Review Article

Advance Application of Artificial Intelligence (AI) In Pharmaceutical Sciences

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ABSTRACT

The incorporation of artificial intelligence (AI) and machine learning (ML) into pharmaceutical sciences has spurred revolutionary breakthroughs in drug discovery, clinical development, manufacturing, and postmarket monitoring. Furthermore, it provides a brief summary of the most recent advancements made by the pharmaceutical industry in drug development.in collaboration with several AIs. AI plays a major role in various areas of pharmacy, such as hospital pharmacy, managing multiple medications, developing drug delivery systems, and discovering new drugs. Different types of artificial neural networks, like recurrent neural networks and deep neural networks, are being used in creating drug delivery formulations and discovering new drugs. The power of technology in quantitative structure-property relationship (QSPR) and quantitative structure-activity relationship (QSAR) has been tested and proven through many real-world uses. To handle problems related to data and numbers, artificial intelligence (AI) was created as a solution.

INTRODUCTION

The combination of artificial intelligence (AI) and machine learning (ML) in pharmaceutical sciences has greatly changed how drugs are discovered, how clinical trials are conducted, and how personalized medicine is developed. This process generally starts with gathering data and building strong systems that show how this data can be used. It also includes making initial estimates and allowing the system to adjust or correct itself as needed.[1] AI is used to study machine learning in order to copy how humans think. [2,3] In many technical and research fields, AI is becoming a key part of industry. [3,4] Using artificial intelligence helps with deeper analysis and better understanding. In artificial technology, this approach combines various useful static models with computational intelligence. The pharmaceutical industry uses artificial intelligence by using automated algorithms to do tasks that

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used to require human intelligence. In the pharmaceutical and biotechnology fields, the use of AI has changed how scientists work on developing drugs and preventing diseases over the past five years. [4]] AI is now being used in hospitals, the pharmaceutical industry, and retail pharmacies to encourage the adoption of AI in pharmacy practices. This is meant to convince pharmacists to accept this new technology and to put in a lot of effort to learn the necessary skills. This will help pharmacists play a role in the future development of the field.

AI Goals:

1: The development of expert systems involves building automated systems that offer guidance and operate with intelligence. These systems help people understand how to take the right steps.

2: Computer-based human intelligence is about creating similar thinking patterns in computers so they can act and think like humans. It involves the key steps needed to deal with tough situations.

3: AI will help bring together different fields such as psychology, ethics, healthcare, natural sciences, and medical science.[7]
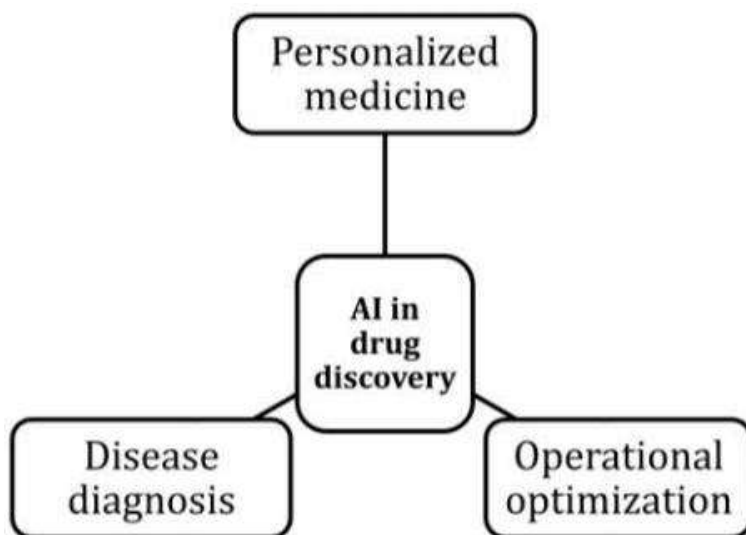

Fig.1 Trends In AI

Classification Of AI:

There are two ways to categorize AI: one based on whether it exists or not, and the other based on how good it is.

1. Weak AI or Artificial Narrow Intelligence (ANI)

It can do a few different tasks, like driving a car, recognizing faces, playing chess, understanding traffic signals, and more.

