parties are vital. These can provide assurance regarding the robustness of the ChatGPT solution's security measures.[12]

The Future of AI-Powered Conversation Technology with ChatGPT

- ChatGPT is revolutionizing the way we communicate with AI-driven technologies. It provides more natural and immersive conversations that simulate human interaction.
- This type of technology also enables more personalized customer service experiences. It also powers streamlined communication processes.

- It has great potential to quickly analyze vast amounts of data. So, it's easy to see why ChatGPT is quickly becoming a popular choice for many companies. Of course, these are companies looking for AI-fueled communication solutions.

Conclusion: Latest technology reflects on three devices: Chatbot, ChatGPT & Open AI; the modern tool that fuels the artificial intelligence to develop the multilingual translation, Personalization of customer service & Automation of customer support. Quill offers prompts and exercises and delivers instant AI-powered feedback to help students write, revise, and revise again until they are able to produce succinct, powerful sentences. An expressive, performant, modern functional programming language. QuillBot's AI trains on datasets, which show it the right and wrong ways to write. A dataset is a collection of information (in QuillBot's case, information on grammar, spelling, punctuation, tone, sentence structure, and clarity) that can be read as a single unit of information by a computer.

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https://www.wjpls.org/home/article_abstract/3214

AI picture of Sourav Hatui

The entire projects on AI+ML and Chatbot+ChatGPT and OpenAI have been guided by eminent professor Dr Dhrubo Jyoti Sen of the same temple of learning.

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Biography

Prof. Dr. Dhrubo Jyoti Sen

Eminent scholar cum researcher Prof. Dr. Dhrubo Jyoti Sen [D.Pharm., B.Sc. (Hons), B.Pharm. (Hons), M.Pharm., Ph.D., FICS, CChem FIC (India), CChem FRSC (UK), CSci (UK), AOM (USA)] who is at present working as a professor of pharmaceutical & medicinal chemistry in Techno India University, School of Pharmacy, Kolkata, West Bengal, India is working in academic field from more than two decades and has published more than 640 research/review papers in peer reviewed national/international journals of high impact factor, presented 13 papers in conferences and has authored 195 conference abstracts in national/international conferences and has published 30 books. He is the son of (Late) Prof. Chiranjib Sen, M.Sc. (Chemistry), FIC (India); Principal, Institute of Pharmacy (Bihar Govt.; Health Department), Agamkuan, Gulzarbag, Patna–800 007, Bihar & Mrs. Archana Sen, B.A. He did Diploma in Pharmacy [1988] and became recipient of K.K. Acharjee Award from the Indian Hospital Pharmacists Association, New Delhi due to first rank in Diploma in Pharmacy examination in state of Bihar. He did B.Sc. (Hons) in Chemistry [1987] from Patna University. Later on, he did B.Pharm. (Hons) [1992] M.Pharm.[1994] & Ph.D. [2001] all from Jadavpur University and entered into the academic field [2000 onwards]. He has one patents funded by Research Grant from Royal Society of Chemistry, UK for £2000 [Novel approach of stereospecific substituted 1–[(Z)–1,2–diphenylethenyl]–4–ethylpiperazine moiety by green chemistry synthesis for growth inhibition of falciparum species & Novel synthesis of stereoisomers of substituted cinnamic acid derivatives with amino/thio propanoic acid adducts for inhibiting viral load of HIV genome] for his novel work. Postgraduate research work on M.Pharm. project entitled as Industrial problems in manufacturing of guaiacol from o–anisidine & manufacture of m–nitrobenzaldehyde; a drug intermediate was performed by GATE [1993] scholarship in the laboratory of Medicinal & Pharmaceutical Chemistry under the guidance of Late Prof. (Dr.) Samir Chandra Lahiri in the Department of Pharmaceutical Technology, Jadavpur University, Kolkata–700032. Doctoral research work on Ph.D. project entitled as Investigation on newer anti–inflammatory, sedative–hypnotic & antimicrobial agents was done in the field of synthetic Medicinal & Pharmaceutical Chemistry with State Govt. Research Fellowship under the supervision of Prof. (Dr.) Jayanta Kumar Gupta, Head of the Department of Pharmaceutical Technology, Jadavpur University, Kolkata–700032. Life member of eight professional bodies [Life Member of the Indian Pharmaceutical Association (1995), Life Fellow of the Indian Chemical Society (1995), Life Fellow of the Institution of Chemists (2003) (India), Life Member of the Indian Science Congress Association (2005), Life Member of the Association of Pharmaceutical Teachers of India (2005), Fellow of the Royal Society of Chemistry, UK (FRSC, 2022), Life Member of Research Scholar Hub (2014). Paper setter and examiner of 15 Indian Universities for D.Pharm, B.Pharm, M.Pharm & Ph.D. [Hemchandracharya North Gujarat University, Patan; Jai Narain Vyas University, Jodhpur; Gujarat University, Ahmedabad; Nirma University of Science & Technology, Ahmedabad; Veer Narmad South Gujarat University, Surat; Annamalai University, Annamalainagar; Gujarat Technological University, Ahmedabad; Ganpat University, Kherva; Sumandeep Vidyapeeth Deemed University, Vadodara, Gujarat; Jadavpur University, Calcutta; Maharaja Sayajirao University of Baroda, Vadodara; Sankalchand Patel University, Visnagar; Techno India University, Kolkata; Ambuja Neotia University, Kolkata; JIS University [Agarpada]. He has guided 45 MPharm projects, 44 BPharm projects and guided 3 PhD scholars and at present 5 are working under his esteemed guidance. Prof. Sen has bagged 40 national/international awards. He is the recipient of prestigious Chartered Chemist [CChem; 2005] & Chartered Scientist [CSci; 2012] awards from Royal Society of Chemistry, UK and he is the first person in pharmacy field from India to achieve Chartered Scientist award recommended by Nobel Laureate [Dan Schehtman; Discovered Quasicrystals in 2011]. He has achieved Jewel of India twice [2009 & 2014]. He has bagged enormous accolades [K.K. Acharjee Award (1988), Chartered Chemist Award, India (2005), Chartered Chemist Award, UK (2005), Jewel of India Award (2009), Rashtriya Vidya Saraswati Puraskar

