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Artificial Intelligence and Its Role In The Development Of Personalized Medicine And Drug Control

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ABSTRACT: DNA sequencing, imaging procedures, and wireless healthcare monitoring devices are all examples of high-throughput, data-intensive precision medicine assays and technologies that have necessitated new methods for analysing, integrating, and interpreting the enormous volumes of data they produce. While several statistical approaches have been developed to deal with the "big data" generated by such tests, previous experience with artificial intelligence (AI) techniques suggests that they may be especially well-suited. Furthermore, data-intensive biomedical technologies applied to study have shown that people differ greatly at the genetic, biochemical, physiological, exposure, and behavioural levels, particularly with regards to disease processes and treatment receptivity. This indicates the need to 'personalise' medications so that they better suit the complex and often individual needs of each patient. AI can play a significant role in the clinical research and development of new personalised health products, from selecting relevant contribute to sustainable to testing their utility, because of the importance of data-intensive assays in revealing appropriate intervention objectives and approaches for personalising medicines. The work here presents a variety of ways in which AI can contribute to the progress of personalised medicine, and we argue that the success of this endeavour is critically dependent on the improvement of appropriate assays and methods for storing, aggregating, accessing, and ultimately combining the data they generate. In addition, the manuscript also discusses the potential future research directions and highlights the shortcomings of various AI methods.

Keywords: Artificial Intelligence, AI in Personalized Medicine, Drug Control, Drug Discovery using AI

1. INTRODUCTION

There are a number of underlying concepts that govern or perhaps dominate today's biomedical research. Many of the issues plaguing precision medicine today may be resolved if AI approaches were trained and validated using huge data sets before being applied to personal data [1]. The given instances emphasise yet another possible use of augmented intelligence: the role of electronics in the hands of individuals to aid in "just in time" risk communication or as an agent of behaviour modification. Despite the fact that most studies to yet have been small and the data restricted, the capacity to identify at-risk individuals will translate into individualised treatment when identification is paired with ways to alert and intervene. Mobile applications, wearables, virtual assistants, and other technologies are all being explored by researchers as potential means of providing individuals with tailored experiences while interacting with autonomous machines [2].

The intersection of AI and precision medicine is illuminating a future in which people's and doctors' access to highly individualised medical diagnostic and treatment information will enhance their ability to provide better care to their patients. The combined effect of these two trends on healthcare is congruent with the long-term objective of reducing the overall illness burden and the expense of treating avoidable conditions [3].

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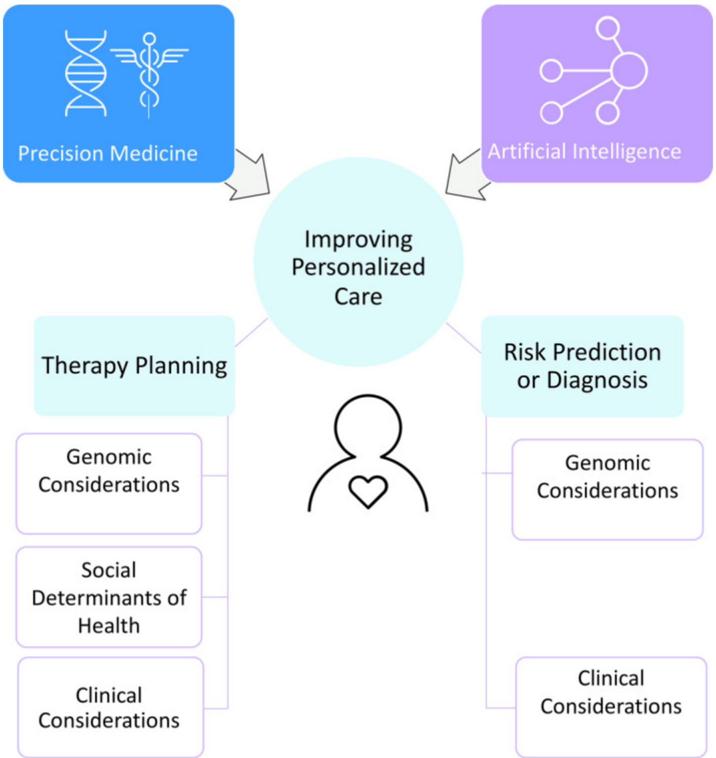

