# Application of Artificial Intelligence in Pharmacy

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**ABSTRACT:**
A subfield of computer science called artificial intelligence (AI) gives robots the ability to interpret complicated data and operate more effectively. The amount of research on AI has skyrocketed, and its application to healthcare services and research is developing at a fasterrate. The advantages and difficulties of AI in medical and pharmaceutical research are covered in detail in this paper. The material was gathered using targeted keywords and phrases, including "artificial intelligence," "pharmaceutical research," "drug discovery," and"clinical trial," from databases including PubMed, Science Direct, and Google Scholar. "disease diagnosis," etc.To choose the studies and examine papers that have been released inthe last five years.

This article discusses in great detail the use of AI in illness diagnostics, digital therapy, individualized treatment, drug development, and pandemic or epidemic forecasting. The most popular AI technologies are deep learning and neural networks; prospective technologies for clinical trial design include Bayesian nonparametric models; wearable technology and natural language processing are employed for patient identification and clinical trial monitoring.

**Keywords:** Artificial intelligence, Pharmacy, Pharmacist, Drug Discovery, Personalized Medicine.

## I.    INTRODUCTION :

Artificial intelligence (AI) is the conglomeration of different intelligent processes and behaviors created by computer models, algorithms, or rules that enable a machine to simulate human cognitive tasks like learning, solving problems, and so on.  AI is rapidly advancing into the healthcare industry and has a significant influence on automation, illness detection, and clinical decision making. Artificial Intelligence (AI) presents potential for further exploration in the realm of pharmaceutical and healthcare research due to its capacity to analyze massive amounts of data from several modalities. A number of recent studies go into detail about the application of artificial intelligence (AI) in the healthcare business as well as other fields. Within the healthcare sector, AI technologies include robotic process automation, machine learning (ML), natural language processing (NLP), physical robots, and more. [1]

Is a branch of research on intelligent machine learning, focusing on intelligent computer systems that produce outcomes akin to those of human attention. In general, this process include gathering information, creating effective methods for using that information, presenting precise or approximative findings, self-corrections, and changes. Artificial intelligence (AI) is often used to analyze machine learning and mimic human cognitive tasks. AI technology is used to obtain meaningful interpretation and to conduct studies that are more accurate. From this angle, artificial intelligence(AI)technology combines computational intelligence with a variety of practical statistical models. AI technology has recently grown to be a vital component of the business with practical applications in several technological and scientific domains. When looking back over the previous 25 years, pharmacies have done a fantastic job of meeting the rising demand for prescription drugs despite shortages of pharmacists, rising operating expenses, and declining reimbursements. Pharmacy has also done a fantastic job of utilizing technological automation to support safety, accuracy, and efficiency in every pharmacy environment, as well as to increase workflow efficiency and reduce operating costs. Pharmacists can interact with more patients and improve their health outcomes when automated dispensing saves them time. It is likely that the first computer was used in a pharmacy in the 1980s. Since then, computers have been used in a variety of applications, 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 more the

pharmacy industry will change over time. Several expert systems have been created in the medical field to help doctors diagnose patients. A number of drug-therapy- focused programs have been reported recently. They direct the selection of medication formularies, drug interactions, and drug therapy monitoring. AI can affect many facets of pharmacy, and pharmacists should think about these possibilities as they can one day be included in everyday pharmacy operations. [2]

Health care is undergoing a change thanks to artificial intelligence (AI), and pharmacy practice is no exception. By enhancing medicine administration, optimizing productivity, and enhancing patient outcomes, artificial intelligence is transforming the way pharmacists provide healthcare. This article explores AI's potential role in pharmacy, highlighting its benefits, limitations, and prospective applications that might impact the pharmaceutical sectorgoing forward. [3]

<u>**Applications Of Artificial Intelligence :**</u>
There are several applications of AI
➢ Maintaining of medical records
➢ Treatment plan designing
➢ AI technology's assistance with repetitive jobs
➢ Support for health and medicine**:**
➢ Medical accuracy
➢ Drug creation

● **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 simpler. The Google Deep Mind health initiative facilitates the expeditious excavation of medical records. Thus, this initiative is helpful in providing faster and better healthcare. This initiative helps to enhance eye therapy at the Moorfields Eye Hospital NHS. [4]

● **Treatment plan 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 provided by this technology takes into account all of the prior data and reports, clinical knowledge, etc. With the help of insights gained from working thousands of hours with physicians at Memorial Sloan Kettering Cancer

