Artificial Inteligence

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***Abstract*—The use of artificial intelligence in medicine has increased over the years, and the technology can provide a better understanding of the relationship accuracy of different models and procedures while also saving time and money.**

. Artificial intelligence is a branch of computer science that solves problems using symbols. It has turned into a scientific problem-solving tool with applications in business, medicine and engineering. This article introduces drug discovery, artificial intelligence, development of regulatory frameworks, intelligence to predict new treatments, development of new peptides from natural foods, treatment and management of rare diseases, drug and dosage compliance, challenges in acquiring intellectual knowledge. property in the pharmaceutical industry. Key words: drug discovery, artificial intelligence, MES, ACPS, treatment and management of rare diseases, medication adherence and drug use, application problems skills in the pharmaceutical industry.

I. INTRODUCTION

Artificial Intelligence (AI) is a field that involves the creation and use of algorithms to analyze and interpret data.

(1) It uses advanced computer algorithms to perform human-like tasks such as analysis and interpretation (2). It is based on understanding intelligent behavior and creating algorithms that reveal this behavior (3). The role of intelligence is to identify potential problems and provide various options to solve them (1). In artificial intelligence, machines act according to the basic emotions of other people. (2) By now, most AI applications are important because they are designed to complete fewer and fewer tasks. AI works through multiple paths, allowing systems to discover new patterns and derive their own rules when given with data and new experiences (4). Some of the critical applications of AI in pharma are designing treatment plans, checking the accuracy of medicine and in drug creation (5). Major pharma companies are adopting AI software or partnering with AI-based startups to accelerate drug discovery. With AI, customization of dosages can be achieved based on individual patient characteristics. AI is also increasingly being used to detect drug effectiveness and to understand adverse drug events. It also helps facilitate the drug approval process by regulatory authorities (6). IBM Watson for oncology, pharmacy robot (which prepares and delivers medicine to the patient), Erica robot (which understands and answers questions with a human face), etc.

Many artificial intelligence tools have been developed, such as (7). Research and development studies using artificial intelligence software in India have started only in recent years (6). In the future, many areas of general pharmaceutical research, rather than just one or two areas, will benefit from the use of AI technology. Pharmacy Education: Artificial intelligence. It covers all areas of health sciences. Improving the computerization of medical education through good educational materials, evaluation and feedback from the internet, social networks and advanced platforms will help improve the standards of medical education. It should include feedback that will help improve performance and provide information about user satisfaction. Due to the diversity of the Internet, information can be easily searched in the second section. There are many websites that provide medical advice to individuals, pharmacists, and other healthcare professionals (2). Personalized Medicine: Medicine is rapidly changing from traditional medicine to patient-centered medicine. To meet personalized medicine needs, further progress can be made by combining technologies such as artificial intelligence, advances in diagnostics, monitoring control prevention, medication therapy, and patient-tailored treatment planning (6). Within a few years, treatments will be customized based on individual genomic signatures. These ideas have already been successfully applied in

oncology. Platforms such as On-compass and Foundation Medicine offer recommendations based on the patient's genetic structure.

Artificial intelligence can be used in clinical decision-making to analyze patient data, recommend treatment, and predict outcomes (2). Drug Discovery: Artificial Intelligence can be adapted to analyze complex data in medical research. As research has become more dependent on complete data, research analysis has become blurred. In this case, pharmaceutical companies can benefit from expertise. Artificial intelligence can help expand the boundaries of clinical research by processing terabytes of data to find the right fit, reducing time-consuming tasks for researchers. (8) Drug discovery and development is not easy, costs billions of dollars and takes a long time. Many molecules can cause many diseases. This is where artificial intelligence can benefit pharmaceutical companies
(7). By making new drugs, researchers can identify more drug users for clinical trials.

