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ARTIFICIAL INTELLIGENCE FOR FUTURE ASPECTS IN PHARMACEUTICALS- A REVIEW

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ABSTRACT
AI is the ability of a machine to display human-like intelligence to perform various tasks, like planning, reasoning, creativity, and planning. Today, you can see AI being implemented in self-driving cars, adaptive learning machines, mobile applications, chatbots, and various other applications. Artificial Intelligence (A.I.) is defined as the ability of a machine to perform cognitive functions that we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem solving, decision-making, and even demonstrating creativity. AI data classification is a process where AI systems are trained to categorize data into predefined classes or labels. By learning from patterns in historical data, AI classification sorts through vast amounts of data, creating order from the digital chaos. The popularity of machine learning (ML), deep learning (DL) and artificial intelligence (AI) has risen sharply in recent years. Despite this spike in popularity, the inner workings of ML and DL algorithms are often perceived as opaque, and their relationship to classical data analysis tools remains debated Machine Learning is a subset of artificial intelligence that helps you build AI-driven applications. Deep Learning is a subset of machine learning that uses vast volumes of data and complex algorithms to train a model. Machine Learning is a subset of artificial intelligence that helps you build AI-driven applications. Deep Learning is a subset of machine learning that uses vast volumes of data and complex algorithms to train a model.

KEYWORDS: Artificial Intelligence, Machine Learning, Deep Learning.

INTRODUCTION
Artificial Intelligence (AI) is a branch of study that studies intelligent machine learning, primarily through intelligent computer programs that produce outcomes akin to those of human attention.[1] This process often entails gathering information, creating effective mechanisms for using that information, presenting precise or approximative conclusions, self-corrections, and adjustments.[2] AI technology has emerged as a critical component of the business recently, finding practical uses in a wide range of technological and scientific domains. Looking back over the previous 25 years, pharmacies have done a fantastic job of meeting the rising demand for prescription drugs despite operating costs rising, a scarcity of pharmacists, and decreasing reimbursements. Additionally, pharmacy has done a fantastic job of utilizing automation as a technology to enhance workflow efficiency and reduce operating costs, all the while encouraging efficiency, accuracy, and safety in every pharmacy setting. Pharmacists can interact with more patients and improve their health outcomes when automated dispensing saves them time.[3] The earliest known use of a computer in a pharmacy was probably in the 1980s. Since then, computers have been used for a wide range of purposes, including data collection, clinical research, retail pharmacy management, drug storage, pharmacy education, and much more. With the development of artificial intelligence, it is impossible to predict how much the pharmacy industry will change over time. To help doctors diagnose patients, a number of expert systems have been developed in the medical field.[4] A number of drug-therapy-focused programs have been reported recently.[5] They direct the selection of drug formularies, drug interactions, and drug therapy monitoring. AI has the potential to affect many facets of pharmacy, and pharmacists should take these into consideration as they could one day be included in everyday pharmacy operations.

AI OVERVIEW

AI, also referred to as machine intelligence, is frequently used synonymously with automation and robotics. Artificial intellect (AI) is the ability of any computer or machine to exhibit human-like behaviors or intellect; robotics, on the other hand, is just the design of machines that can perform tough repetitive jobs.[6] Artificial Intelligence is widely used in the creation of digital computers or computer-controlled robots that can do intellectual and cognitive tasks that humans can. These mental and cognitive functions include language, learning, reasoning, solving problems, and perception. Because it is solely intended to carry out specific activities, such as internet search, voice and facial recognition, car control and driving, and so on, the type of artificial intelligence that is now in use is known as narrow AI or weak AI. The AI community's ultimate objective is to create machines that are capable of doing all cognitive activities better than humans on their own. The general AI, also known as Strong AI (ADI), is concerned with building machines that are capable of carrying out every cognitive work performed by humans.[7]

AI CLASSIFICATION

AI can be divided into two categories.[8],[9],[10]

Based on the caliber	Weak intelligence Artificial narrow intelligence Artificial general intelligence Artificial super intelligence
Based on presence	Type 1 reactive machine Type 2 limited memory system Type 3 is based on the theory of mind Type 4 self awareness

Weak intelligence or Artificial narrow intelligence

This system is built and educated to carry out specific tasks, like playing chess, driving, facial recognition, and traffic signals. Examples include social media tagging and Apple SIRI, a virtual personal assistant.

