



## Artificial intelligence in pharmaceutical and health care management

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### ABSTRACT :

Artificial intelligence (AI) refer to the ability of algorithms encoded in technology to learn from data so they can perform automated task without explicit programming of every step by human. The research focused on AI has increased tremendously , and its role in healthcare services and research is emerging at greater place . This review elaborate on the opportunities and challenges of Ai in healthcare and pharmaceutical research. AI also represent risk and ethical challenge that must be addressed if societies, health system and individual are to fully reap its benefit. The development and adoption of appropriate principle, rules and regulation have become more urgent with the speed of technological advance in use of AI and its rapid adoption and uptake for diverse and occasionally unforeseeable uses. Computing has played a critical role for decades; computer -aided drug design dates to 1930s , and , in early 1980s , the “ next industrial revolution ” was proclaimed , with pharmaceutical designed solely by computer .

**Key words :** Artificial intelligence , clinical trials , disease diagnosis , drug discovery, prediction , digital therapy , research and development.

### Introduction :

Recently AI technology becomes more important in field of research and industrial technology. Pharmacy has also done a great job of addressing the growing demand for prescriptions, even when faced with pharmacist shortages, growing operating costs while promoting safety accuracy and efficiency .The purpose of this article to review information related to Artificial intelligence(1).

AI also use in healthcare and having major role in data and information storage and management such as – patient medication history, stock sale record, and automatic machine like CT scan , MRI , and simply healthcare measures. It includes Machine learning, computer program,

- ‘Unsupervised learning’ attempts to extract information from which provides similar results as same as human attention process. It is use for providing more accurate analyses as well as to attain useful misinterpretation labels; for examples patients with similar symptoms to identify a common cause.
- The fundamental of AI
- Maintaining of medical records
- Treatment plan design
- Patient medication history
- Health support and medication assistance
- Accuracy of dose
- Drug creation
- prediction of disease
- diagnosis of disease
- In research and development
- patient medication adherence
- Digital therapy (2).

### AI network and tool :

Artificial Intelligence encompasses a variety of domains, including reasoning, representation understanding, and information retrieval, with a core paradigm being machine learning (ML). ML employs algorithms capable of identifying patterns within a labeled data-set. A specialized area within ML is deep learning (DL), which utilizes artificial neural networks(ANNs). These networks consist of a series of interconnected advanced computational units known as ‘perceptrons,’ which are analogous to biological neurons in humans, simulating the transmission of electrical signals in the human brain.

The MLP community encompasses various applications, including pattern recognition, optimization support, technique identification, and control systems. These models are typically trained using supervised learning methods that operate in a single direction and can serve as general pattern classifiers. RNNs, or recurrent neural networks, are characterized by their closed-loop architecture, enabling them to memorize and store information, such as Boltzmann constants and Hop-field networks. CNNs, or conventional neural networks, consist of a series of dynamic structures with local connections, defined by their topology, and are utilized in image and video processing, biological system modeling, complex brain function processing, pattern recognition, and advanced signal processing. More sophisticated forms include Homophone networks, RBF networks, LVQ networks, counter-propagation networks, and ADALINE networks. Numerous tools have been developed based on these networks, which form the foundational structure of AI systems. One notable application of AI technology is the IBM Watson supercomputer, designed to assist in analyzing patient medical records and correlating them with a vast database to recommend treatment options for cancer. This system is also capable of rapid disease detection, as demonstrated by its ability to identify breast cancer in just 60 seconds.

• **AI in clinical trail** – AI can also reduce the no of patients require for trial

Based on an experimental data and results. Researcher use the twin to predict how same patient would progress the same results or compare with other. It is use for management of data regarding clinical trials for example The Novartis researchers reported that it can extract data from unstructured reports, as well as annotate images or lab results, by predicting values in results and identify subgroups among a population that responds uniquely to a treatment. It develops the language model to extract billing code from medical records such as symptoms , side effects, adverse drug reactions, drug interactions etc.(3) .

