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ARTIFICIAL INTELLIGENCE: A REVIEW

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ABSTRACT

The usage of artificial intelligence in pharmaceutical technology has grown over time, and it now helps us comprehend the correlations between various formulations and process factors while also saving time and money. A subfield of computer science called artificial intelligence works with the solution of issues via symbolic programming. With numerous applications in business, medicine, and engineering, it has significantly developed into a science of problem-solving. The article discusses drug discovery, artificial intelligence tools, manufacturing execution systems with automated control systems, AI to predict new treatments, the development of novel peptides from natural foods, the management and treatment of rare diseases, drug adherence and dosage, and obstacles to AI adoption in the pharmaceutical industry. The use of artificial intelligence in medicine administration has the potential to save many lives. Drug dispensers like Expense, which have Bluetooth connectors, have been utilised to alert patients when their medications are prepared for ingestion. Artificial intelligence (AI), which assists in the early detection of emerging illnesses, will eventually replace pharmacists.

KEYWORDS: Artificial Intelligence, health care, neural networks, milestones, sensors.

INTRODUCTION

Artificial intelligence (AI) is described in the context of health as the application of algorithms and software to complement human awareness or attention during the analysis of intricate medical data. Machine intelligence, another name for artificial intelligence, is a tool for analysing massive volumes of organised and unstructured data to produce wise and correct conclusions. A more accurate definition of artificial intelligence (AI) is the ability of

computers to draw judgments without clear-cut human input. These three forms of artificial intelligence (AI) are generally used.

They are

a) Human created algorithms

b) Machine learning

c) Deep learning

Artificial intelligence (AI) is described in the context of health as the application of algorithms and software to complement human awareness or attention during the analysis of intricate medical data.

For each of the aforementioned lifecycle stages, AI usage may be taken into consideration. In pharmaceutical firms, artificial intelligence (AI) refers to the use of automated algorithms to a variety of jobs that normally need human intellect. The application of AI in the pharmaceutical and biotechnology sectors has recently changed how scientists find new therapeutic targets, reposition and repurpose drugs, create novel compounds, run clinical trials, and carry out all other tasks related to the lifespan of medical products. The need to reduce the cost of developing new drugs is one of the key drivers of interest in AI. According to a Massachusetts Institute of Technology research, just 13.8% of medications make it through clinical trials successfully. To finish the full clinical trial procedure and receive Food and Drug Administration (FDA) approval, a business may anticipate spending USD 1.3 billion on average.

History

The Logic Theorist was invented by Allen Newell and Herbert A. Simon. The renowned conference was first held in 1956 by Dartmouth College, The market for artificial intelligence is expected to generate up to 10 times more revenue between 2017 and 2022. The market for natural language processing, which has several applications such as text prediction, speech and voice recognition, is expected to expand by 28.5% in 2017. Big data and business analytics generated US$ 122 billion in revenue globally in 2015, and it is anticipated that this amount would surpass US$ 200 billion by 2020.[5] Since the 1950s, artificial intelligence has had a turbulent history. When IBM's Deep Blue computer beat chess champion Garry Kasparov in 1997, the perception that it was a field for dreamers began to shift. In 2011, IBM's brand-new Watson supercomputer was successful in taking home the $1 million prize

on Jeopardy in the US. Since then, Watson has diversified into the healthcare and pharmaceutical industries, forming a relationship with Pfizer in 2016 to quicken the development of new immuno-oncology drugs. In December 2016, IBM and Pfizer released IBM Watson, a cloud-based platform that offers features including medical lab results and gives researchers the opportunity to see connections across various data sets using dynamic visualisations.

THE WAVES OF AI

FIRST WAVE- (c.1970-1990)

The initial wave of artificial intelligence research gave us "knowledge engineering" optimization tools that effectively handled practical issues.

Reasoning is strong but lacks the capacity to learn or generalize.

- GOFAL-Good Old Fashioned Al.
- Symbolic, heuristic, rule based.
- Handcrafted knowledge, “expert systems.”

SECOND WAVE- (c.2000s-present)

The second phase of artificial intelligence gave rise to machine learning programmes. These employ statistical analysis to address challenging pattern recognition issues. Second-wave artificial intelligence algorithms see and learn, frequently on par with human perception and learning, unlike their first-wave counterparts. Second-wave artificial intelligence is strong, but in order to effectively perform its analysis, it needs well-organized, regularly coded, and full data sets. The third wave of artificial intelligence is now overcoming this restriction.

