THE FUTURE OF PHARMACY: HOW ARTIFICIAL INTELLIGENCE IS TRANSFORMING THE FIELD?

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Abstract: *The pharmaceutical sector is not an exception to how quickly artificial intelligence (AI) is changing other industries. AI is being used more and more in the pharmaceutical sector to automate, improve, and personalize processes ranging from medication administration to drug development. This review focus on how AI is being used in drug discovery, Health care system, etc. We will also talk about the benefits and drawbacks of artificial intelligence in the pharmacy sector. The new AI pharmacy system automates repetitive operations, offers individualized treatment plans, lowers costs, and improves patient outcomes while replacing the outdated manual processes and human decision-making of the previous pharmacy system. But it's crucial to make sure AI is applied morally and sensibly and that its effects on society and the workforce are properly taken into account. The primary advantage of incorporating artificial intelligence (AI) into certain pharmacy applications is increased precision and effectiveness in patient treatment. All things considered, this paper will provide some insight into the pharmacy industry's future and the revolutionary potential of artificial intelligence in this sector*

Index Terms -*Artificial Intelligence; Future of Pharmacy; Milestones in AI; Drug Discovery; Health Care System; Advantages and Disadvantages of AI.*

I. INTRODUCTION

In older system, all things are doing manually so that the chances of error are increased and the misshaping are takes place E.g., We fill the entry of medication in the entry register by manually it takes time , error and wastage of paper also. Increases the man power. In other hand AI can solve this problem in some minutes or seconds. Artificial intelligence (AI) is the ability of machines to do tasks such as sensing, thinking, learning, and decision-making that usually require human intelligence. In general, this process entails gathering information, creating effective methods for using that information, presenting precise or approximate conclusions, self-corrections, and adjustments. Artificial intelligence (AI) is typically used to analyze machine learning and mimic human cognitive activities. AI technology is used to achieve both practical interpretation and more accurate analysis. From this angle, artificial intelligence (AI) technology combines a variety of practical statistical models with computational intelligence. AI technology has recently grown to be an essential part of the industry with practical applications in numerous technical and scientific domains. When considering the last 25 years, the pharmacy industry has performed well in meeting the rising demand for prescription drugs despite shortages of pharmacists, rising operating expenses, and declining reimbursements. Additionally, pharmacy has done a fantastic job of utilizing automation as an enabling technology to boost workflow effectiveness and reduce operating costs while fostering accuracy, efficiency, and safety in every pharmacy setting. Pharmacists can interact with more patients and improve their health outcomes when automated dispensing saves them time. The implications of AI in pharmacy apps for people at homes are immense, providing several advantages to users. Users of pharmacy apps with AI integration can obtain prescription information, dose and administration guidelines, and medical advice from the comfort of their homes. Those who live in isolated places or have mobility problems may find this to be extremely helpful. AI can also examine a user's medical background and assist in creating customized drug schedules that include dosage, frequency, and timing to make sure users are taking their prescriptions as directed. Users no longer have to wait for a pharmacist's office hours to get help with medication-related questions or concerns thanks to AI integration in pharmacy apps.

II. Main AI Domains [6-9]

Artificial Intelligence (AI) is a broad branch of computer science that encompasses a multitude of applications that can be integrated to impact nearly every aspect of our life, hence increasing productivity and enhancing human capabilities. Among these, Machine Learning (ML), Neural Networks (NN), Deep Learning (DL), Robotics, Computer Vision (CV), and Natural Language Processing (NLP) are the noteworthy six broad areas (Figure 1). When combined, these computer-based methods

