STM JOURNALS

Emerging Trends in
Personalized Medicines

ISSN: 3049-1347
Volume 2, Issue 2, 2025
July–December
DOI (Journal): 10.37591/ETPM

https://journals.stmjournals.com/etpm

Review ETPM

Progression of Health and Wellness: Artificial Intelligence (AI) and Deep Learning (DL) for Precision Medicines

Bhupinder Singh[1,*], Ritu Gautam[2]

Abstract

Deep learning and artificial intelligence in the field of precision medicine is revolutionizing healthcare to make personalized therapeutic approaches desirable based on the unique characteristics of the patient. AI technologies improve diagnostic accuracy by analyzing medical data, spotting patterns, and anomalies that human experts may miss. AI-driven models are instrumental in precision medicine, where they can predict patient response to therapies to tailor treatment plans, enhancing outcomes and reducing adverse effects. The usage of AI in drug discovery and development identifies potential drug candidates and predicts their efficacy which reduces potential means and costs. One such approach, deep learning, is particularly groundbreaking in genomics, as it unravels intricate genetic data, paves the way for predictive genomics and gene editing, and provides a deeper understanding of disease mechanisms. AI helps in disease prevention and promotion of wellness by enabling early detection, driving lifestyle intervention, and improving mental health care. But we still face challenges related to data privacy, algorithmic bias, and ethics. These are all important issues to consider for ensuring that AI is applied responsibly and equitably in healthcare. Future horizons promising perhaps real-time monitoring of health continuum, multi-omics data integration, more personalized AI-assisted clinical trials, and ultimately patient empowerment. This shift towards precision medicine through the evolution of AI and deep learning technologies has the potential to revolutionize the way healthcare is delivered and significantly enhance health outcomes and quality of life on a global scale.

Keywords: Artificial intelligence, deep learning, precision medicine, genomics, personalized treatment

INTRODUCTION

It is recently that progress in the healthcare industry has witnessed a paradigm shift with the integration of artificial intelligence (AI) and deep learning technologies. In fact, these technologies have transformed the landscape of precision medicine, which seeks to customize medical treatment specifically to the individual patient's unique features. Precision medicine uses genetic, environmental, and lifestyle factors to help enhance disease diagnosis, prevention, and treatment. Deep learning forms the basis of this revolution and AI depends on that to deliver better predictions, treatment plan customization, and patient outcomes. In this article, it will consider how AI and deep learning help precision medicine, and how they will affect health and wellness.

***Author for Correspondence**
Bhupinder Singh
E-mail: bhupindersinghlaw19@gmail.com

[1]Professor, Sharda School of Business Studies, Sharda University, Greater Noida, Uttar Pradesh, India.
[2]Assistant Professor, School of Business Studies, Sharda University, Greater Noida, Uttar Pradesh, India.

Received Date: July 01, 2025
Accepted Date: July 22, 2025
Published Date: July 26, 2025

Citation: Bhupinder Singh, Ritu Gautam. Progression of Health and Wellness: Artificial Intelligence (AI) and Deep Learning (DL) for Precision Medicines. Emerging Trends in Personalized Medicines. 2025; 2(2): 1–5p.

ARTIFICIAL INTELLIGENCE IN PRECISION MEDICINE: ENHANCING DIAGNOSTIC ACCURACY

By analyzing huge amounts of medical data to identify patterns and anomalies that may go

unnoticed by human experts, AI technologies have greatly improved diagnostic accuracy. With their ability to extract patterns from large datasets, machine learning algorithms are well-suited to help healthcare providers make informed decisions based on a wide range of data sources, including electronic health records (EHRs), medical images, and genomic sequences. For example, deep learning-based models have shown impressive results in image-based disease detection, such as cancer [1]. For detection in breast cancer, improved identification of malignant tumors in the form of mammograms has enabled AI algorithms to outperform the yearly work of radiologists, resulting in early interventions and improved survival rates [2].

PERSONALIZED TREATMENT PLANS

Precision medicine seeks to replace one-size-fits-all treatment. AI-based algorithms can process patient data, such as genetic profiles, to suggest individualized treatment approaches. Such models consider each patient's individual genetic profile, lifestyle and medical history to identify the most effective therapies. For instance, AI can recommend an optimal drug for a specific patient by predicting the patient response to certain drugs, allowing clinicians to choose drugs with the highest probability of success and lowest probability of adverse effects [3]. This strategy has been especially beneficial in oncology, where targeted therapies driven by genetic mutations have demonstrated great efficacy in enhancing patient outcomes.