Artificial general intelligence or strong AI

Another name for it is human-level AI. It can make the intellectual capacities of humans simpler. As a result, it can figure out the answer when faced with a new challenge. AGI is capable of all human functions.

Artificial super intelligence

It is intelligence that outperforms intelligent humans in all domains, from science to the arts, including mathematics, drawing, and space. It ranges from the computer just little than humans to trillion times smaller than humans.

AI scientist Arend Hintze[11] categorized AI technology as to whether it was already in use or not. They are listed in the following order.

Type 1: We refer to this kind of AI system as a reactive machine. For instance, the IBM chess algorithm Deep Blue defeated Garry Kasparov in the 1990s. It lacks the memory to draw on prior experiences, but it can recognize checkers on a chessboard and make predictions. It is useless in other circumstances and was made with certain uses in mind. AlphaGo from Google is another example.

Type 2: A limited memory system is the name given to this kind of AI system. This approach can apply lessons learned from the past to current and upcoming issues. Only this strategy is used in the design of various decision-making functions in autonomous cars. The acts that take place in the future, such as cars changing lanes, are documented using the observed data. The observations are not retained in the mind indefinitely.

Type 3: The term "theory of mind" refers to this kind of AI system. It implies that every person has thoughts, goals, and wants that influence the choices they make. This AI doesn't exist.

Type 4: We refer to this as self-awareness. The AI systems are sentient and have a sense of self. If the machine is self-aware, it recognizes the situation and makes use of the concepts found in other people's minds. This AI doesn't exist.

Machine learning (ML)

The goal of machine learning (ML) is to use examples and observations to automatically identify significant relationships and patterns.[12] With companies augmenting decision-making for productivity, engagement, and employee retention[13], trainable assistant systems adapting to individual user preferences[14], and trading agents shaking up traditional finance trading markets.[15] AI advances have made it possible for intelligent systems with human-like cognitive capacity to emerge and permeate our personal and professional lives.

Deep learning (DL)

The biological functioning of neural networks, deep learning is a family of machine learning algorithms that is gaining popularity and outperforming traditional machine learning algorithms in many applications.[16] The sole reason for this is their ability to generate outcomes more quickly and precisely. It makes use of a number of methods to try and model high-level abstraction in data.[17] All facets of the model are directly learned from the data using deep learning techniques. The lowest-level features that provide an appropriate representation of the data are used first. After that, it offers more advanced abstractions for every unique issue that it is used to solve. As training data volume rises, deep learning becomes increasingly beneficial. As hardware and software infrastructure have grown, so too has the creation of deep learning models.[18]

Multiple layers, which are made up of numerous linear and non-linear transformations, are used in deep learning models. Conventional machine learning algorithms have proven to be limited in their ability to analyze large amounts of data due to increases in data size or

advancements in the big data area.[19] In this task of analysis, deep learning approaches have been producing by mining a vast library of chemicals.

AI population selection for clinical trials

The perfect AI tool for clinical trials would be able to recognize the patients' condition, pinpoint the gene targets, and forecast the effects of both the intended drug and its side effects. In a Phase II trial of individuals with schizophrenia, a novel AI platform named AiCure was also created as a mobile application to measure medication adherence. It was found that AiCure increased adherence by 25% when compared to the conventional "modified directly observed therapy".[36] An essential step in clinical research is choosing the patients. Examining the connection between in vitro phenotypes and human-relevant biomarkers enables a more reliable, quantitative evaluation of the uncertainty of treatment responses in a particular patient. Enrolling a particular patient population in Phase II and III clinical trials is made possible by the development of AI techniques to find and forecast illness biomarkers that are meaningful to humans. Clinical trial success rates would rise if AI predictive modeling was used to choose a patient population.[37,38]