Good at picking up information and observing, but little capacity for logic or generalisation.

- Statistical learning, deep neural nets, CNNs, RNNs.
- Advanced text,speech,language and vision processing.

THIRD WAVE- (est.2020s-2030s)

The third phase of artificial intelligence development has begun. Third-wave AI systems are capable of analysing enormous data sets, finding patterns, and producing algorithms to explain them. The context of various data pieces is normalised by these systems, which also provide original, fresh theories more quickly and accurately than human researchers.

Excellent generalisation skills and perception of learning and reasoning.

- Contextual adaptation,able to explain decision.
- Can converse in natural language.
- Requires far fewer data samples for training.

FOURTH WAVE- (est.2030s to -)
able to handle any intellectual task.
capable of carrying out any mental work that a person can.

- AGI-Artificial general intelligence. Possibly leading to ASI (Artificial Superintelligence) and the "Technological Singularity."

Classification of Artificial Intelligence

AI may be categorised in two distinct ways: based on quality and presence.

According To Their Calibre**:**

- Artificial Narrow Intelligence (ANI)
- Artificial General Intelligence (AGI)
- Artificial Super Intelligence (ASI)

According To Their Presence:

- Type 1: Reactive machchine
- Type 2: Limited memory system
- Type 3: Based upon "Theory of Mind"
- Type 4: Self-awareness

The Following Categories Of AI Exist Based On Their Capabilities.

I. Weak AI or Artificial Narrow Intelligence (ANI): It only does a limited range of tasks, such as facial recognition, driving, playing chess, and traffic signalling.
II. Strong AI or Artificial General Intelligence (AGI) It carries out all tasks like a person and is referred to as human-level AI. It can simplify human intelligence and do challenging tasks.
III. Artificial Super Intelligence (ASI): It is far more active than humans and is wiser than them in terms of sketching, math, and space.etc.

According To Their Presence

I. Type 1: Because it lacks a memory system, it is only utilised for applications with a limited scope. Reactive machine is the name of it. There are several examples of this memory, such as an IBM chess software that can forecast moves and recognise the checkers on the chessboard.
II. Type 2: It has a meagre memory system that it may use to draw on prior knowledge to address various issues. There are certain recorded observations that are utilised to record subsequent actions in automated cars' decision-making systems, but these recordings are not kept forever.
III. Type 3: Its foundation is the "Theory of Mind." It indicates that people's own thoughts, intentions, and aspirations have an impact on the decisions they make. This system doesn't exist. AI.
IV. Type 4: It is sentient and self-aware, meaning it has a sense of who it is. This system is also artificially uncreated.

Tools of Artificial Intelligence

Many tools have been developed to address the various issues facing the pharmaceutical business. The results of these instruments have shown promise. The following are a few well-known tools that have attained astounding popularity.

Erica Robot

Professor Hiroshi Ishiguro of Osaka University in Japan created the new care robot Erica. Together with Kyoto University, the Advanced Telecommunications Research Institute International, and the Japan Science and Technology Agency, Erica was created (ATR). It speaks Japanese and has a blend of facial traits from Europe and Asia. Like any other typical human person, it enjoys watching animated movies, longs to go to Southeast Asia, and seeks a life partner with whom it can have conversations. The robot was created with the ability to understand inquiries and respond with human-like facial expressions, but it is unable to move on its own. Ishiguro altered the traits of 30 attractive women and utilised the average to create Erica, making her the "most beautiful and intellectual" android.

IBM Watson for Oncology

Supercomputers created by IBM are referred to as Watson. It is a gadget designed for question-answering that combines powerful analytical tools and artificial intelligence. It is intended for the treatment of cancer and helps oncologists make wiser decisions. It operates

by examining a patient's medical records using a large database and a team of experts, and then assigning treatment choices based on the results. It might be appropriately structured or unstructured, but it is helpful in interpreting meaning and context data in clinical notes and reports. It may simply compile analytical data on the patient and express it in straightforward English, which might prove to be a crucial step in determining the best course of therapy for the patient.It combines important details from a patient's file with outside research, clinical research, and data before deciding or suggesting the most suitable treatment options. With more than 200 textbooks, 12 million text pages, and 290 medical periodicals, Watson has amassed a huge collection of knowledge from the literature and justifications that MSK has carefully selected. A 39-year-old Indian software engineer was recently told that she had a rare kind of breast cancer that was spreading quickly over both of her breasts and might result in the removal of both. Dr.Somashekhar, an oncologist in Bengaluru, uploaded her medical records and genomic information into Watson, which gave her treatment choices 60 s.