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Worked as a Study Director with Dr. Xudong Yuan (Study Director) and Mr. Rutesh Vyas (Scientist) for the joint project Assessment of anti–obesity and hypolipidemic activity of synthesized compounds in diet induced obesity and hypercholesterolemia mice model after oral administration at Department of Pharmaceutical Science, AMS College of Pharmacy and Health Science, Long Island University, Brooklyn, New York, USA. Played the role of referee for my M.Pharm. students for getting admission into the AMRSC category of the Royal Society of Chemistry, UK: Mr. Vishal J. Patel (2006), Mr. Amitkumar K. Joshi (2007), Mr. Dipesh A. Chaudhary (2007), Mr. Mehul K. Patel (2008), Mr. Meghal V. Modi (2008), Mr. Krishna A. Patel (2008), Mr. Maulik K. Prajapati (2008), Mr. Dhavalkumar M. Patel (2008), Avani H. Sheth (2010), Yatri R. Shah (2010), Parimal M. Prajapati (2010). Appointed as a judge of the essay competition for the topic Self-medication–how safe? Ask your pharmacist: At the National Pharmacy Week, organized by the Indian Pharmaceutical Association, Mehsana branch, 19–25 November 2006. Received financial assistance of Rs.50800/– under travel grant scheme (air–fare, registration & per–diem) for attending 10th Annual Florida Heterocyclic and Synthetic Conference, USA: 08–11 March 2009 from (AICTE) All India Council for Technical Education, New Delhi in the year 2008. Awarded £2000 as research grant from the Royal Society of Chemistry, UK for the research work Synthesis, characterization and Pharmaceutical screening of quinazoline coumarin fused ring heterocyclic derivatives in the year 2009. Biography included in Marquis Who's Who in the World 2011 (28th Edition) from New Providence, New Jersey, USA. Registered VIP#35153364. Name included in the list of Leading Educators of the World–2011 by the International Biographical Center, Cambridge, United Kingdom. Name included in the list of Top 100 Educators–2011 by the International Biographical Center, Cambridge, United Kingdom. Received Rs.1400000/– as a Research Grant under Modernization and Removal of Obsolescence Scheme (MODROBS) from AICTE, New Delhi for the year 2011–12. Appointed as a Judge in scientific session of oral/poster session of Colloquium–2020 at JIS University, West Bengal on 11–13 June 2020. Selected in 100 Eminent Academicians of India 2021 book [Vol. 1 December 2021; ISBN: 978–81–950538–6–5; Published By: International Institute of Organized Research (I2OR),