Various models can be developed to study pharmacokinetics and pharmacodynamics. Artificial intelligence, combined with clinical thinking, will allow doctors to ensure the value of future research (8). Artificial intelligence systems can also be useful in clinical research in identifying, comparing and recruiting suitable patients for relevant studies (9). Artificial intelligence can accelerate the drug discovery process, reduce research and development costs, increase the success of clinical trials, and support the development of effective drugs. It can be used to predict potential toxicity in clinical studies. Artificial intelligence has the power to change the future of healthcare, but it still needs to be adapted to achieve the best results (10). Artificial intelligence can be used to identify and identify new drug targets and develop better drug models, diagnostics or biomarkers. It can be used to reinvent drugs, finding new directions for existing drugs or drug candidates, thus accelerating clinical trials (5). Organic synthesis and design, synthetic complex scoring, molecular design automation, prediction of organic reaction results, computer-aided synthesis and retrosynthesis, prediction of drug performance in in vitro tests, discovery of off-label use, prediction of toxicity, personal probabilities are an important field in medicine. It is based on artificial intelligence (6). Effective use of medications: One of the responsibilities of the pharmacist is to provide the appropriate medication in the correct dosage and quantity when taking medication and to check for drug interactions and/or side effects in the context of various medications. Artificial intelligence robots are increasingly being used to perform these tasks previously performed by humans (7). Cognitive processes can help improve the amount of information, management style, or treatment planning and provide guidance to physicians
(5). Algorithms can be used to create prescriptions and check whether prescriptions follow the correct instructions by periodically updating the function (8). Machines combined with artificial intelligence can be used to predict and analyze the outcomes of treatment plans for a variety of diseases and conditions (9). Figure 1. Application of artificial intelligence in medicine; This picture represents the use of skills in different areas of pharmacy. Medications: Artificial intelligence platforms have been developed to use patients' medical information, such as medication use, to create treatment plans. It can help create a patient registry to guide physicians in choosing the best medication schedule (6). Drug Safety: Drug safety is a critical issue from pre-marketing to post-marketing. Developing artificial intelligence systems to analyze data can reduce the risk of drug toxicity. Artificial intelligence in pharmacovigilance will help eliminate many manual tasks, thus saving a lot of time and resources
(6). Manufacturing: When we talk about pharmaceuticals, pharmaceutical manufacturing is complex, from how much paper is made to the finished product, and requires careful attention to raw materials and their processes. These properties affect the quality of the finished product (1). Over the past two decades, smart technology has been widely used to develop and improve designs such as controlled release and immediate release (11). AI systems can shorten drug development time, improve safety and quality, and discover ways to reinvent existing drugs. The use of technologycan automate many processes such as pharmaceutical logistics, tracking, packaging and processing and greatly reduce errors(6).

