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ROLE OF ARTIFICIAL INTELLIGENCE IN PHARMACEUTICAL MARKETING

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ABSTRACT

All branches of science have been invaded by the development of computing and technology. One fundamental area of computer science, known as artificial intelligence (AI), has influenced everything from basic engineering to pharmaceuticals. The fields of medicinal chemistry and healthcare have discovered uses for AI. Computer-aided drug designs have recently supplanted more traditional techniques of medication development. Artificial intelligence (AI) and machine learning (ML) have emerged during the past ten years as the revolutionary technologies that are most expected to have a profound impact on pharmaceutical research and development. The next frontier in bio sciences for pharma is artificial intelligence (AI). In order to give a personalised and better-tailored therapeutic regimen, artificial intelligence systems may learn and anticipate beneficial interventions for individuals utilising a variety of personal data. In this overview, we cover computer-aided drug design's foundational components and processes, as well as the opportunities and challenges they present for the pharmaceutical business. Even though it is impossible to forecast the future, AI will play a major role in shaping pharmacy as we know it.

KEYWORDS: Artificial intelligence, Deep learning, computer science, Pharmaceutical industry, Drug development.

INTRODUCTION

Artificial intelligence [AI] is the copying of human cognition processes by computers, especially computer systems. These include knowledge (the acquisition of information and the rules for utilising it), reasoning (the application of rules to arrive at potential conclusions),

and self-correction. John McCarthy, who worked in the Stanford University Department of Computer Science, provided the first definition of artificial intelligence. In 1955, when he first coined the phrase, he gave it the definition "the science and engineering of constructing clever and quick-witted robots." The discipline was founded on the idea that intelligence, a key aspect of human nature, may be precisely characterised and recreated by a computer. This essay examines artificial intelligence's present use in the pharmaceutical industry as well as its potential future applications and drawbacks. Since its establishment as a field of study in 1956, artificial intelligence has gone through a number of waves of optimism, followed by setbacks and a reduction in financing (known as a "AI winter"), then new strategies, achievements, and increased investment. Since its inception, AI research has experimented with and abandoned a wide range of methodologies, including modelling human problem-solving, formal logic, extensive knowledge libraries, and animal behaviour imitation. Machine learning that is heavily based in mathematics and statistics has dominated the subject in the first two decades of the twenty-first century. This approach has been very effective in solving many difficult issues in both business and academia.[1]

The numerous subfields of AI study are focused on specific objectives and the use of certain techniques. Reasoning, knowledge representation, planning, learning, natural language processing, sensing, and the capacity to move and control things are some of the classic objectives of AI research. One of the long-term objectives of the area is general intelligence, or the capacity to solve any issue. Artificial intelligence (AI) researchers have integrated and modified a wide range of problem-solving techniques, including as formal logic, artificial neural networks, search and mathematical optimization, as well as approaches from statistics, probability, and economics, to address these issues. AI also draws on a wide range of disciplines, including computer science, psychology, linguistics, and philosophy.

The idea that human intellect "can be so thoroughly characterised that a computer may be constructed to imitate it" served as the foundation for the study. This sparked philosophical discussions about the mind and the moral ramifications of constructing intelligent artificial entities, which have been topics of myth, literature, and philosophy since antiquity. Since then, computer scientists and philosophers have argued that artificial intelligence (AI) might endanger humanity's existence if its reasoning capabilities are not directed toward advantageous ends. A subfield of computer science is artificial intelligence.[2] The term "artificial intelligence" has numerous meanings. AI, sometimes known as machine

intelligence, is defined by Wikipedia as "intelligence demonstrated by machines, in contrast to the natural intelligence displayed by people and animals".[3] According to SAS analytics, "Artificial intelligence [AI] enables computers to learn from experience, adapt to new inputs, and carry out jobs like to those performed by humans.[4] " In that case, what would artificial intelligence be? It is focused on a certain set of actions that show intellect.[5] These are the programmes that assist in making the computer behave in ways that make people appear intelligent. Artificially intelligent systems are such procedures or systems. It has become recognised as new technology. At its foundation, artificial intelligence is a field of computer science that aids in the understanding and creation of intelligent things, sometimes referred to as software programmes.