• **AI in disease diagnosis** – Disease Diagnosis is not a single step there are so many test is required for diagnosis of disease . so AI can be done by using machines to learn predictive patterns from large amounts of healthcare data that may be difficult for humans to interpret. AI not only use for diagnosis it is also use for predict future disease as well as health care cost . ML is a sub field of AI that forces the computer to “learn” patterns from large volumes of data, then take decisions based on the collected artificial experience.(4) computer aided diagnosis has a major role in medical imaging and diagnostic radiology CAD is a concept established by taking into account equally the roles of physicians and computers, whereas automated computer diagnosis is a based on algorithm of computer . For example CAD scheme make use of the lateral chest image to improve the potential of lung nodules , Computer-aided diagnosis use for detection of breast cancer in early stage based on mammogram Computers aided diagnostics is also use for detection of abnormalities of patients because computers are better performing task than human (5).

• **Drug discovery** – Traditionally for discovery of small molecules takes a lot of time fir synthesizing the new molecule but now a days AI reinventing process and accelerating the discovery of drug . AI assisted other technology like ML and generative AI impact on chemistry Traditional there are lots of chemical testing assays synthesis is required so it take minimum 4 to 5 years on other hand computational methods involve virtual screening with the help of ML technique. It improves success rate , lower cost , increase speed and new innovations in short period of time as compared to traditional one .

Machine learning applied to medicinal chemistry: 1) design – prediction of protein structure , virtual screening , and prediction of structural, molecules and chemical properties. 2) plan – it is planning for synthesis of new molecule and p Find out their yield , percent purity , identification of problems.

3) Test – screen the molecules for ability to interact with other protein and prediction of safety accuracy and efficiency. 4) Analyses – large volumes of test data to Analyses correlation and design future experiment to to promising drug candidate.

Based on these techniques several key AI model is emerged

- protein structure prediction
- de nova molecular design
- prediction of property
- Quantitative structure activity relationship
- synthetic accessibility (6) .