2. Strong AI or Artificial General Intelligence (AGI)

It can do all the things humans can do and is known for being at the human level in AI. It has the potential to make human thinking easier, improve skills, and handle new challenges.

3. Artificial Super Intelligence

- It is smarter than humans.
- It can do more things than humans can.

- Like math, space, drawing, and other areas. AI can be grouped in this way, depending on whether it exists right now or not.

Type 1.

It is used in applications with a limited scope. These systems cannot benefit from past experiences because they don't have a memory system. They are called reactive machines. An example of this is the IBM chess software, which can recognize checkers and make decisions on the chessboard without using prior knowledge.

Type 2.

It has a limited memory system, which means it can use past experiences to solve new problems.

This type is used in vehicles with automatic transmissions. These systems can make decisions based on a few observations that are recorded, but they don't keep track of all the details for long.

Type 3.

It depends on the "Theory of Mind." It means that human choices are affected by their individual thoughts, goals, and desires. This is not real AI.

Type 4.

It has self-awareness, which means it knows about itself and is conscious. This system is also not real AI.

Table 1. Classification Of AI

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

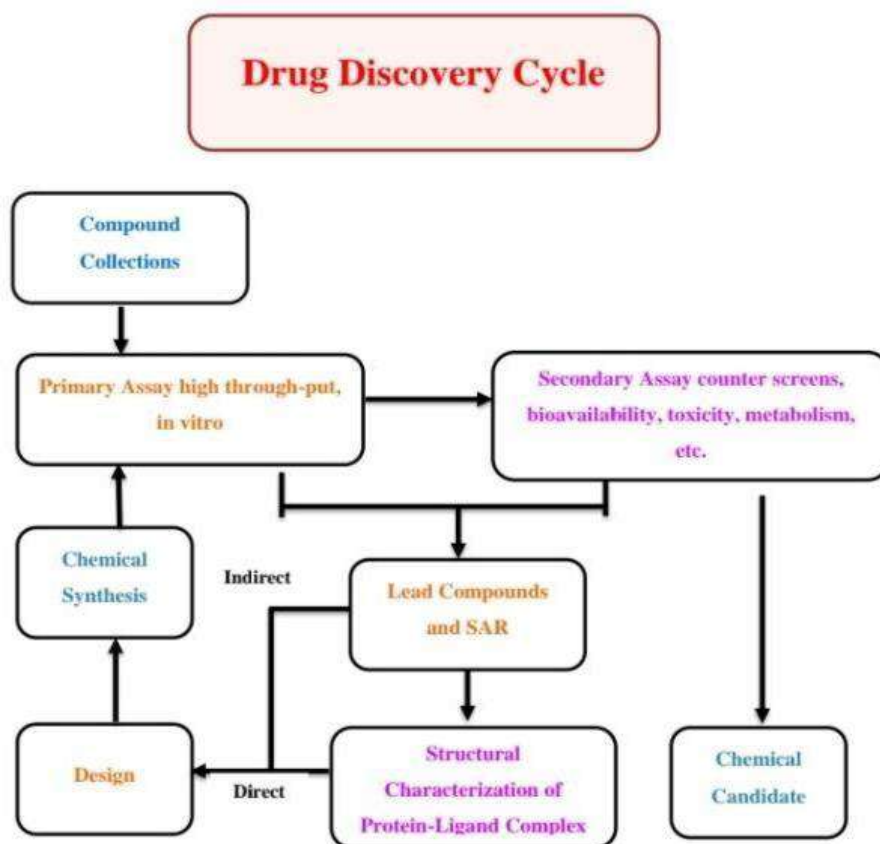**Artificial Intelligence in Drug Discovery [6]**

