INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

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Review Article

The Transformative Role of Artificial Intelligence in the Pharmaceutical Industry

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ARTICLE INFO

Received: 07 July 2024
Accepted: 20 July 2024
Published: 24 July 2024

Keywords:
Artificial Intelligence

DOI:
10.5281/zenodo.12808200

ABSTRACT

The review discusses a number of artificial intelligence (AI)-related topics in pharmaceutical development. Furthermore, it provides a brief overview of current advancements in medication discovery by the pharmaceutical sector in collaboration with various AI. Advancements in computing and technology have had an impact on all aspects of science. AI has become an essential component in every field of research and technology, from basic engineering to medicine. AI has significantly impacted pharmaceutical chemistry and health care. AI helps with patient recruitment, data processing, and monitoring in clinical trials, which are an important stage of drug research. The use of AI algorithms to detect medical disorders and predict trial outcomes has great promise for improving patient care and trial success rates. AI implementation in the pharmaceutical business is limited by variables such as high upfront costs, job displacement worries, and data gathering limitations.

INTRODUCTION

Artificial intelligence (AI) is a subfield of computer science that uses symbolic programming to solve problems. Over the last five years, Al has transformed the pharmaceutical and biotech sectors by revolutionizing the way scientists discover new treatments and cure ailments. It has grown into a science of problem solving with numerous applications in business, health care, and engineering. Recently, AI has played a major role in numerous domains of pharmacy, including drug discovery, drug delivery formulation development, polypharmacology, hospital pharmacy, and so on. The primary goal of this artificial intelligence is to identify practical information processing challenges and provide an abstract explanation of how to solve them. Such an account is known as a method, and it corresponds to a theorem in mathematics. Artificial intelligence (AI) is a scientific discipline concerned with the study of intelligent machine learning, particularly clever computer programs that produce outcomes similar to human cognitive processes(Singh et al., 2024).

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Artificial intelligence (AI) technology has recently emerged as an essential component in a variety of businesses due to its useful applications in a wide range of technical and scientific disciplines. The pharmaceutical market today accepts treatments that have been developed after a lengthy and costly procedure. The bulk of pharmaceuticals cost billions of dollars and take ten years or longer to reach the pharmaceutical market. This necessitates more money and time for drug development. The concept of AI appears to be more promising in overcoming these disadvantages, which should lead to effective medication development initiatives. AI is being applied to new technologies such as pharmaceuticals, prostheses, and growing and advanced robotics. Additional benefits of AI in the drug development process include discovering pharmacological targets, suggesting compounds from data libraries with chemical alterations, and occasionally repurposing the medicine(Kalyane et al., 2020) .

AI GOALS:

- Expert system development: entails establishing automated systems that work intelligently and advise individuals on how to continue.
- Human intelligence in computers: It will aid in the development of similar cognitive structures in computers, allowing them to act like humans and take the required steps to overcome difficult circumstances.
- AI will help with the implementation of numerous disciplines, including psychology, medical science, ethics, natural sciences, and health (Flasiński, 2016; Morley et al., 2020).

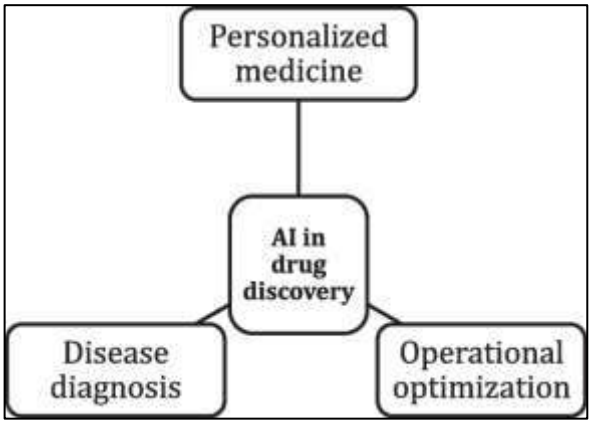

Fig no. 1 Trends in AI

The basic concept of AI in pharmaceutics :

There are two major categories of AI developments. The first category includes technology approaches and software, such as expert systems, which simulate human experience and generate judgments based on a set of criteria. The second type includes devices that replicate how the brain operates, such as artificial neural networks (ANNs). One of the most useful properties of artificial neural networks is their ability to generalize. These properties make them ideal for dealing with formulation optimization challenges in the pharmaceutical product development process (Agatonovic-Kustrin and Beresford, 2000)

How does AI works : Building an AI system entails meticulously duplicating our qualities and skills in a machine and leveraging that machine's processing capacity to outperform our abilities. Understanding the various sub-domains of AI and how they can be applied to different industries necessitates a thorough examination of the subject.