FIGURE 1. **Personalized Medicine and Heath Care**

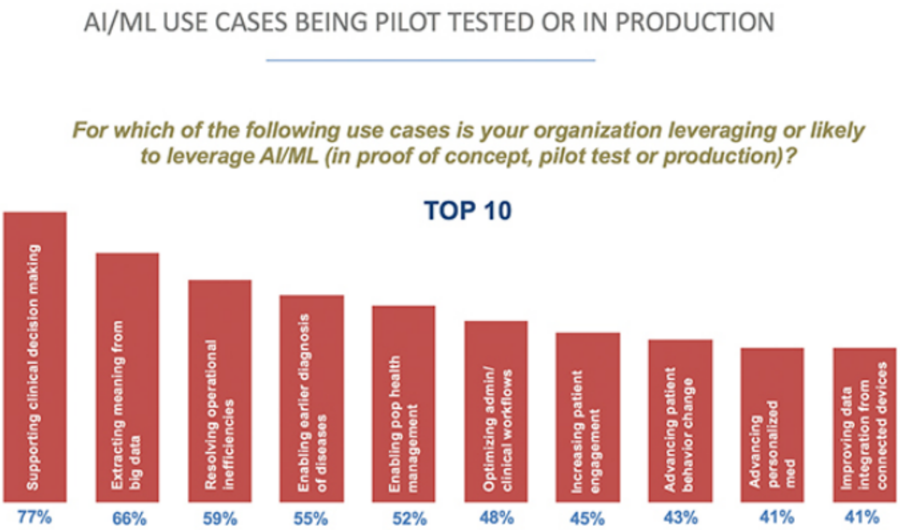

FIGURE 2. **Key Use Cases of Artificial Intelligence in Heath Care**

The concept of "personalised medicine," which holds that each person's health care needs must be addressed in light of their own genetic, biochemical, physiological, exposure, and behavioural characteristics [4], Making use of new data-heavy assays like DNA sequencing, proteomics, radiology procedures, and wireless health monitors;. 'Big data' research paradigms, in which large amounts of data, such as those generated from arising data-intensive biological and medical assays, are compiled from alternative viewpoints, harmonised, and available for analysis, allowing for the identification of patterns that would otherwise go unnoticed if the data points were analysed separately; and 4. Artificial intelligence (AI; which we define here to encompass algorithms-based machine learning, learning techniques, neural network constructions, and a broad variety of related techniques) to discover meaningful patterns in large data sets [5].

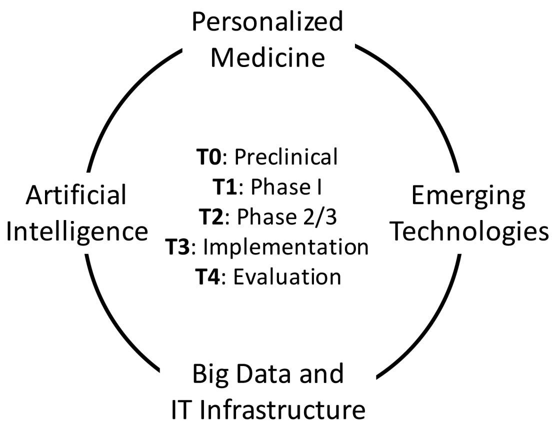

FIGURE 3. **Assorted Phases in Personalized Medicines**

As these four developing topics span disciplines as diverse as cell biology, genetics, pathology, computers, computer science, statistic, clinical science, and medicine, it is not a simple task to bring together the research efforts related with them. Since it is uncertain how relevant clinical and pathological insights may be obtained from big data-generating devices which might complement or build upon the insights from expert in diverse fields [6], AI will play a unique role in this accession process if the objective is to develop personalised medicine. Because of this, AI has the potential to greatly improve many aspects of the research and development process for new drugs, general therapies, and other goods, including diagnostics, prognostics, decision assistance systems, etc. In this segment, we detail and comment on current research that make use of AI at each of these stages [7].