II. HISTORY OF ARTIFICIAL INTELLIGENCE

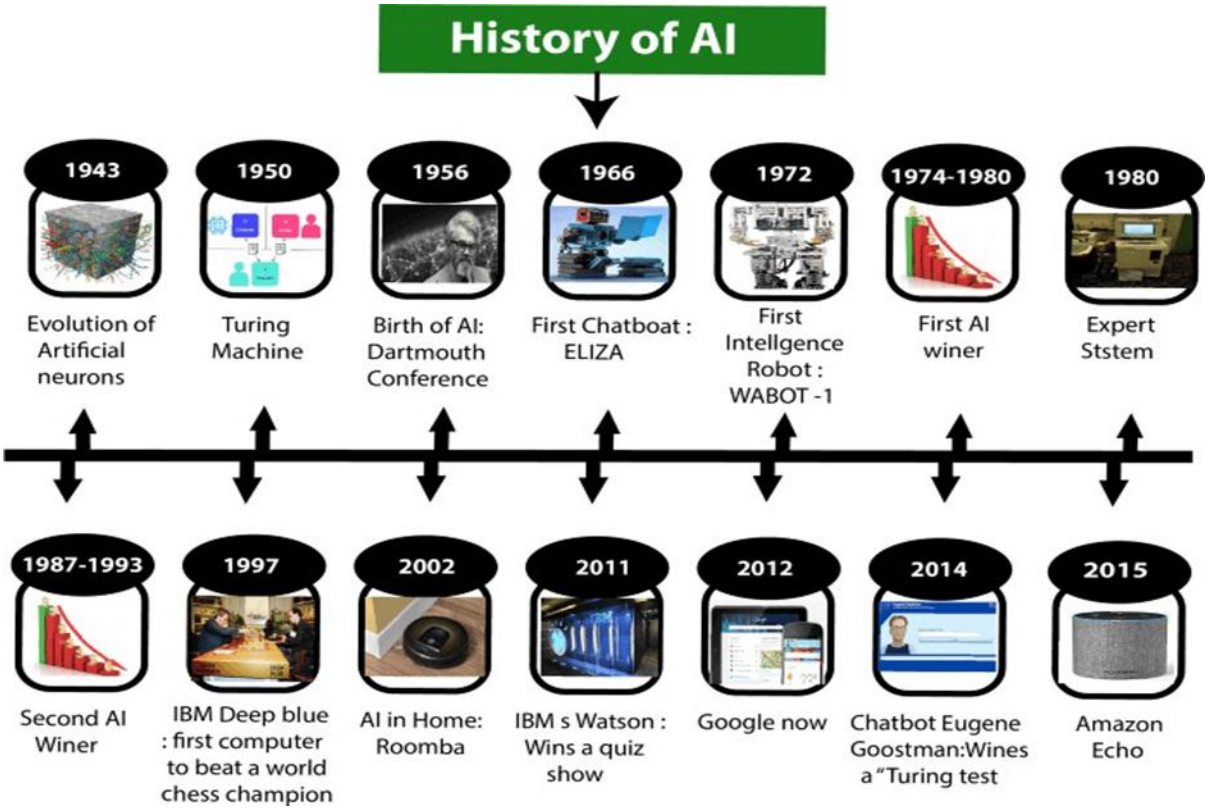

Fig 1. History of AI

Maturation of Artificial Intelligence (1943-1952)

- 1943 - The first study on what is now considered artificial intelligence was done by Warren McCulloch and Walterpits in 1943. They reported the structure of the brain.
- 1949 - Donald Hebb introduced a new law that changed the strength of connections between neurons. His law is now called Hebbian learning.
- 1950 - British mathematician Alan Turing started using machine learning in 1950. Alan Turing published the book "Computing Machines and Intelligence", which he proposed during the experiment. The test can check the machine ability to exhibit intelligent behavior equivalent to human intelligence, called a Turing test.

The birth of AI (1952-1956)

- 1955 - Allen Newell and Herbert A. Simon created the first cognitive theory called "Theory of Logic". The program proved 38 of 52 mathematical theorems and found new, nicer proofs for some theorems.
- 1956 - American computer scientist John McCarthy used the word artificial intelligence for the first time at the Dartmouth Conference. It was the first study of artificial intelligence [1,2].

Golden Years - Early Enthusiasm (1956-1974)

- 1966 - Scientists talk about developing algorithms that can solve mathematical problems. Joseph Weizenbaum created the first chatbot called ELIZA in 1966.
- 1972 - Japan produced the first intelligent robot called WABOT-1.

The First Artificial Intelligence Winter (1974-1980)

- The winter of 1974-1980 was the first Artificial Intelligence Winter. Winter AI refers to the time when computer scientists face a shortage of government funding for AI research.
- Interest in publishing intelligence in the intelligence winter is not good [3].

The Prosperity of Artificial Intelligence (1980-1987)

- 1980-After the winter of artificial intelligence,

artificial intelligence returned with "experts". Expert systems are programmed to mimic the decisions of human experts.

- In 1980, the first national conference of the American Artificial Intelligence Association was held at Stanford University.

Second AI Winter (1987-1993)

- Second AI Winter from 1987 to 1993
- Businesses and governments once again stopped investing in AI research due to prohibitive costs. Results. Professional systems such as XCON are very affordable.