- **Machine learning (ML):** ML teaches a computer how to draw conclusions and make decisions based on previous information. Without relying on human experience, it discovers patterns and studies past data to understand the significance of these data points and arrive with a possible conclusion (Ma and Sun, 2020).

- **Deep learning (DL):** A machine learning technique is deep learning. DL revived neural network in 2000s which trained deeper networks. It trains a machine to read inputs through layers in order to classify, infer, and predict outcomes. For example, it aids in understanding the complex internal representations required for understanding difficult languages or assessing objects by going through in-depth layers of activity vectors and determining the connection strengths that motivate these vectors using stochastic gradients(Bengio et al., 2021).
- **Neural networks (NN):** These systems function in a manner similar to human neural cells. They are a series of algorithms that replicate the way the human brain operates by capturing the link between multiple underlying variables. These systems act in a similar way to human neural cells. They are a set of algorithms that mimic how the human brain works by capturing the relationship between several underlying factors.
- **Computer vision:** Computer vision algorithms try to understand a picture by dissecting it and looking at different parts of it. This helps the machine classify and learn from a set of photographs, allowing it to deliver better findings based on previous observations(Kakani et al., 2020).
- **Cognitive computing:** Cognitive computing algorithms seek to imitate the working of the human brain by interpreting text, audio, images, and other inputs in the same way as humans do and provide the appropriate results. Enroll in free courses on AI applications(Bini, 2018).

AI used:

The following are some examples of how AI is used in data processing:

- Data searching and optimization for search engines to generate the most relevant results.
- If-then logic chains, which can be used to execute a sequence of instructions based on arguments.
- Pattern detection to uncover notable patterns in large data sets for unique insights.
- Using probabilistic models to predict future outcomes(Jacob and Magerko, 2015).

Applications of AI in pharmaceuticals and drug delivery:

When an AI system is used to govern processes such as manufacturing or clinical trials, the power of long-term learning is frequently lost during training. The pharmaceutical industry has improved since the relatively recent adoption of Quality by design (QbD) approaches; yet, the latest industry 4.0 initiatives appear to show a sector in rapid development. As a result, there is a high possibility that an early AI application will be implemented. Unlike other scientific domains, pharmaceutical sciences might cause delays in data codification and standardization. Data collection and standardisation are required to effectively train AI in the former(Colombo, 2020).

AI in Research & Development:

Drug discovery is being accelerated by global pharmaceutical businesses using artificial intelligence (AI) and sophisticated machine learning (ML) approaches. These intelligence technologies are intended to recognize complex patterns in large datasets, making them perfect for addressing problems involving complex biological networks. This talent is helpful for studying illness patterns and deciding which drug combinations will be most effective in treating specific disease characteristics. Pharmaceutical companies can then invest resources in the

research and development of these pharmaceuticals, which have the best chance of effectively treating an ailment or medical condition(Agatonovic-Kustrin and Beresford, 2000; Kakani et al., 2020).

Drug Discovery Process and Design:

Artificial intelligence (AI) is becoming more widely used in the pharmaceutical sector for drug creation and development. Al is important for therapeutic target identification and validation, ranging from small molecule development to the discovery of novel biological targets. It is also used in the field of multi-target drug development and biomarker identification, offering an effective approach with a high degree of. One of the key benefits of the pharmaceutical industry is that the use of Al in drug testing reduces the amount of time needed to complete clinical trials and launch products into the market. Pharmaceutical researchers, for example, can use longitudinal EMR (Electronic Medical Records) records and other genomic data to discover and validate new cancer medicines. All systems that use machine learning (ML) and other data analytics algorithms can extract insights from EMR data to design and create medications that effectively cure tumors(Agrawal, 2018; Ms. S. S. Satkar et al., 2024).