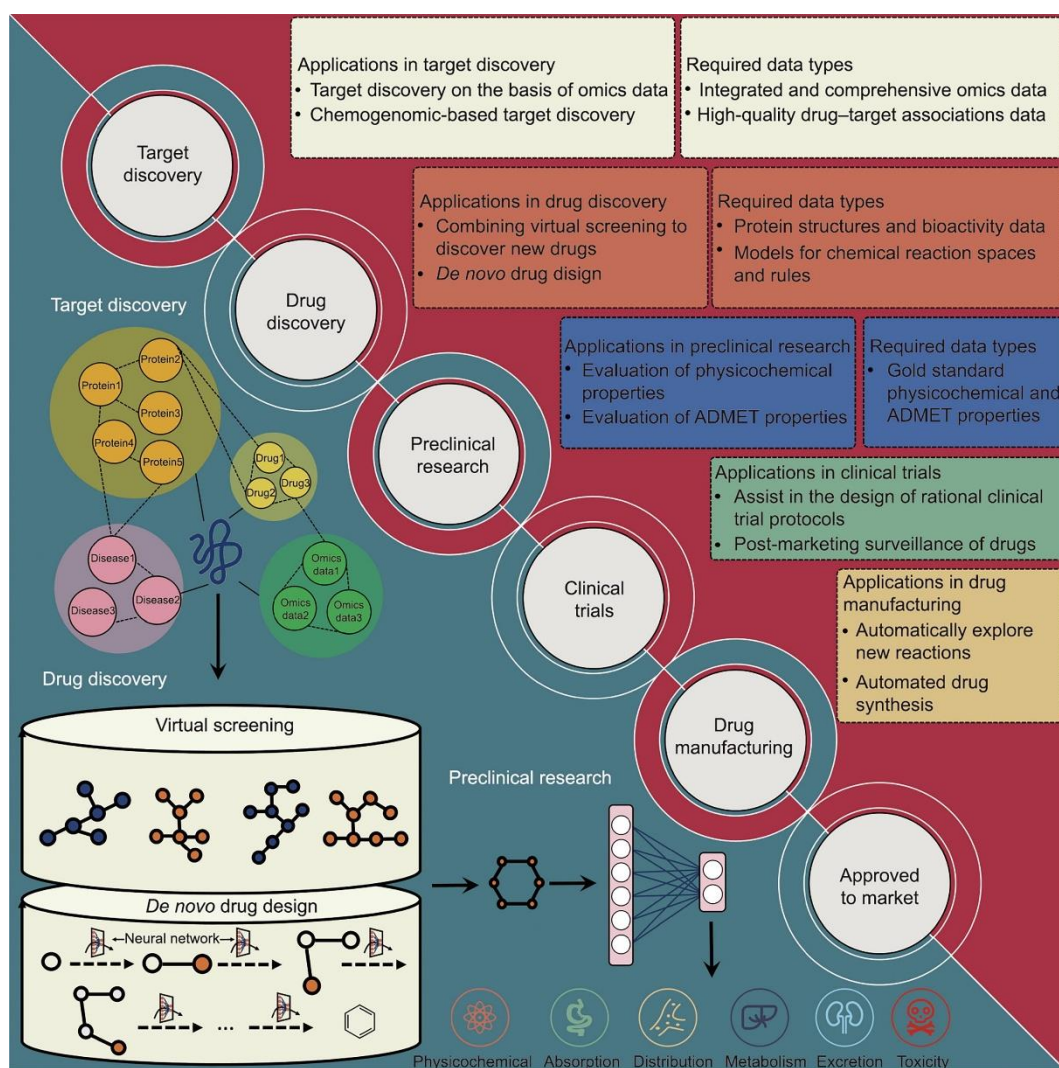


fig 1.1 applications for AI in pharmaceutical industries

AI in drug manufacturing – traditionally manufacturing process is very expensive and required long period of time. So AI introduce benefits to pharmaceutical manufacturers in form of innovative technology, smart maintenance , challenges to regulator, regulate the process design and control, improve availability of medicine to patients,

#### So how manufacturers can use AI for design and control?

1. Process and scale up optimization – AI models employed ML use for process development data for quickly design and identify required parameters or scale up strategy for reducing time and waste
2. Process control – Advance process control allow adaptive management of manufacturing process which combines with real sensor data use for process control. Pharmaceutical Manufacturers are expecting to impart advanced process control that combine AI techniques with chemistry and physics knowledge to improve manufacturing efficiency and output.
3. Process monitoring and fault detection – AI is use for detection of better monitoring equipment and detect the changes in ongoing process. It also detect deviation in maintenance activities in manners and minimize process down time
4. Trend monitoring – AI method integrate with process performance metrics for better monitoring even across product location, and allow for corrective and preventive measures of manufacturing discrepancies before the impact supply chain , cause drug shortage The main important use of AI is monitoring the quality from raw materials to end product after manufacturing, AI imaging the packaging , labels , glass vials to detect the deviation. It is also use for detection of cluster problem from customer complaint and deviation report

Even FDA use AI for translating document , screening adverse effect , forecasting the volume regulatory submission. Because it detects the false leading drug information , identify safety , respond to public inquiry (7).

**AI in digital therapeutic :** Digital therapeutic is new concept which purpose to change the behavior of patients and treat medical condition using different technology Health have also collaborated to clarify the definitions between digital health, digital medicine, and digital therapeutics to better support consumers, developers, and manufacturers of digital health tools . it having higher quality software program to prevent, manage and treat the disorder.

They also describe how digital therapeutics must adhere to proper safety and efficacy protocols in randomized clinical trials, incorporate best practices for design and delivery, include patient privacy and security protections, publish clinically meaningful outcomes in peer-reviewed journals, and receive regulatory approval to support product claims of risk, efficacy, and intended use(8).

Nowadays, scientists and researchers use machine-learning (ML) and deep-learning (DL) models in several applications, including agriculture, environment , text sentiment analyses , medicine , and cyber security .

During ongoing corona-virus disease (COVID 19) pandemic researcher shows effectiveness of ML and DL .for example Some studies have provided valuable insights on ML using predictive models built with limited data on patients with COVID-19 , including prediction of the need for supplemental oxygen and big data for predicting the need for hospital admission. Created models and compared the performance of AI in collaboration with a clinician with that of AI in predicting the need for oxygen supplementation in patients with COVID-19, based on local non-image data (9).

