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ARTIFICIAL INTELLIGENCE IN PHARMA SECTOR

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Abstract— Artificial intelligence (AI) is a branch of computer science that deals with the problem-solving by the aid of symbolic programming. It has greatly evolved into a science of problem-solving with huge applications in business, health care, and engineering. One of the pivotal applications of AI is the development of the expert system. With the advent of big data and AI, robots are now becoming more trustworthy for doctors, and a large number of institutions are now employing robots along with human supervision to carry out activities that were previously done by humans. The major advantage of AI is that it reduces the time that is needed for drug development and, in turn, it reduces the costs that are associated with drug development, enhances the returns on investment and may even cause a decrease in cost for the end user. A large number of researches are being carried out to improve the current available AI technology to make the pharmacy profession more efficient. The present article briefly describes the importance of AI in the process of drug development and then looks at the various AI tools that are available at the disposal of a modern-day pharmacist to aid in a more efficient functioning.

KEYWORDS: Drug Discovery, tools of AI, MES, ACPS, treatment and management of rare diseases, drug adherence and dosage, challenges to adoption of AI in pharma., Artificial intelligence, Artificial neural network, Drug discovery, Drug delivery research, Hospital pharmacy.

➢ INTRODUCTION:

Artificial intelligence (AI) is a branch of computer science that deals with the problem –solving by the aid of symbolic programming .it has greatly evolved into a science of problem-solving with huge application in business, health care, engineering [1]. The main objective of this artificial intelligence to identify useful information processing problems and give an abstract account of how to solve them. Such an account is called as methodand it corresponds to a theorem in mathematics. Artificial intelligence as a field that deals with the design and application f algorithms for analysis of learning from and interpreting data. Artificial intelligence en compasses many branches of statistical and machine learning, pattern recognition, and clustering, similarity- based methods [2]. AI is a flourishing technology which finds application in multiple aspects of life and industry. In Recent times the pharmaceutical industry discovers novel and innovative ways to use this powerful technology to help solve some of the biggest problems facing pharma today.

Artificial Intelligence (AI) is the branch of engineering science which deals with creation of intelligent machines, particularly intelligent computer programs. It is the ability of computer or a robotic computer enabled system to process the given information and produce outcomes in a manner similar to the attention process of human in learning, decision making and solving problems. AI is a branch of computer science that aims to create intelligent machines, which becomes an essential part of the technology industry. AI has brought a prominent revolution in pharmaceutical industries. It is being majorly exploited in each and every fieldof healthcare industry. This technology is a culmination of human intelligence and computer processing. It is an advanced version of computer aided technique that consists of collecting the information from various sources, then preparing rules accordingly to be followed for handling the required information, and drawing possible outcomes to determine appropriate results and processes can resemble the human behavior. It consists of subunits such as machine learning and deep learning which provide ease in working with neural works

Recently, AI technology becomes a very fundamental part of the industry for useful applications in many technical and research fields. Reflecting on the past 25 years, pharmacy has done a great job of addressing the growing demand for prescriptions, even when faced with pharmacist shortages growing operating costs, and lower reimbursements. Pharmacy has also done a great job of leveraging enabling

technology automation to improve workflow efficiency and lower operating costs while promoting safety, accuracy, and efficiency in every pharmacy setting. Automated dispensing gives pharmacists more time to engage with a greater volume of patients while also enhancing their health outcomes.

The first application of a computer in a pharmacy presumably dates back to the 1980s and since then, computers have been utilized in everything from data collection, retail pharmacy management, clinical research, drug storage, pharmacy education, clinical pharmacy, and lots more, and with the emergence of artificial intelligence, there is no telling just how much the Pharmacy sector will evolve in the long run. There have been several expert systems developed in medicine to assist physicians with medical diagnosis[5]. Recently, several programs focusing on drug therapy have been described[6]. They guide drug interactions, drug therapy monitoring, and drug formulary selection.

