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Artificial Intelligence in Pharmaceutical Industry

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ABSTRACT

At the same time, the increasing use of artificial intelligence (AI) in medicine has the potential to save time and money while improving our understanding of the connection between various models and processes. Artificial intelligence is a subfield of computer science called artificial intelligence that focuses on the use of functional symbols to solve problems. Artificial intelligence plays an important role in many areas of pharmacy, such as drug discovery, drug development, poly pharmacology and hospital pharmacy. Artificial intelligence is a branch of computer science that uses symbols to solve problems. It has been very successful in solving scientific problems and is widely used in business, medicine and engineering. Today, artificial intelligence is not used to help teach, but to create artificial intelligence in computer-assisted instruction (ICAI) systems. This is an attempt to create a computer teacher.

Keywords: Artificial Intelligence (AI), Mechine challenges to adoption of artificial intelligence in pharma, drug adherence and dosage, drug discovery, Treatment of rare disases

Introduction

A subfield of computer science called artificial intelligence (AI) focuses on using artificial intelligence to solve problems. It has evolved into a problem-solving science with broad applications in business, medicine and engineering. [1] (AI) is the study of machine intelligence, which are intelligent computers that typically provide results similar to human processes. These processes generally include acquiring knowledge, using the acquired knowledge to develop effective procedures, determining or predicting outcomes, and self-adjustment.[2] Brand The purpose of these skills is to identify practical problems and provide solutions. Description of the problem. In mathematics, theorems related to this interpretation are called methods. In artificial intelligence, algorithms are designed and used to analyze, learn and understand data. Statistics and machine learning, pattern recognition, clustering and similar models are among the different types of artificial intelligence. Artificial intelligence is a new technology with many applications in business and daily life. The pharmaceutical industry has recently found new and creative ways to use this powerful tool to help solve some of the most challenging problems pharmaceutical companies face today. In the healthcare industry, artificial intelligence generally refers to the use of algorithms to complete tasks that require human intelligence. Over the past five years, the application of artificial intelligence in medicine and biotechnology has transformed the way scientists develop new drugs and treat diseases. [3] The main purpose of this type of intelligence is to identify relevant information based on the problem and provide details of the solution. Interpretations corresponding to mathematical theorems are called methods. Artificial intelligence is a technology with many applications in life and business. In recent years, the pharmaceutical industry has found new and innovative ways to use these powerful tools to help solve some of the biggest problems facing the pharmaceutical industry today. Artificial intelligence in medicine refers to the use of automated algorithms to perform tasks that normally rely on human intelligence. In vivo responses can also be evaluated using information models and the evaluation of therapeutic drugs, appropriate drugs, etc. Pharmacokinetics can also be predicted. [4] Based on the importance of pharmacokinetic prediction, the use of computer models increases their effectiveness and affordability in drug research [5]. There are two main groups in the development of artificial intelligence technology [6]. The first category includes traditional computational methods that involve experts such as mechanical engineers trying to mimic human experience and reporting the results [7]. The second technology involves systems that can use artificial neural networks (ANNs) to simulate the brain. Labor standards. system. In particular, many artificial neural networks (such as deep neural networks (DNN) or recurrent neural networks (RNN)) control the development of artificial intelligence technology. DNN problems have been shown to be more predictive than simple machine learning methods [10] in Merck Kaggle [8] and NIH Tox21 problems [9]. Machine learning uses appropriate statistical techniques and can learn with or without training.

DEFINITIONS AND CONCEPTS

1. **Artificial Intelligence:** Artificial intelligence (AI) is an integration of computer science and physiology. Intelligence in simple language is the computational part of the ability to achieve goals in the world. Intelligence is the ability to think to imagine creating memorizing and understanding, recognizing patterns, making choices adapting to change and learn from experience. Artificial intelligence concerned with

making computers behave like humans more human like fashion and in much less time than a human takes so is called as Artificial Intelligence (Poole and Goebel, 1998)[11]

2. **Learning:** Learning is defined as the acquiring of knowledge or skill, in a particular domain. This definition is related to human beings. In psychology, various generalized definitions of learning have been proposed, and many of them interpret learning as the change in behavior of a being, subject to a given situation, or as a sequence of his or her repeated experiences in that situation.[12]