THE MAKING OF A NEW DRUG

AI and deep learning techniques have sped up drug discovery and development processes by predicting potential drug candidates and predicting their effectiveness. Conventional drug discovery is slow and costly, whereas AI models can quickly search through large chemical banks and find molecules capable of producing the desired therapeutic outcome. Such AI-based methods can also forecast the interactions of a drug with specific proteins or biological pathways, minimizing the chances of failure during clinical trials [4]. AI may also be applied toward discovering existing drugs with potential use in new indications, providing a cost-efficient approach to drug development and treatment [5].

DEEP LEARNING AND GENOMICS: DECODING GENOMIC DATA

Deep learning methods have provided tremendous value to the area of genomics, where complex genomic data can be modeled to derive useful information. Identifying and predicting the functional impact of genetic variants associated with diseases using deep learning models AI algorithms, trained on whole-genome sequences, can identify rare mutations that could give rise to a person's condition, leading to early diagnosis, and tailored interventions. In addition, the ability to integrate genomic data with other omics data, including transcriptomics and proteomics, may offer models insights into disease mechanisms [6].

GENOMIC PREDICTIONS AND RISK MODELING

Predictive genomics driven by AI can evaluate an individual's susceptibility to certain disorders as per genetics. AI models can detect genetic factors which improve the risk of chronic diseases, such as diabetes, cardiovascular disease, and neurodegeneration, by modeling massive genomic data sets [7]. With access to this data, healthcare providers can take preventive actions to eliminate risks and push for early treatments that will lead to better patient results while also driving down the cost of healthcare.

Gene Editing and Precision Therapies

Deep learning has also propelled the field of gene editing, especially in the context of CRISPR-based technologies. AI has found application in optimizing CRISPR guide RNAs (gRNAs), the sequences used to direct the CRISPR machinery to specific genomic targets. This ability is critical to the development of gene therapies for genetic diseases since precise targeting is necessary for therapeutic efficacy. The widespread utilization of precision gene editing approaches, aided by advancements in AI-driven techniques, has catalyzed the rational design and large-scale testing of innovative therapies [8].

AI IN THE PREVENTION OF DISEASE AND PROMOTION OF WELLNESS: EARLY DETECTION AND PREVENTION

AI's ability to process vast amounts of data and spot subtle trends could help with one of the most important parts of disease prevention. AI models can identify early indicators of diseases by analyzing longitudinal health data so that timely measures can be taken to prevent the progression of diseases. One such example of this is where AI algorithms analyze data derived from wearable devices and identify irregular heart rhythms that could point to an increased risk of cardiovascular events [9]. This enables healthcare providers to take preventive measures and make lifestyle adjustments to prevent the disease from occurring.

LIFESTYLE AND BEHAVIORAL INTERVENTIONS

They empower people to make healthier choices through tailored suggestions and insights. Artificial intelligence algorithms also help analyze vital health information, which can be tracked by wearable gadgets, such as smartwatches or waist belts, to assess physical activity, sleeping practices, and eating habits of an individual. AI can also process behavioral data and determine factors that promote unhealthy habits, leading to targeted interventions to promote positive behavior change [10]. By providing tailored solutions, these personalized wellness interventions enable individuals to regain a sense of control over their health and lifestyle choices, leading to improved quality of life and well-being.

MENTAL HEALTH SUPPORT

Big Data has the capacity to reshape mental health support through analytics and customization [11]. AI-powered models have also been developed to monitor social media activity, speech patterns, and physiological data to identify early indicators of mental health conditions including depression and anxiety. By recognizing those signals, AI-driven applications can provide timely support and interventions that reduce the burden of mental illness and promote overall well-being. Additionally, AI-based chatbots and virtual therapists provide affordable and immediate mental health services, especially in underserved regions where mental health professionals are scarce.

ETHICAL CONSIDERATIONS AND CHALLENGES: DATA PRIVACY AND SECURITY

AI and deep learning will probably be involved in studies and processes related to precision medicine; therefore, the data need to be protected. The process of collecting and analyzing large volumes of sensitive health data require strong protection to ensure patient information does not fall prey to unauthorized access and breaches. Maintaining patient trust and confidentiality requires ensuring that data is anonymized, encrypted, and compliant with data protection regulations [12]. Health organizations should focus on cybersecurity precautions to reduce risks from data exposure and to make sure AI technologies are used ethically.