FIG.1- ARTIFICIAL INTELLIGANCE

- **ARTIFICIUAL INTELLIGENCE :-**

AI describes all forms of intelligence in machines. This ranges from reasoning and language processing to learning based applications. ML is one of the most commonly used forms of AI in clinical applications. ML is a type of AI which is heavily based on statistical methods and relies on the capability of computers to infer relations and make predictions rather than human efforts. ML approaches can be further subdivided in unsupervised learning to explore and cluster data, and supervised learning, aimed at to mimic biological neural networks. A neural network consists of input- and output layer and hidden layers in between, the nodes connecting the different layers get different weights which are optimized during the training. Neural networks are particularly good at recognizing patterns in the data they are trained on and can process fast amounts of data. This makes them useful and commonly applied in a wide range of applications. Each ML model is based on a theoretical understanding of the problem at hand, and on an experimental part that the model learns upon training. The larger the experimental part, the more difficult a model is to understand, the so-called black-box models. Although it is still understood what goes into the model and what comes out, the internal reasoning and weighing of factors is not transparent unless measures are taken to make these factors transparent. Besides ML, natural language processing (NLP) is also increasingly used. NLP is the domain within AI that focusses on processing and interpreting natural human language and can, for example, help to “read” and process the huge amount of (un)structured text. In pharmacology, NLP can be used to mine databases and electronic health records (EHRs) to obtain data related to pharmacology, such as clinical outcomes.2,3 Advanced NLP approaches can also help to interpret the data and filter the most important items and structure the data to allow for interpretation and further studies

Al systems can be considered simply as a two-stage system: In the first stage, it understands the thinking and decisionmaking mechanism of the human mind; In the second stage. it repeats these mechanisms autonomously. The definition of the concept of artificial intelligence is defined as "Digital technology and/or applications that have the ability to imitate human beings, interact, learn, adapt and apply by expanding their experience" (7). The concept of Al was brought to the agenda for the first time by Turing in the 1950s and the possibility of a machine to think like a human is philosophically discussed.

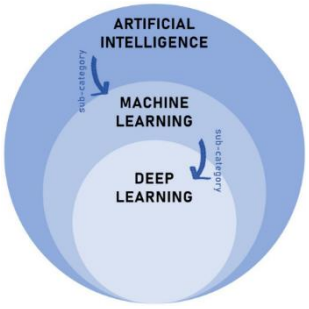

FIG.2- PARTS OF ARTIFICIAL INTELLIGENCE

a)AI, Machine Learning (Ml), and Deep Learning (DL)

AI is described as the use of techniques that enable computers to mimic human behavior. AI also contains a subfield called machine learning (ML), which uses statistical methods with the ability to learn with or without being explicitly programmed. ML is categorized into supervised, unsupervised, and reinforcement learning.

1) Supervised Learning comprises classification and regression methods where the predictive model is developed based on the data from input and output sources. Output from supervised ML entails disease diagnosis under the subgroup classification; and drug efficacy and ADMET prediction under the subgroup regression.

2) Unsupervised Learning comprises clustering and feature-finding methods by grouping and interpreting data based solely on input data. Through unsupervised MI, outputs such as disease subtype discovery from clustering and disease target discovery from feature-finding methods can be attained.

3) Reinforcement Learning is largely driven by decision-making in a given environment and its execution to maximize its performance. The outputs from this type of ML include de novo drug designs under execution – where both can be achieved via modeling and quantum chemistry.

A further subfield of ML called deep learning (DL) uses artificial neural networks that adapt and learn from the vast amount of experimental data. The big data and associated data mining and algorithm methods could provide us with the capacity to discover new compounds that could potentially be new drugs, uncover or repurpose drugs that could be more potent when used individually or in combination and improve the area of personalized medicine based on genetic markers. The emergence of DL was observed with the increasing amount of data and the continuous growth of computer power. The striking difference that makes DL a subfield of AI is the flexibilityin the architecture of neural networks such as convolutional neural network (CNNs), recurrent neural networks (RNNs) and fully connected feed forward networks. It is believed, with proper establishment of methods in AI, we will witness the transition into an era of minimized failures in

clinical trials and a faster, cheaper and effective drug development processes.