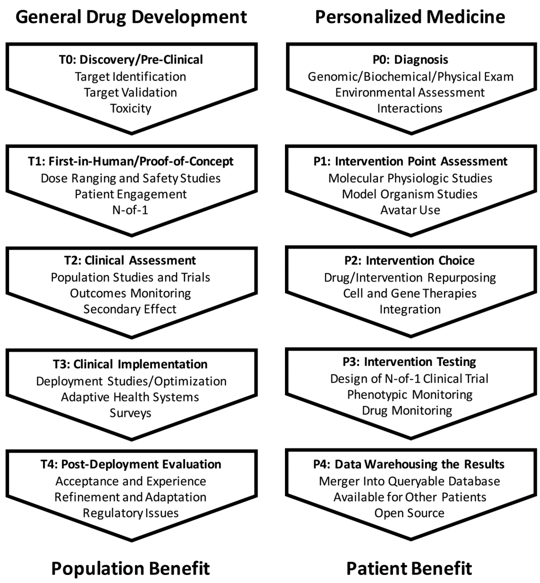

FIGURE 4. **Benefits and Key Advantages towards Implementation Patterns**

A mechanism similar to that used in medication and device discovery underlies the actual delivery of customised medicine. Thus, P0 activity entails making a diagnosis or estimating an individual's risk of disease; P1 activity entails identifying the primary pathophysiologic processes, if not recognised, that are affecting (or likely to cause) the a disease that might be susceptible to modulation by an effective interventions; P2 activity considers the identification of a specific interventions given what was identified in P0 and P1; and P3 activity entails testing the action on the relevant individual [8].

There are a few important details to remember while working with such procedures. First, it has been noted that the communication of data from one component to another, or the transitions between components, is of crucial importance, even though the science attributed with each constituent involves unique knowledge and expertise and provide a breeding soil for partnering with AI tools and scientists individually of the other components

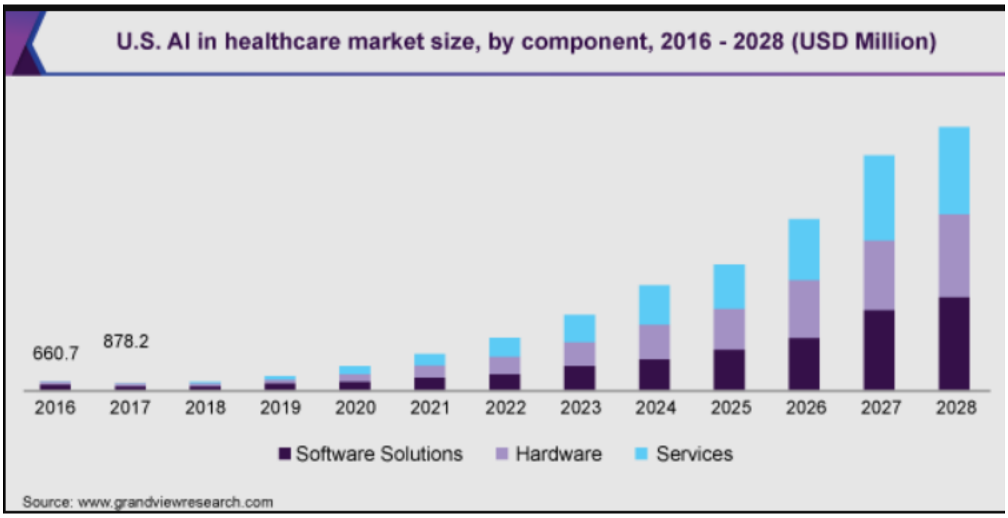

FIGURE 5. **Predictive Data Analytics**

2. ASPECTS TOWARDS LIMITATIONS

While AI has great potential, there are several obstacles that prevent it from being used to create truly individualised pharmaceuticals. Just a few of the most important ones are touched on quickly here. The first criticism levelled by big data analysis is that they often fail to reveal crucial individual-level linkages despite the fact that they pool data from several people in order to spot patterns that represent relationships between points at the population level. In the absence of 'ergodicity,' models may be useless in selecting appropriate therapies for specific patients. For instance, as more economic indicators are accumulated on each individual, any projections of the target individual's heath trajectory might also rely more on the legacy datasets on that entity and less on the population level data in order to accurately predict the target individual's health trajectory. Training AI systems to recognise this is a vital step toward improving individualised healthcare [9].

Second, there's a pressing need to evaluate the efficacy of AI-driven medical technologies. The motivation for this comes from the fact that various AI and big relevant data health care systems, like IBM's Watson therapy decision support system, have shown uneven outcomes. Traditional randomised clinical studies for evaluating the efficacy of such systems have been explored in the literature, and several AI-based decision analysis tools have been demonstrated to be effective in such trials. Vetting AI-based decision support systems like IBM's Watson may be necessary because of the possibility for incorrect suggestions or forecasts if the underlying system's decision making capabilities was trained on an incomplete or biassed data set. Case in point: Google's flu prediction engine, which has a fairly poor reputation. If the system for matching pharmaceuticals to patient profiles is demonstrated not to operate better than standard of care or an alternate technique of matching drugs to patient features, then a few further issues may be raised in the context of the trials, in which the underlying scheme is being evaluated. It's possible that the medications, or a significant proportion of them, are useless, which would have a negative influence on how well the matching method works as a whole. Also, it's possible that the medications themselves are effective, but that the inappropriate matcher or scheme is preventing them from being administered to the right patients. These concerns arose in light of the study, a so-called "bucket trail" that showed the medication matching strategy to be no more effective than conventional methods of treating patients [8, 9].