One of the pioneers of contemporary computer sciences was the British mathematician Alan Turing, who worked in the late 1950s.

In the middle of the 20th century, Turing pioneered the concept of intelligent behaviour in computers. He and other researchers investigated the use of such intelligent procedures across the board in the healthcare and medical fields.[7]

Natural language processing, computer vision, chatbots, intelligent agents, machine learning, and voice recognition are all examples of artificial intelligence. Artificial intelligence is employed in practically every industry, from banking to healthcare, medical imaging to diagnostics.[8]

The new age of healthcare

The majority of facets of contemporary life, including entertainment, business, and health care, are being impacted by big data and machine learning. Google is aware of the ailments and symptoms people are searching for, just as Google is aware of the movies and television shows people choose to watch on Netflix, Amazon, and Google. All of this information may be utilised to create incredibly thorough personal profiles, which not only have the potential to be highly useful for behavioural understanding and targeting but also for forecasting healthcare trends. There is a lot of hope that the use of artificial intelligence (AI) will significantly advance all facets of healthcare, from diagnosis to therapy. Numerous examples of tasks where AI algorithms are performing on par with or better than humans include the analysis of medical pictures and the correlation of symptoms and biomarkers from electronic medical records (EMRs) with the characterisation and prognosis of the disease.[9]

The need for healthcare services is always growing, and many nations are struggling with a lack of healthcare professionals, particularly doctors. Healthcare organisations are also struggling to stay up with all the latest technological advancements and consumers' high expectations for service levels and results similar to what they have come to expect from consumer goods like those from Apple and Amazon.[10] In addition to opening up options for on-demand healthcare services utilising health tracking applications and search platforms, advancements in wireless technology and cellphones have also made remote interactions, which are accessible anywhere and anytime, a new method of delivering healthcare. Such services are important for impoverished areas and places lacking experts and assist in lowering expenses and avoiding unneeded clinic exposure to infectious diseases. Telehealth technology is especially significant in emerging nations where the healthcare infrastructure can be developed to match the present demand and where the healthcare system is increasing. Although the idea is straightforward, these solutions still require extensive independent validation to demonstrate their patient safety and efficacy.[11]

The healthcare ecosystem is beginning to recognise the significance of AI-powered technologies in the newest medical technology. It is claimed that AI may provide benefits to every process within healthcare operation and delivery. For instance, the ability of AI to reduce costs for the healthcare system is a key factor in the adoption of AI applications. It was predicted that by 2026, AI applications may save the US healthcare system $150 billion annually. The shift from a reactive to a proactive healthcare strategy that emphasises health maintenance rather than illness treatment is largely responsible for these cost savings. This is anticipated to lead to a decrease in hospital stays, medical visits, and treatments. Through constant monitoring and coaching, AI-based technology will play a significant part in assisting individuals in maintaining their health by ensuring earlier diagnosis, customised treatments, and more effective follow-ups.[12]

The healthcare industry for AI is anticipated to expand quickly and reach USD 6.6 billion by 2021, or a 40% compound yearly growth rate.[13]

Technological advancement

In the last ten years, there have been a lot of technical advancements in the fields of data science and artificial intelligence. The present wave of AI hype is distinct from earlier ones, despite the fact that research in AI for a variety of applications has been underway for several decades. Rapid development of AI tools and technologies, including in the field of healthcare,

has been made possible by a winning trifecta of faster computer processing, larger data libraries for data collecting, and a vast talent pool for AI.[14] The degree of AI technology, its uptake, and its effects on society are all expected to change dramatically as a result of this.[15]