b)Deep Learning

AI is a flourishing technology which finds application in multiple aspects of life and industry. In recent times the pharmaceutical industry discovers novel and innovative ways to use this powerful technology to help solve some of the biggest problems facing pharma today. Artificial Intelligence 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 artificial intelligence in the pharma and biotech industry has redefined how scientists develop new drugs, tackle disease, and more [1]. The year 1956 is usually considered to be the year when AI was born, as it was in 1956 that Dartmouth College had organized the famous conference. However, the preceding year, that is, 1955, saw its first AI system that was called Logic Theorist and the people who developed it was Allen Newell, Herbert A. Simon. Nearly, 40 theorems of Principia Mathematica by Alfred N. Whitehead and Bertrand Russell were proved using this system. However, the designers of the system could not get it published [4].The scientists and engineers who are producing intelligent machines have made enormous progress in the speed and memory capabilities of their devices, to the point where they vastly exceed those of humans in many respects. However, the intellectual mechanism of even the most modern robots are still limited to what a designer can program into them in the first place. Now, with the advent of big data, companies are harnessing the power of AI to deliver more focused solutions in a variety of areas; AI helps them understand data in real time. The land marks were given in table 1

c)Artificial neural networks (ANN)

Artificial Neural Networks are systems that imitate biological neural networks (19). ANN performs the desired tasks by learning from the examples given. In ANN systems, input passes the information through the layer and interprets it as output. An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron receives signals then processes them and can signal neurons connected to it. The "signal" at a connection is a real number, and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called edges. Neurons and edges typically have a weight that adjusts as learning proceeds. The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that a signal is sent only if the aggregate signal crosses that threshold.
Typically, neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layers multiple times.

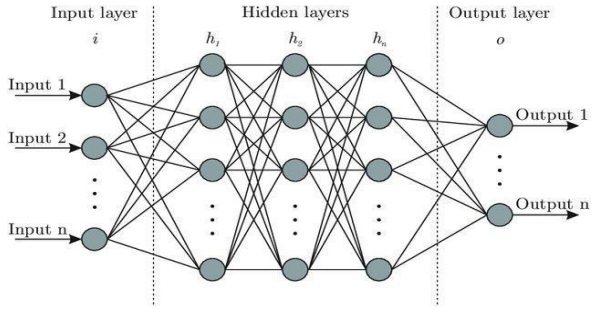

FIG.3 -ARTIFICIAL NEURAL NETWORK

➢ HISTORY:-

Allen Newell ,Herbert A Simon.was developed the Logic Theorist .it was born in 1956 that dartmouthcollege had organized the famous conference [4], It has been forecasted that the revenue from AI market will be increasing by as much as ten-fold between the years 2017 and 2022. Natural language processing market, which has several applications including text prediction, and speech and voice recognition has been said to achieve a growth of 28.5% in the year 2017. Worldwide revenue from big data and business analytics was US$ 122 billion in the year 2015 and it is being expected that the figures will rise to more than US$ 200 billion by the year 2020 [5]. Artificial intelligence has a rocky history spanning back to the 1950s. For a long time it was seen as a field for dreamers, but that started to change in 1997 when IBM‟s Deep Blue computer was able to defeat chess champion Garry Kasparov. By 2011, IBM‟s new Watson supercomputer was able to win the US$1m prize in the US game-show Jeopardy. Since then, Watson has expanded into healthcare and drug discovery, including a partnership with Pfizer in 2016 to accelerate drug discovery in immuno-oncology. In December 2016 IBM in collaboration withPfizer introduced IBM Watson, a cloud-based such asmedical lab reports and helps researchers with the ability to identify relationships between distinct data sets through dynamic visualizations
The year 1956 is usually considered to be the year when AI was born, as it was in 1956 that Dartmouth College had organized the famous conference. However, the preceding year, that is, 1955, saw its first AI system that was called Logic Theorist and the people who developed it was Allen Newell, Herbert A. Simon. Nearly, 40 theorems of Principia Mathematica by Alfred N. Whitehead and Bertrand Russell were proved using this system. However, the designers of the system could not get it published.