BIAS AND FAIRNESS

These models can unintentionally continue biases reflected in the training data. Healthcare providers and researchers must be vigilant against bias in AI systems, as it can result in unequal diagnosis, treatment, or outcomes across demographic groups. This demands the creation of varied and representative databases that genuinely portray the population's variations. Moreover, continuous monitoring and validation of AI models are essential to detect and mitigate biases, promoting fair and equitable delivery of healthcare [13]. Transparent and explainable AI systems are deemed critical to achieving trust and accountability of precision medicine.

REGULATORY AND ETHICAL GOVERNANCE

AI technology is progressing at such an accelerated pace in all industries, including healthcare, so it is crucial to establish regulatory and ethical frameworks to guide the practice of AI in the healthcare setting. Policymakers need to set standards for use of AI technologies, ensuring responsible and safe use of them, such as algorithm transparency, accountability, and liability. Ethics – wider than privacy – should also include issues of patient autonomy and informed consent and what these AI-driven

decisions will mean for people in their day-to-day [14]. The ethical and responsible use of AI in precision medicine requires multidisciplinary collaboration among healthcare professionals, researchers, policymakers, and technology developers.

CONCLUSIONS AND PATH AHEAD

Artificial Intelligence and Deep Learning for Precision Medicine: Opening new paths to health and wellness further advancements in disease identification, treatment, and preventative measures can be anticipated as these technologies continue to evolve. These AI-powered approaches will allow for more individualized and effective interventions, ultimately enhancing patient outcomes and revolutionizing healthcare delivery. AI and deep learning are expected to play even bigger roles in precision medicine in the coming years, with improvements in the following areas:

- *Real-time Health Monitoring:* Wearable devices and sensors powered by AI will monitor vital signs and health parameters 24/7 for real-time detection of health issues and personalized interventions.
- *Integration of Multi-Omics:* The combination of various omics data (genomics, proteomics, metabolomics, etc.) will offer a comprehensive perspective on a patient's health, allowing for more accurate and tailored treatments.
- *AI-Driven Clinical Trials:* AI tools will simplify the design and execution of clinical trials, helping to select patients, make treatment predictions and otherwise improve the efficiency of drug development.
- *Patient Lace:* AI will be able to offer real-time personalized health offerings along with self-management headwear and exercises combining wearable tech and virtual doctor to help patients actively involve in their health care journey.

For AI now to further transform the realm of precision medicine, we must retain ethics, data privacy and fairness at the forefront of its deployment to ensure it serves and benefits all citizens and communities. Leveraging the power of AI and deep learning, this can usher in a future where precision medicine is a staple of health and wellness, transforming the trajectory of our quality of life and health outcomes.

REFERENCES

1. Singh B, Kaunert C. Computational thinking for innovative solutions and problem-solving techniques: Transforming conventional education to futuristic interdisciplinary higher education. In: Fonkam M, Vajjhala N, editors. Revolutionizing curricula through computational thinking, logic, and problem solving. Hershey (PA): IGI Global; 2024. p. 60–82. https://doi.org/10.4018/979-8-3693-1974-1.ch004.
2. Singh B, Vig K, Dutta PK, Kaunert C. Unraveling agile transformation for customer satisfaction in changing market conditions: Roadmap for industry embracing change in project management. In: Misra S, Jadeja R, Mittal M, editors. Practical approaches to agile project management. Hershey (PA): IGI Global; 2024. p. 305–21. https://doi.org/10.4018/979-8-3693-3318-1.ch017.
3. Singh B, Kaunert C. Wind and solar energy as renewable energy for sustainable global future: Projecting future multi-sector sustainable policies and innovation. In: Ara A, Thakore R, editors. Promoting multi-sector sustainability with policy and innovation. Hershey (PA): IGI Global; 2024. p. 210–45. https://doi.org/10.4018/979-8-3693-2113-3.ch009.
4. Singh B, Kaunert C. Aroma of highly smart Internet of Medical Things (IoMT) and lightweight EdgeTrust expansion medical care facilities for electronic healthcare systems: Fortified-chain architecture for remote patient monitoring and privacy protection beyond imagination. In: Hassan A, Bhattacharya P, Tikadar S, Dutta P, Sagayam M, editors. Lightweight digital trust architectures in the Internet of Medical Things (IoMT). Hershey (PA): IGI Global; 2024. p. 196–212. https://doi.org/10.4018/979-8-3693-2109-6.ch011.
5. Singh B, Jain V, Kaunert C, Dutta PK, Singh G. Privacy matters: espousing blockchain and artificial intelligence (AI) for consumer data protection on e-commerce platforms in ethical marketing. In: Saluja S, Nayyar V, Rojhe K, Sharma S, editors. Ethical marketing through data governance