3. **Machine Learning:** In simple words learning means either acquiring new knowledge or enhancing or updating individual's skills. Learning new knowledge is the combination of various processes such as acquisition of significant concepts, understanding their meanings and relationships to each other and to the area concerned. Skill enhancement can be interpreted in biological terms as reinforcing a pattern of neural connections for performing the desired function (Bavakutty, 2006). Scientific study of algorithms and statistical models when the computer system used to perform a specific task is called Machine learning. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to perform the task (Bishop, 2006) [13]

History

The natural language business market, which has many applications such as text prediction, speech recognition and speech recognition, is expected to grow by 28.5% in 2017. Global revenue from big data and business analytics is expected to be $122 billion in 2015, and this amount is expected to increase. It will exceed 200 billion dollars by 2020.[14] Artificial intelligence has had a turbulent history since the 1950s. The history of artificial intelligence dates back to the 1950s. He was long seen as the ruler of dreamers, but starting in 1997, this began to change. When IBM's Deep Blue computer beat chess champion Garry Kasparov. In 2011, IBM's new Watson supercomputer was featured on US "Jeopardy!" He won a $1 million prize on the game show. Watson has expanded into clinical and drug discovery, including a partnership with Pfizer in 2016 to accelerate drug discovery in immuno-oncology [16]. In December 2016, IBM partnered with Pfizer to create IBM Watson, a weather-based diagnostic that helps scientists collaboratively identify relationships between different data sets. [15].

ARTIFICAL INTELLIGENCEIN DRUG DISCOVERY

Drug discovery often takes a long time to test the drug against disease patterns. Finding compounds that are interesting and worthy of further study requires further analysis. To speed up this screening process, the Novartis research team used images from machine learning algorithms to predict undetected topics that might be worth further investigation. Because computers are faster at discovering new information than human screening and laboratory testing, new drugs can be delivered more quickly while also reducing the labor costs associated with research guidance for each compound [17].Current AI strategies from leading biopharmaceutical companies include:[a]Mobile platforms to improve health outcomes – enabling patient consent by typing real-time information to improve patient outcomes. [b] Drug Discovery - Pharmaceutical companies are partnering with software companies to test the use of technology in the expensive and extensive drug discovery process [18].

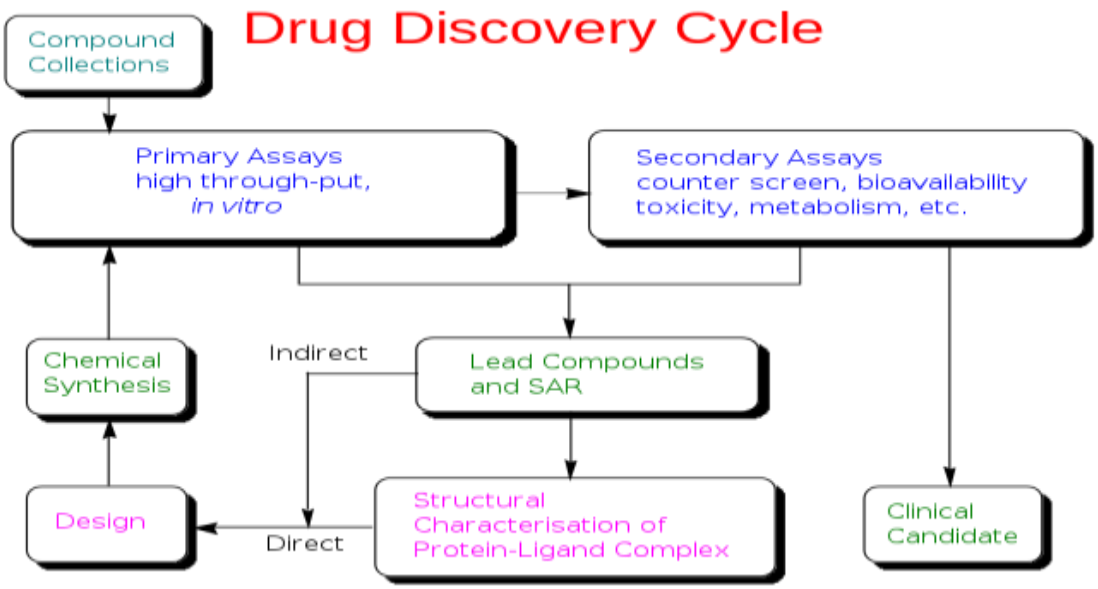

Fig No:1 Drug Discovery Cycle

TOOLS OF AI

Robot pharmacy:

UCSF Medical Center uses robotics to prepare and track medications to improve patient safety. According to them, the technology was preparing 3,50,000 doses of medicine without any errors. The robot has proven to be superior to humans in both size and ability to deliver the correct medication. Robotics may involve the preparation of oral and injectable medications, including toxic chemicals. This gives UCSF pharmacists and nurses the freedom to hone their skills by focusing on direct patient care and collaborating with healthcare providers. [19].