The current AI initiative by the top biopharmaceutical companies include:

- Using a mobile platform, health outcomes can be improved by making patient suggestions based on real-time data.
- drug development- pharmaceutical corporations, in collaboration with software companies, are attempting to use the most cutting-edge technology in the costly and lengthy process of discovering drugs(Raza et al., 2022).
- Portable stage to improve prosperity outcomes - the ability to recommend patients using tactics for consistent data combination and, similarly, work on leniency outcomes.
- Drug Disclosure Pharma associations, along with programming associations, are attempting to realize the most cutting-edge advances in the pricey and wide collaboration of medicine.
- UCSF Medical Center uses mechanical development for drug availability and follow-up with the goal of improving patient security. They demonstrate that the development has correctly structured 3, 50, 000 pharmaceutical partitions. The robot has outperformed humans in terms of both size and ability to deliver precise solutions. The limitations of robotic development include an oral plan as well as faultless treatments that include harmful chemotherapeutic drugs. This has given medicine subject matter experts the flexibility to disclose(Pooja S. Devkate*, 2023).

Structure-based drug discovery relies heavily on a target protein's three-dimensional (3D) shape. This is critical because designing innovative therapeutic compounds frequently involves understanding the 3D chemical landscape of the ligand-binding region within the target protein. To accomplish this purpose, researchers have usually used techniques such as homology modeling and de novo protein design. These methods have been widely used in the field to acquire insight into the structure of the target protein and to aid the rational creation of possible therapeutic medicines(Park, 2019).

AI in Diagnosis:

The FDA recently cleared the sale of Gl Genius, a medical gadget that utilizes an Al algorithm and machine learning to detect indicators of colon cancer. This technology helps professionals spot possible lesions in the colon during a colonoscopy. ML algorithms can leverage EMRS data to produce real-time predictions for medical

diagnosis and therapy recommendations. Healthcare providers throughout the world use machine learning (ML) technology to securely store sensitive patient data in the cloud or a centralized storage system. These records are known as electronic medical records (EMRS), and doctors can consult them as and when necessary. Deep learning, brain systems management, and computation-based innovation are now routinely used for the differentiation, extraction, and delivery of data. A large amount of data has been obtained. The two major disorders where artificial intelligence has acquired prominence are cancer and memory(Pooja S. Devkate*, 2023).

AI in Remote Monitoring:

Remote monitoring represents a huge improvement in the pharmaceutical and healthcare businesses. Several pharmaceutical companies have already developed wearables with Al algorithms that allow them to remotely monitor patients with life-threatening diseases. Tencent Holdings, for example, collaborated with Medopad to develop Al technology that can remotely monitor Parkinson's patients and reduce the time required to do a motor function assessment from 30 minutes to three minutes. Combining this Al technology with smartphone apps allows for remote monitoring of a patient's opening and closing motions.

The potential for Remote Patient Monitoring (RPM) devices to transform at-home care was highlighted during the pandemic, which illustrated the problems of remote care while also bringing significant growth to the sector. According to a recent estimate by Global Data, the market for RPM devices is expected to reach $760 million by 2030. The Thematic Research - Virtual Care and Telemedicine - 2023 paper investigates how technology is allowing the healthcare industry to increase efficiency and overcome geographical boundaries by offering remote consultations, diagnosis, and treatment in non-emergency situations(Nazari et al., 2024).

Manufacturing:

Pharmaceutical firms can utilize artificial intelligence (AI) to oversee and improve various elements of the production process, including: Pharmaceutical businesses can use aluminum to increase productivity, efficiency, and speed up the production of life-saving pharmaceuticals. Process automation, waste reduction, quality assurance, predictive maintenance, and design optimization(Kalyane et al., 2020).

