ISSN: 2347-6567

*International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)*

*IJAMSCR |Vol.12 | Issue 3| Jul - Sept -2024*

**www.ijamscr.com**

DOI : https://doi.org/10.61096/ijamscr.v12.iss3.2024.380-385

**Review**

# Artificial intelligence in pharmacy

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Published on: 09 Sept 2024

Published by:
DrSriram Publications



## Abstract

A branch of computer science called artificial intelligence makes it possible for machines to function well. By taking on complex data processing Duties, its use in pharmaceutical technology has grown, improving workflow efficiency, lowering operating cost, and promoting safety, accuracy, and Productivity. It could Potentially save time and money in addition to assisting us in better understanding the connections Between various formulations and process parameters. Artificial intelligence (AI) research has been shown to be able to analyze and interpret various critical pharmacy fields, including drug development dosage forms design, and hospital pharmacy. Thanks to artificial intelligence's significant contributions to the management and preservation of data and information, the healthcare industry has seen impressive advancements.

**Keywords:** AI, Telepsychology, MEDI Robot, Innovative peptides & Drug screening.

## INTRODUCTION

Artificial intelligence (AI) is an area of computer science that studies problem solving using symbolic programming. AI's ability to diagnose diseases has greatly improved, disease analysis is now necessary to ensure patient safety and provide well-through-out remedies.AI is entering the health care industry at a rapid pace. In the biotech industry, AI is regarded as having "a key supporting role in the fight to treat and stop" the virus and could help a solution arrive sooner than it otherwise would have.AI is acknowledged for playing a critical supporting role in the fight against and containment of the virus, which could hasten the biotech industry's search for remedies.[1] Among the new projects using AI technology in pharmacy are drug delivery formulations, research, and discovery, among other healthcare uses. Already, this movement has transcended hype to inspire optimism.

The employment of AI models also makes it feasible to predict in-vivo responses, the pharmacokinetic properties of the treatments, the right dosage, etc.[2] because Pharmacokinetic prediction is important for drug development, using in silico models contributes to the medicines cost and efficacy. There are 2 primary groups of AI technological developments. The 1st consists of conventional computing techniques, including expert systems which are able to simulate human experiences and draw judgments. Starting with the most basic concepts, such expert systems.[3] The latter is made up of systems that use artificial neural networks (ANNs) to simulate how the brain functions.

**Types of artificial intelligence**

**Depending on their presence and caliber**

a. weak AI, or artificial narrow intelligence (ANI)
b. Artificial general intelligence (AGI)
c. Artificial super intellect (ASI)[4]
    a. Weak AI, or artificial narrow intelligence (ANI)
       It is skilled in particular tasks, including traffic light management, chess Practice driving and facial recognition, among others.[5]
    b. Artificial general intelligence (AGI)
       Also known as strong AI, is sometimes called human level AI because it is able to emulate human talents. This kind of AI is applicable of handling new tasks and streamlining human cognitive processes.
    c. Artificial super intellect (ASI)
       It is more advanced than human intellect and demonstrates far higher activity in domains such as mathematics, drawing, and space- related tasks, both in terms of what is now on hand and what is under development.[6]

**Depending on the existence (4 main artificial type of intelligence)**

a. Reactive machine
b. Restricted mind system
c. Theory of mind
d. Self-awareness
    a. Reactive machine
       Because it lacks a memory system, it can only be used for specialized, onetime tasks and is unable to draw on prior knowledge. We call this type of machines reactive machines. One famous example of such a system is IBM's chess program which is capable of predicting and identifying chess board pieces.
    b. Restricted memory system
       It has a limited memory system that makes use of prior knowledge to solve different problems. When it comes to autonomous cars, this system is good at making choices based on observations that are recorded and then used for further actions. However, these records are not kept around forever.
    c. Theory of mind
       This concept is based on the idea that "theory of mind", which suggest that each person's distinct ideas, goals and wants have an impact on the decisions they make. There is not now a system of this type for AI.
    d. Self-awareness

It has awareness of itself, including the awareness of one self. But this particular kind of AI system is not available right now.