Center, IBM Watson for Oncology, a software as a service, is a cognitive computing decision support system that analyzes patient data against thousands of historical cases and offers treatment options to help oncology clinicians make educated decisions. [5]

● **AI technology's assistance with repetitive jobs:**
AI technology is also helpful with some repetitive tasks, such analyzing radiography, X-ray imaging, ECHO, ECG, and other tests to identify and detect illnesses or problems. IBM introduced Medical Sieve, an algorithm that functions as a "cognitive assistant" with strong analytical and reasoning skills. In order to combine deep learning with medical data and enhance the patient's condition, a medical startup is required. For every bodily component, there is a separate computer program that is employed in a certain illness state. For practically every kind of imaging analysis, including X-ray, CT, ECHO, ECG, etc., deep learning may be used. [6]

● **Support for health and medicine:**
AI technology has been shown to be effective in providing health support services as well as pharmaceutical help in recent years. Molly, a virtual nurse created by start- ups, is greeted with a kind face and voice. Its goal is to support patients with their chronic ailments during medical appointments and assist them in directing their own treatment. An program called AI Cure, which works with a smartphone's camera, keeps track of 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. [7]

● **Medical accuracy:**
AI has a positive effect on genetic development and genomics. Using patterns found in genetic data and medical records, Deep Genomics [8], an AI system, may be used to find mutations and their connections to illnesses. This technique provides physicians with information on what happens within a cell when genetic variation modifies DNA. Craig Venter, the creator of the human genome project, creates 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 may be used to pinpoint their precise location.[9]

• **Drug creation:**

Research and development for medicines costs billions of rupees and takes more than ten years. The AI program "Atomwise", which makes use of supercomputers, is helpful in determining treatments from the molecular structure database. It launched a virtual search campaign for an Ebola virus treatment that is both safe and effective using already available medications. Two medications that led to 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. Big data was created by a Boston-based Biopharma business for patient management. It stores information to determine the causes of some patients' illness survival. They distinguished between air conditions that are conducive to health and those that are conducive to sickness using biological data from patients and artificial intelligence. [10]

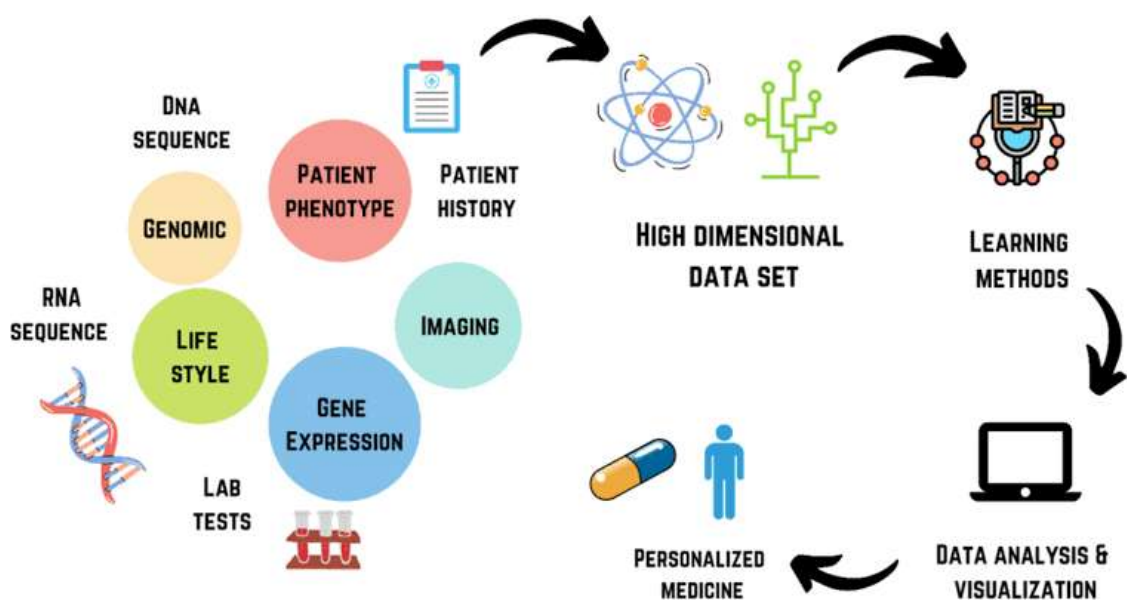**Artificial intelligence in digital therapy/personalized treatment.**