In particular, the discovery of deep learning (DL) has had an influence on the way we look at AI tools today and is the basis for much of the recent enthusiasm around AI applications. Finding associations that were too complicated for earlier machine learning algorithms to depict is now possible with DL. This is mostly based on artificial neural networks, and DL networks contain more than 10 layers of connections compared to older neural networks that only had 3-5 layers. This is equivalent to simulating millions of artificial neurons.[16]

There are several businesses that are leaders in this field, including Google's Deep Mind and IBM Watson. These businesses have demonstrated that their AI is capable of outperforming humans at a variety of jobs and games, such as Go and Chess. Numerous applications connected to healthcare are now being employed for Google's Deep Mind and IBM Watson. Although IBM Watson is being used to research enhanced cancer treatment and modelling, drug development, and diabetes management, it has not yet demonstrated therapeutic usefulness to patients. Deep Mind is also being considered for uses in medical imaging-based diagnostics, mobile medical assistants, and patient deterioration forecasting.[17] Many technologies dependent on data and computing have exponential development curves. The best-known illustration is Moore's law, which describes the rise in performance of computer processors exponentially. By providing reasonable services, a lot of consumer-focused applications have seen comparable exponential development. The mapping of the human genome and the digitalization of medical data might lead to a similar development pattern in healthcare and life science as genetic sequencing and profiling become more affordable and act as platforms for data collecting. Although at initially these regions may appear minor, eventually exponential development will take over. Humans typically struggle to comprehend exponential trends and have a propensity to overestimate the short-term (like one year) effects of technology while underestimating the long-term (like ten years) effects.[18]

Use of AI in healthcare and pharma industry

Artificial intelligence is being employed in the healthcare industry and is altering how biological research is conducted. It may be thought of as a group of technologies that enable machines to sense, perceive, analyse, and produce data so they can carry out administrative and clinical healthcare duties. Additionally, it helps with training and research.[19–21] Artificial

intelligence systems have been created to help healthcare workers with their daily responsibilities and tasks by utilising the information gained through data analysis. Artificial neural networks (ANNs), evolutionary computation, and hybrid intelligent systems are examples of these systems. Artificial intelligence can assist in preventing biases that result from medical cognition, such as "Recency bias," which occurs when a doctor is more likely to provide the same course of therapy to a patient they treat later than they would a patient they treated earlier.[22] The issue of reporting electronic health information can be solved by using machine learning, a branch of artificial intelligence, to steer these records toward predictive modelling and analysis. We may combine an individual's omic [proteome, metabolome, microbiome, and genome] data with his or her electronic medical record using artificial intelligence to forecast the likelihood that they will acquire a certain disease, which can subsequently be treated with preventative medication.[23]

The use of artificial intelligence and machine learning in healthcare is made possible by seven key characteristics. The exchange of data and digitization of patient history records come first. The strength of digital mapping over human interaction comes in second. The third is the flexibility and simplicity of evaluating diverse data sources. The ability to simplify healthcare operations and accredit patients is its fourth strength. The fifth is AI's capacity to help researchers build hypotheses. The sixth reason is the availability of deep learning and open sharing tools, and the seventh component is AI's capacity to enhance outcomes even in the presence of enormous data sets.[24]

The full pharma value chain, which includes R&D, production, supply chain management, sales, and marketing, is being digitally transformed with a lot of focus in the pharmaceutical business. In order to better manage patients' and customers' medical problems, new models of cooperation in research and competence in operations are being made possible by the digital uprising. These solutions go "beyond the pill." Data from electronic medical records may be utilised for insightful analysis and interpretation, and AI algorithms can be used to make crucial decisions. Healthcare IoT devices are crucial in the current era of healthcare because they can provide data for patient treatment regimens, patient records, and massive AI-driven healthcare analytics systems.[25,26]