The role of artificial intelligence (AI) in the following areas:

1. Disease diagnosis
2. Digital therapy/ personalized treatment
3. Radiation therapy
4. Retina
5. Carcinoma
6. Other chronic disorders
7. Drug discovery
8. Prediction of bio activity and toxicity
9. Clinical trails
10. Designing clinical trials, identifying patients, recruiting, and enrolling
11. Monitoring trails, patient adherence and end point detection
12. Forecasting of an epidemic/pandemic.[7]

**Artificial intelligence in E-therapy (Tele-psychology)**

AI might be able to infer a significant association from the raw data sheets. This also applies to the diagnosis, treatment plan, and mitigation of the illness. It is possible to apply many of the more modern techniques used in the developing discipline of computational knowledge to almost every area of medical study. Complex clinical problems require the acquisition, analysis, and use of lot of knowledge, which presents a difficulty. AI's progress in medicine has helped doctors solve difficult clinical problems. Healthcare professionals can receive assistance with data manipulation from system such as Artificial Neural Networks (ANNs), evolutionary computational models, fuzzy expert systems, and hybrid intelligence systems. The nervous system seen in animal functions as the Artificial Neural Networks (ANNs) foundation. Concurrent data processing is carried out using a network of interconnected computer processing, which resemble neurons. The binary threshold function was used by the first artificial neuron, with separate layers for the input, middle, and output layers, the multiple feed-forward perceptron rose to prominence. A connection with a given numerical weight connects each neuron.[8] Paul Bowers presented a brand-new technique called "Back propagation learning" using a powerful learning algorithm in 1974. Applications for artificial neural network can be found in waveform analysis, data interpretation, and picture diagnosis. The study of reasoning, thinking, and inference that can understand and apply real-world occurrences is known as fuzzy logic. Its main method is a continuous membership range from 0 to 1, where 1 denotes truth and 0 untrue. Vasodilation and anaesthetics have also been managed by fuzzy controllers in surgical settings. Inspired by the ideas of natural evolution, this evolutionary computation method emphasizes survival of the fittest.

**Artificial intelligence system in Radio oncology**

The use of automated treatment planning, a new technology progress, provides noteworthy benefits for the planning of radiation therapy treatments. It lowers error rates and effectively improves plan quality, consistency, and quality. Three parts make up the treatment process: multi criteria optimization, modelling of prior clinical knowledge, and automated rule application. Clinical guidelines can be implemented by a simple computer software with predetermined structures. The reasoning process normally involved in manual treatment planning systems, which can also analyse the anatomy and physiology of a patient. Radio-mics can be used to evaluate toxicity and forecast treatment results for specific radiation therapy patients.[9]

**Artificial intelligence in Ophthalmology**

Retinal high- solution imaging has made it feasible to evaluate human in an amazing manner. A retina expert or ophthalmologist can design a customized treatment strategy and put in a place a continuously evolving learning healthcare system. Utilizing a single retinal image and high- definition drugs.[10]