The Emergence of Intelligent Agents (1993-2011)

- 1997 - 1997 - This is the year that IBM Deep Blue became the first computer to defeat the world chess champion, Garry Kasparov.
- 2002 - Artificial intelligence enters homes for the first time with the Roomba vacuum cleaner.
- 2006 – Smart Intelligence did not enter the global market until 2006. Companies such as Facebook, Twitter and Netflix have also started to use artificial intelligence[4,5] Deep Learning, Big Data and General Artificial Intelligence (2011-present)
- 2011 - 2011, IBM's Watson Win Jeopardy questions , here you have to solve complex questions and riddles. Watson has proven that it can understand natural language and solve complex problems quickly.
- 2012 – Google introduced "Google Now", an Android app feature that provides users with predictive information.
- 2014 – In 2014, the chatbot "Eugene Goostman" won the famous "Turing Test" competition.
- 2018 - "Project Debaters" from IBM debate difficult topics with two debate experts and are very successful.
- Google introduced artificial intelligence "Duplex", a virtual assistant that can make an appointment with the hairdresser at any time without realizing that the woman on the other end is talking to the machine [6]

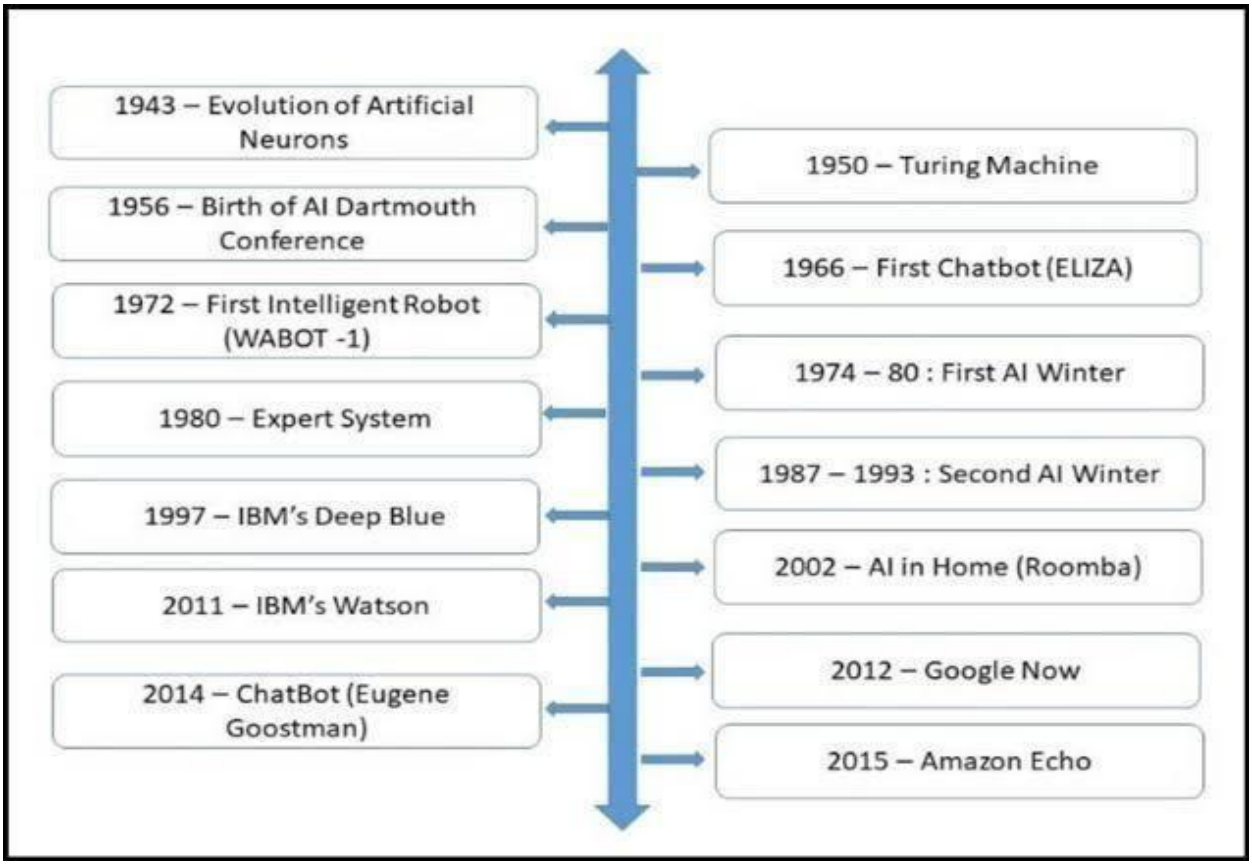

Fig. 2. Milestones in the area of AI uses.