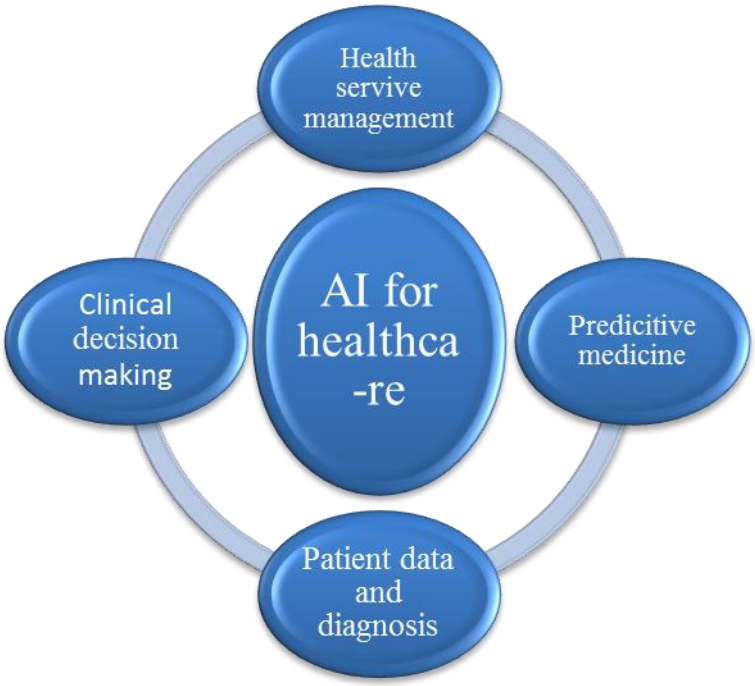

Figure Dominant variables for AI in healthcare.

Intelligence in pharmaceutical marketing

The process of encouraging the sales of a corporation goods and services is termed marketing.[27] According to an interview with Jon Recnick, President, Real-World & Analytics Solutions, IQVIA, "Machine learning and artificial intelligence allows the global life science sales, marketing, and branding team to come up with more successful and practical commercialization strategies from the insights uncovered from AI." Additionally, he stressed how AI/ML helps healthcare organisations to go deeper into more detailed layers of HCP, patient, and payer data to uncover previously untapped insights, provide predictions for possible future actions, and facilitate better and quicker decision-making.[28]

Additional benefits of using AI in the pharmaceutical industry include improved value propositions, optimal resource allocation for better market share gains, the capacity to maximise growth, and specialised sales and marketing data and channels [advanced analytics for pharma marketing efficiency and growth]. Businesses such as Google and IBM and several other companies are springing up to specialise in using AI in illness detection. Artificial intelligence that is both predictive and descriptive is being used in India. Additionally in India, businesses that provide medical supplies and equipment employ descriptive and predictive AI.[29]

To improve the effectiveness of its promotional plan and its implementation, a top US

pharmaceutical business employed physician level knowledge discovered by optimising data from multichannel marketing activities. They attempted to maximise return on investment by using specific targeting, segmentation, and promotional campaigning strategies. In six months, there was a steady rise in sales of around $25 million without an increase in marketing costs. In a different case study, a pharmaceutical business with headquarters in Europe used AI and machine learning to determine the HCPs' preferences for digital interaction. The new insights enabled the organisation to categorise doctors and build a digital engagement plan as per knowledge obtained from a physician. It revealed a rise in the number of emails sent to HCP that were opened and inquiries about further product information.[30]

The healthcare network as a whole shows several instances of AI use and acceptability. A person's DNA may be studied with the use of artificial intelligence, which can then suggest the most successful treatment choice with the fewest negative effects.[31] Businesses all across the world are embracing artificial intelligence, especially those in the pharmaceutical and healthcare sectors. The application of AI may aid in the improvement of commercialization tactics, from patient compliance to a sales call, as well as in the search for speedier, more informed decisions along the route from molecule to market. Artificial intelligence is being used by a number of pharmaceutical firms, including Pfizer, GSK, Novartis, Lundbeck, Takeda, AstraZeneca, and Teva, to enhance marketing efforts for both new and existing medications. According to a report by Eularis, the usage of sales communications that were specifically tailored with the use of artificial intelligence analytics led to a 43% rise in prescribing for sales professionals who did so in comparison to those who did not. Dr. Merton of JLABS predicted that "AI would be better at processing stakeholder aligned information to the consumer, enabling more focused dissemination of information to the customer." Additionally, he noted that marketing expenses ought to drop shortly.[32]