Fig.2 Drug Discovery Cycle

Pharmaceutical companies have been able to speed up their processes because of the use of AI in the healthcare field. It helps them find new drugs more quickly, speeds up how medications are given, and automates the process of identifying targets. AI also helps with drug repurposing by looking at chemicals that might have effects other than their intended use. This leads to faster drug development and fewer unnecessary steps in both healthcare and the AI industry. Some of the biggest biopharmaceutical companies, like Pfizer, are working on various treatments. They are using IBM Watson, a machine learning system, to study immuno-oncology treatments. IBM Watson is especially useful for handling images and signals, and it can also predict changes in functions such as bladder control, epileptic seizures, and stroke. Another benefit of AI is its role in public health and epidemiology, which are parts of healthcare. It can detect outbreaks of several diseases, including

malaria, tuberculosis, dengue fever, and the flu. Additionally, AI has been used to predict the spread of the Zika virus and the ongoing COVID-19 outbreak.

AI in Clinical science practice

AI plays an important role in the healthcare industry by performing key tasks such as collecting, tracking, organizing, and storing data. By carefully analyzing large amounts of genetic information, AI can spot patterns that help identify genetic changes and link them to various health conditions.

AI In Diagnosis and Targeted Genomic Treatments

Healthcare institutions use artificial intelligence (AI) in many ways, such as helping to organize and choose the best treatment methods and types of

medication for each patient. They also use AI to manage and plan treatment program.
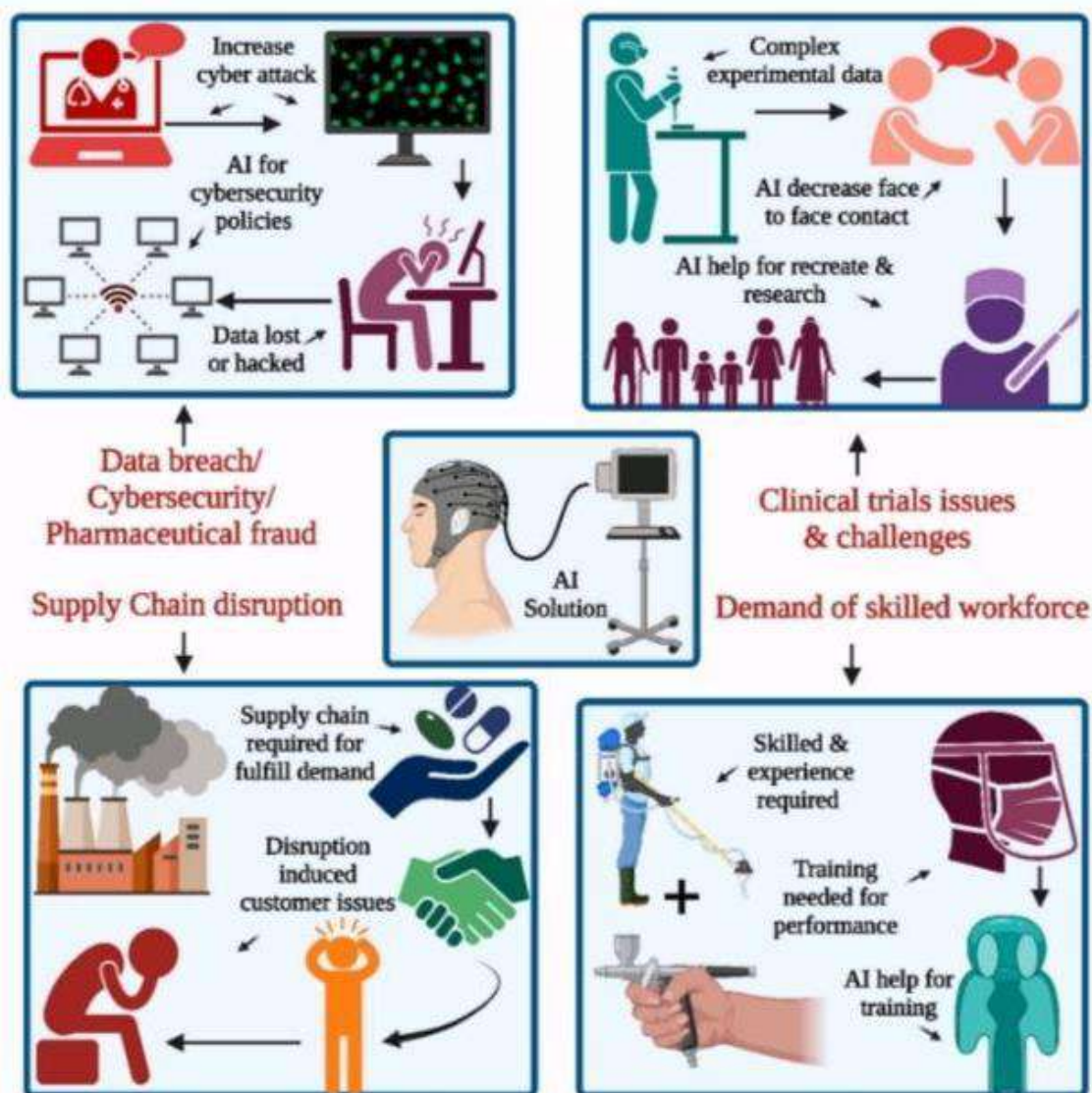
Fig.3 Depicts a possible AI solution to be pharmaceutical industries challenges acquiring a proficient Workforce is a prerequisite in all sectors to leverage their expertise, proficiency, and aptitude in product innovation the second pertains to supply chain disruption and clinical trials experimentation challenges the incidence of cyberattacks is on the rise, with data breaches and security emerging as significant concerns for the industry.