Artificial Intelligence in Drug Discovery

Drug discovery usually takes a long time to evaluate compounds against cell diseases. 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 analysis and laboratory testing, new drugs can be delivered faster and the work involved in guiding research for each compound can also be reduced. 3].Current AI strategies from top biopharmaceutical companies include: [a] Business processes to improve health outcomes—ensure the patient can benefit from educating patients by collecting real-time information. [b] Drug Discovery - Pharmaceutical companies, in collaboration with software companies, are trying to use new technologies in the expensive and expensive drug discovery process[7].

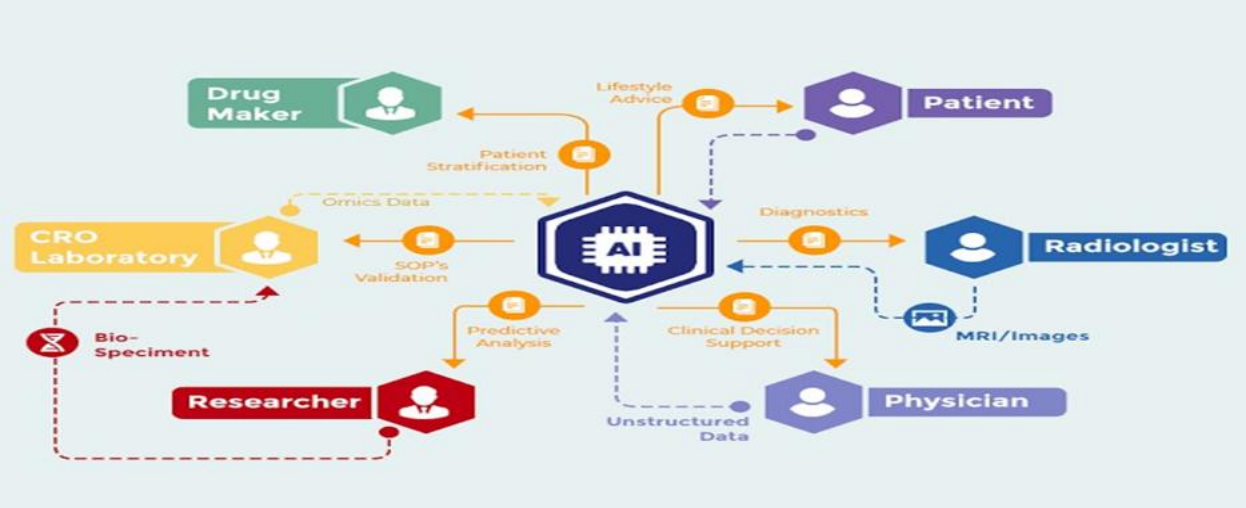

Fig. 3. AI in Pharma Industry

III. ARTIFICIAL INTELLIGENCE TOOLS

ROBOTIC PHARMACY

Improving patient safety, UCSF Medical Center uses artificial intelligence to prepare and track medications. According to them, the technology prepared 3,50,000 doses without any errors. The robot has proven to be superior to humans in both size and ability to accurately dispense medication. Robotics' capabilities include the preparation of oral and injectable medications, including chemical poisonings. This gives UCSF pharmacists and nurses the freedom to hone their skills by focusing on direct patient care and collaborating with healthcare providers. [8]

MEDi Robots:

MEDi is medicine and engineering. It is the short form of artificial intelligence. Artificial Intelligence ToolThe pain management tool was developed as part of a project led by Tanya Beran, professor of community health at the University of Calgary in Alberta. He came up with the idea after working in a hospital where children were screaming during treatment. The robot first establishes a relationship with the children and then tells them what to expect during treatment[9]. Even though a robot cannot think, plan, or reason, it can be designed to display intelligence. [10].