According to Bjarni-Kornbech, VP, Marketing & Communications at Agnitio, the demand of doctors for increased online interaction is now a reality. He added that the remote channel is the one that is expanding quickly. According to a poll conducted by eyeforpharma, marketers' inability to prove the technology's value and return on investment is a big barrier to their adoption of new technologies. The sales crew must receive training on how to use CRM systems. However, only a small number of businesses make the effort to train their sales staff in this way. According to Bjarni-observations, Kornbech's it is necessary to link consumer

interaction data into the CRM and, ideally, couple the data from the marketing engine in order to bring actual value. After then, it is necessary to get everything together and make it accessible to the field force.[33]

In the past, as well as in the present, marketing and sales teams frequently spoke with doctors who were likely to write about their product through a variety of means. The method proved ineffective for promoting a product and it causes an overuse of human and financial resources. Through the application of analytics, machine learning in business applications has aided in the development of more complex and persuasive brand strategies and sales techniques. Providers of healthcare are becoming more motivated to participate in digital healthcare enterprises. Currently, 70% of doctors identify as alpha geeks. Pharma sales must adjust to physicians' shifting demands and preferences. Doctors are gradually reducing their face-to-face interactions with medical personnel while also becoming more receptive to internet alternatives.

By evaluating each customer's preferred method of contact, such as call, text, email, webinar, face-to-face meeting, etc., as well as it might also be established to what tone they would respond, brand teams may use machine learning to make the most of such quick interactions. Brand teams now have the ability to implement more focused multi-channel marketing campaigns in order to increase their engagement in the digital space thanks to machine learning and analytics.[34]

Artificial Intelligence (AI) in drug discovery

Testing chemicals against samples of sick cells is a time-consuming process in the drug development process. Further investigation is necessary to identify chemicals that are physiologically active and merit further study. The research teams at Novartis utilise pictures generated by machine learning algorithms to forecast which untested chemicals could be worth further investigation. As new data sets are discovered by computers far more quickly than by conventional human analysis and laboratory experimentation, new and effective medications can be made accessible sooner while also incurring lower operational expenses than manual examination of each chemical. The leading pharmaceuticals firms' current AI initiatives include: mobile platform to enhance health outcomes -the capacity to propose patients by means of real time data collecting and thereby improve patient outcomes. Drug development is an expensive and time-consuming process, thus pharmaceutical corporations are working with software businesses to incorporate the most cutting-edge technology.[35]

Big data and artificial intelligence (AI) are becoming essential to drug creation because to the vast data collection in the several Chemin formatics databases. To mine these databases and meet the unique requirements of different drug discovery procedures, such as virtual drug screening and de novo molecule design and discovery in this big data age, innovative algorithms and architectures have had to be developed. Information mining in the chemical realm has undergone a paradigm shift as a result of the advancement of deep learning neural networks and its variations, as well as the concomitant rise in chemical data. The current paper outlines the use of big data and artificial intelligence (AI) tools to meet the rising need for research in drug discovery pipelines.[35]

Why AI ?