Fig No: 2 Robot Pharmacy

MEDI Robot

Medical Electronic Data Interchange is called MEDi. Artificial intelligence-based tools. Tanya Beran, a professor of public health studies at the University of Calgary in Alberta, is leading a project to develop a clinical user interface. He came up with the idea after working in a hospital where children were screaming during treatment. Even though the robot cannot think, plan or reason, it will be designed to have intelligence. [20,21] The robot began to establish a relationship with the children before explaining what to expect during treatment.

Erica Robot:

Erica is a new type of old person developed in Japan by Professor Hiroshi Ishiguro of Osaka University.) is an international research organization (ATR) established in collaboration with the Japan Science and Technology Agency, Kyoto University and the Advanced Telecommunications Research Institute. He speaks Japanese and has a mixture of European and Asian faces [22]. Like any normal person, he loves animated movies, wants to travel to Southeast Asia, and wants a life partner who can talk to him. The robot cannot walk on its own; However, the ability to understand and answer questions similar to the human face has developed. Erica is the "most beautiful and smartest" robot because Ishiguro adjusted the features of 30 beauties and used the average to add the robot's nose, eyes, etc. created.[23]

TUG Robot:

The Aethon TUG robot is designed to move autonomously in hospitals and transport medicines, food, samples, equipment and heavy loads such as fabric waste and garbage. It comes in two configurations, fixed and fixed cart, with a replaceable central platform that can be used to transport shelves, boxes and carts. While rigid trucks are used to transport drugs, sensitive materials and laboratory samples, the exchange platform is used by Vyas et al.: Artificial Intelligence: A New Era for the Pharmaceutical Industry Asian Journal of Pharmacy • April-June 2018 • 12 75 Transportation Products shipped on different shelves. TUG can offer different types of trucks or racks, making it very useful and resourceful [24].

Automated control process system [ACPS]:

The elements of [ACPS] include:

- Sensing process variables‟ value.
- Transmission of signal to measuring element.
- Measure process variable.

• Presenting the value of the measured variable.

• Set the value of the desired variable.

• Comparison of desired and measured values.

• control signal transmission to final control element. and

• Control of manipulated value.

Sensing process variables‟ value.

• Transmission of signal to measuring element.

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- Control signal transmission to final control element and
- Control of manipulated value.

Berg:

Berg, a biotechnology company in Boston, is a major player in the use of artificial intelligence in a variety of processes. There is intelligence-based medical research with extensive patient data to find and use various disease-causing biomarkers and then decide on treatment based on the information received. The company's advice is to crash it. for purpose for purpose for purpose for purpose for purpose for purpose for cutting cuttings

MANUFACTURING EXECUTION SYSTEM (MES)

The benefits of using MES include compliance with guaranteed legal regulations, minimized risks, increased transparency, shortened production cycles, optimized resource utilization, controlled, and monitored production steps, and optimized up to batch release [25].