represent the most difficult domains that have been well researched and are frequently employed in day-to-day activities, broadening our repertoire of methods for data analysis.
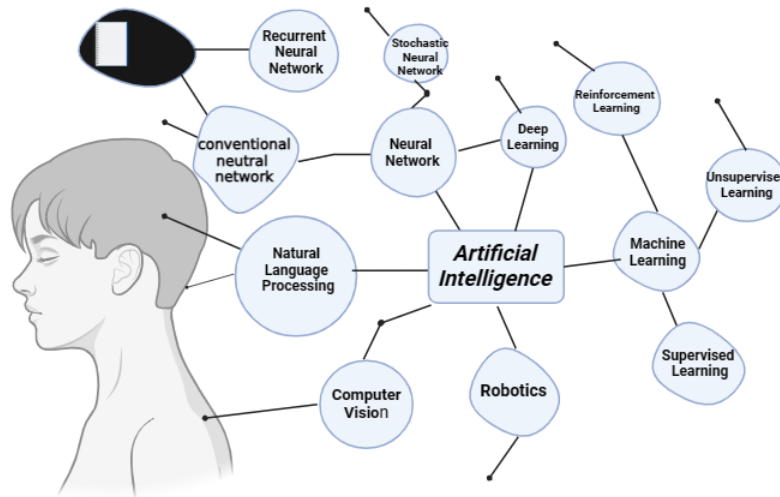
FIGURE 1: Main AI domains

III.   MILESTONES IN AI [4]

In 1956, the term "Artificial Intelligence" was used for the first time. Nonetheless, the idea of artificial intelligence has been used since 1950 in conjunction with symbolic approaches and problem-solving techniques. In Table 1, five significant turning points in the field of AI applications are listed.

Table 1: Significant turning points in the application of AI.	
Year	**Events**
1943	It was demonstrated by Walter Pitts and Warren McCulloch that neurons coupled in a network are capable of performing logical operations such as "and," "or," and "not."
1956	The term 'artificial intelligence' was first coined.
1958	Frank Rosenblatt invented perceptrons, which are single-ended neural networks with a one-way information transmission capability.
1974	"First AI Winter" has begun.
1986	Georey Hinton popularized the Back Propagation technique, which is heavily utilized in deep learning.
1987	"AI Winter" has begun.
1997	IBM Deep Blue overcame Russian grandmaster Garry Kasparov.
2013	Google used British technology to undertake efficient photo research
2016	AlphaGo, an AI developed by Google DeepMind, defeated Go Champion Lee Sedol.

IV.   CLASSIFICATION OF AI [10-14]

AI can be categorized into two distinct ways: according to **calibre** and presence
AI can be classified as follows based on their capabilities:

i. **Artificial Narrow Intelligence (ANI) or Weak AI:** It carry out a narrow range task, i.e., facial recognition, drive a car, practicing chess, traffic signalling, etc.
ii. **Artificial General Intelligence (AGI) or Strong AI:** It carries out all the things as humans and also called as human level AI. It can simplify human mentality and able to do unfamiliar task.
iii. **Artificial Super Intelligence (ASI):** It is clever than humans and has much more activity than humans drawing, mathematics, space, etc.

  According to their presence and not yet present, AI can be classified as follows:
i. **Type 1:** It is used for narrow purpose applications, which cannot use past incidents as it has no memory system. It is known as reactive machine. There are some examples of this memory, such as a IBM chess program, which can confess the checkers on the chess playing board and capable of making predictions.
ii. **Type 2:** It has limited memory system, which can apply the previous incidents for solving different troubles. In automatic vehicles, this system is capable of making conclusion there are some recorded observations, which are used to record more distant actions, but these records are not stored permanently.
iii. **Type 3:** Its foundation is "Theory of Mind." It implies that people's decisions are influenced by their unique ways of thinking, as well as their goals and ambitions. AI that doesn't exist is this system.
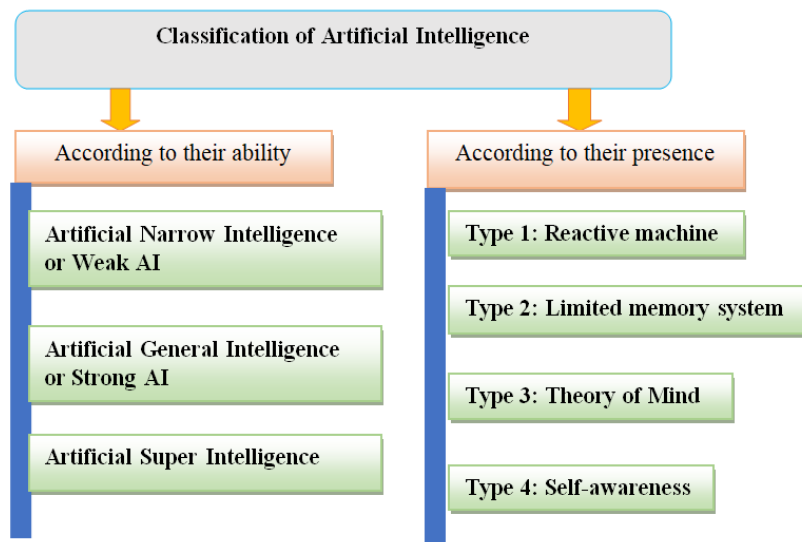iv. **Type 4:** It has self-awareness, i.e., the sense of self and awareness. This system is also non-existing AI.