**AI in healthcare management :** The emergence of artificial intelligence (AI) in healthcare is inevitable and is changing the way we diagnose, treat, and care for patients. These technologies have improved healthcare research and outcomes by providing more accurate diagnoses and more personalized treatments. In medicine, AI can help doctors quickly analyze large amounts of medical data to detect signs of disease and conditions that might otherwise be missed. The potential applications of AI and medicine are vast, from analyzing radio-graphs for early detection to predicting electrical outcomes from medical records. With the use of AI.(9)

**Artificial intelligence makes the lives of patients, doctors and hospital administrators easier by doing the work usually done by people in less time and at a lower cost. . >Rapid drug discovery**

And patient experience

Manage medical records

Perform robotic surgery

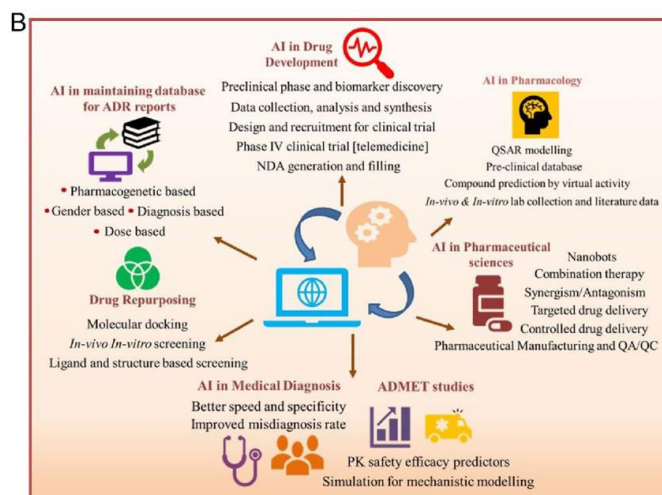
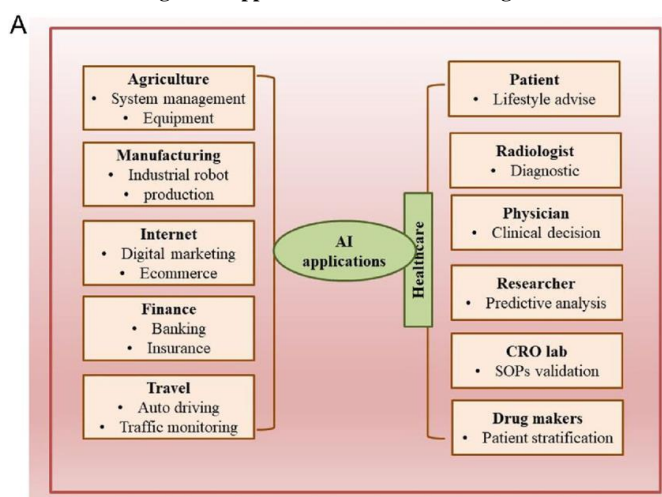
In short, artificial intelligence is reinventing and revitalizing modern healthcare through machines that can predict, understand, learn and apply. Medical professionals and medical staff experience. Artificial intelligence data processing and prediction capabilities allow healthcare providers to better manage their resources and increase efficiency in all areas of healthcare.(10)

Thanks to this technology, doctors can make faster and more accurate diagnoses, healthcare administrators can find electronic medical records faster and patients can receive timely, personalized treatment. >

**Examples of Artificial Intelligence in Healthcare**

To help you better understand this rapid change, we have collected some examples and use cases of Artificial Intelligence in Medicine.(11).

**Fig 1.2. : application of Artificial intelligence**



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## AI in disease prediction and early identification :

Today, more than 70% of medical decisions involve the results of laboratory tests. These tests are also important for early detection of patients at risk for complex diseases such as cancer. Since symptoms of disease often appear in test results, using predictive models can help identify concerns; these concerns are likely to occur before physical pain occurs. In the laboratory's data workflow, routine test results can be combined with other patient information, such as age and gender, and used in custom predictive models. By combining this information, laboratories can create disease-specific patient outcomes to help alert physicians to areas of concern and/or populations where pain may be a risk or diagnosis. Siemens Healthiness is working with many healthcare organizations to leverage machine learning and computing to create AI-powered clinical decision-making tools that can be integrated into existing testing/surveying practices for business activities.(12)

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## Conclusion :

In recent years, there has been a significant surge in interest regarding the *application* of AI technology in various critical areas of pharmacy, including drug discovery, dosage form design, and hospital pharmacy. AI methodologies are perceived to emulate human cognitive processes, enabling knowledge acquisition, problem-solving, and decision-making. The implementation of automated workflows and databases utilizing AI techniques has demonstrated considerable effectiveness in analysis. Consequently, the application of AI facilitates the development of new hypotheses, strategies, and predictions, as well as the analysis of various related factors, all while minimizing time and cost.

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