AI in polypharmacology

Nowadays, the "one-disease–multiple-targets" paradigm has a greater grasp of pathogenic processes in diseases at the molecular level than the "one-disease–one-target" paradigm. Poly-pharmacology is the phrase for one disease with numerous targets.[39] Numerous databases are available to incorporate various information about molecular pathways, crystal structures, binding affinities, pharmacological targets, disease relevance, chemical properties, and biological activities. These databases include ZINC, Ligand Expo, KEGG, ChEMBL, pubchem, DrugBank, STITCH, BindingDB, Supertarget, and PDB. AI might go through these databases to create molecules with many pharmacological properties. Recently, a success story about the use of AI in the design of polypharmacological agents was published in the literature. The authors created the computational platform DeepDDI to predict alternative drugs for intended clinical use that have no adverse health effects and to better understand drug-drug interactions and associated mechanisms.[40]

AI in targeted genomic therapy and diagnosis

AI is used in hospital-based healthcare systems in a variety of ways, including the organization of dose forms for specific patients and the selection of appropriate or practical administration routes or treatment protocols.[41,42]

Maintaining of medical records

Keeping up with patient medical records is a difficult endeavor. By using the AI system, data collection, storage, normalization, and tracking are made simple. In a brief amount of time, Google's Deep Mind Health Project[43] helps to retrieve medical records. Therefore, this initiative is helpful for providing healthcare more quickly and effectively. This project helps to improve eye treatment at the Moorfields Eye Hospital NHS.

Treatment planing designing

AI technology makes it feasible to create treatment programs that are both effective and efficient. An artificial intelligence (AI) system is required to take control of the situation when a patient develops a severe condition and choosing an appropriate treatment plan becomes challenging. The treatment plan recommended by this technology takes into account all of the prior data and reports, clinical expertise, etc. Software as a Service IBM Watson for Oncology[44] is a cognitive computing decision support system that compares patient data to thousands of past cases and insights gained from working thousands of hours with physicians at Memorial Sloan Kettering Cancer Center. It then offers treatment options to assist oncology clinicians in making well-informed decisions. The research compiled by Memorial Sloan Kettering, which includes more than 200 textbooks, 300 medical periodicals, and nearly 15 million pages of text, supports these therapy alternatives.[44]

Health support and medical assistance

AI technology has been shown to be effective in recent years for both pharmaceutical assistance and health support services. A friendly face and a nice voice greet Molly[45], a virtual nurse created by start-ups. Its goal is to support patients with their chronic ailments during doctor appointments and assist them in directing their own treatment. An app called Ai Cure[46] that works with a smartphone's webcam tracks patients and helps them manage their ailments. Patients who take part in clinical trials and those with severe drug conditions can both benefit from this app.

Accuracy of medication

AI has a positive effect on genetic development and genomics. Using patterns found in genetic data and medical records, Deep Genomics[47], an AI system, can be used to find mutations and their connections to diseases. This technique provides physicians with information on what happens inside a cell when genetic variation modifies DNA. Craig Venter, the creator of the human genome project, created an algorithm that uses a patient's DNA to provide physical traits. Early detection of vascular and cancerous disorders can be helped by the application of "Human Longevity" AI technology, which pinpoints their precise location.

Drug creation

Pharmaceuticals require billions of rupees and more than ten years to manufacture or create. The AI program "Atomwise[48], which makes use of supercomputers, is helpful in determining the treatments from the molecular structure database. It launched a virtual search campaign for an Ebola treatment that is both safe and effective using currently available medications. The two

medications that triggered the Ebola infection were found by the technology.

Drug Design

Drug discovery, clinical testing, and approval for production are all steps in the multistep process of drug research and development (Figure 1). Millions of dollars and years of work go into the protracted, costly, and complex process of drug discovery.[49,50] Preclinical testing, lead discovery, lead optimization, and target identification make up this approach.[51,52,53] Conventional drug development starts with the identification of a particular ailment, followed by the identification of an appropriate target, the identification of an effective molecule (including testing for molecular synthesis and bioactivity), and preclinical research. Clinical testing has a success probability of less than 15%, even with significant financial and temporal investments.[54] Poor pharmacokinetic features (absorption, distribution, metabolism, excretion, and toxicity [ADMET]) account for around half of drug discovery failures.[55] With the advent of computer methods, drug discovery has become much faster and more successful.[56]

Molecular dynamics (MD) simulations, which have been extensively used in drug development, are said to be able to record the position and motion of every atom in a system in accordance with Newtonian mechanics.[57] This method can contribute information to experiments by revealing the specifics of the target protein's binding, unbinding, and structural changes.[58] Thermodynamics, kinetics, and free energy profiles of target-ligand interactions can also be obtained by MD simulations.[59] Enhancing the lead compound's binding affinity may be possible with the help of this information. MD simulations are utilized to verify the accuracy of docking data because they provide more trustworthy binding affinity results.[60] Furthermore, by investigating atomic-electronic interactions between the ligand and target, quantum mechanics (QM) techniques, such as density functional theory (DFT)[61,62] and ab initio calculation methods[62,63], can be applied to virtual screening (VS). However, these QM methods are quite costly to compute and are not typically used for VS in industry.