Third, it's possible that learning systems, where the recommendation rules or algorithms are continually updated, are a better means to evaluate at least decision support tools than randomised clinical trials [10].

Unfortunately, this might take a long time to grow into a machine with accurate and reliable decision making, and it would also require a lack of objectivity in the initial data sets used to seeding the learning system in order to assure generalizable findings [10]. Finally, deep learning and tensorflow algorithms are used in many AI-based decision assistance products.

Using a sufficiently large training set, these algorithms may make very accurate predictions; nevertheless, the relationships between the data used to train the algorithm and the predictions it generates are not always clear. Because of this 'Black Box' issue, many AI-based systems may not be trusted to provide accurate predictions in situations when human lives are at risk. Furthermore, not all AI methods are built to establish causal links between inputs and outcomes, but rather to make just associative or predictive claims. However, recognising causal linkages is vital if the objective is to, for example, find a pharmacological target that, when adjusted, leads to a desired result.

3. RESEARCH PERSPECTIVES IN ASSORTED DIMENSIONS OF PRECISION MEDICINE

The convergence of AI with precision medicine has the potential to completely alter the healthcare system. Methods used in precision medicine are able to classify individuals into phenotypes based on their unusual reactions to therapy or specific medical requirements. By using complex computing and inference to uncover insights, AI makes it possible for the system to understand and learn, and it augments the intellect of clinicians to make better decisions. The most pressing problems in precision medicine may be overcome through translational studies of this intersection of fields; in particular, the integration of non-genomic and cytogenetic determinants with patient symptoms, health characteristics, and lifestyle data should improve the accuracy of diagnosis and prognosis.

A recent report by the National Academy of Medicine discussed the present and future of AI in healthcare, highlighting "unprecedented opportunities" to supplement the care of specialists and the aid that AI can provide in combating the realities of being human (such as fatigue and inattention) and the hazard of machine error. The research emphasises the need of exercising caution while using these technologies despite the many potential benefits they provide. Transformation and advancement in the development and implementation of AI in healthcare are fuelled by the digitalization of healthrelated data and the fast use of technology. There may be obstacles to the application of AI in healthcare, such as multimodal data integration, security, distributed learning (which requires fundamental advancements in fields like privacy, large-scale machine learning, and decentralized optimization), prediction accuracy, and bias.

A lot has changed in the last decade in terms of AI's development and acceptability across many industries, but the healthcare sector is one that has experienced significant growth and acceptance. Artificial intelligence (AI) opens up several prospects for developing innovative goods, services, and business strategies. But there are also social and ethical concerns with how AI is used, particularly in regards to privacy, safety, and human rights.

Many different types of artificial intelligence (AI) are employed in the medical field, ranging from entirely virtual (such as deep learning-based health information administration systems and active coaching of clinicians in their treatment choices) to cyber-physical). Many image based detection and diagnosis in healthcare are now able to perform as well as, or even better than, physicians because to the ability of AI technology to spot complicated patterns and hidden structures.

Clinical decision-support systems powered by AI might help doctors make more accurate diagnoses, provide more insight to aid in making tough choices, and streamline the process of extracting and documenting patient information from electronic health records. Natural language processing (NLP), pattern recognition, efficient search, prediction, and bias-free reasoning are all areas of computing that are on the cusp of significant advancement, which will ultimately lead to new capabilities in artificial intelligence (AI) that can solve pressing issues today.

Similarly, research into precision medicine is expanding rapidly. The sequencing of the human genome has sparked a revolution in medical practise known as "precision medicine," which may be best characterised as the establishment of "a New Taxonomy of human illness based on molecular biology." The discipline has progressed to appreciate how a person's health, illness, and treatment choices may be accurately characterised by integrating multi-omic data with medical history, social/behavioral variables, and environmental understanding. This study will utilise the terms "precision medicine" to refer to the aforementioned approach to healthcare and research agenda, and "personalised care" to express how this approach affects each patient uniquely.