AI in Marketing:

Since the pharmaceutical industry is sales-driven, artificial intelligence (AI) can be an effective tool in pharmaceutical marketing. With Al, pharmaceutical businesses can do research and develop unique marketing techniques that promise great income and brand awareness. Al may help firms map the customer journey, allowing them to identify which marketing techniques drove traffic to their site (lead conversion) and eventually persuaded the converted visitors to make a purchase from them. This enables pharmaceutical businesses to focus more on marketing techniques that result in the highest number of conversions and increased revenue. All tools may also assess past marketing campaigns and compare the results to discover which ones were the most profitable(Nazari et al., 2024).

- Collaborating with academic institutions focused on aluminum research and development to help pharmaceutical businesses use aluminum.
- Partnering with Al-driven medical discovery firms provides access to advanced technologies, industry knowledge, and expert assistance.
- Teach R&D and production teams how to use Al tools and procedures effectively for increased productivity.

AI of next-generation 3D printed medicines :

Pharmaceutical 3D printing (3DP) pipelines and AI can collaborate. Individualized pharmaceutical administration must replace the long-standing "one size fits all" paradigm in medicine. Pharmaceutical 3DP can provide tailored pharmaceuticals in the clinic, but it now requires the presence and ability of qualified 3DP practitioners. There are numerous common process optimization methods, such as Finite element analysis (FEA) and mechanistic modeling, but none can fully optimize the multiple steps of pharmaceutical 3DP. In contrast, ML can intelligently optimize each stage in the production of 3DP medicines. This will eventually reduce the need for continued expert input in the development of 3DP medications, removing impediments to the technology's clinical application(Elbadawi et al., 2021; Park, 2019).

AI with nanotechnology:

Because of contemporary molecular commodities' longer production periods, higher prices, and lower efficiency, AI has gained in importance in the pharmaceutical, pharmaceutics, and drug delivery industries. Even the development of existing formulations is based on time-consuming, costly, and unpredictable error-prone research. A novel system called as "computational pharmaceutics," which proposes a large potential change to the medication delivery paradigm, is integrating big data, AI, and multiscale modelling methodologies into pharmaceutics. This system arose in response to the exponential growth of computing power and algorithms during the last decade.

AI to forecast new treatment: Advances in AI have reignited interest in treatments for rare diseases. More than 350 million people around the world are currently affected by over 7000 rare diseases. Heal, a biotech business headquartered in the United Kingdom, has raised $10 million in investment to investigate innovative treatments for unusual conditions. Another Swiss biotech company, Thera chon, has been awarded $60 million to develop treatments for rare genetic diseases (Sultana et al., 2023).

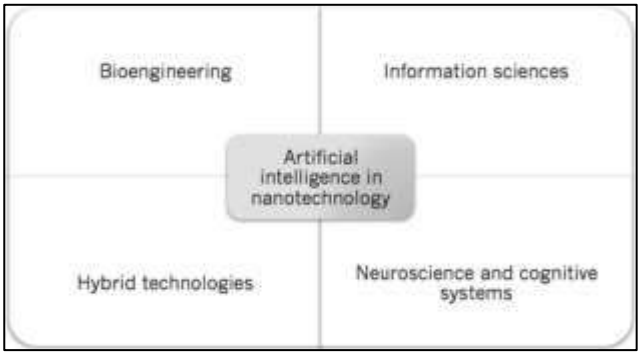

Fig no. 2 AI in nanotechnology

Artificial Intelligence in telepsychology [E-therapy]:

AI may be able to extract significant relationships from raw datasheets. This also applies to the disease's diagnosis, treatment plan, and mitigation. Many of the more recent technologies used in this burgeoning discipline of computational understanding have the potential to be applied to almost any branch of medical science. To handle complex clinical problems, one must conquer the challenge of learning, analyzing, and using a multitude of knowledge. The advancement of AI in medicine has helped practitioners resolve difficult clinical dilemmas. Systems such as artificial neural networks (ANNs), evolutionary computational models, fuzzy expert systems, and hybrid intelligent systems can assist healthcare staff with data manipulation(Mulholland et al., 1995).