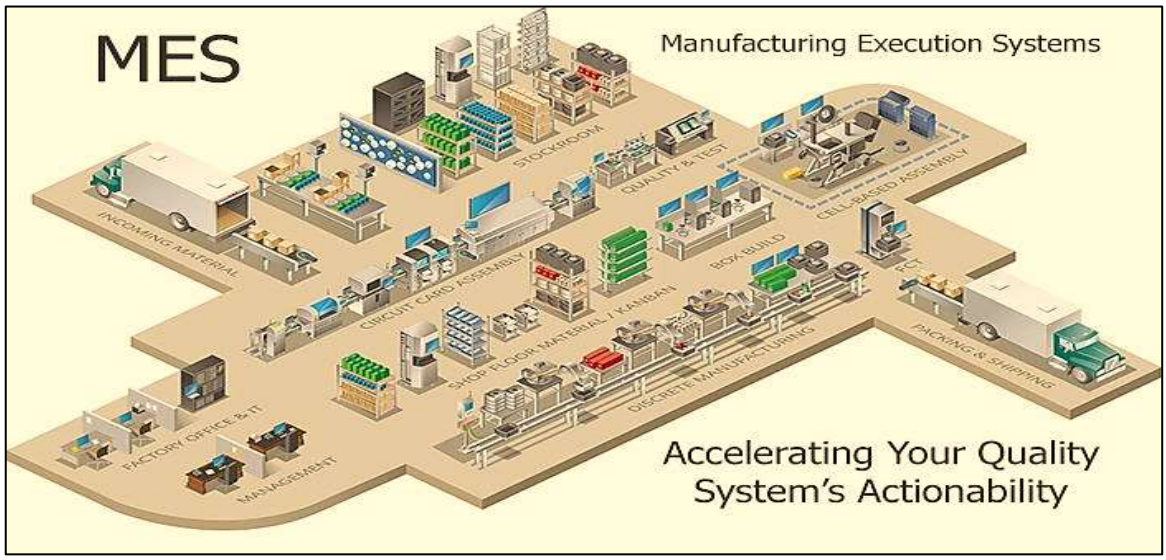

Fig No: 3 Manufacturing Execution System

AI TO PREDICT NEW TREATMENTS

Verge uses data collection and analysis to solve big problems in drug discovery. So they use an algorithmic approach to identify hundreds of genes that are difficult to study in brain diseases such as Alzheimer's, Parkinson's or amyotrophic lateral sclerosis. The Verge's view is that the collection and analysis of genetic information will have a positive impact on the drug discovery phase, starting with preclinical trials. The idea is that Verge can use artificial intelligence to monitor the effects of certain drug treatments on the human brain, starting from the pre-clinical stage. So pharmaceutical companies can learn more about the effects of drugs on the human brain sooner rather than later. Verge uses artificial intelligence to monitor the effects of certain treatments on the human brain, focusing specifically on the preclinical phase.

Development of Novel Peptides from Natural food

The Irish start up Nerites leverages AI and other novel technologies make a easy the discovery of new and more robust food and healthy ingredients. BASF (Baden Aniline and Soda Factory") will take advantage of this partnership to develop novel functional peptides derived from natural foods. In practice, BASF uses Nuritas AI and DNA analysis capabilities to predict, analyze, and validate peptides from natural sources. The main goal of BASF is to discover and deliver to the market peptide-based therapies that‟ll help treat conditions like diabetes.

Treatment and Management of Rare diseases

Advances in AI, renewed interest in rare disease treatments. Currently, more than 350 million people worldwide suffer from more than 7,000 rare diseases. It's not all doom and gloom for rare patients, however, as British biotech company Heal has secured $10 billion in Series A funding to develop new drugs for rare diseases. Thera Chon, another Swiss biotech company that uses artificial intelligence to develop drugs for rare genetic diseases, has raised $60 million in funding.

DRUG-ADHERENCE & DOSAGE

Abbvie is partnering with New York-based Acura to speed drug testing and improve medication adherence. In this partnership, AbbVie uses facial and image recognition algorithms from the AiCure mobile SaaS platform to monitor compliance. More specifically, patients use their smartphones to film themselves swallowing the medicine, and the AI-powered platform verifies that the person has swallowed the medicine well. The results were excellent, showing a 90% improvement in compliance. Genpact's AI solutions are frequently used in clinical trials to adjust doses for specific patients to improve

outcomes. In this collaboration, Bayer leverages Genpact's Pharmacovigilance Artificial Intelligence (PVAI) to not only monitor medication adherence but also detect side effects early.

USING AI TO MAKE SENSE OF CLINICAL DATA & TO PRODUCE BETTER ANALYTICS

Apple‟s Research kit makes it easy for people to enroll in clinical trials and studies without having to go through physical enrollment. It‟s a clinical research ecosystem designed around its two flagship products, the iPhone and the Apple Watch. Duke University, for example , uses patient data collected by these Apple devices and AI-driven facial recognition algorithm to identify children with autism. Research kit has made it easy to make better sense of collected health data.