FIGURE 2 : Classification of AI.

V.   ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE TECHNOLOGY:

The use and nature of AI are complex. It is a complex synthesis of computer science, mathematics, and other fields. The intricacy of programming enables machines to mimic human cognitive capacities. [15-18].

i.   ADVANTAGES OF AI

- **Error Reduction -** Artificial Intelligence (AI) lowers human error and improves the likelihood of more precise accuracy. Since intelligent robots have metal bodies and can withstand the harsh atmosphere of space, they are a good choice to be sent to study the planet.
- **Difficult Exploration -** The mining and fuel exploration industries can make use of it. Artificial intelligence (AI) technologies may be useful for exploring the ocean to get beyond human constraints. The robots can carry out more demanding and tiresome tasks with ease and without becoming tired thanks to programming.
- **Daily Application -** AI has practical applications in daily life. The GPS system is extensively used by everyone and is useful for lengthy travels. Thanks to the installation of artificial intelligence (AI), androids can anticipate what a user will enter and automatically repair spelling mistakes. Take Lady SIRI and the Cortana robots, for instance.

An artificial intelligence application recognizes and tags a person's face when they publish a photo on social networking sites like Facebook or Twitter. In banking and financial sectors, artificial intelligence (AI) systems are frequently utilized for data management, organization, and scam detection.

- **Digital Assistants -** Advanced firms utilize artificial intelligence (AI) systems that "avatar," which are models of digital assistants, to eliminate the demand for human resources. Because they are emotionally neutral, the avatars reason logically and make the proper choices. Emotions in people are typically linked to moods, which impair judgment and reduce productivity. Machine intelligence was not used to observe this issue.
- **Repetitive Jobs -** One task at a time is all that humans can do. Machines are faster thinkers than humans and are capable of multitasking. Dangerous jobs can be carried out by machines, and their parameters—such as speed and time—can be changed.
- **Medical Applications -** These days, doctors use artificial intelligence (AI) to evaluate patients and analyze health concerns. The AI program is teaching doctors about different medications and their adverse effects. Artificial surgery simulators are helping surgeons in training to learn more. They receive training through the use of artificial surgery simulators, such as those that simulate the heart, brain, GIT, etc.
- **No Breaks -** Eight hours a day, plus two or three breaks, is what humans can do. Machines don't need regular breaks and refreshments like humans do. In most cases, the machines have lengthy programming that allows them to work continually without becoming confused or bored. They consistently produce.
- **Increase technological Growth Rate -** AI technology facilitates access to a world of more sophisticated technical advancements. Millions of computer modeling programs may be created by the AI system, which would be useful for discovering new chemical compounds and entities. For example- QSAR, QSPR.
- **No risk of harm -** When accidents occur at fire stations where humans are employed, the staff members are affected. In contrast, robots are emotionless and lack feeling. Furthermore, it is feasible to mantle the pieces of broken devices.
- **Act as aids -** AI-enabled machines can be utilized around-the-clock to assist the elderly or children with disabilities. They serve as a resource for education. They are also helpful in providing security alerts during bank robberies, fires, and harsh weather.
- **Limitless functions -** There are no limits for machines; they are superior to humans in every way. They provide us more free time, are impersonal, more accurate, and efficient.

ii.   DISADVANTAGES OF ARTIFICIAL INTELLIGENCE TECHNOLOGY [1, 19, 20]:

