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ARTIFICIAL INTELLIGENCE IN PHARMACY

Vipin Mishra¹, Sujeet Pratap Singh², Pramod Mishra³, Tarkeshwar Prasad Shukla⁴

^{1,2,3,4}Department of Pharmacy SCPM College of Pharmacy, Gonda, U.P., India.

¹ mishravansh123456@gmail.com

 $^2 singh sujeet 0068 @\,gmail.com\,^3 pramod dmishra 000 @\,gmail.com\,^4 tk 007.shukla @\,gmail.com\,^4 tk$

ABSTRACT

Artificial intelligence (AI) has come quite a distance from the mid-twentieth century with the development of its latest application areas from science, healthcare, and pharmaceuticals to feature the pioneers who would have laid the foundation for AI. Aside from his work with Warren McCullough and Walter Pitts and Alan Turing, whose disseminations in the early period of the development of the field have produced all sorts of rather recurrent stages of growth and stagnation along with resurgent periods, John McCarthy would also be able to mark the year 1956 when AI found an establishment as an academic discipline. It is known that there are various advancements that AI can trigger in science and medicine. Protein structure prediction, genomic data analysis, gap-filling methods, and complex datasets make extensive use of AI's applications in science. Drug discovery and development, clinical research designs, disease diagnostics, and prevention have been streamlined with AI's use in the pharmaceutical sector. Further, it predicts epidemics, remotely monitors patients, and provides efficient manufacturing processes. Additionally, AI-powered tools provide personalized healthcare, secure electronic medical records, and devise better marketing strategies for pharmaceutical products. This review highlights an in-depth introduction to the past of artificial intelligence and how the technology has evolved by different industries to its current transformative effects towards the field of pharmaceutical research and healthcare. In addition to that, it speaks of AI as a global solution to some of the problems facing the world, such as treatment for rare diseases, epidemic management, and advanced healthcare delivery, thus making it one of the most potent propellers for innovation in modern medicine.

Keywords: Artificial intelligence, Pharmacy, Machines.

1. INTRODUCTION

Designed by Newell and Simon in 1995, it may be considered the first AI program. The person who finally coined the term artificial intelligence and is regarded as father of AI is John McCarthy.

When was AI introduced?

• In 1956, the beginning of AI can be traced to classical philosopher's attempts to describe human thinking as a symbolic system.

• But the field of AI wasn't formally founded until 1956, at a conference at Dartmouth College, in Hanover, New Hampshire, where the term AI was coined [6].

1. History of AI

1. Maturation of AI (1943-1952)

- Year 1943-The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943.They propose model of artificial neurons.
- Year 1949-Donald Herb demonstrate an updating rule for modifying the connection strength between neurons. His rule is now called Habana learning.
- Year 1950-The Alan Turing who was an English mathematician and pioneered machine learning in 1950. Alan Turing publishes "Computing machinery and intelligence "In which he proposed at a test. The test can check the machine ability to exhibit intelligent behavior equivalent to human intelligence, called a Turing test[1,2,3,4,5].

2. The birth of AI (1952-1956)

- Year 1955-An Allen Newell and Herbert A. Simon created the first artificial intelligence program which was named as "Logic theorist". This program had proved 38 of 52 mathematics theorems, and find new and more elegant proofs for some theorems.
- Year 1956-The word AI first adopted by American computer scientist John McCarthy at Dartmouth conference. For the first time, AI coined as an academic field [1,2].
- 3. The golden years-early enthusiasm (1956-1974)
- Year 1966-The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum

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created the first chatbot in 1966, which was named as ELIZA.

• Year 1972-The first intelligent humanoid robot was built in Japan which was named as WABOT-1[1,3,5].

4. The first AI winter (1974-1980)

- The duration between years 1974 to 1980 was the first AI winter duration. AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches.
- During AI winter, an interest of publicity on AI was decreased [3].
- 5. A boom of AI (1980-1987)
- Year 1980-After AI winter duration, AI came back with "Expert system ". Expert system was programed that emulate the decision-making ability of human expert.
- In the year 1980, the first national conference of the American association of AI was held at Stanford University[8].

6. The second AI winter (1987-1993)

- The duration between the years 1987 to 1993 was the second AI winter duration
- Again, investors and government stopped in funding for AI research as due to high cost but not efficient result. The expert system such as XCON was very cost effective. The emergence of intelligent agents (1993-2011)
- Year 1997-In this year, IBM deep blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
- Year 2002-for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- Year 2006 AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI[4,5]
- 7. Deep learning, big data and artificial general intelligence (2011-present)
- Year 2011-In the year 2011, IBM's Watson won jeopardy, a quiz show, where it had to solve the complex questions as well as riddles. Watson had proved that it could understand natural language and can solve tricky questions quickly.
- Year 2012 Google has launched an Android app feature "Google now ", which was able to provide information to the user as prediction.
- Year 2014 In the year 2014, Chat bot "Eugene Goostman" won a competition in the infamous "Turing test".
- Year 2018 The "Project Debater" from IBM debated on complex topics with two master debaters and also performed extremel well.
- Google has demonstrated an AI program "Duplex" which a virtual assistant was and which has hairdresser appointment on call and lady on other side didn't notice that she was talking with the machine [6].