➢ Milestones in the Artificial Intelligence Process

Year Milestone
1943 =Neurons can do logical operations like “and”, “or” or “not”, when they are connected as network. This process was proved by Walter Pitts and Warren McCulloch.
1951 =First neural network, which solved a problem from the real world i.e. SNARC (Stochastic Neural Analog Reinforcement Computer) was by Marvin Minsky
1956 =At Dartmouth college conference the term “Artificial Intelligence” was coined.
1958 =Perceptron (neural networks that transmit information in one direction) was created by Frank Rosenblatt which is the

origin for todays AI progress.
1969 =Minsky supported the symbolic representation of problems in his book-"Perceptron's".
1974-1980 =During this period interest on AI was dropped, which is called as "First AI Winter".
1986 =Back propagation algorithm design was developed by Georey Hinton which is widely using in deep learning.
1987-1993 =This phase is called as "AI Winter"
1997 =This year IBM Deep blue defeated the Garry Kasparov (Russian grandmaster).
2013 =Google used British Technology to perform efficient research on photos.
2016 =Google DeepMind, software AlphaGo defeated the Go Champion lee Sedo

➢ A NEW WAVE IN PHARMACY PRACTICE:-

Throughout its history, pharmacy has successfully adopted a range of "general purpose technologies" (GPTs) that were developed during the first three industrial revolutions. GPTs are defined as technologies that affect an entire economy and have the potential to disrupt the economic life of whole societies.(Helpman, 1998) To date, only 24 GPTs have emerged, including the steam engine, trains, electricity, computing, the internet, artificial intelligent and blockchain.(Lipsey et. al., 2005). During their history, apothecaries, chemists and druggists and modern-day pharmacists have all used GPTs to: create the pharmaceutical industry; invent new processes for making dyes; improve brewing techniques; advance photography and film-making; introduce robotic and barcode dispensing; harness sensor technology in dossetts and pill boxes. As this list suggests, pharmacy evolved because of its industrial-scale adoption of GDPs from the first three revolutions.
Schwab (2017) argues that society is at the beginning of a Fourth Industrial Revolution (4IR). This era will radically change the human use of technology, with major implications for the ways we live and work. The first industrial revolution started after 1760 and led the move from hand production to machines, which created many new industrial processes including chemical manufacturing. The second revolution occurred after 1870 and was initially stimulated by new methods for the mass production of steel, but then spread to the developments in other industries such as chemicals and transport. The third revolution (the "Digital Age") began in the 1960s with the development of electronics, information technology (IT) and automated production. We are now entering the 4IR, which will create innovative capabilities for people and machines through the adoption of technologies such as cyber-physical systems, the Internet of Things (IOTs) and the Internet of Systems (Gatouillat et. al., 2018).

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For all industrial sectors, the consequences of the 4IR are predicted to be unprecedented. Schwab (2017, p.2) describes the potential risks and benefits:

The changes are so profound that, from the perspective of human history, there has never been a time of greater promise or potential peril. My concern, however, is that decision-makers are too often caught in traditional, linear (and non-disruptive) thinking or too absorbed by immediate concerns to think strategically about the forces of disruption and innovation shaping our future.
Just as these words apply to all industries, Schwab's message also applies to pharmacy. If the pharmacy sector is stuck in traditional, linear thinking that assumes the future will be an extension of the past, then the fourth revolution may be less of a promise and more of a threat. In consequence, outsiders may take over many activities that have traditionally been considered to be solely pharmacy work. For instance, online dispensaries may move business away from local "bricks and mortar" pharmacies. Phone apps may replace the need for face-to-face pharmaceutical care, with online platforms for patient counselling. In response, there is a pressing need for the pharmacy sector as a whole to consider how fourth wave technologies will affect the future of its clinical and commercial activities.

➢ Tools of AI:-

Robot Pharmacy :-

The objective of improving the safety of patients, UCSF Medical Center uses robotic technology for the preparation and tracking of medications. According to them, the technology has prepared 3,50,000 medication doses without any error. The robot has proved to be far better humans both in size as well as its ability to deliver accurate medications. The abilities of the robotic technology include preparations of oral as well as injectables medicines which include chemotherapy drugs that are toxic. This has given freedom to the pharmacists and nurses of UCSF so that they can utilize their expertise by focusing on direct patient care and working with the physicians.