- **High Cost -** Due to the intricate equipment design, upkeep, and repair, the introduction of AI requires a significant amount of resources. The machine's software needs to be updated on a regular basis. It takes a great deal of time and money to recover the machine and restore it. To design a single AI system, the R&D department needs a lot of time. Money is consumed more as a result.
- **No Replicating Humans -** With the extra benefit of lacking morality and emotions, robots equipped with artificial intelligence (AI) technology are able to reason similarly to humans. As a result, they carry out the assignment exactly as it is

intended, lacking the ability to form an opinion. Occasionally, it results in serious issues. Robots cannot make a choice if they are not conversant with the problem. They may give a fake report at that point or have a breakdown.

- **No Improvement with Experience -** Artificial intelligence (AI) machines are not as malleable as human beings with life experience. Machines are not concerned with belonging, caring, or unity. They are unable to distinguish between those who work hard and those who do not.
- **No Original Creativity -** Machines lack emotional intelligence and empathy, in contrast to humans. Machines cannot hear, see, feel, or think like humans can. Humans are creative beings, and robots cannot see what they are thinking. There is no method that can duplicate the basic innate abilities of humans.
- **Unemployment -** There will be widespread unemployment if machines take the place of people in all industries. Humans are inherently highly dependent on one another. As a result, they grow sluggish and lose their creative spark.

VI. AI IN DRUG DISCOVERY [21-24] -

Chemical producer and Pharmaceutical manufacturers are using deep study and NLP to analyse and understand vast number of patents and genomic data science information. Greater than 12,000 publications are post daily across all journals and databases. Human beings alone are unable to operation the total accessible information for advanced scientific research. Manufacturing companies are using deep education software like "NVIDIA DGX-1". AI supercomputers absorb and analyse the information to recognize the relation joining the compounds to suggest the new drug candidate. Generally, it takes nearly 15 years to convey a drug discovery idea from initial starting point to a marketed product. The industries are presently spending over $1 billion per drug. The procedure is shown in Figure 3.

FIGURE 3: Drug Development Process

VII. AI IN HEALTH CARE SYSTEM [25-29] –

Artificial intelligence (AI) systems in healthcare can help doctors by organizing patient dose forms, administration routes, or treatment regimens more efficiently. It could better arrange patient itineraries or treatment plans in the healthcare and medical fields and give doctors all the information they need to make an informed choice.

- **Maintaining of medical records-** Maintaining medical records in the healthcare system is a challenging endeavor. The application of AI technology has made data gathering, storage, normalization, and tracing easier. In order to provide quicker and better healthcare, Google has created the Google Deep Mind Health Project, which is helpful for quickly mining medical records. The Moorfields Eye Hospital NHS is receiving support from this project to enhance its eye care services.
- **Treatment plan designing-** Using AI in treatment plan design is beneficial. The AI system is helpful if the patient's health is critical and choosing an appropriate treatment plan is challenging. IBM Watson launched software to assist oncologists, which takes into account patient reports, clinical expertise, historical data, and recommends an appropriate treatment plan to the doctors.
- **Assisting in repetitive tasks -** Artificial Intelligence (AI) can be helpful in repeated work environments such as radiology, X-ray image analysis, ECG, and ECHO to discover issues and pinpoint locations. IBM introduced the Medical Sieve algorithm. It functions as a "cognitive assistant" and has strong reasoning and analytical skills. It is appropriate for analyzing radiological images, pinpointing the location and quickly identifying issues. Combining deep learning with medical data can help a medical start-up enhance patient outcomes. Up until now, computer programs used for diagnosis were created using historical data on characteristics unique to a given disease. As a result, a customized program is offered for every body area for a limited number of medical issues. On the other hand, deep learning is beneficial for a wide range of illnesses affecting the entire body and all imaging modalities, such as CT, X-rays, Echo, ECG, and so forth.
- **Obtaining in-person and online consultations –** Based on patient history and medical knowledge, Babylon, an online health service and medical consultation platform introduced by British subscription, provides medical consultations. Users of the app must enter the symptoms of their health issues for it to monitor and compare the data with the disease's information stored in the database. It will offer an appropriate plan of action. Patients are reminded about the medication process by the app. The time spent waiting for a doctor is decreased when using the app.
- **Assistance with medication and health support –** Artificial Intelligence is helpful in these areas. Molly, a virtual nurse created by a start-up, has a friendly visage and a lovely voice. Its objective is to help people keep track of their health and medical interventions. In between doctor visits, it provides support for people with chronic conditions. An further software called AiCure uses the webcam on smartphones to monitor patients' adherence to their prescriptions and provide support in managing their diseases. Patients who are in acute medication situations or who take part in clinical studies can benefit from this app.
- **Medical accuracy -** AI has a positive effect on genetic development and genomics. Using patterns found in genetic data and medical records, Deep Genomics, 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. When vascular illnesses and cancer are still in their early stages, "Human Longevity" AI technology can be used to pinpoint their precise location.
- **Drug development-** It takes over ten years and billions of rupees to create a single medicine. The AI system "Atomwise," which makes use of supercomputers, is helpful in determining treatments from the molecular structure database. It launched a virtual search effort to find safe and efficient treatment for the Ebola virus using currently available medications. Two medications that caused an Ebola infection were found using technology. In contrast to months or years when analysis was done by hand, this study was finished in a single day. A Boston-based Biopharma company created big data for patient