Erica Robot:

Erica is a new type of adult robot created in Japan by Hiroshi Ishiguro, a professor at Osaka University.) was developed in collaboration with the Japan Science Foundation and Technology Agency, Kyoto University, and the International Advanced Telecommunications Research Institute (ATR). He speaks Japanese and has a mixture of European and Asian faces [11]. Like any normal person, he loves animated movies, wants to visit Southeast Asian countries, and wants to spend a life with someone he can communicate with. The robot cannot walk on its own; but it is designed to understand and answer

questions using human-like faces. Erica is the "most beautifulsmartest" robot because Ishiguro arranged the features of 30 beauties and averaged the robot's nose, eyes, etc. used to create. [12].

TUG Robot:

The Aethon TUG robot is designed to move around hospitals and distribute medicines, meals, samples, documents and carry heavy objects such as bedding and garbage. It is available in two configurations: fixed and fixed trolley, as well as a replaceable base platform that can be used to transport shelves, boxes and carts. While rigid trucks are used to transport drugs, sensitive materials and laboratory samples, bartering is also used by Vyas et al: Artificial Intelligence: A New Era in the Pharmaceutical Industry Asian Journal of Pharmacy •< br> 4, 2018 June Month • 12 75 Cargo can be loaded on more than one rack. TUG can transport different types of trucks or racks, making it very useful and resource-efficient [13].

Automatic Process Control System [ACPS]:

[ACPS] content includes:

Evaluation of the importance of different processes. Send the signal to the measuring device.

Evaluate different processes. Display the value of the parameter.

Setting the values of the required changes. Control signals are sent to the last control element. Maintain cost control.

Berg:

Berg is a Boston-based biotechnology company and a major player in the adoption of artificial intelligence across its various systems. He has research on cognitive-based medicine, which uses large patient data to find and identify various disease-causing biomarkers and then decides on treatment status as information is received. The company's motto is to break the deadlock, improve MES including compliance with Management Rules and regulations, reduce risk, increase transparency, reduce production cycles, improve resource utilization, control and monitor production levels and optimize batch release [15].

Manufacturing Execution System (MES)

The benefits of using MES include compliance with accepted rules and regulations, reducing risks, increasing visibility, improving the cycle. In short, to improve resource utilization, control and monitor production steps and optimize until the batch is released [15].

Artificial Intelligence Predicts New Treatments

Verge uses data collection and analysis to solve big problems in drug discovery. So they used this method to identify hundreds of genes that work intensively 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 preliminary 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. Therefore, pharmaceutical companies can learn more about the effects of drugs on the human brain as soon as possible. In particularVerge is using AI to monitor the effects of certain treatments on the human brain, focusing on the pre-clinical stage[3]

Developing new peptides from natural foods

Irish startup Nerites Using AI and developing new, more powerfulfood and other new technologies that will facilitate health discovery. BASF (Baden Aniline Soda Plant) will use this partnership to develop new functional peptides from natural foods. In practice, BASF uses Nuritas AI and DNA Analysis functionality to predict, identify and validate peptides of origin. BASF's main goal is to discover and bring to market peptide-based therapies that will help treat diseases such as diabetes.

Treatment and management of rare diseases

Advances in knowledge, new interest in rare diseases. Currently, more than 350 million people worldwide suffer from more than 7,000 rare diseases. For a few patients, however, it's not all gloom and doom. British biotech company Kho has secured $10 million in Series A funding to use its expertise to develop new drugs to treat rare diseases. Thera Choon, another Swiss biotech company that uses artificial intelligence to develop drugs to treat rare genetic diseases, received $60 million in funding.

Health and Drug Administration

Abbvie partners with New York-based Acura to

speed drug testing and improve medication compliance. 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 are dramatic, with improvements in compliance of up to 90%. Genpact's AI solutions are frequently used in clinical trials to modify patient-specific medications to be more effective. In this partnership, Bayer leverages Genpact's Pharmacovigilance Artificial Intelligence (PVAI) to not only monitor medication adherence but also detect side effects earlier.

Use AI to understand medical data and provide better analysis

Apple's Research Suite makes it easy for people to enroll in clinical trials and research projects without requiring physical registration. This is a research ecosystem built around its two products, the iPhone and Apple Watch. For example, Duke University uses patient data collected from these Apple devices and AI- powered facial recognition to identify children with autism. Research Suite makes it easy to better understand the health data you collect.