**Fig.1** AI in accuring and analyzing data of patient in personalizing treatment.
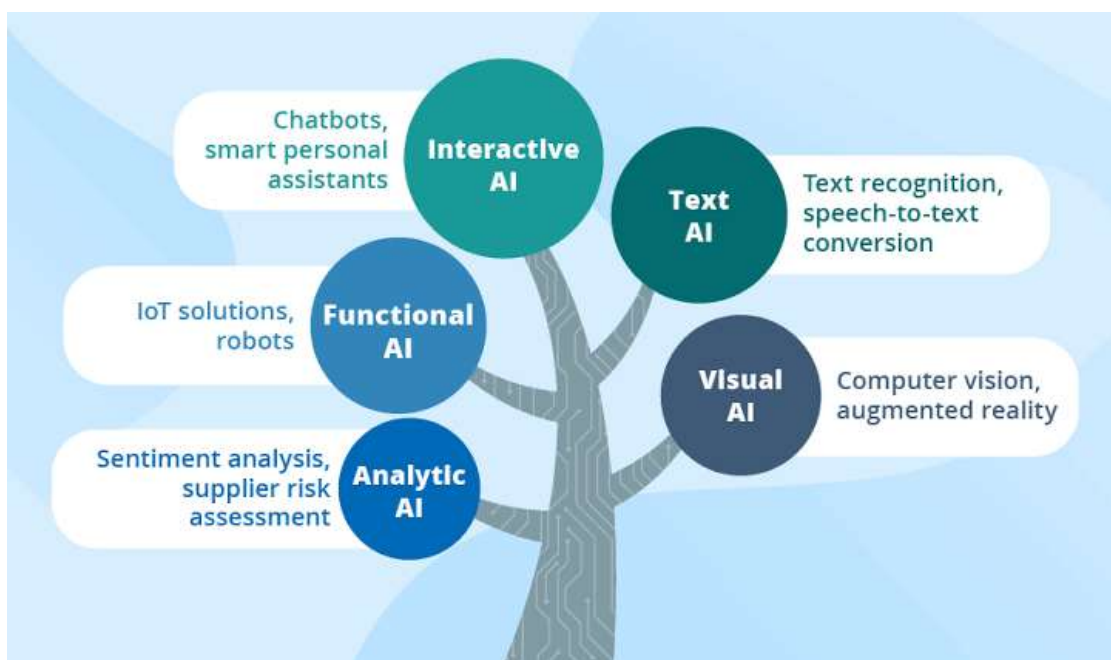
**Fig.02** : Types of Artificial Intelligance

### AI could be used to Increase efficiency in Healthcare diagnoses :

Although it's early in its application, employing AI to identify conditions might save treatment costs by up to 50% and improve health outcomes by 40%, according to Harvard's School of Public Health. A study team from the University of Hawaii discovered that implementing deep learning AI technology might enhance breast cancer risk prediction. This is one use case example. An AI system can be taught on a far wider number of images than a radiologist—up to a million or more radiological images—but more study is required, as the main researcher noted. With the exception of hardware, that algorithm may also be duplicated for free. An ML algorithm was created by an MIT group to decide whether a human expert is required. In several cases, a hybrid human-AI model performed the best, such as detecting cardiomegaly in chest X-rays. An further published study discovered that AI was superior than trained physicians in identifying skin cancer. Researchers from the US, Germany, and France employed deep learning techniques on over 100,000 photographs to detect skin cancer. They discovered that AI performed better when compared to the findings of 58 renowned dermatologists. [11]

### AI Governance in healthcare :

Concerns about potential bias, lack of transparency, privacy issues regarding data used to train AI models, safety and liability concerns, and more must be addressed as AI becomes more and more integrated into healthcare delivery. "AI governance is necessary, especially for clinical applications of the technology," stated Laura Craft, VP Analyst at Gartner. "However, because new AI techniques are largely new territory for most [health delivery organizations], there is a lack of common rules, processes and guidelines for eager entrepreneurs to follow as they design their pilots."

To create a paper titled Ethics & Governance of Artificial Intelligence for Health, the World Health Organization (WHO) conferred with several Ministries of Health and top authoritiesin the fields of ethics, digital technology, law, and human rights for eighteen months. This research highlights six consensus principles to guarantee AI serves the public interest, as well as hazards and ethical concerns associated with employing AI in healthcare :

1. Protecting autonomy
2. Promoting human safety and well-being
   3.Ensuring transparency
4. Fosteringaccountability
5.Ensuring equity
encouraging the use of sustainable and adaptable tools

Along with maximizing the potential of the technology, the WHO study offers guidelines

for managing AI in healthcare that also hold healthcare professionals responsible and attentive

tothe communities and individuals they serve. [11]



**Fig.03** :  Benefits Of AI For Healthcare

Artificial intelligence (AI) tackles both particular and complex issues by applying personalized knowledge and learning from the answers it generates. The medication development process might undergo a transformation because to remarkable advances in AI technology and processing capacity. The pharmaceutical sector is now having trouble maintaining its drug development programs due to rising R&D expenses and declining productivity. In this overview, we go over the main reasons behind the low approval rates of new drugs, potential methods artificial intelligence (AI) might boost the productivity of the drug research process, and the partnerships between the biggest names in the pharmaceutical business and AI-driven drug discovery companies.