Robot Pharmacy

Robotic technology is used by UCSF Medical Center to prepare and track pharmaceuticals with the aim of boosting patient safety. In their paper, they claim that the technology has effectively and with little mistake manufactured 3,50,000 doses of medicine. The robot has shown to be significantly superior to humans in terms of size and its capacity to administer precise drugs. The manufacture of hazardous chemotherapy medications for oral and injectable use is one of the capabilities of robotic technology. This has freed up room for the UCSF nurses and pharmacists, allowing them to employ their skills by concentrating on providing direct patient care and collaborating with the doctors. The computers in the pharmacy's automated system first electronically gather medicine orders from the UCSF doctors and pharmacists. The robots then gather, package, and administer individual dosages of medication. The dosages are then mechanically assembled into a plastic ring with a barcode. All of the drugs that a patient has to take during a 12-hour period are contained in the thin plastic ring. The automated system's capacity to produce sterile chemotherapy preparations and fill intravascular syringes with the appropriate drugs adds to its range of capabilities. The automated facility also includes two non-refrigerated pharmacy warehouses for storing supplies and drugs, a refrigerated pharmacy warehouse, and an inventory management system that maintains track of every product. These are completely automated facilities.

MEDi Robot

MEDi is renowned for its expertise in both engineering and medicine. A project for a pain management robot was overseen by a professor of community health sciences at the University of Calgary in Alberta. After she started working in a hospital, the idea for creating this robot came to her when she overheard children crying during a surgery. The robot initially establishes a cordial rapport with the kids before explaining what would happen during a surgery. It gives them instructions on what to do, how to breathe while having the treatment, and how to handle it. Robots, as we all know, cannot think, plan, or make decisions, but they may be designed to appear to have AI. The face recognition technology used in MEDIi was developed internally by Aldebaran Robotics. It can speak 20 different languages and is very flexible to various scenarios. The robot retails for $9000, but once the apps required for the robot to assist in medical operations are installed, the price jumps to between $15,000 and $30,000. The robot was first designed to alleviate pain, but over time its applications have evolved to include comfort during surgeries, physical therapy, and fundraising.

Terminologies used in Artificial Intelligence

- **Neural network**

Algorithms for neural networks are built up in a sequence that lines up before acknowledging the fundamental sequence in a collection of data from an incoming process that mimics how the human brain functions. Neural networks operate on the neuronal system in the manner described above; they may be artificial or natural. Since neural networks can adapt to changing input, the optimal outcome is produced by the network without the requirement for new output criteria to be designed. The development of trading systems is increasingly embracing the neural network idea, which has its origins in artificial intelligence.

- **Basics of Neural Networks**

Neural networks have helped processes like algorithmic trading, time-series forecasting, and the categorization of securities to exist throughout industrial evolution when money/financial circumstances have mattered. A neural network is capable of functioning similarly and intelligently to the neural networks seen in human brains. Neurons in a neural network that collects and also classifies information based on a certain construction perform mathematical functions. A neural network made up of interconnected nodes and layers. A perceptron, which is a technique for supervised learning of binary classifiers and is similar to multiple

linear regression, is a component of each node. In a multi-layered perceptron, perceptron layers are linked (MLP). Input layers handle the collection of input patterns. Classifications or output signals on the output layer can be mapped to input patterns. Hidden layers adjust input weightings until the neural network's margin of error is minimised. Regarding the output, it is assumed that hidden layers would extract important elements from the input data that have predictive value. By extracting features from an outline, a utility comparable to statistical methods like principal component analysis is realised.