As opposed to making medical decisions based on data gleaned from the population as a whole, precision medicine allows doctors to instead take into account each patient's specific background and history. With this tool, doctors can more easily provide individualised treatment for each patient [11]. Discoveries in precision medicine open doors to opportunities that were previously closed.

The early diagnosis of disease and the development of individualised therapies are only two examples of how advances in precision medicine are translating into a better health care system. Multiple data collecting and analytics tools fuel precision medicine's capacity to tailor treatment to each individual. More specifically, the unprecedented possibility to derive novel phenotypes from real-world clinical and biomarker data is made possible by the confluence of high-throughput genotyping with the worldwide deployment of EHRs. When integrated with EHR data, these phenotypes may help show the need of further therapies or refine the identification of disease variations.

Genotype-guided therapy is perhaps the most researched effect of precision medicine on modern healthcare. The right dosage of warfarin has been established with the use of genetic data, which clinicians have utilised as a guideline. Genotype-based pharmacological recommendations were released by the Clinical Pharmacogenetics Application Consortium to assist physicians in making informed decisions about patient care in light of genetic test findings. Patients with breast or lung may benefit from individualised treatment strategies based on tumour genomic analysis, which can provide. When applied to healthcare, precision medicine has the ability to improve diagnostic accuracy, identify at-risk patients before they show symptoms, and provide individualised treatment programmes that are both effective and safe. Examples from Biobanks in various countries, such as the UK Biobank, BioBank Japan, and Australian Genomics Heath Alliance, show the power of shifting attitudes toward precision medicine on a global scale, and this trend is not limited to the United States.

While AI and precision medicine show great potential, additional research, testing, and practise adjustments are needed. Adopting standardised data formats (such as Fast Consolidated Level Resources), getting adequate and high quality labelled data for training algorithms, and resolving regulatory, economic, and sociocultural needs are all obstacles that researchers must overcome [12].

Data collection, storage, normalisation, and tracking are all important uses of AI in healthcare. Google's artificial intelligence (AI) research division has unveiled a new initiative called DeepMind Health, which will be used to sift through mountains of medical information in an effort to improve and speed up healthcare delivery. Moorfields Eye Hospital NHS Foundation Trust began working together on a joint endeavour to enhance eye care in 2016. Moorfields provided DeepMind with a collection of one million randomized eye scans and some anonymous statistics about eye health and illness management to explore how technology may aid to evaluate eye scans.

Oncologists now have access to more therapy choices because to IBM Watson's new oncology initiative. Watson for Oncology's superior capacity to interpret the context and significance of structured and non - structured material in case information and reports that may be pivotal in deciding on a treatment course is a major selling point. Treatment options for a patient are then determined by the program's incorporation of clinical knowledge, variable on the basis, and data.

Medical Sieve is IBM's newest software offering. The project's ultimate goal is to create a sophisticated "cognitive assistant" with extensive clinical knowledge and the ability to think critically and reason analytically. Medical Sieve has the right credentials to help with radiology and cardiology-related clinical decisions. The 'cognitive health assistant' can analyse radiological pictures to more quickly and accurately diagnose issues. Radiologists may soon just need to review the most complex cases requiring human oversight.

The Dutch firm Zorgprisma Publiek utilises IBM Watson in the cloud to sift through digital hospital and insurance company bills. If a doctor, clinic, or hospital often makes the same errors with a given ailment, they may use this information to do better and save people from being hospitalised unnecessarily [13].