India – 2021, Number 3179, Sector 52, Chandigarh (160036) – India]. Appointed as an External Subject Expert of Sankalchand Patel University, Visnagar for PhD program in pharmacy in 2018. Appointed as a Subject Expert of Doctoral Progress Committee (DPC) of Gujarat Technological University, Ahmedabad for PhD program in pharmacy in 2018. Appointed as a Subject Expert of Research Advisory Committee (RAC) of The Neotia University, Kolkata PhD program in pharmacy in 2020. Worked as DPC member for PhD topic of Chirag Gohil [2016–2020]: Design and Synthesis of MDM2 Inhibitors to Reactivate p53 Function. Guided by Dr. Malleshappa Noolvi [Professor and Principal, Shree Dhanvantary Pharmacy College, Kim (E), Dist.: Surat 394 110, Gujarat, India]. Life Member of the Indian Pharmaceutical Association, Fellow of the Indian Chemical Society, Life Fellow of the Institution of Chemists (India), Life Member of the Indian Science Congress Association, Life Member of the Association of Pharmaceutical Teachers of India, Fellow of the Royal Society of Chemistry, UK, Life Member of Research Scholar Hub. Paper setter of Pharmaceutical/Medicinal Chemistry [DPharm, BPharm, MPharm & PhD] and examiner of 15 Indian Universities [Hemchandracharya North Gujarat University, Patan; Jai Narain Vyas University, Jodhpur; Gujarat University, Ahmedabad; Gujarat University, Ahmedabad; Nirma University of Science & Technology, Ahmedabad; Veer Narmad South Gujarat University, Surat; Annamalai University, Annamalainagar; Gujarat Technological University, Ahmedabad; Ganpat University, Kherva; Sumandeep Vidyapeeth Deemed University, Vadodara, Gujarat; Jadavpur University, Kolkata; Maharaja Sayajirao University of Baroda, Vadodara; Sankalchand Patel University, Visnagar; Techno India University, Kolkata; Ambuja Neotia University, Kolkata; JIS University, Agarpada]. Attended 80 symposiums, 18 workshops, 10 Faculty Development Programs. Delivered a Special Guest Lecture on the topic Organometallic agents: A diversion towards chemotherapeutic agents as well as pharmaceutical aids held at the Department of Pharmaceutical Engineering & Technology, School of Engineering & Technology, Bharathidasan University: [Accredited Grade–A from NAAC], Tiruchirappalli, Tamilnadu, on 10 March 2005 which has been highly appreciated by the audience. Delivered a Guest Lecture on Reflection of green chemistry in protection of environment in AICTE Sponsored Quality Improvement Programme on Glimpses of current advances in the field of pharmaceutical sciences held at M.S. University of Baroda, Vadodara, Gujarat on 8 June 2010. Delivered a Guest Lecture as a resource person on one day national e–conference on Immunomodulator Neutraceuticals and its Quality Control for the topic Journey of good health starts from micronutrients and end at macronutrients at Laxminarayandev College of Pharmacy, Bharuch, Gujarat on 31 July 2021.

Dr. Dhananjoy Saha

Dr. Dhananjoy Saha [BPharm, MTech, PhD] is working as Deputy Director, Directorate of Technical Education, Bikash Bhavan, Salt Lake City, Kolkata–700091 and West Bengal, India. He did B.Pharm., Master of Biomedical Engineering and PhD from Jadavpur University, Kolkata, West Bengal, India. He has research interests: IPR, Pharmaceutical, Biomedical Engineering, Tissue Engineering and Sports Science having more than 20 years of research experience. He has worked as examiner of Patents and Designs, Assistant controller of Patents and Designs at Intellectual Property office, Ministry of commerce and Industry, Government of India from 2002 to 2009. He has published more than 85 papers in international journals, 25 papers in national and international conferences, 1 patent, many invited talks on IPR at national and international organizations, visited country like Japan Patent office regarding training on IPR in Pharmaceutical in the year of 2007. He has completed many courses conducted by World Intellectual property Organization (WIPO), Geneva, Switzerland. He is life member of Society of Biomaterials and artificial organs, India, Indian Institute of Chemical Engineers, The Institution of Engineers.