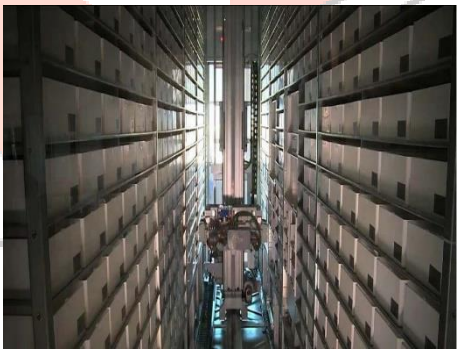

FIG.4- ROBOT PHARMACY

MEDi Robot :-

MEDi is a short form for Medicine and Engineering Designing Intelligence. The pain management robot was developed as part of a project led by Tanya Beran, professor of Community Health Sciences at University of Calgary in Alberta. She got idea after working in hospitals where children scream during medical procedures.The robot first builds a rapport with children scream during medical procedure. During the medical procedure, it guides them on what should be done, how to breathe during the procedure, and how to cope. Although the robot cannot think, plan, or reason, it can be programmed such that it shows to have AI. MEDi, manufactured by Aldebaran Robotics, having inbuilt facial recognition technology, can speak 20 different situations. The retail price of the robot is $9000; however, the cost rises to $15000- $30000 when the applications

needed for the robot to help in medical procedures are installed. The robot was initially developed for pain management, but with time its use has expanded to comfort between procedures, physical rehabilitation, and fundraising.

FIG.5- MEDI ROBOT PLAYING WITH BOY

Erica Robot:-

Erica is a new care robot that has been developed in Japan by Hiroshi Ishiguro, a professor at Osaka University. It was developed in collaboration with Japan Science and technology Agency, Kyoto University, and the Advanced Telecommunications Research Institute International (ATR). It can speak Japanese and has a blend of European and Asian

facial feature. The robot cannot walk independently, however, it has been developed with the ability to understand and answer questions with human-like facial expressions. Erica is the "most beautiful and intelligent" android as Ishiguro fixed up the feature of 30 beautiful women and used the average for designing the robot's nose, eye and so on.

Fig :- 6- ERICA ROBOT WITH HIROSHI ISHIGURO

Tug Robot :-

Aethon TUG robots are designed to autonomously travel through the hospital and deliver medications, meals, specimens, materials, and haul carry heavy loads such as linen and trash. It has two configurations, i.e., fixed and secured carts as well as exchange base platform that can be used to carry racks, bins, and carts. The fixed carts are used for delivering medications, sensitive materials, and laboratory specimens, whereas, the exchange platform is employed to transport materials that can be loaded on different racks. The TUG can deliver several types of cartsor racks thus making it a very flexible and utilizable resource.

FIG. 7 -TUG ROBOT DISTRIBUTING MEDICINE

Berg :-

Berg is Boston-based biotech and is one of the key players employing AI in its various processes. It has an AI based platform for drug discovery, which has a huge database of patients and this is used to find as well as validate the various biomarkers responsible for causing diseases and then decides therapies according to obtained data. The motto of the company is speed up the process of drug discovery and to bring about a reduction in the cost with the aid of AI as it obliterates guesswork that is involved in the process of drug development. The steps that are followed by berg include procurement of sequencing data from samples of human tissue, finding information regarding metabolites, and protein formation, and testing of data using algorithms of AI to correctly determine the actual cause of disease.

➢ APPLICATION OF AI :-

Manufacturing Process Improvement

• In development and production, AI provides numerous opportunities to improve processes.
• AI can perform quality control, shorten design time, reduce materials waste, improve production reuse, perform maintenance and more.
• AI can be used in many ways to make production more efficient with faster output and less waste.
• For example, a process that typically relies on human intervention to input or manage process data can be done using CNC (computer numerical control).
• The AI machine learning algorithms not only ensure tasks are performed very precisely, but also analyze the process to find areas where it can be streamlined.
• This results in less material waste, faster production and more meeting the product's Critical Quality Attributes.

Drug Discovery and Design

• From designing new molecules to identifying novel biological targets, AI is playing a role in drug target identification and validation; target-based, phenotypic, as well as multi target drug discoveries; drug repurposing; and biomarker identification.
• The key benefit for pharma companies is the potential for AI, especially when implemented during drug trials, to reduce the time it takes a drug to get approval and reach the market.
• This can result it great cost savings, which could mean lower cost drugs for the patients, as well as more treatment choices.