Artificial Intelligence in oncology:

Because of its diverse uses, artificial intelligence has grown in importance in cancer detection and therapy domains. A multilayer perceptron neural network was trained using gene expression data to predict non-Hodgkin lymphoma subtypes. The neural network's output layer consists of lymphoma subtypes, whereas the input layer is made up of 20,863 genes. Lymphoma has several

subtypes, including Burkitt lymphoma, diffuse large B-cell lymphoma (DLBCL), follicular lymphoma, marginal zone lymphoma, and mantle cell lymphoma. An artificial neural network was trained on gene expression data to identify novel prognostic indicators for MCL. The findings revealed that 58 genes provided high accuracy survival predictions, with 10 being connected to poor survival and 5 being favorable(Ramesh et al., 2004).

According to a multivariate study of gene expressions using the multilayer perceptron (MLP), three genes are associated with poor survival and four with good survival in DLBCL patients. RNA-Seq provided the genetic and transcriptional data for the Cell-of-Origin (COO) and DLBCL classification utilizing an AI deep learning technique on the next-generation sequencing (NGS) technology. Artificial intelligence has made categorization assays and other therapeutic applications more cost-effective, efficient, and repeatable. AI decreases time while retaining excellent cancer diagnostic accuracy.

Artificial intelligence – enhanced Drug Screening:

Testing chemicals on samples of sick cells is a standard stage in the lengthy drug discovery process. Further analysis is required to discover chemicals that are physiologically active and warrant further exploration. To speed up the screening process, Novartis research teams use photos from machine learning algorithms to suggest which untested chemicals are worth further investigation. New and efficient treatments can be made available sooner because computers uncover new data sets far faster than traditional human analysis and laboratory operations. This also reduces the operational costs associated with the labor-intensive manual examination of each compound(Moore, 2019).

Artificial intelligence in chronic pain management:

Computerized therapies utilize computer programming techniques. The behavioral and cognitive method include using joysticks or multiple-choice questions. The therapies are mostly concerned with questions. A novel computer interaction method has recently been developed. The patient can follow prescription advice and perform their own biopsies. Artificial intelligence (AI) can help monitor chronic diseases through virtual medical assistants. An integrated system combines a single-lead ECG sensor, deep learning, and physical activity data from a smart watch and accelerometer to predict the occurrence of arterial fibrillation.

The automatic system identifies difficulties and recommends the most effective solutions for each patient. It is currently being used to optimize insulin therapy. In patients with Machine learning-based clinical decision support can predict short and long-term HbA1c responses after insulin introduction for type 2 diabetes mellitus. Advanced diabetes management tools, including web-based apps for smartphones and tablets, are now available to patients(Bhattamisra et al., 2023).

Radiomics in Radiation Therapy:

Radiomics can forecast patients' prognoses using substantial tumor information in a non-invasive, quick, and low-cost approach. Patients are stratified into subgroups such as EGFR and Several imaging indicators were used to identify non-EGFR patients. AI could enable successfulradiomics by identifying biomarkers and stratifying patients. Developing mathematical image-feature models of biomarkers can help identify cancer phenotypes and guide decision-making at each stage of radiation treatment (diagnostic, treatment planning, execution, and follow-up). Artificial intelligence, like as machine learning, has the potential to improve radiomic prognosis. As open-source machine learning software becomes more accessible to radiation

oncology staff, the third wave of AI may lead to practical applications in the field. Radiomic techniques can anticipate individual patient results and toxicity in radiation therapy, making them useful in precision medicine(Arimura et al., 2019).

Type of Artificial Intelligence (AI):

Type 1 (Based on Ability):

a) Weak AI or Narrow AI: This type of AI is limited to a single specific task and refers to the situation in which machines with enough intelligence to accomplish activities on their own can be built to appear intelligent. For example, in a poker game when a computer defeats a human player, all rule S movements must be entered into the system; thus, each scenario must be manually entered beforehand. Every poor AI will help the creation of a strong AI.

b) Strong AI: Machines capable of thinking and performing activities independently, much like humans. There are no good examples of this yet, but several significant players in the field are eager to move closer to developing a strong AI, which has resulted in quick growth.

Type 2 (Based on Functionality):

(a) **Reactive Machine:** This is one of the most basic types of AI because it lacks prior memory and cannot utilize past information to guide future behavior. For example, an IBM chess program defeated Garry Kasparov in the 1990s.