Pharma data has greatly expanded in recent years. Due to advancements in gadgets like sensors, picture capture devices, mobile phones, genetic data gathering, e-consultation, etc., it is currently produced in the form of petabytes.[36] Today's pharmaceutical sector encompasses a variety of disciplines, including academics, mathematicians, business intelligence, and research & development, in addition to being a drug development agency. Unstructured data is produced by the pharmaceutical sector. It may contain data relating to patient prescriptions, medical picture reports, doctor notes, history, and many more. The patient's medical history is taken into account and thoroughly reviewed before his therapy is determined. Numerous analytical tools and techniques are needed to manage all of this unstructured data.[37] Data processing, data extraction, and data visualisation may all be done using these technologies. There are various open-source programmes available for managing pharmaceutical data, and each of these platforms has benefits and drawbacks. It is necessary to close the gap between data gathering and processing.[38] There is a lot of information overload in healthcare as a result of the growing number of patients. The massive amounts of patient data may be used for evidence-based practise by applying machine learning.[39]

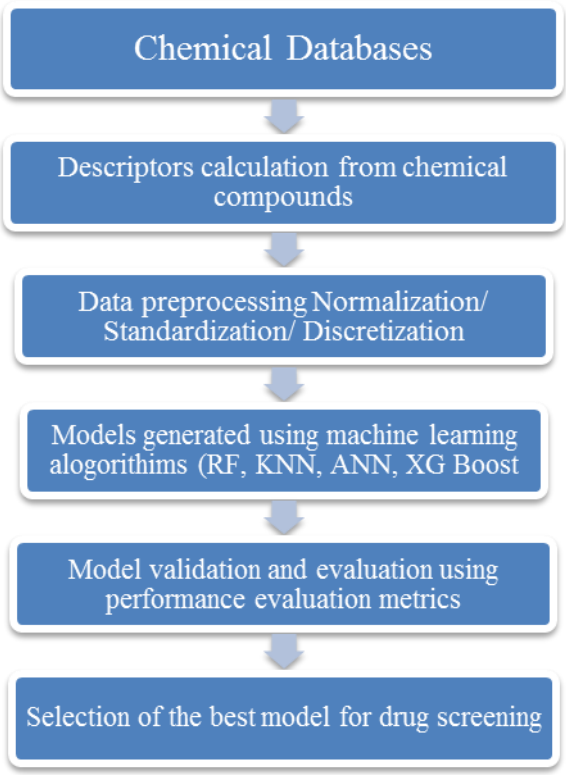

Figure 1: Workflow of Machine Learning(ML) Process in Drug Discovery.

The pharmaceutical sector has evolved similarly to other profit-driven industries during the past ten years thanks to changes in marketing tactics and technology on a worldwide scale. The goal of this sector is also to enhance earnings. Pharmaceutical marketers interact extensively with healthcare professionals[40] but frequently find it challenging to do so. They participate with the aid of multimillion-dollar marketing campaigns and make use of all available advertising techniques. Pharma businesses invest a lot of money not only in building and safeguarding their brand but also in worldwide competition with the drugs that make up its components. Numerous research[41,42] revealed a high correlation between doctors' propensity to prescribe drugs and their acceptance of gifts, gratuities, unrelated compensation, etc. Other research highlighted the effect that presents have on doctors' prescription practises.[43]

Growth of AI/ml/e-health market

According to Grand View Research Inc., the global health industry is expected to reach USD 308.0 billion by 2022. The primary driver of the market is anticipated to be the shift of the healthcare sector to a digital healthcare system for patient analysis and management.[44] The European Commission has introduced an eHealth action plan 2012-2020 that will give patients and healthcare professionals the ability to connect devices and technology in other

countries, particularly in Europe. Additionally, it recommends funding studies to provide individualised medicine. The healthcare ecosystem is beginning to recognise the significance of AI-powered technologies in the newest medical technology. The operation and delivery of healthcare processes are thought to benefit from AI. For instance, the ability of AI to reduce costs for the healthcare system is a key factor in the adoption of AI applications. In 2026, it is predicted that AI applications would reduce US healthcare spending by $150 billion annually. The shift from a reactive to a proactive healthcare strategy that emphasises health maintenance rather than illness treatment is largely responsible for these cost savings.[45] This is anticipated to lead to a decrease in hospital stays, medical visits, and treatments. Through constant monitoring and coaching, AI-based technology will play a significant part in assisting individuals in maintaining their health by ensuring earlier diagnosis, customised treatments, and more effective follow-ups. A research from Accenture's Technology Vision 2017 claims that by 2035, artificial intelligence would enable yearly economic growth to double.[46]