Rare Diseases and Personalized Medicine

• Combing information from body scans, patient biology and analytics, AI is being used in various ways to detect diseases

such as cancer, and even predict health issues people might face based on their genetics.

• One example is the IBM Watson for Oncology, which uses each patient's medical information and history to recommend apersonalized treatment plan.

• AI is also being used to develop personalized drug treatments based on an individual's test results, reactions to past drugs and historical patient for drug reactions.

Identifying Clinical Trial Candidates

• Besides helping to make sense of clinical trial data, another use of artificial intelligence in the pharmaceutical industry is finding patients to participate in the trials.

• Using advanced predictive analytics, AI can analyze genetic information to identify the appropriate patient population for a trial, and determine the optimal sample size.

• Some AI technology can read freefrom text that patients enter into clinical trial applications, as well as unstructured data such as doctor's notes and intake documents.

Drug Repurposing

• For budget-pressed pharma companies, repurposing drugs promises to be one of the most immediate areas that AI-based technologies can deliver great value.

• Repurposing previously known drugs or late-stage drug candidates towards new therapeutic areas is desired strategy for many biopharmaceutical companies as it presents less risk of unexpected toxicity or side effects in human trials and likely less R&D spend.

Research and Development :-

• Pharma companies across the globe are developing advanced AI powered tools and ML algorithms to smoothen drug innovation process.

• These technology tools are designed to detect complex patterns in large datasets and therefore can be used to resolve problems associated with complex biological networks.

• The ability to study patterns of various diseases and to determine which composite formulations are best suited for the treatment of specific symptoms of a particular disease is excellent pharma industries can invest in the R&D of such drugs that are more likely to treat a disease or medical condition successfully.

➢ CHALLENGES TO ADOPTION OF AIIN PHARMA

While AI has an extensive potential to help redefine the pharmaceutical industry, the adoptionitself is not an easy walk in the park.

Challenges that pharma companies face while trying to adopt AI:

The unfamiliarity of the technology – for many pharma companies, AI still seems like a"black box" owing to its newness and esoteric nature.

Lack of proper IT infrastructure – that"s because most IT applications and infrastructurecurrently in use weren"t developed or designed with artificial intelligence in mind. Evenworse, pharma firms have to spend lots of money to upgrade their IT system.

Much of the data is in a free text format – that means pharma companies have to go aboveand beyond to collate and put this data into a form that"s able to be analyzed. Despite allthese limitations, one thing is for certain: AI is already redefining biotech and pharma.And ten years from now, Pharma will simply look at artificial intelligence as a basic,everyday, technology.

➢ LIMITATION OF AI:-

Streamlining electronic records; which are messy and unorganized across the heterogenous databases &are to be cleaned first.

Transparency: people need transparency in health care they receive , which is quite a task given the complexity of the processes involving artificial intelligence.Data governance: medical data is private and in accessible legally . consent from the public is important

Hesitant to change: pharma companies are known to be traditional and resistant to change . we have to break the stigma to give the best care we can.

Can cost a lot of money and time to build, rebuild, and repair. Robotic repair can occur to reduce time and humans needing to fix it, but that'll cost more money and resources.

Storage is expansive, but access and retrieval may not lead to connections in memory as well as humans could

They could never, or, at least, seemingly never with our technological perceptions, recieve creativity that humans have.

This can prevent common sense occurring. Even if coded with common sense and to learn, it seems hard for them to get as much common sense that humans could.

As seen partially with smartphones and other technology already, humans can become too dependent on AI and lose their mental capacities.

Machines can easily lead to destruction, if put in the wrong hands. That is, at least a fear of many humans

Artificial Intelligence and the Future of Pharma Industry :-

The future of pharmaceuticals is clearly AI-enabled. While the extent of its potential is still being figured out, it is certain that the industry is in for AI-assisted revolutions; experts anticipate a significant impact on drug discovery, research, and development.

Keep reading to find out how AI will shape the future of pharmacy.