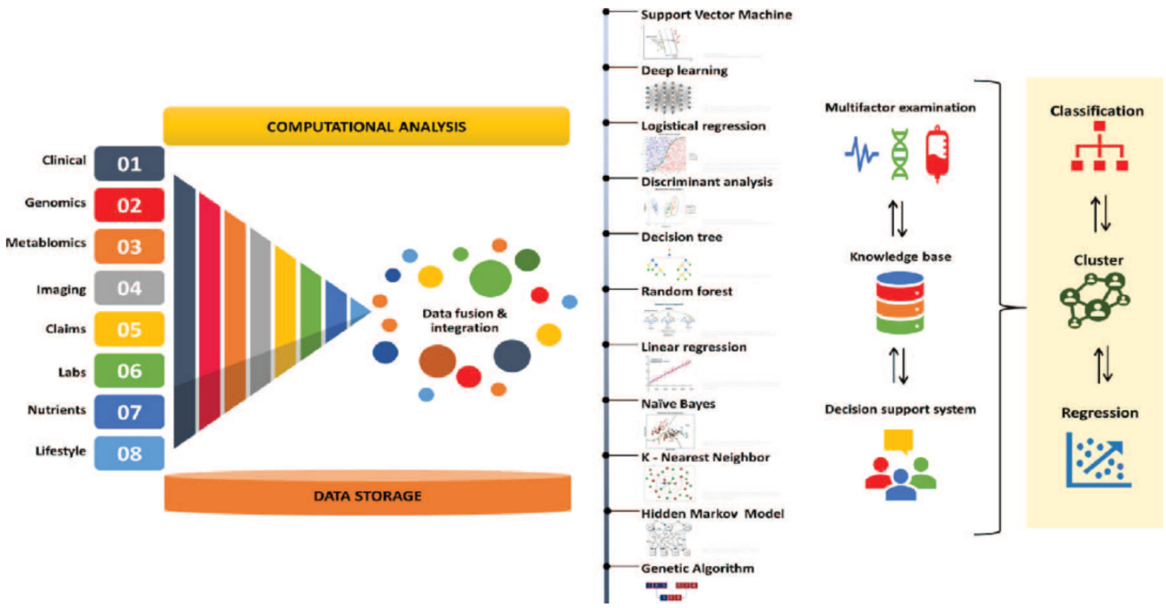

FIGURE 6. **Artificial Intelligence Based Approach for Predictive Analytics in Personalized Medicine and Drug Discovery**

The goal of Deep Genomics is to find mutations and disease links by analysing huge troves of genetic information and medical records. Scientists are developing next-generation computational tools to predict the cellular responses to natural or therapeutic genetic variation.

Clinical studies for new drugs may take years, if not decades, and cost billions of dollars to complete. If this process could be sped up and made more cost-effective, it would have a profound impact on modern health care and the dissemination of medical discoveries. Atomwise employs powerful computers to sift through a library of molecular structures in search of potential treatments. In 2016, Atomwise began an online hunt for potential Ebola treatments already on the market that were already safe to use. The company's AI algorithm was able to anticipate two medications that showed promise in reducing Ebola's infectiousness. This analysis, which would usually take months or even years to conduct, was finished in less than a day [14].

While the trends are encouraging, several businesses have yet to provide evidence of the effectiveness of their approach and the toxicity of ANI in studies that have been examined by experts in the field.

4. CONCLUSION

This manuscript presents how AI has the potential to significantly contribute to the development of customised medicine in the future. AI-based health solutions will not only become more widely used, but they may also take use of new computer technologies like quantum computing to get faster and deal with ever-growing data sets. Larger data sets, which may be used as seeds and key offs for the formulation of more accurate forecasts, are anticipated to result from improved and more advanced monitoring health monitoring equipment. Future AI-based wellness products and applications will likely involve a deeper grasp of biology in addition to leveraging increased speed and computing efficiency. Much work in the fields of artificial intelligence (AI), machine learning (ML), and statistical analysis has centred on discovering such straightforward input/output relationships among data points; doing so under the constraints that are known to govern relevant phenomena presents an exciting new avenue for exploration. In conclusion, much of the application of AI in the development of personalised medicines is geared toward the management of people with outright disease: identifying the neurological dysfunction, determining which therapies might make most sense to just provide given what is recognised about that pathology and the process of action of the meddling, and testing to see if the technique works. As a result, the bulk of AI-based products and technologies used to advance customised medicine centre on the diagnosis, prognosis, and treatment of people. The high expense of present therapies, especially in the case of cancer, makes a pressing need for innovation and efficiencies all the more pressing. However, there has been a lot of progress and interest in using AI for illness prevention. For instance, 'polygenic risk scores' that may be used to identify a person with an elevated hereditary risk for disease and could benefit from closer monitoring have been demonstrated to be valuable in the development of AI and machine learning approaches. [86–88] In addition, illnesses may be stopped in their tracks before complex therapies are required for more severe manifestations of the disease by combining knowledge of genetic susceptibility to disease with ongoing surveillance to detect early indicators of disease. Using artificial intelligence (AI) methods with cutting-edge sensors might significantly improve this kind of monitoring. At the end of the day, the excitement around the use of AI methods is not going to die down. Manufacturing, sales and marketing, banking, the financial sector, and even transportation might all be affected by AI. Artificial intelligence (AI) has the potential to significantly contribute to the necessary advances across all of these sectors. This segment has been able to demonstrate that the healthcare sector has just as much to gain from AI as any other, provided that it is integrated and tested properly.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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