Limitations of artificial intelligence

Patients should be aware that digital consultants are only guided by human doctors since empathy and compassion are two human attributes that robots lack. Additionally, as AI is a technology shrouded in scepticism, it should not be expected of the patient to trust it right away. Because of this, routine activities are typically handled by artificial intelligence, leaving the primary duty for patient care exclusively to the human doctor. In 2008, Google used simply keywords or popular search phrases in its search engine to try and predict the seasonal frequency of influenza. Since a person's search habits change dramatically over the course of a year, the model was swiftly abandoned since it was so badly made and couldn't make accurate future predictions. Medical research is interested in artificial intelligence, but its practical application is not without challenges. The regulation-related issue is the first barrier. Standards that can gauge the success and safety of AI systems are not currently provided by regulations. The US FDA made an effort to offer guidelines for evaluating AI systems in order to get over this challenge. The "General Wellness Product" was the first standard that set apart AI systems. The last guideline established the rule for compatible designs in clinical trials and following the revelation of policies, and the second guideline justified using real-world data to assess the effectiveness of AI systems.[47]

Data sharing is yet another significant barrier. AI systems must be regularly trained using

data input from clinical research in order to function effectively. However, it is necessary to maintain incorporating such data into the systems for continued system growth and improvement once they have been trained with all the previous data. The need for transparency and compliance with public interest while promoting and supporting innovation in the field would be another hurdle for adopting artificial intelligence.[48]

Chatbots have been working for a while. Many customers are aware that interacting with chatbots implies doing so with a machine, which makes them feel ignored and unimportant by the business. Such chatbots should only be utilised in situations when the public would accept them positively and you have human support. An business should employ AI primarily to help their sales staff, but if it is causing a rift between you and your customer, your plan may backfire.[49]

Because artificial intelligence is diverse, implementing it requires some serious work. Additionally, the bulk of marketing academics lack the knowledge and training necessary to comprehend the ideas and concepts underlying artificial intelligence and machine learning. Neural nets, expert systems, and case-based reasoning have been the three primary applications of AI in marketing to far.[50] It is believed that artificial intelligence will have both short-term and long-term consequences on pharmaceutical marketing and sales practises. Not determining whether the technologies will be capable enough to be beneficial, but rather guaranteeing their acceptance in routine clinical practise, is the biggest hurdle for AI in various healthcare sectors. For widespread adoption to take place, AI systems must be approved by regulators, integrated with EHR systems, standardised to a sufficient degree that similar products work in a similar fashion, taught to clinicians, paid for by public or private payer organisations, and updated over time in the field. These difficulties will eventually be resolved, but it will take considerably longer than it will for the technology to advance. We anticipate limited application of AI in clinical practise during the next five years and more widespread usage within the next ten years.[51]

A.I and medical visualization

It might be difficult to interpret data that arrives in the shape of a picture or a video. To develop the capacity to recognise medical events, experts in the area must train for many years. In addition, they must actively study new material as fresh research and information become available. However, the demand is continually rising and there is a substantial scarcity of expertise in the industry. Consequently, a novel strategy is required, and AI

appears to be the instrument that may close this demand gap.[52]