- **Neurofuzzy Logic**

Fuzzy systems employ learning algorithms to control their parameters through the processing of data samples, and these algorithms are derived from neural network theory. Modern neuro-fuzzy systems are typically represented using specialised multilayer feed forward neural networks, such as ANFIS, GARIC, NEFCLASS, and others. The self-organizing feature maps shown below are a well-known example of the fuzzification of neural network design. Neuro fuzzy networks have different propagation, link weights, and activation functions than conventional neural networks. Various ways were discovered based on the data gathered, but the neural fuzzy system's most popular phrase describes those that exhibit the distinct characteristics listed below: The fuzzy system is helped by neural network theory by being trained with an algorithm made possible by the theory of neural networks. Local information is used to operate the learning process and create local moderation in the fundamental fuzzy system. An illustration of a neurofuzzy system is a 3-layer feed-forward neural network. First layer represents input variables, middle layer, also known as the buried layer, represents fuzzy rules, and third and final layers represent output variables. Fuzzy sets are encoded as (fuzzy) connection weights. To use a learning method on a fuzzy system like this does not always need representation.

- **Fuzzy Logic**

Modern control systems like expert systems frequently employ fuzzy logic. Fuzzy logic can solve problems much like human beings, but far more quickly than the human brain, and it also has a similar relationship to decision-making. It works by obtaining data, which is then transformed into more meaningful data by arranging constrained truths into fuzzy sets. It is utilised in large firm business for systems that help decision-making and for personal development. The process of chemical distillation, drying, and pH maintenance are all advantages in the chemicals production business. Fuzzy logic is capturing the attention of

artificial intelligence applications and natural language processing. Fuzzy Logic is employed in business with the help of neural networks because it mimics how the human brain makes judgments and does it more quickly and easily. This is accomplished by gathering data and transforming it into more useful data with the aid of creating fuzzy sets out of incomplete facts.

- **Genetic Algorithms**

In 1970, John Holland used genetic algorithms. Genetic algorithms offer a search method specifically suited to optimization; they make the premise that the trial population will evolve through an iterative process. The initial population of the solution is formed, and every population member's fitness is assessed as a result.

- **Evolutionary Computing**:

It is a frequent word that elaborates on the computational process by which solutions are evolved using the inheritance laws of recombination, mutation, and selection. Evolutionary algorithms are a key component of formulation research and are applied in this field in a variety of ways.

Advantages of Artificial Intelligence Technology

The AI technology recognises and tags the person's face when they share photos on social media sites like Twitter and Facebook. In order to manage and organise data and to spot fraud, financial and banking organisations frequently deploy AI systems.

- Daily Application

AI has practical uses in everyday life. The GPS technology is extensively used and is useful for lengthy journeys. Due to the installation of AI in androids, it anticipates what a user will type and fixes any spelling mistakes. Robots like Cortana and Lady SIRI are two examples.

- Error Reduction

AI enhances the likelihood that human beings will achieve more accuracy and precision while reducing error. Because of their metal bodies, resistance, and increased capacity to withstand the harsh atmospheric conditions of space, intelligent robots are appropriate to be sent into space to investigate.

- Difficult Exploration

It is applicable to the mining and fuel exploration industries. To circumvent human constraints, AI systems can be used to examine the ocean. By programming the robots, they may effortlessly and without fatigue execute increasingly difficult and demanding tasks.

- Repetitive Jobs

One work can be completed by a human at a time. Machines are faster at multitasking and thinking than people. Machines are capable of doing hazardous activities, and their characteristics, such as speed and time, may be changed.

- Digital Assistants

Advanced corporations utilise artificial intelligence (AI) systems, or "avatars," which are models of digital assistants, to eliminate the need for human personnel. The avatars think logically and make the proper judgments since they are not affected by emotions. Human emotions are typically linked to moods, which impair judgement and reduce productivity. Artificial intelligence was not used to observe this issue.

- Medical Applications

With the aid of AI, doctors are now evaluating their patients and analysing health risks. An AI algorithm is teaching doctors about different medications and their negative effects. Artificial surgical simulators aid in the learning process for trainee surgeons. They receive training with the aid of artificial surgical simulators, including as brain, heart, and GIT simulators.

- No risk of harm

If an accident occurs when people are working at a fire station, it hurts the employees. Machines on the other hand, do not feel or have emotions. Additionally, it is feasible to mantle the pieces of broken machinery.

- Limitless functions

The capabilities of machines are limitless, and they are superior to humans in every task. They give us more free time, are less sentimental, and are more effective and accurate.