Find safer patients for clinical trials faster

Despite the abundance 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 fail to meet deadlines. With more than 18,000 clinical trials currently seeking candidates in the United States, the

$65 billion medical diagnostics industry needs an 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 in

Challenges in Adopting AIIN PHARMA

While AI has vast potential to help transform the pharmaceutical industry, its personal adoption will not be easy br> park . Challenges faced by pharmaceutical companies when trying to adopt AI:

Ignorance of the technology - For many pharmaceutical companies, AI is still something of a "black box" because it is of a "new and esoteric nature".

Lack of IT infrastructure - This is because most of the IT applications and infrastructure used today are not designed or built with AI in mind. To make matters worse, pharmaceutical companies have to spend a lot of money improving their IT systems.

Most of the information is in plain text; This means that pharmaceutical companies must review this information and convert it into a verifiable form. Despite all these limitations, one thing is certain: Artificial

intelligence is redefining biotechnology and medicine. Ten years from now, pharmaceutical companies will see AI as a vital, modern technology.

IV. AI IS A GOOD IDEA FOR THE PHARMACEUTICAL INDUSTRY

The pharmaceutical industry can leverage technological advances to accelerate innovation. One of the technological developments that comes to mind recently is artificial intelligence, the development of a computer that can perform tasks such as visual perception, speech recognition, decision making, and interpreting words that normally require human intelligence. IBM estimates that across healthcare, approx. As of 2011, there is 161 billion gigabytes of data. With the huge amount of data in this field, artificial intelligence can provide real assistance in analyzing data and presenting results that can help in making decisions, thus saving people work, time and money, thereby helping to save people's lives. Predicting epidemics; Using machine learning/artificial intelligence, the history of epidemics can be examined, social media can be analyzed, and when and where epidemics will occur can be predicted with facts. In addition to the uses mentioned, there are many other uses such as: Personalization helps create new tools for patients, doctors, and more. Research Analytics: Use Research Analytics to identify test candidates through Media Interviews and PhD Interviews.

Limitations:
Simplify electronic documents; This file is not good and does not belong to different files and needs to be cleaned first. Transparency: People want transparency in their treatments; This is a difficult task considering the complex process that requires expertise. Information management: Medical information is personal and cannot be legally accessed. Public approval is essentially an aversion to change: Pharmaceutical companies are known to be reluctant to change. We need to break the dirt and give the best care.

Benefits and problems
- Effective use of missing data,
- Fast analysis of data,
- Having the ability to make changes according to limits and tastes and create rules of understanding.
- Improve product quality and performance at lower cost,
- Reduce time to market,
- Develop new products,
- Improve user experience responsiveness,
- Build trust, and[3].
- If coded correctly, artificial intelligence's error rate is lower than humans. They will have incredible accuracy, accuracy and speed.
- They are unaffected by harsh environments, allowing them to complete dangerous tasks, explore space, and avoid obstacles that could cause injury or death
- This also means that mining and mining are dangerous to humans. fuel.
- Replace people in repetitive tasks, difficult jobs and more intense work environments.
- predict what users will do to type, ask, search and take action. They can easily help and suggest various actions.

Artificial Intelligence Applications in the Pharmaceutical Industry Management of Artificial Intelligence in the Pharmaceutical Industry:
1. A successful search.
2. Drug development.
3. Diagnosis.
4. Prevent disease.
5. Disease prediction.
6. Remote monitoring.
7. Producing.
8. business.
9. Rare diseases and personalized medicine.
10. Biomedical process and medical information.
11. Identify candidate diagnoses.

R&D
Companies around the world are using advanced machine learning and artificial intelligence-based tools to facilitate drug discovery. These intelligent tools are designed to identify complex patterns in large data sets and can therefore be used to solve problems related to the synthesis of biological systems [17].

Drug Development
Artificial intelligence has the potential to improve research and development. Intelligence can be fully realized from the creation and identification of new molecules for effective medicine and discovery [18].