(b) **Limited Memory:** Some of the decision-making functions of self-driving automobiles have been created with limited memory. Limited Memory: observations needed to advise activities that will occur in the near future, such as a car changing lanes, are not permanently kept. This also applies to Apple's chatbot, Siri.

(c) **Theory of Mind**: This form of AI should be capable of understanding people's emotions, beliefs, opinions, and expectations, as well as interacting socially.

(d) **Self-awareness:** An AI with its own consciousness, super intelligence, self-awareness, and, in a nutshell, the ability to function as a fully human creature. If the machine is self-aware, it understands the situation and applies the ideas found in other people's brains. This is not an existent AI(Troulis et al., 2002).

Aggregation and synthesizing information	Combines new ribonucleic acid (RNA) sequencing technologies with proprietary machine learning
Understanding disease mechanism	Analysis of genome-wide screens Provide detailed soatialn 3D structure of proteins Identity proteins involved in regulating the cell cycle Discovery of the next generation of therapies against cancer Training computer vision and medicine learning models
Generating novel drug candidates	Structure based deep (Convolutional neural network) CNN Screen compound libraries for efficacy against a disease Network-based machine learning approach

Fig no. 1. AI development

Advantages & Disadvantages of AI:

Advantages of AI technology:

1. **Minimize the error:** Reduced risk increases the likelihood of achieving greater accuracy and precision.
2. **Difficult Exploration:** It can be used in mining and fuel exploration sectors. AI systems can be used to research the ocean and overcome human constraints. Because of programming, robots can perform increasingly demanding and tiresome activities with ease and without fatigue.

3. **AI is useful in daily applications:** Everyone uses GPS, and it is especially beneficial for long drives. Because of the implementation of AI in Androids, it predicts what the user will enter and corrects spelling problems. For example, Lady SIRI and Cortana are robots.
4. **Digital Assistants:** Organizations utilize AI 'avatar' models of digital assistants to eliminate the need for human personnel. These avatars are free of emotional thinking, allowing for logical decision-making. Human emotions are commonly related with moods that impair judgment and reduce human efficiency.
5. **Repetitive Jobs:** Humans can only perform one task at a time. Machines think faster than humans and can multitask. Machines can perform dangerous jobs and vary their characteristics, such as speed and time.
6. **Medical application:** Nowadays, clinicians assess patients and analyze health risks with the help of AI. The AI initiative is teaching clinicians on numerous medications and their side effects.
7. **Increase technological:** Growth Rates AI technology enables entry into the field of advanced technical advancements. The Al system has the potential to generate millions of computer modeling programs, which could aid in the discovery of novel chemical compounds and entities. For example, consider QSAR and QSPR(Nazari et al., 2024).

Disadvantages of AI technology:

1. **High cost:** The launch of AI requires a significant investment due to the sophisticated design of machinery, repair, and maintenance. The machine's software needs to be updated on a regular basis. Reinstalling and recovering the machine takes a significant amount of time and money. The R&D division takes a long time to build a single AI machine.
2. **No Replicating Humans:** Robots with AI technology can think like humans, but without emotions or moral beliefs. As a result, they complete the assigned work as programmed
and are unable to make judgments. It can sometimes cause serious issues. Robots cannot make decisions when confronted with unknown problems(Morley et al., 2020).
3. **No improvement with experience:** Machines using AI technology cannot be improved in the same way that humans can via experience. Machines aren't interested about belonging, caring, or community. They fail to distinguish between hardworking and nonworking individuals.
4. **Unemployment:** If machines replace humans in all fields, it will lead to widespread unemployment. In general, humans are highly dependent. As a result, individuals lose their creative abilities and become sluggish.

Current Challenges / Future with AI:

1. Many large pharmaceutical companies are investing in artificial intelligence (AI) to produce improved diagnostics or biomarkers, find pharmacological targets, and design novel medicines.
2. Merk formed a cooperation with numerate in March 2012, with the goal of researching innovative small molecule medications that target CVS illness.
3. Robotics plays an active role in the development of medical devices. Manufacturing uses robotics to cut costs, while the food and drug administration strictly regulates output. In December 2016, Pfizer and IBM announced a collaboration to speed up drug discovery in immuno-oncology.