Machine vision for diagnosis and surgery

The interpretation of pictures and videos by machines with abilities on par with or better than those of humans, including object and scene identification, is known as computer vision. The use of computer vision in areas like image-based diagnostics and image-guided surgery is having a significant influence. Since statistical signal processing has been the basic foundation for computer vision, artificial neural networks are currently being used more frequently as the preferred learning approach. Here, computer vision algorithms for categorising pictures of lesions in skin and other tissues are developed using deep learning (DL). It is believed that video data contains 25 times.[53] might give a better data value depending on resolution over time by using high-resolution diagnostic imaging like CT. Although it is still early, video analysis offers a lot of potential for clinical decision assistance. As an instance, real-time video analysis of a laparoscopic surgery yielded 92.8% accuracy in identifying all of the phases and, interestingly, the identification of any steps that were either missed or unanticipated. One significant use of AI and computer vision in surgical technology is to improve certain procedures and abilities like suturing and knot-tying. In various surgical operations, such as animal intestinal astomosis, the Johns Hopkins University's smart tissue autonomous robot (STAR) has proven that it can outperform human surgeons. Although a fully autonomous robotic surgeon is still a dream for the far future, academics are interested in applying AI to improve several elements of surgery. A group at the Alpen-Adria Universität Klagenfurt's Institute of Information Technology utilises surgical movies as training material to recognise a particular surgical operation as an illustration of this. The algorithm, for instance, assesses the likelihood of the intervention as well as the particular place in the body when a dissection or cutting act is conducted on the patient's tissues or organs. Such algorithms are naturally based on the training on several films and may prove to be very helpful for difficult surgical operations or for circumstances when an unskilled surgeon must do an emergency surgery. In order to ensure clinical relevance and quality and to speed the transition from the laboratory to the clinical setting, it is crucial that surgeons actively participate in the creation of such tools.[54]

Future scope of artificial intelligence in pharma marketing

The employment of computer science is rising quickly in all fields, including medicine, production, R & D, and sales. More money was allocated to healthcare AI initiatives in 2016

than to any other AI project in any other field. However, among the exhilaration, there is a lack of commitment owing to some unmet expectations.[55]

Radiographs, retinal scans, and ultrasounds are just a few examples of the numerous sorts of visual data that artificial intelligence has shown capable of analysing. AI enables the cost-effective acquisition of a huge number of such images. Building a trusted connection between physicians and artificial intelligence systems is made easier by integrating these technologies with clinical practise. When they cooperate, they both do better.[56]

The global pharmaceutical business invests a lot of money in R&D. According to a recent poll by Global Data, artificial intelligence may be considered as leading the way in enhancing the efficiency and efficacy of R&D. The poll also revealed that big data and AI have the potential to alter and change pharmaceutical companies over the next two years.[57]

Artificial intelligence is enhancing marketing strategies day by day and is becoming more useful.

An organisation may map the client journey by utilising AI. As a result, the business will be able to recognise each consumer uniquely and sign them up for its marketing campaign. Future AI systems are anticipated to develop and grow, becoming capable of performing a range of jobs without the need for human intervention.[58]

Artificial Intelligence in Pharma is a good idea

The pharmaceutical industry may speed up innovation by utilising new technologies. Artificial intelligence, the development of computer systems capable of performing activities typically requiring human intelligence, such as visual perception, speech recognition, decision-making, and language translation, would be the most recent technical development that comes to mind. According to an IBM estimate, the total amount of data in the healthcare industry was at 161 billion GB as of 2011. Due to the enormous amount of data that is accessible in this field, artificial intelligence can really assist in data analysis and result presentation that will aid in decision-making, save time, money, and human effort, and ultimately save lives. Epidermic outbreak prediction; utilising machine learning/artificial intelligence, one may examine the social media activity, research the history of the epidemic, and forecast where and when the epidermic will occur with a high degree of accuracy.[58]

CONCLUSION

Artificial intelligence operates as a supporting role in normal chores and delivers improved insights. It increases efficiency and gives the marketing department better insights and reliable data, which facilitates selling. AI provides consistency, cost-efficiency, the ability to solve complicated issues and make judgments, as well as the ability to prevent lost data. Each technology has advantages and disadvantages, and artificial intelligence is no exception. Therefore, before incorporating AI into sales, marketing, or any other element, it should be properly assessed. Future AI research should be focused on aligning with demands and trends that may emerge shortly.

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Conflict of Interest

The Authors declare no conflict of interest.

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