Diagnosis
Doctors can use advanced machine learning to collect, process and analyze medical data of many patients. Doctors around the world are using machine learning techniques to securely store patient information in the cloud or centralized storage facilities. This is called an electronic medical record (EMR) [19].

Preventing Diseases
Pharmaceutical companies can use this expertise to develop treatments for rare diseases as well as known diseases such as Alzheimer's and Parkinson's. Generally,pharmaceutical companies do not spend their time and resources on finding treatments for rare diseases since the ROI is very low comparedto the time and cost it takes to develop drugs for treating rare diseases [20].

Epidemic prediction
AI and ML are already used by many pharma companies and healthcare providers to monitor and forecast epidemic outbreaks across the globe. These technologies feed on the data gathered from disparate sources in the web, study the connection of various geological, environmental and biological factors on the health of the population of different geographical locations, and try to connect the dots between these factors and previous epidemic outbreaks. Such

AI/ML models become especially useful for underdeveloped economies that lack themedical infrastructure and financial framework to deal with an epidemic outbreak.

Remote monitoring
It is a breakthrough in the pharma and healthcare sectors. Many pharma companies have already developed variables powered by AIalgorithms that remotely monitor patients suffering from life-threatening diseases.

Manufacturing
Pharma companies can implement AI in manufacturing process for higher productivity, improved efficiency, and faster production of life-saving drugs. AI can be used to manage and improve all aspects of the manufacturing process, including:
Quality control.
Predictive maintenance.
Waste reduction.
Design optimization. Process automation.

Marketing
Given the fact that the pharmaceutical industry is a sales-driven sector, AI can be a handy tool in pharma marketing. Pharmaceutical companies are researching and developing unique marketing strategies to generate high revenue and brand awareness with the help of artificial intelligence.

Future Scope of AI
Artificial Intelligence in Scientific Research. Artificial Intelligence in Cyber Security.
Artificial intelligence in data analysis. Artificial intelligence in transportation. Artificial intelligence at home.
Artificial intelligence in medicine etc.

Artificial Intelligence in Scientific Research
Artificial Intelligence is making progress in many scientific fields. Artificial intelligence can process information much faster than the human mind. This is ideal for studies where the source contains large amounts of data. Artificial intelligence has already been successful in this field [21].

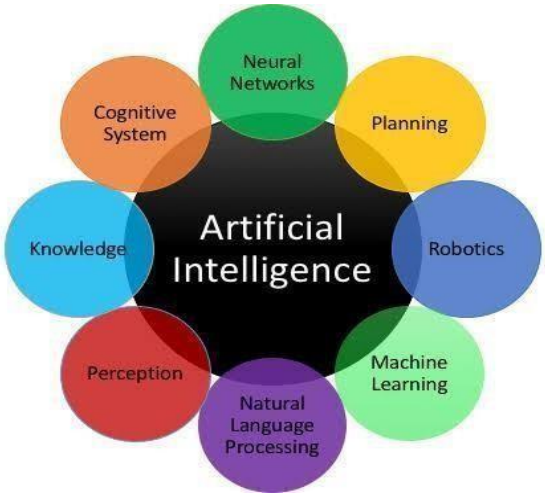

Fig 4. The future Scope of Artificial Intelligence

Artificial Intelligence in Cyber Security
Cyber security is another field that benefits from artificial intelligence. As organizations move data across IT networks and the cloud, threats from hackers are becoming more serious.

Artificial Intelligence in Data Analysis
Data analysis can benefit greatly from artificial intelligence and machine learning. AI algorithms can be improved through iteration so that their accuracy and precision increase accordingly. Artificial intelligence can help data analysts process big data.

Artificial Intelligence in Transportation
The transportation sector has been using artificial intelligence for decades. Since 1912, planes have been flying in the sky using autopilot. The autopilot system controls an aircraft's trajectory, but it is not limited to just the aircraft. Ships and planes also use autopilots to help them stay on course.

Artificial Intelligence in the Home
Artificial Intelligence has found a special place in the human home as home assistants. Amazon Echo and Google Home are popularsmarthome devices that let you perform various tasks with just voice commands.

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