4. Many pharmaceutical companies view AI as a "black box" due to its technical nature and lack of familiarity(Ahuja, 2019; Kalyane et al., 2020).

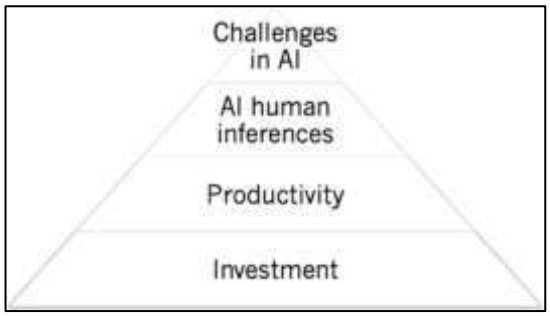

Fig no. 3. Challenges in AI

Top 10 Pharma Industries Using Artificial Intelligence (AI):

1. **AstraZeneca:** AstraZeneca is leveraging data science and artificial intelligence (Al) to increase productivity in research and development. They are also using Al to enhance their research capacity and streamline their operations.
2. **Bayer:** Bayer is leveraging big data and advanced analytics, including Al, to better their R&D operations. Bayer is also employing Al to bring about a fundamental transformation in the pharmaceutical industry's innovation paradigm.
3. **Bristol Myers Squibb:** Bristol Myers Squibb is a firm believer in science's ability to address the most pressing concerns in modern healthcare, and he sees computer science and digital capabilities like artificial intelligence (AI) and machine learning as ways to enable and enhance that power.
4. **GlaxoSmithKline:** GlaxoSmithKline is using AI and machine learning to provide anatomical and functional data for the development and discovery of novel biomarkers/phenotypes and imaging endpoints in clinical studies.
5. **Johnson & Johnson:** Johnson & Johnson is incorporating AI into several elements of its operations. However, recent news pieces have provided few particular details about their AI projects.
6. **Novartis:** Novartis and Microsoft have collaborated to dramatically expedite the development of revolutionary medicines for people throughout the world, extending its capabilities from research to commercialization.
7. **Takeda Pharmaceutical:** Takeda Pharmaceutical has entered into a five-year strategic partnership with Accenture and Amazon Web Services to accelerate its digital transformation, which includes the use of Al.
8. **Pfizer:** In December 2016, Pfizer announced a partnership with IBM Watson to boost immune-oncology drug discovery. In May 2018, Pfizer announced a fast-tracked Al partnership, and the Massachusetts Institute of Technology named Pfizer to its Machine Learning for Pharmaceutical Discovery and Synthesis Consortium. Pfizer recently announced a collaboration with Chinese technology startup XtalPi to boost their medication design research and examine the molecular stability of an organic chemical. In April 2019, Pfizer collaborated with Concerto Health Al to use Al and real-world data in oncology. The collaboration will perform unique synthetic control arm and prospective Real World Data outcomes study designs for treatments both before and after approval.
9. **Roche:** Roche is using Al to accelerate drug discovery, improve clinical trial effectiveness, and identify new therapeutic targets by processing massive amounts of data.

10. **Sanofi:** Sanofi is leveraging artificial intelligence (Al) to support its R&D efforts. Specifically, Al is being used to examine massive amounts of data in order to identify potential drug targets and improve the effectiveness of clinical trials.

AI TO PREDICT NEW TREATMENTS:

Verge's drug discovery process automates data collecting and analysis to identify hundreds of genes linked to complicated brain illnesses including Alzheimer's, Parkinson's, and ALS. Verge believes that gathering and analyzing gene data might positively impact medication discovery, starting with preclinical studies. Verge aims to employ AI to monitor the impacts of medicinal therapies on the human brain, starting from the preclinical phase.