With the advent of AI, there has been an obvious shift in the paradigm of innovations in the pharmaceutical industry. Over the past five years, the industry has been enjoying the fruits of the technology to discover new drugs, tackle or prevent illnesses, process medical data, and more.

From preventing epidemics to discovering vaccines, the industry has numerous responsibilities on its shoulders that call for high-quality solutions. But thanks to AI, most of the tasks that traditionally relied on the capacity of human intelligence have now been automated and fast-tracked. Artificial Intelligence is currently key to improving efficiency and expediting the production of drugs. In the future, AI is expected to produce computational workflows that can increase the quality of solutions by several folds.

Here are some prominent predictions regarding the impact of AI on the pharmaceutical industry:

AI will be used for more technical advancement

Pharmaceutical professionals have already recognized the potential of AI to revolutionize the field. AI and Machine Learning are at the forefront of leading the digital future of the industry. Premier pharmaceutical companies have already

collaborated with AI vendors; the technology will soon be leveraged more for manufacturing, discovery, and most importantly, research.

AI will be used for the management of chronic diseases

Global drug development and pharmaceutical companies are expected to invest more in AI to facilitate the research and discovery of chronic diseases and terminal illnesses. In the US, chronic diseases constitute one of the major reasons for death. It is safe to say that AI will be used to improve the management of chronic diseases, bring down operational costs, and certainly, boost the patient's health. Some of the chronic diseases that will receive attention in the coming years include cancer, chronic kidney disease, diabetes, and idiopathic pulmonary fibrosis.

More healthcare companies will invest in AI

Studies show that almost 62 percent of healthcare companies are already planning on investing in AI. By 2025, around 50 percent of healthcare companies are expected to fully utilize the benefits of AI. AI will also be used to boost the success rates of newly discovered drugs. According to a study conducted by MIT, only 13.8 percent of drugs pass the trials. AI can help increase the success rate of drugs while bringing down the cost of operations.

AI will be used to refine the candidate selection process

AI will redefine the future of pharmaceuticals by fine-tuning the process of candidate selection in clinical trials. It will ensure that the most suitable candidates are chosen for trials by performing a detailed analysis of data and filtering the candidate pool. Factors that impact the accuracy of results can also be filtered to lower errors.

AI will enhance the process of medical data extraction

AI and Machine Learning tools are expected to be a lot more accessible in the future than it is now. This will help organizations to screen and diagnose patients with greater accuracy. AI will also allow experts to extract more meaningful information from existing medical data.

Though AI and ML techniques can be potentially generalized across fields, proper implementation in the pharmaceutical industry requires expertise in respective scientific domains. This in turn increases the demand for professionals with advanced degrees and exposure.

CONCLUTION :-

Artificial Intelligence serves as marked platform in the advancement of pharmaceutical sector. AI saves time as well as provides the required set of data analysis and quality control. The various components of AI such as ANN, deep learning, genetic programming etc. are being used for rationale design of drug molecules. The AI has also influenced the area of healthcare by playing a major role in clinical research by conclude the adverse effects. Artificial intelligence can lead to the development of various technologies and software that would help improve the pharmaceutical product development and health management strategies. Artificial intelligence is the design and application for analysis of learning and interpretation of data

Human being is the most sophisticated machine that can ever be created. The human brain, which is working hard to create something that is much more efficient than a human being in doing any given task and it has great success to extent in doing so. The AI tools like Watson for oncology, tug robot and robotic pharmacy has change the profession considerably. The bigger the healthcare sector gets more sophisticated and more technologically advanced infrastructure it will need.

Artificial intelligence is the design and application of algorithms for analysis of learning and interpretation of data During past few years, a considerable amount of increasing interest towards the uses of AI technology has been identified for analyzing as well as interpreting some important fields of pharmacy like drug discovery, dosage form designing, polypharmacology, hospital pharmacy, etc., as the AI technological approaches believe like human beings imagining knowledge, cracking problems and decision making. The uses of automated workflows and databases for the effective analyses employing AI approaches have been proved useful. As a result of the uses of AI approaches, the designing of the new hypotheses, strategies, prediction and analyses of various associated factors can easily be done with the facility of less time consumption and inexpensiveness.

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