Disadvantages of Artificial Intelligence Technology

- High Cost

Due to the intricate equipment designs, repairs, and upkeep required for AI, a significant sum is required for its debut. The machine's software has to be updated on a regular basis. Reinstalling and recovering the system requires a significant effort and financial investment. One AI machine is designed over a lengthy period of time by the R&D department. Money is therefore being consumed more.

- Unemployment

There will be a significant increase in unemployment if machines replace people in all areas. Humans are often very dependent creatures. They become sluggish as a result and lose their ability to be creative.

- No Replicating Humans

Robots using AI technology have the ability to think like humans, with the added benefit of lacking moral principles and emotions. As a result, they carry out the assigned duty exactly as planned and are unable to use judgement. It can sometimes result in serious issues. Robots are unable to decide if the situation is unknown to them. They either make a fake report at that point or experience a collapse.

- No Improvement with Experience

AI-powered machines cannot be improved by experience like human beings can. Machines don't show concern, belonging, or caring. They are unable to distinguish between those who work hard and those who do not.

Artificial Intelligence In Pharma Is A Good Idea

Utilizing technical breakthroughs, the pharmaceutical industry may speed up innovation. The most recent technical breakthrough that comes to mind is artificial intelligence, the creation of computer systems that are capable of carrying out activities that would typically need human intellect, such speech recognition, visual perception, decision-making, and language translation. According to an IBM estimate, the whole healthcare area had over 161 billion GB of data in 2011. As there is a vast amount of data in this field, artificial intelligence can really help by evaluating the data and providing findings that would aid in decision-making, save human effort, time, and money, and ultimately help save lives. Epidermic outbreak prediction; utilising machine learning/artificial intelligence, one may examine the social

media activity, research the history of the epidemic, and forecast where and when the epidermic will occur with a high degree of accuracy.

Limitations

Streamlining electronic records; They need to be cleaned up first since they are disorganised and untidy throughout the many databases.

Transparency: People require openness in the medical treatment they receive, which is a difficult undertaking given the intricacy of the artificial intelligence-based systems.

Data governance: Medical information is confidential and legally accessible. It's crucial to obtain public approval.

Hesitant to change: The pharmaceutical industry is notorious for being conservative and reluctant to change. To provide the greatest treatment possible, the stigma must be eliminated.

Challenges to Adoption of Artificial Intelligence in Pharma

Even while AI has a significant potential to help reshape the pharmaceutical sector, adoption is not without its challenges.

Challenges that pharma companies face while trying to adopt AI:

- The unfamiliarity of the technology — due to its youth and esoteric nature, AI still looks like a "black box" to many pharmaceutical businesses..
- A lack of appropriate IT infrastructure, which is a result of the fact that the majority of present IT applications and infrastructure were not created or designed with artificial intelligence in mind. Even worse, pharmaceutical companies must invest a lot of money to improve their IT infrastructure.
- Since a large portion of the data is in free text format, pharmaceutical firms must go above and beyond to compile and convert this data into a format that can be examined. Despite these limits, one thing is certain: AI is already changing how the biotech and pharmaceutical industries operate. And in ten years, the pharmaceutical industry will just see AI as a common, everyday technology.

Partnerships between Artificial Intelligence (AI) and Pharmaceutical Companies And Areas Of Collaboration In Drug Development.

PHARMA	AREA OF COLLEBRATION	ARTIFICIAL INTELLIGANCE
Roche	to pursue personalised medicine through large-scale genome sequencing and medical learning.	Bina
Sumitomo dainippon Pharma	to find new therapies for psychiatric illnesses	Exscientia
Astellas pharma	Drug repurposing	Biovista
Bayer pharma	using cellphones and other wearable technology to track real-time data	Xbird
GlaxoSmithKline	to find novel, targeted small molecules	Exscientia
Abbvie	Introducing the AI-based patient monitoring platform's workings can boost adherence.	AiCure

Role In Hospital Pharmacy In Artificial Intelligence

A health care system that organises dose forms for specific patients, chooses the best or accessible administration methods, or applies treatment guidelines

I. Treatment plan designing:

With the use of AI technology, effective treatment programmes may be created. 15 The AI system is required to maintain control when a patient's health gets severe 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. IBM Watson has started an initiative to assist oncologists.

II. Health support and medication assistance:

In recent years, the usage of AI technology has been found to be effective for both medication assistance and health support services. 6 The voice and visage that Molly (a virtual nurse created by a start-up) hears are kind. Its purpose is to support patients with chronic conditions in between medical appointments and to assist individuals in directing their own care. The smartphone camera software Ai Cure keeps track of patients and helps them manage their diseases.