**The process of developing drugs :**

The feedback-driven drug development process begins with data that are already accessible and gathered from a variety of sources, including literature-based information, high- throughput compound and fragment screening, and computer modeling. The steps in this procedure are induction and deduction in turn. Ultimately, this cycle of induction and deduction produces molecules with optimal hit and lead contents. Merely automating certain stages of the cycle lowers error and unpredictability and boosts drug development productivity. [12]
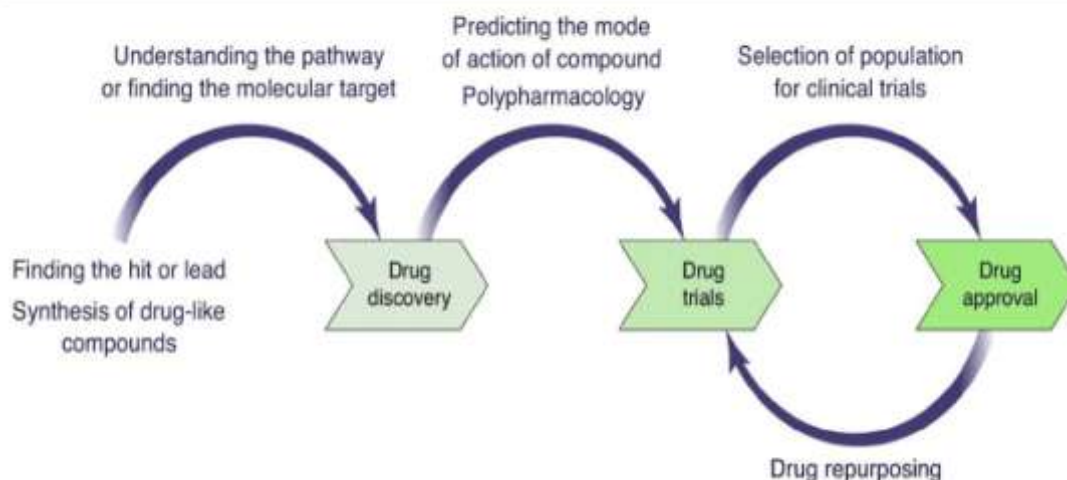
**Fig.04 :** AI in drug development

**Applications of Artificial Intelligance in Pharmacy :**

1. Research development.
2. Drug development.
3. Diagnosis.
4. Disease Prevention.
5. Epidemic Prediction.6.Remote Monitoring.
7. Processing Bio-medical And Clinical Data.
8. Marketing.
9. Rare disease and Personalized Medicine.
10. Identifying Clinical Trial Candidates

## II. CONCLUSION :

Artificial intelligence (AI) is the result of fusing human resources and expertise with artificial intelligence. The subject of artificial intelligence research is still in its infancy, and many fascinating applications are being explored, even for those who see the technology as an enemy. As such, it is strongly recommended that pharmacists possess the hard skills needed to enable AI augmentation. Exposure to and education about artificial intelligence are essential in all aspects of pharmacy practice. Pharmacy students should be exposed to the concepts of AI and data science through a health informatics curriculum as part of their PharmD degree. Allowing pharmacists to learn about AI through ongoing education is also essential. Pharmacy residencies or data science courses that focus on AI-related topics should be available to pharmacists who wish to gain more hands-on experience with AI development, governance, and application. In order to ensure that our profession is ready to manage these changes in healthcare, the pharmacy education system must be adaptable, given the rapid advancement of new technology.

Artificial Intelligence and its remarkable capabilities are constantly being developed in an effort to reduce the challenges that pharmaceutical companies face. These challenges impact the entire lifecycle of a product as well as the process of developing new medications. The increase in industry start-ups may be explained by this. The healthcare business is now dealing with a number of complex difficulties, one of which is the rising cost of medications and treatments. As a result, society needs to change drastically in this regard.

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