1.Data Protection and Cybersecurity

Challenges include more pharmaceutical fraud, data breaches, hacking, and cyberattacks.

AI Role: Implement AI-based cybersecurity measures to prevent data loss and stop hacking attempts.

2. Research And Communication

Challenges include handling complex experimental data and reduced in-person communication. AI helps by assisting in repeating experiments, analyzing research data, and supporting team collaboration from a distance.

3. Disrupting The Supply Chain

Problems: When there are issues with delivery or production, it becomes harder to meet what customers need and expect. AI helps by predicting how much demand there will be, making the supply chain work better, and reducing the effect these problems have on customers.

4. Workforce And Clinical Trials

Problems: There is a need for a well-trained workforce, detailed training programs, and challenges in conducting clinical trials.

AI Function: In healthcare settings, AI can help with training support, tracking performance, and offering guidance for making decisions.

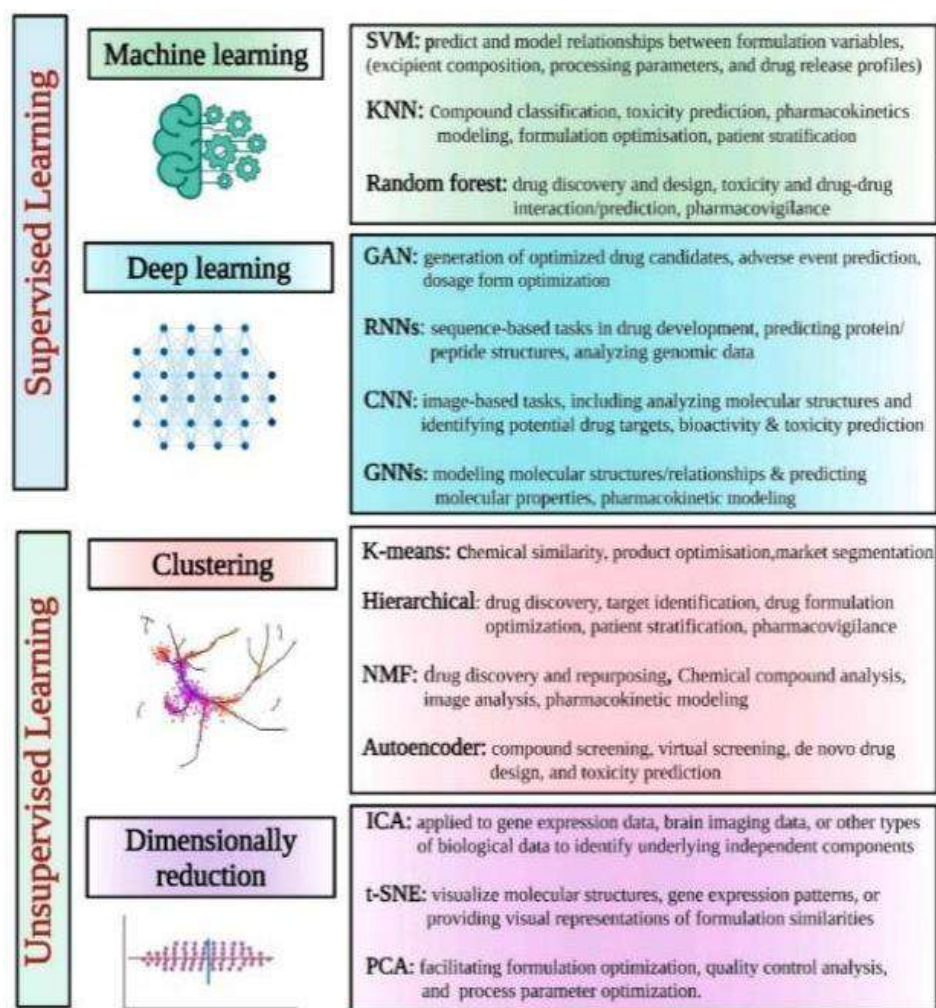**Current Pharmaceutical Challenges and Role Of AI**