FINDING MORE RELIABLE PATIENTS FASTER FOR CLINICAL TRIALS

Despite the wealth of patient data, finding the right patients for clinical trials is a challenge for large pharmaceutical companies. For example, finding and finding the best drug candidates can take an average of 7.5 years and cost between $161 million and $2 billion per drug. Unfortunately, 80% of clinical trials cannot be completed on time. With more than 18,000 clinical trials currently recruiting candidates in the United States, the $65 billion medical diagnostic industry is in need of a serious overhaul. Extracting valuable information from patient data may be the most difficult challenge facing pharmaceutical companies. Fortunately, this is where artificial intelligence and machine learning come into play. Help reform the pharmaceutical industry is not easy to adopt. Challenges faced by companies when trying to gain expertise: For many pharmaceutical companies, this technology is ineffective, but due to its new and esoteric nature, Intelligence is still like a "black box". There is no IT infrastructure as most of the IT applications and infrastructure used today were not designed or built with AI in mind. To make matters worse, pharmaceutical companies need to spend a lot of money improving their IT systems. Much information is in plain text, which means pharmaceutical companies must go beyond planning and convert this information into a form that can be used. Being observed. Despite these limitations, one thing is clear: intelligence is currently redefining the biotechnology and pharmaceutical industries. Ten years later. Companies see artificial intelligence as a simple and modern technology.

Fig No:4 challenges to adoption of AI in pharma

AI IN PHARMA IS A GOOD IDEA

The pharmaceutical industry can use new technologies to make changes. Artificial intelligence, the development of computer systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making and translation, will be the most innovative approach that comes to mind. According to IBM's estimates, there are 161 billion gigabytes of data in the healthcare sector as of 2011. Although the amount of data in this field is huge, artificial intelligence can help by evaluating the data and providing results. Help you make decisions, save work, time and money and help save lives. Pandemic prediction: Using machine learning and artificial intelligence, it can learn about past events, analyze social media, and predict with high accuracy where and when the event will occur. In addition to the aforementioned use cases, there are a wide range of

alternatives, including customizing the course of therapy and developing new tools for patients and doctors. Using predictive analytics to social media and doctor visits to find trial participants is known as clinical trial research [26].

- **The unfamiliarity of the technology – for many pharma companies, AI still seems lik**

LIMITATIONS

Electronic documents that need to be streamlined must first be cleaned up because they are disorganized and dispersed over several databases. Transparency: Given the difficulty of AI-based processes, consumers require transparency in the health care they receive. Medical data are confidential and legally accessible, according to data governance. It is crucial to obtain public approval. Pharma businesses are renowned for being conservative and change resistant. To provide the best care, we need to eliminate stigma [27].

BENEFITS AND ISSUES Effective use of incomplete data sets,

- rapid analysis of data,
- ability to accommodate constraints and preferences and ability to generat

BENEFITS AND ISSUES

- Efficient use of incomplete data sets.
- Quick data analysis
- Flexibility to account for preferences and limits
- Capacity to produce clear rules. improving product performance
- Quality at a cheap cost
- Shorter time to market
- Development of new products
- Improved customer response
- Improved confidence amongst patients
- Shortening the time to market
- Creating innovative products
- Getting better client feedback
- Boosting confidence. If properly coded, AI would have a lower mistake rate than humans.

They will be very fast, accurate and precise. They protect the environment, enable them to perform dangerous tasks, explore the environment, and resist pressures that could harm or kill us. This also requires digging and digging up things that are harmful to humans. Replace heavy labor and repetitive, boring tasks with machines. Think about what users will type, ask, search for and do. They are always ready to help, can make suggestions or order. It can detect card fraud based on future processes. Information is managed and organized. Chat with people as avatars or robots for fun or to complete tasks. Artificial intelligence used in many video games is an example of this. They are able to make reasoned decisions with few or no mistakes because they are able to think clearly and without emotion. This may be done for medical reasons, such as assessing mental and physical health concerns. This can provide information about side effects and medical procedure simulations. Robotic surgery, including radiosurgery in the future, will be able to do procedures with greater precision than humans.

Application

1) In Formulation: Controlled Release Tablets:

Hussain and colleagues from the University of Cincinnati (OH, USA) conducted the first study using neural networks to model drug formulations. In several studies, they simulated the in vitro release properties of various drugs dispersed in matrices prepared by various hydrophilic polymers. In all cases, neural networks with a hidden layer [28] were found to provide good performance in predicting drug release. In a recent study on the production of diclofenac sodium from a tablet matrix prepared from cetyl alcohol, the pharmaceutical company KRKA dd (Smerjeska, Slovenia) and the University of Ljubljana (Slovenia) investigated the use of neural networks. guess the drug. Investigate oscillation rates and optimize them using two- and three-dimensional response surface analysis [29]. Tablets released now: Studies in this area began with two studies about three years ago. One by Turkoglu and coworkers from the University of Marmara (Turkey) and the University of Cincinnati11 used both neural networks and statistics to model tablet