management. It stores information to determine the causes of some patients' illness survival. They distinguished between climatic circumstances that are conducive to health and those that are not by using AI technology and biological data from the patients. .. It supports applications for problem-solving, healthcare, and medication development and creation.

- **AI assistance for patients in the healthcare system**- One of the ten most promising technologies of 2016 is the "open AI ecosystem." Compiling and contrasting the data from social awareness algorithms is helpful. A tremendous amount of data, including treatment history and patient medical history from infancy until that age, is recorded in the healthcare system. Ecosystems can analyze this massive amount of data and provide recommendations regarding the patient's lifestyle and behaviors.

- **Analyzing the healthcare system**- If all of the data in the system is computerized, data retrieval is simple. Ninety-seven percent of Dutch invoices are kept in digital format and include treatment details, the name of the doctor, and the facility. Consequently, these are easily retrievable. Zorgprisma Publiek, a nearby business, uses IBM Watson cloud technology to analyze the bills. If something goes wrong, it recognizes it right away and fixes it. As a result, it enhances and prevents hospitalization of patients.

- **The diagnostic and imaging sector-** it is a vital and dynamic domain within the healthcare industry that necessitates the integration of artificial intelligence technology. There have been 50 healthcare AI-based firms created to date. Their primary areas of focus are wearables for patients, mental health, cancer, and heart illnesses. Figure 6 displays a list of businesses and startups using AI technology for healthcare diagnostics. Stamey et al.'s neural network technique, the Prost Asure Index, is helpful in distinguishing between benign and malignant prostate cancer. The accuracy, sensitivity, and specificity of this model are 90%, 81%, and 92%, respectively. A commercialized artificial neural network (ANN) model, PAPNET is a computerized automated screening device designed to detect cervical cancer.

- **Prognosis-** In the healthcare system, predicting the best course of therapy is crucial. To increase their chances of survival, high-risk patients must be accurately identified within the healthcare system. ANNs can analyze complex cancer data by leveraging the relationship between variables. Patients with colorectal and breast cancer are predicted to live longer using neural networks. They are also helpful in evaluating the results of prostate and lung cancer.

- **Healthcare system AI finance activity-** 690 million dollars have been invested in AI start-up projects to date. iCarbonX ($154 million) and Flatiron Health ($175 million).

VIII.   CONCLUSION

During past few years, a considerable amount of increasing interest towards the uses of AI technology has been identified for analyzing as well as interpreting some important fields of pharmacy like drug discovery, health care system , etc., as the AI technological approaches believe like human beings imagining knowledge, cracking problems and decision making. It has been demonstrated that automated databases and workflows may be used to conduct efficient analysis using AI techniques.In the end, artificial intelligence (AI) will complement human skill rather than replace it, even though it will attract significant investment from throughout the pharmacy sector and have a wide-ranging impact.

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