Healthcare Analysis

Retrieving data in the healthcare system is simple if all of the data is computerized. Ninety-seven percent of Dutch invoices are kept in digital format.[64] These invoices include treatment details, doctor names, and hospital names. As a result, these are easily retrievable. Zorgprisma Publiek, a nearby business, uses IBM Watson cloud technology to analyze the bills. In the event of an incident, it detects it right away and reacts appropriately. As a result, it enhances patient outcomes and prevents hospitalization.

AI in hospital and community pharmacy

It is not appropriate to implement outdated pharmacy and healthcare systems in the current day. According to the researchers, the existing healthcare system needs to be modified in order to address the growing crisis. There is occasionally a medicine shortage in pharmacies, posing a serious risk to public health. A forecast of the impending medicine scarcity is required. Another factor contributing to this scarcity is medication theft, which can happen to nurses, pharmacists, and other professionals. There must be a mechanism to protect the medications from people like these.[65]

Email personalization is made possible by machine learning algorithms, which enable faster and more accurate personalization than any human. It is possible to boost service delivery efficiency by utilizing chatbots.[66] Chatbots are able to simulate conversations between consumers and sales or customer service representatives. Customer complaints and inquiries can be automatically resolved by chatbots, and more complex inquiries are forwarded to human staff. This idea is applicable to retail pharmacies. It is possible to program the chatbots to imitate patient-pharmacist interactions.

Walgreen[67] and Medline, a telehealth company, partnered to establish a video chat platform that enables users to communicate with medical specialists. AI has applications in inventory management as well. Imagine being able to anticipate your patients' needs in the near future as a retail pharmacist, stock them, and use customized software to send emails to remind them of their medication requirements. It is possible to anticipate a patient's future drug purchases with AI-powered data analytics. AI-powered medication purchase predictions for patients will assist pharmacists in making informed stock procurement choices.

The University of California, San Francisco (UCSF) Medical Center uses robotic technology for drug preparation and tracking in an effort to increase patient safety. They claim that the technology has flawlessly prepared 3,50,000 doses of medication. The robot has shown itself to be far superior to humans in terms of both size and medication delivery accuracy. One of the capabilities of robotic technology is its ability to prepare injectable and oral medications, including hazardous chemotherapy agents. This has allowed the UCSF nurses and pharmacists to focus on providing direct patient care and collaborating with the doctors, allowing them to make use of their expertise. The computers in the pharmacy's automated system initially electronically receive medicine orders from the doctors and pharmacists at UCSF. Subsequently, the robotics select, package, and dispense specific amounts of tablets. Machines then put the doses together on a plastic ring with a barcode. The slender plastic ring holds all of the prescription drugs that a patient has to take within 12 hours. The automated system's capacity to fill intravascular syringes with the appropriate drugs and

make sterile preparations intended for chemotherapy are two further functions it can perform.[68]

CONCLUSION

In this article, we have mentioned about the AI overview and it's classification and also the brief explanation about the machine learning and deep learning. Machine learning consists of thousands of data points while deep learning uses millions of data points. Machine learning algorithms usually perform well with relatively small datasets. Deep Learning requires large Amounts of data to understand and perform better than traditional machine learning algorithms. Machine learning allows programs to function without constant human input by utilizing patterns and inference, rather than explicit instructions. While humans are involved in creating and training these systems, mature machine learning can improve over time on its own. Ongoing research efforts and emerging trends in Deep learning, such as explainable AI, transfer learning, and reinforcement learning, offer promising directions for future advancements. In conclusion, Deep Learning has the potential to revolutionize various industries and drive advancements in Artificial intelligence.

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