Fig.4 Different Supervised and Unsupervised AI leaning Model for Pharmaceutical Application

Because of their many advantages, the industry continues to study small compounds to enhance products and boost customer satisfaction. Chemical development. The method for making

synthetic derivatives is cheap and easy to do. Because of this, there are many stable and effective medicines made with small molecules in the pharmaceutical industry. These methods encourage companies to invest more in new inventions.However, the field of biomolecular medicine is still growing rapidly.This is because small molecules have a limited size and their innovations and research don't spread easily.The way small molecules are shaped also affects how they work and how well they respond.[7-13] Since infusion is the preferred method, these compounds have a complicated pharmacokinetic profile. It is also the most practical way to give them. Molecular stability and pharmacokinetic control are key parts of studies involving nucleic acids. The main goals are to improve the pharmacokinetic exposure and increase the availability of these molecules. These problems can be solved with new technological advances.

Associated topics. [14-17]

Even though AI has a lot of potential in improving how medicines are delivered and in finding new drugs, it still has major downsides that require humans to step in. People or experts need to look at the complex results and make sense of them. The main thing AI does is work with the data sets to make predictions, but the final understanding and interpretation of those results depend on the gray areas and real-world situations. Zone needs someone to step in and help reach the right answer.AI can feel things.There are issues with how the algorithm looks at data and checks its ideas.AI has a lot of potential for useBecause of this, a lot of work could help reduce the limits it has.Make AI reliable and good at what it does.[18]] The approach used in AI relies on machine learning, or its areas like natural language processing and deep learning. The learning process can be either supervised or unsupervised, and the type of algorithm used also plays a role. The most important thing to know is that supervised learning is a type of machine learning that uses known inputs and outputs, unlike unsupervised learning, which deals with finding patterns on its own. Supervised learning works by predicting outputs, such as labels or targets, based on different inputs or features. On the other hand, unsupervised learning aims to group data based on similarities in their features.[19]

Application Of Artificial Intelligence [20-24]

Fig.5 Application of Artificial Intelligence

1.Keeping Medical Records

The Google Deep Mind health initiative, started by Google, helps collect, store, track, and organize medical data quickly. [25] This initiative improves the quality and efficiency of healthcare, and the Moor Fields Eye Hospital NHS uses it to enhance eye treatments.[26]

2.Creating Treatment plans

Artificial intelligence is used to create effective treatment plans for patients with serious medical conditions. IBM Watson for Oncology is a type of smart computing system that looks at a patient's information and compares it to a large amount of past medical data, helping cancer specialists make better decisions.[27]

3.Repetitive Assisting Tasks

Artificial intelligence can help in identifying and diagnosing various illnesses or conditions, such as through X-ray imaging, radiology, ECHO, and ECG. Medical Sieve acts as a cognitive assistant with the ability to analyze and reason. Deep learning can be used for different types of imaging analysis, including X-ray, CT scan, ECHO, and ECG.