III. Keeping track of medical records

Keeping track of patients' medical data is a difficult endeavour. By using an AI system, data collection, storage, normalisation, and tracing are made simple. The Google Deep Mind health initiative, which was created by Google, helps to quickly extract medical information.

As a result, this initiative is beneficial for providing quicker and better healthcare. This initiative assists the Moor Fields Eye Hospital NHS in improving eye care.

IV. Helping with repetitive work

AI technology may also help with some jobs that are repetitious, such looking at X-ray images, radiology reports, ECHOs, ECGs, etc. to find and identify illnesses or abnormalities. 15 IBM's Medical Sieve algorithm is a "cognitive assistant" with strong analytical and deductive skills. To enhance patient conditions using deep learning and medical data, a medical start-up is required. For each bodily component, there is a customised computer software that is employed in particular illness situations. Almost all forms of imaging analyses, including X-ray, CT scan, ECHO, and ECG, may be performed using deep learning.

V. AI aids individuals in the healthcare system by gathering and comparing data from social awareness algorithms. The extensive data stored in the healthcare system includes the medical history of the patients as well as the treatment history profile from the patient's birth, habits, and way of life.

ARTIFICIAL INTELLIGENCE IN DRUG DISCOVERY

AI in drug design	Predicting 3D structure of target protin Predicting drug-protein interactions AI in determining drug activity AI in de novo drug design.
AI in polypharmacology	Designing biospecific drug molecules Designing multitarget drug molecules
AI in chemical synthesis	AI in prediction of reaction yield AI in prediction of retrosynthesis pathways Developing insights into reaction mechanisms AI in designing synthetic route
AI in drug repurposing	Identification of therapeutic target Prediction of new therapeutic use
AI in drug screening	Prediction of toxicity Prediction of bioactivity Prediction of physicochemical property Identification of and classification of target cells.

Some Recent Researches on the Uses of AI in the Development Of Drug Delivery Systems.

Sr.No	Drug delivery systems	AI approaches used
1.	Ibuprofen Pills With Prolonged Release From Various Cellulose Derivatives	Adaptive Neural-Fuzzy Inference System
2.	Both Novel Pills Comprising Granulated Pellets And Conventional Tablets Containing Pellets	ANNs
3.	Ultrasonic Medication Release From Liposomes	ANNs
4.	Tablets For Oral Disintegration	ANN and DNN
5.	Flexible Nanoliposomes Of Pilocarpine Hcl For Ophthalmic Use	RSM and ANN
6.	Rosiglitazone maleate floating tablets	ANNs
7.	Diclofenac sodium nanoparticles in gelatine	Central composite design and ANNs
8.	Formulations For Ultradeformable Nanoliposomes With Timolol	ANN and multiple linear regression (MLR) analysis
9.	A liposomal gel with besifloxacin HCl in it	32 full factorial design and RSM
10.	Risperdal Transdermal Administration Via Transferosomal Gel	Central composite design and RSM
11.	Prednisone Pellets In Several Units	Box–Behnken design, RSM and ANN
12.	Tablets With A Ph-Dependent Mesalamine Matrix	ANN, multi-layer perception (MLP) algorithm and RMSE
13.	Topical Delivery System Based On Nanostructured Lipid Carriers Carrying Voriconazole	Box–Behnken design and QbD

SUMMERY

The goal of artificial intelligence (AI) is to create intelligent modelling that aids in knowledge envisioning, problem solving, and decision making. AI has recently played a significant role in a number of pharmacy-related domains, including drug discovery, the creation of drug delivery formulations, polypharmacology, hospital pharmacy, etc. AI technology methods think, solve problems, and make decisions similarly to how humans do. The construction of novel hypotheses, strategies, predictions, and assessments of many connected elements may be done with the ease of reduced time consumption and affordability thanks to the usage of AI technologies.

CONCLUSION

Artificial intelligence is very helpful in the pharmaceutical industry because it has been used to analyse and interpret data in a number of pharmacy-related fields, including dosage form design, polypharmacology, drug discovery, hospital pharmacy, etc. Artificial intelligence

provides accurate information on patients and expected outcomes with successful results gleaned from global data.

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