formulations of hydrochlorothiazide. The networks produced were used to prepare three-dimensional plots of massing time, compression pressure and crushing strength, or drug release, massing time and compression pressure in an attempt to maximize tablet strength or to select the best lubricant [30]. Although trends were observed no optimal formulations were given. The trends were comparable to those generated by statistical procedures. Comparable neural network models were generated and then optimized using genetic algorithms. It has been shown that the best formulation depends on the limit of the type of material used in the formulation and the relative importance of the output parameters. High tablet strength and low friability can only be achieved at the expense of burst time. In all cases, the preferred diluent is lactose and the preferred granulation technology is fluidized bed [31].

(2) In the development of products:

The development of medicine is an optimization problem. It involves the optimization of different recipes and techniques. One of the biggest benefits of neural networks is their expandability. These properties make them suitable for solving problems in establishing quality in the construction of commercial products [21]. The ANN model is recommended for adaptability and predictive ability in product quantity development when examining the effects of various factors (such as formulation, compression parameters) on tablet products (such as dissolution). Artificial neural networks provide a useful tool for the development of microemulsion-based drug delivery in a miniaturization experiment.

ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE (AI)

One of the major advantages of artificial intelligence is that its decisions are based on facts rather than emotions. Even after our utmost efforts, it is a well known fact that human decisions are always affected in a negative way by our emotions.

. Advantages of Artificial Intelligence (AI) The benefits of artificial intelligence are incredible, what this area can offer us, is to evolve definitively and move on to the history of artificial robots. Following are the main advantages of Artificial Intelligence (AI).

- Finished task faster than a human,
- Stressful and complex work completed easily,
- Difficult work done in short period,
- Various functions can done at a time,
- Success ratio is high,
- Less errors in task and defects also,
- More efficiency in short time,
- Less space, less size

, • Calculation of long term and complex situations, and

- Discover unexplored things. i.e. outer space.

. Disadvantages of Artificial Intelligence (AI)

Some of the main disadvantages of Artificial Intelligence (AI) in our daily lives are as follows

. • Some time it can be misused leading to mass scale destruction

, • Programme mismatch sometime done opposite to the command,

- Human jobs affected,
- Unemployment problem increased,
- Creativity is depend upon programmer,
- Lacks the human touch,
- Younger generation becomes lazy,
- Require a lot of time and money, and
- Technological dependency increased.

CLASSIFICATION OF AI

AI can be classified into two different ways:according to calibre and their presence [32-33].According to their ability, AI can be categorized as: i) Artificial Narrow Intelligence (ANI) or Weak AI: It performs a narrow range task, i.e., facial identification, steering a car, practicing

chess, traffic signalling, etc. ii) Artificial General Intelligence (AGI) or Strong AI: It performs all the things as humans and also known as human level AI. It can simplify human intellectual abilities and able to dounfamiliar task. iii) Artificial Super Intelligence (ASI): It is smarter than humans and has muchmore activity than humans drawing, mathematics, space, etc. According to their presence and not yet present, AI can be classified as follows: i) Type 1: It is used for narrow purpose applications, which cannot use past experiences as it has no memory system. It is known as reactive machine. There are some examples of this memory, such as a IBM chess program, which can recognize the checkers on the chess playing board and capable of making predictions. ii) Type 2: It has limited memory system, which can app

ly the previous experiences for solving different problems. In automatic vehicles, this system is capable of making decisions there are some recorded observations, which are used to record further actions, but these records are not stored permanently. iii)Type 3: It is based upon "Theory of Mind". It means that the decisions that human beings make are impinged by their individual thinking, intentions and desires. This system is non-existing AI. iv). Type 4: It has self-awareness, i.e., the sense of self and consciousness. This system is also non existing AI.

Conclusion

Humans are the most complex machines ever created. The human brain strives to create something more efficient than humans in completing any task and achieving great success. Artificial intelligence tools like Watson for oncology, tug robots and pharmacy robots are changing the industry. As the healthcare industry grows, the process must become more complex and high-tech. Artificial intelligence is the creation and use of algorithms to analyze, learn and interpret data. It is necessary to understand the advantages and disadvantages of artificial intelligence and machine learning for better users and their implementation in libraries and educational institutions. Artificial intelligence is impacting the way information is processed and searched, and information professionals will be able to use this new technology to improve their services and help users find and access certain information more easily and quickly.

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