2. TYPES OF AI

There are 4 types of artificial intelligence:

- Reactive machines.
- Limited memory.
- Theory of mind.
- Self-awareness.
- AI was first applied in
- In 1960's researchers emphasized developing algorithms to solve mathematical problems and geometrical theorems.
- In the late 1960's computers scientists worked on machine vision learning and developing machine learning in robots were built[12]

3. AI In Science

AI technologies are now used in a variety of scientific research fields.For example: Using genomic data to predict protein structure understanding the role it plays in the body...machine learning can p bridge the gap between these two types information .AI is wide ranging branch of computer sciences concerned with building smart machine capable of performing tasks that typically required human intelligence. It is the endeavor to replicate or simulate human intelligence in machines [9,10].

4. AI In Pharmacy

AI mainly used in pharmaceutical industries for:



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- 1. Drug discovery
- 2. Clinical research
- 3. Disease diagnosis
- 4. Novel medication
- 5. Prediction
- 6. Data analysis

AI in pharma refers to use of automated algorithms to perform tasks which traditionally rely on human intelligence. Over the last five years the use of AI in pharma and biotech industries have redefined how scientists develop new drugs, tackle disease and more [11,12].

2. RESEARCH & DEVELOPMENT

Pharma companies around the world are leveraging advanced ML Algorithms and AI-powered tools to streamline the drug discovery process. These intelligent tools are designed to identify intricate patterns in large datasets, and hence, they can be used to solve challenges associated with complicated biological networks [17].

Drug development

AI holds the potential to improve the R&D process. From designing and identifying new molecules to target-based drug validation and discoveries AI can do it all [18].

Diagnosis

Doctors can use advanced machine learning system to collect, process, and analyze vast volumes of patients' healthcare data. Healthcare providers around the world are using ML technology to store sensitive patient data securely in the cloud or a centralized storage system. This is known as electronic medical records (EMRs) [19].

Disease prevention

Pharma companies can use AI to develop cures for both known diseases like Alzheimer's and Parkinson's and rare diseases. Generally, pharmaceutical companies do not spend their time and resources on finding treatments for rare diseases since the ROI is very low compared to the time and cost it takes to develop drugs for treating rare diseases [20].

Epidemic prediction

AI and ML are already used by many pharm 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 the medical infrastructure and financial framework to deal with an epidemic outbreak [21].

Remote monitoring

It is a breakthrough in the pharma and healthcare sectors. Many pharma companies have already developed variables powered by Algorithms 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[13].

Marketing

Given the fact that the pharmaceutical industry is a sales-driven sector, AI can be a handy tool in pharma marketing. With AI, pharma companies explore and develop unique marketing strategies that promise high revenues and brand awareness [14].

AI in healthcare

The medical sector is also using this technology for its advantages. AI is helping medical researchers and professionals in numerous ways [22].

3. CONCLUSION

The AI has emerged as an industrial revolutionizing tool for many, including science and pharmacy. Its journey from the development of artificial neurons to highly advanced algorithms capable of recognizing natural human language and making decisions truly reflects its prospective growth in the rapid phases of advancement. The history of AI is represented both by its most turning-point accomplishments and by years called "AI winters," the entry of both into the molding of its current form. AI applications in pharmacy are nowhere near complete. AI is pushing drug discovery

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processes through complex biological data analysis, which has opened the mining of new molecular targets to predict drug efficacy early in the discovery process. This capability is critical in addressing the deficiencies of time, cost, and complexity associated with Alzheimer's and rare diseases. With advances in data analysis and EMRs, new roles for AI are emerging for revolutionary diagnosis and prevention of diseases, thus empowering timely and more feasible decisions on the part of all health professionals. AI has the potential to be applied to epidemic prediction, with modelbased machine learning forecasting from environment and epidemiologic data incidence of new outbreaks. This is an important part of global health, especially in the less medically endowed parts of the world. AI also leads to better patient care, through online patient monitoring systems and wearable instruments that can supply the same real-time health information to both the patient and the healthcare provider thereby improving treatment adherence and outcomes.AI streamlines the entire system in making a pharmaceutical, enhancing efficiency, precision, and scalability. It will also play a very vital role in pharma marketing; with predictive analytics, companies can be expected to devise effective strategies to be applied for product marketing and raising brand awareness. There are huge applications of AI in science and pharmacy, but having such advancements does not mean that everything is smooth. Data privacy, algorithmic bias, and accountability are some of the major ethical issues in this field. The implementation cost is high which does not favor or promote the skill development of the persons who would operate it. Balance needs to be struck between technology and ethics so as not to minimize the chances of enhancing the benefits of AI and increasing the effects of its dangers. It advances in the new field boundaries of science, pharmacy, and health with new routes to the old challenges. One from drug development speeds the patient and epidemic management, and rendering better human health outcomes in much capability. There remain challenging areas of ethical issues and resources; however, accessing AI's evolution with a stronger regulatory framework and inter-discipline collaboration would bring about a world in which AI has become an indispensable tool in the advancement of medical science and globally improving health. The more AI improves, the more it will be able to support efficiency, accuracy, and innovation across industries, making it one of the pillars of modern technology. Serious attention must be paid to the potential limitations of AI while forging ahead with its responsible use so that it becomes a powerful force in solving critical scientific and health challenges in the world today.

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