**Artificial intelligence in Oncology**

Because of its many uses, AI has grown in significance in the domains of cancer detection and treatment. Utilizing gene expression data, a multiplayer perceptron neural network was trained to identify non-Hodgkin lymphoma subtypes.[11] The neural network's input player is made up of 20,863 genes, and the output layer is made up of lymphoma sub types. The sub types of lymphoma include Burkitt, Mantle Cell Lymphoma (MCL), Follicular lymphoma marginal zone lymphoma, and Diffuse Large B-cell Lymphoma (DLBCL). An artificial neural network was trained to discover novel prognostic indicators for MLC using gene expression data. According to the finding, 58 genes exhibited high accuracy survival prediction; five of these were favourable and 10 were associated with bad survival. A multivariate study of gene expression utilizing the Multilayer Perceptron (MLP) in DLBCL patient indicates that four genes are connected with favourable survival and three genes with by survival. The genetic and transcriptional information required for Cell-Of-Origin (COO) and AI deep learning technique based DLBCL classification in the Next-Generation Sequencing (NGS) platform was obtained via RNA-seq. Assays for categorization and future clinical application are now more affordable, effective, and repeatable thanks artificial intelligence. AI speeds up cancer diagnosis while keeping excellent accuracy.[12] The degree of malignancy in gastrointestinal patients is determined by Colorectal Cancer (CRC) screening technologies, and visual nocturnal imaging is a vital tool for predicting the course of gastric cancer by identifying Helicobacter pylori infection. AI is a versatile clinical technique for early lung cancer detection and screening. Deep learning and machine learning algorithm are useful in lung cancer screening because they can preserve vast volumes of data and accurately classify pulmonary nodules. AI currently assists remote institutes and pathologists with responsibilities. Facing a shortage of pathologists, the development of this technology in pharmaceutical and healthcare research hinges on the availability of user-friendly tools that don't require a background in computational science. Such tools can help overcome the limitations of AI in translation research. Over the past 10 years, AI has shown great promise in diagnosing breast cancer. By utilizing a combination of quantitative and qualitative MRI features, AI-assisted techniques can predict treatment response in breast cancer patients even before Neo Adjuvant Chemotherapy (NAC) begins, AI-based software supports radiologists by helping them differentiate between benign and malignant breast lesions, reducing the likelihood of false-negative mammogram interpretations.[13]

**Artificial intelligence in chronic pain management**

AI-based computer programming techniques offer various computerized therapies, primarily focusing on behavioural and cognitive approaches using joysticks or multiple-choice questions. A new method of computer interaction has recently been developed, allowing patients to follow medication recommendations and even perform their own biopsies. Regular monitoring is essential for chronic diseases, and AI can create virtual medical assistants to assist with this task. For instance, and integrated system can predict the occurrence of article fibrillation using a single-lead ECG sensor, deep learning, and physical activity data from a smartwatch and accelerometer.[14] The automated system identifies issues and retains the most effective solutions for each patient, already being used to optimize insulin therapy. In patients with type2 diabetes mellitus, machine learning-based technologies like clinical decision support can also predict both short-and long-term HbA1c responses following the initiation of insulin. Patients now have more advanced options for managing their diabetics, such as web-based apps for smartphones and tablets.[15]

**Artificial intelligence- Enhanced drug screening**

The drug discovery process often involves testing compounds against samples of diseased cells. Further analysis is required to identify biologically active compound worthy of additional investigation. Novartis research teams use machine learning logarithms to analyse images and predict which untested compounds might be worth for the exploration, there by speeding of the screening process. Computers can discover new data sets much faster than traditional human analysis and laboratory experiments, leading to the quicker availability of new and effective medications. This approach also reduces operational costs associated with the labour-intensive manual investigation of each compound.[16] the current AI initiatives by leading biopharmaceutical companies includes:

1. A mobile platform can enhance patient outcomes by utilizing real-time data collection to provide personalized recommendations.
2. In drug discovery, pharmaceutical firms and software companies are collaborating to integrate cutting-edge technologies in to the costly and time-consuming process.

**Framework for Artificial intelligence (Tools for Machine learning)**
**(Advanced methods)**

**Robot pharmacy:** To improve patient safety, UCSF Medical centre uses robotic technology to track and manufacture drugs. They assert that 3,50,000 doses of medication have been perfectly manufactured by the technique. The robot has proven to be much more accurate at delivering medication than people, and it is also smaller.[17]

**MEDI Robot:** MEDI stands for Medical and Engineering Designing Intelligence. AI tools the University of Calgary's Tanya Bean, an Albertan professor of community health sciences, coordinated the initiative that led to the creation of the pain management robot. she got the concept from working in hospital where children scream during procedures. Following the development of a rapport. The robot goes over what to anticipate during medical procedure with the children.[18]

**TUG Robots:** Phaethon TUG robots are designed to navigate hospitals autonomously while delivering heavy objects like trash and linen as well as supplies, meals, and prescription. It is available in two configurations: permanent and secured carts, and an exchange base platform for moving racks, bins, and carts.