1. **Treatment and Management of Rare diseases:**
   Recent breakthroughs have led to increasing interest in treating rare diseases. Globally, about 350 million people suffer from over 7,000 conditions. Various uncommon diseases. Heal, a UK-based biotech business, has won $10 million in Series A funding to explore innovative treatments for uncommon ailments. Therachon, a Swiss biotech startup, has also gotten $60 million in funding(Zhu, 2020).
2. **COVID-19 Accelerates Use of Ai in the Pharmaceutical Industry:**
   The Johns Hopkins School of Public Health developed an AI-powered COVID-19 mortality risk calculator. Inform public health policies with preventive research. The COVID-19 pandemic has expedited the implementation of artificial intelligence (AI) in the pharmaceutical industry, particularly in healthcare. Artificial intelligence has improved healthcare in various fields, including medical imaging, chronic illness management, population health, and precision medicine. Algorithms have the potential to improve healthcare efficiency, minimize administrative costs, and speed up disease detection.
3. **AI in COVID-19 vaccine development:**
   Artificial intelligence (AI) can help in drug development by identifying optimal chemical compounds and conducting simulations. This technology allows for speedier testing and identification of potential targets for novel drugs. In January, Google Deep Mind introduced Alpha Fold, a deep-learning system that predicts the structure of understudied proteins, including those associated with COVID-19. Protein structure prediction is a time-consuming technique, but it helps scientists examine viruses and build vaccines to induce immune responses. Alpha Fold has made these projections available to the wider scholarly community.
4. **Drug adherence and Dosage form:**
   Abbvie collaborated with Acura of New York to boost drug adherence and alertness during trials. Abbvie specifically used the face. The AI Cure mobile SaaS platform uses an image recognition algorithm to monitor adherence. Patients use their smartphones to record themselves eating a pill, and the Al-powered platform confirms that they swallowed the correct tablet. Adherence increased by up to 90%, resulting in impressive outcomes. Genpact's Al solution has been utilized in clinical trials to optimize dosage for specific patients and achieve desired results. Bayer partners with Genpact to use Pharmacovigilance Artificial Intelligence (PVAI) for monitoring drug adherence and detecting potential side effects.

Artificial intelligence can analyze data and provide valuable insights for decision-making and cost savings. Investing time and money can

ultimately save lives. Machine learning and artificial intelligence can help predict epidemic outbreaks. The pharmaceutical industry may boost innovation by leveraging technology breakthroughs. Recent technical developments: One example of technological innovation is the creation of artificial intelligence, which can do functions traditionally performed by humans, such as visual perception, speech recognition, decision-making, and language translation. IBM estimates that the Healthcare domain has around 161 billion GB of data as of 2011. AI can analyze and present data to aid decision-making, save time and money, and perhaps save lives.

Vision of Artificial Intelligence:

There are many unmet pharmaceutical requirements. In healthcare, a revolution is underway. A Johnson & Johnson spokesperson stated that "artificial intelligence is giving us the ability to discover new treatments and techniques faster than we would have thought possible just a decade ago." This is a great time to work in this industry as well. The healthcare AI business is rapidly growing and offers rewarding career opportunities. Artificial intelligence (AI) is being used in the pharmaceutical industry to accurately anticipate possible epidemics. This entails using AI to learn from historical outbreak data and other information sources. AI is being used in healthcare to prevent medical errors and reduce hospital readmission rates.

CONCLUSION

AI has proved its usefulness in a variety of drug discovery fields. AI can assist scientists in designing, planning, managing, maintaining, and controlling pharmaceutical development and delivery. It is hardly a panacea, and it will not cause seismic changes overnight. However, it has the ability to improve efficiency, generate important insights, and provide new perspectives in the pharmaceutical development process. Pharmaceutical businesses are focusing on developing new science and practices while managing risks. AI's success in medication research and development depends on its ability to integrate new domains. As the healthcare industry expands, there will be a greater demand for improved infrastructure. The creation and Artificial intelligence refers to the use of algorithms to interpret and analyze data.

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HOW TO CITE: Saleha Tamboli, Shital Gondkar, The Transformative Role of Artificial Intelligence in the Pharmaceutical Industry, Int. J. of Pharm. Sci., 2024, Vol 2, Issue 7, 1793-1806. https://doi.org/10.5281/zenodo.12808200