standards and effective technology. Hershey (PA): IGI Global; 2024. p. 167–84. https://doi.org/10.4018/979-8-3693-2215-4.ch015.

6. Singh B, Dutta PK, Kaunert C. Replenish artificial intelligence in renewable energy for sustainable development: Lensing SDG 7 affordable and clean energy and SDG 13 climate actions with legal-financial advisory. In: Derbali A, editor. Social and ethical implications of AI in finance for sustainability. Hershey (PA): IGI Global; 2024. p. 198–227. https://doi.org/10.4018/979-8-3693-2881-1.ch009.
7. Singh B, Kaunert C. Augmented reality and virtual reality modules for mindfulness: Boosting emotional intelligence and mental wellness. In: Hiran K, Doshi R, Patel M, editors. Applications of virtual and augmented reality for health and wellbeing. Hershey (PA): IGI Global; 2024. p. 111–28. https://doi.org/10.4018/979-8-3693-1123-3.ch007.
8. Singh B. Lensing legal dynamics for examining responsibility and deliberation of generative AI-tethered technological privacy concerns: Infringements and use of personal data by nefarious actors. In: Ara A, Ara A, editors. Exploring the ethical implications of generative AI. Hershey (PA): IGI Global; 2024. p. 146–67. https://doi.org/10.4018/979-8-3693-1565-1.ch009.
9. Singh B. Social cognition of incarcerated women and children: addressing exposure to infectious diseases and legal outcomes. In: Reddy K, editor. Principles and clinical interventions in social cognition. Hershey (PA): IGI Global; 2024. p. 236–51. https://doi.org/10.4018/979-8-3693-1265-0.ch014.
10. Singh B, Kaunert C. Salvaging responsible consumption and production of food in the hospitality industry: Harnessing machine learning and deep learning for zero food waste. In: Singh A, Tyagi P, Garg A, editors. Sustainable disposal methods of food wastes in hospitality operations. Hershey (PA): IGI Global; 2024. p. 176–92. https://doi.org/10.4018/979-8-3693-2181-2.ch012.
11. Singh B. Evolutionary global neuroscience for cognition and brain health: Strengthening innovation in brain science. In: Prabhakar P, editor. Biomedical research developments for improved healthcare. Hershey (PA): IGI Global; 2024. p. 246–72. https://doi.org/10.4018/979-8-3693-1922-2.ch012.
12. Singh B, Kaunert C. Revealing green finance mobilization: harnessing FinTech and blockchain innovations to surmount barriers and foster new investment avenues. In: Jafar S, Rodriguez R, Kannan H, Akhtar S, Plugmann P, editors. Harnessing blockchain-digital twin fusion for sustainable investments. Hershey (PA): IGI Global; 2024. p. 265–86. https://doi.org/10.4018/979-8-3693-1878-2.ch011.
13. Singh B, Kaunert C. Harnessing sustainable agriculture through climate-smart technologies: Artificial intelligence for climate preservation and futuristic trends. In: Kannan H, Rodriguez R, Paprika Z, Ade-Ibijola A, editors. Exploring ethical dimensions of environmental sustainability and use of AI. Hershey (PA): IGI Global; 2024. p. 214–39. https://doi.org/10.4018/979-8-3693-0892-9.ch011.
14. Singh B. Blockchain technology in renovating healthcare: Legal and future perspectives. In: Kaushik K, Dahiya S, Aggarwal S, Dwivedi A, editors. Revolutionizing healthcare through artificial intelligence and Internet of Things applications. Hershey (PA): IGI Global; 2023. p. 177–86. https://doi.org/10.4018/978-1-6684-5422-0.ch012.