**Erica robot:** The mew care robot Erica was developed by professor Hiroshi Ishiguro of Osaka University in Japan. It was developed in collaboration with the Japan Science and Technology Agency, Kyoto University, and the Advance Telecommunications Research Institute International (ATRII). It speaks Japanese and has an Asian-European blend of facial traits. It takes pleasure in animation. [19]

**Benefits of Artificial intelligence Technologies**

The prospect benefits of Artificial intelligence technology are as follows:

**Improved accuracy:** Artificial intelligence significantly reduces errors and enhances precision, leading to increase accuracy. In space exploration, resilient robotic entities made of durable materials are utilized to withstand extreme conditions, making them ideal for navigating challenging atmospheric environments. [20]

**Challenging expeditions:** AI proves to be highly practical in industries such as mining and fuel exploration. Additionally, AI technologies are capable of exploring the ocean, overcome limitations caused by human errors.[21]

**Everyday applications:** AI is integrated into many aspects of our daily lives. For example, GPS systems are commonly used during long journeys, AI-powered devices assist in predicting user inputs and correcting spelling errors.[22]

**AI assistants:** Sophisticated organizations are increasingly employing AI systems like "avatars" or digital assistant models to enhance their operations.[23]

**Clinical applications:** AI programs assist doctors in assessing patient's conditions and analysing potential side effects or health risks associated with their medications.AI applications, such as surgical simulators for the heart, gastrointestinal track, brain and more, provide valuable learning opportunities for trainee surgeons.[24]

**Accelerated technological progress:** Nearly all of the worlds most advanced technological developments incorporate artificial intelligence.AI plays a key role in creating new molecules, developing computational modelling programs in advancing drug delivery formulations.[25]

**Assistance and support:** AI technology services people of all ages, from children to the elderly, around the clock. It plays a vital role in education by acting as a resource for teaching and learning.

**Limitless potential:** Machines, free from emotions and limitations, can outperform humans in various tasks executing them with greater efficacy and precision.[26]

**Vision of Artificial Intelligence**

In the pharmaceutical industry, there are numerous unmet needs, particularly in health care, where a revolution is correctly underway. A representative from Johnson &Johnson stated that "artificial intelligence is enabling us to discover new treatments and techniques faster than we could have imagined just a decade ago". This is an exciting time to be involved in this fields, as the market for healthcare AI is rapidly expending, offering lucrative and fulfilling career opportunities.[27] In the pharmaceutical sector, affords are being made to leverage AI to accurately predict the timing and locations of potential epidemic outbreaks. This involves using AI that learns from historical outbreak data and other information sources. With in healthcare, AI is also employed to proactively prevent medical errors and reduce the frequency of hospital re-admission.

## CONCLUSION

AI has the potential to address a wide range of issues, including social distancing contact tracing, diagnosis, workplace safety, and more, especially in the context of COVID-19 and future pandemics. However, errors could hinder progress, so it is crucial to consider many factors to ensure AI solutions effectively meet real-world needs. Humans represent the most advanced machines ever designed, with the brain being an incredibly successful tool that strives to create something more efficient than itself. The field of AI has undergone significant changes, thanks to tools like robotic pharmacy, the tug robot and Watson for oncology. As the healthcare sector grows, there will be an increasing demand for more sophisticated and technologically advanced infrastructure. The creation and implementation of algorithms for data interpretation and learning analysis is the essence of artificial intelligence.

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