4.Medication Assistance and Health Support

Molly, a digital nurse, and Ai Cure are tools made to help people who have trouble taking their medications and are taking part in clinical trials. Molly has a friendly voice and image, while Ai Cure helps monitor patients and assist them in managing their health issues.[28]. Deep Genomics is an example of how AI helps in genomics and genetic research by identifying gene mutations and linking them to diseases. Craig Venter's "Human Longevity" project uses a person's DNA to predict their physical traits.

5.Creating AI Drug

AI technology uses powerful computers to find safe and effective ways to treat Ebola viruses. It also uses big data to understand why some patients get sick. This helps in designing apps for drugs, healthcare, and solving problems.[29]

6.Health System Support

The open ecosystem gathers and compares data from social cognitive algorithms. It offers patient history, treatment analysis, and suggestions for lifestyle and habits.

7.Health System Analysis

With Health Systems, searching for data is simple when everything is stored on computers. The Netherlands supports 97% of digital formats, including data on processing, doctor names, and hospital names.[30]

Advantages Of AI [31-33]

1.Error Minimization

This helps cut down on mistakes, improves precision, and lets the robot explore space more effectively.

2.Complex research:

This system is helpful for extracting resources, exploring fuel sources, and gathering information about the ocean.

3.Daily Applications:

AI is used in everyday tasks like GPS navigation, Android devices, correcting predictions, and spelling errors.

4.Unlimited functions:

Cars aren't limited by borders. Without an emotional machine, you can accomplish more, producing things more effectively and accurately than humans.

5.Digital Assistant:

AI systems like Avatar are used to help reduce human effort because they are emotional and capable. They can make logical decisions without being influenced by human emotions.

6.Iterative tasks:

People can only focus on one task at a time, but machines can process and analyze multiple tasks quickly. Machine settings like speed and time can be adjusted according to your needs.

Medical Use:

Artificial Intelligence programs help doctors and surgeons evaluate and analyze patients' conditions, including drug side effects and health risks. They also assist with artificial surgery simulations.

Like help:

AI technology can assist both children and the elderly around the clock, providing educational resources to everyone.

Disadvantages of AI [34-36]

1. Costly:

The use of AI brings about high costs. Building complex machinery, maintaining, and repairing them are very expensive. Designing a single AI machine takes a long time and requires a lot of work from the research and development team. AI machines need regular software updates, and reinstalling or recovering them takes more time and money.

2. No reproducing humans:

Robots with AI experience can think like humans and stay emotionless, which helps them perform tasks with more accuracy without making judgments.

3.No Improvement with Experience:

Human workers can improve themselves through experience. However, AI machines cannot be improved by gaining expertise. They can't tell which person is hardworking and which one isn't.

4. Lack of authentic creativity:

AI devices lack sensitivity and emotional intelligence. Humans can hear, see, feel, and think, and they can come up with creative ideas. These qualities can't be achieved by machines.

5. Unemployment:

Widespread use of AI in many areas might result in major job losses. Due to this, human workers may lose their work habits and creativity.

CONCLUSION:

AI has shown its value in many areas of drug discovery. It can assist scientists in designing, planning, managing quality, maintaining processes, and controlling quality in pharmaceutical development and delivery. However, it's not a solution that can solve everything overnight or bring major changes quickly. Still, it can boost efficiency, provide helpful insights, and offer new ways of looking at the drug discovery process. AI technologies work by mimicking how humans think, solve problems, and make decisions. Using automated workflows and databases for effective AI analysis has proven to be very helpful. Education and exposure to AI are important across all areas of pharmacy

practice. With AI-powered tools, it's easier to create new ideas, strategies, and predictions, as well as perform various analyses. These elements can be implemented more quickly and at a lower cost. The integration of AI technologies offers great potential for speeding up drug development, improving patient results, and transforming the pharmaceutical industry, helping it move from era 4.0 to era 5.0.

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