



EDITORIAL

Moment of Convergence: Training of medical graduates in bridging the gap between evolving technology in Artificial Intelligence-Machine Learning (AI-ML) & health care education

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Artificial intelligence (AI) gives healthcare professionals ease when it comes to monitoring, understanding and analyzing needs and lifestyle patterns. The application of AI in recent years has effectively improved Cancer screening, Tuberculosis diagnosis, Diabetic retinopathy screening, Chronic Obstructive Pulmonary Disease (COPD) diagnosis and management. It can also aid in the early detection and prevention of diseases by capturing the vitals of patients. Natural language processing (NLP)-based virtual personal assistants can help in appointment scheduling, monitoring, and understanding the needs of patients.

By 2040, there will be a major impact of health on the global economy & almost 1/4th of the economy generated by Artificial Intelligence-Machine Learning (AI-ML) will be through the latter's health applications.

AI for "Precision medicine, sometimes known as 'personalized medicine' is an innovative approach & increasingly gaining momentum. It comprises tailoring disease prevention and treatment that takes into account differences in **people's genes, environments, and lifestyles. Health-related applications on AI-ML are far-reaching, such as:**

- a) Diagnostics, Devices- artificial retina, Imaging, histo-pathology, etc.
- b) AI for hospital administration
 1. Fraud detection and prevention
 2. Supply chain management

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3. Automated documentation and data entry
4. Readmission risk prediction
5. Clinical decision support system
6. Patient engagement and remote monitoring
7. Operational efficiency through automation

The involvement of tech companies in healthcare is consumer-like. This is part of a broader trend that is driving change in healthcare. Digital technology and data are putting more information in patients' hands, increasing their data needs.

Evolving technology - Generative and Transformative

Generative Technology

Generative technologies involve the creation of new content, data, or information. These systems are capable of producing outputs that are not explicitly programmed but are instead generated based on patterns and learning from data such as:

- Generative adversarial networks (GANs) - GANs consist of two neural networks, a generator, and a discriminator, that are trained together competitively. For example, DeepArt and This Person Does Not Exist use GANs to generate realistic images of non-existent people or artwork.
- Natural Language Generation (NLG) – NLG is a technology that converts structured data into human-readable text. For example, chatbots, news article generation,

and report writing systems often use NLG to create content.

- Style Transfer Algorithms - These algorithms can take the artistic style of one image and apply it to another, creating visually appealing compositions. For example, PRISMA is an app that uses neural networks to transform photos into artworks by emulating famous painting styles.

Transformative Technology

Transformative technologies bring about significant changes and innovations, often reshaping entire industries or aspects of society such as:

AI-ML involves the development of systems that can learn and make decisions without explicit programming. For example, predictive analytics, image and speech recognition, and autonomous vehicles are transformative applications of AI and ML.

Blockchain Technology - A decentralized and distributed ledger technology that ensures secure and transparent transactions without the need for intermediaries. For example, cryptocurrencies like Bitcoin and Ethereum use blockchain for secure and transparent financial transactions.

5G Technology - The fifth generation of wireless technology that provides faster and more reliable communication, enabling the Internet of Things (IoT) and other advanced applications. For example, enhanced mobile broadband, low-latency communications, and support for massive IoT connectivity are transformative aspects of 5G.

These examples illustrate the dynamic nature of technology, with generative technologies creating new content and transformative technologies reshaping how we interact with the world.

Healthcare education and practice ***Medical education – implementation, evaluation, and feedback***

The implementation of medical education involves the design and execution of educational programs for aspiring healthcare professionals. It encompasses the delivery of content, practical training, and the use of technology to enhance learning experiences, for example, virtual reality (VR) simulations, online learning platforms, etc.

Evaluation in medical education involves assessing the knowledge, skills, and competencies of students to ensure they meet the required standards. Various assessment methods are employed to measure the effectiveness of the educational process. For example, objective structured clinical examination (OSCE), computer-based testing (CBT), etc.

Feedback is an essential component of medical education, providing learners with information on their performance, identifying areas for improvement, and reinforcing positive aspects of their work for example, obtaining feedback from peers, instructors, and self-assessment to provide a holistic view of a learner's performance offers a well-rounded perspective and helps learners understand their strengths and weaknesses.

Health Administration

AI and ML have the potential to significantly enhance efficiency and reduce costs in hospital administration.

Predictive analysis for patient flow:

ML algorithms can analyze historical data to predict patient admissions, discharges, and transfers. This helps in optimizing bed utilization, reducing wait times, and improving overall patient flow (Figure 1).

It's important to note that integrating AI and ML into healthcare requires a deep understanding of both medical principles and technology. Therefore, combining a medical background with specialization in AI and ML can position a professional to contribute significantly to the intersection of medicine and technology.

Clinicians predict that technological literacy will be the most important capability for doctors and nurses in 10 years. However, there is currently a maze on whether could it be integrated. Many clinicians report on being overwhelmed by the sheer amount of data and information they are expected to take on. This has led to concerns that, increasing the role of health technology will take up more of their time rather than saving it. There is also widespread support amongst clinicians to overhaul education and training to ensure they can keep pace with the rapid rate of technological advances. Thus,

- 56% of clinicians globally predict they will base most of their clinical decisions using tools that utilize artificial intelligence.
- 69% report being overwhelmed with the current volume of data.
- 69% predict the widespread use of digital health technologies to become an even more challenging burden in the future.
- 83% believe training needs to be overhauled so they can keep pace with technological advancements [1].

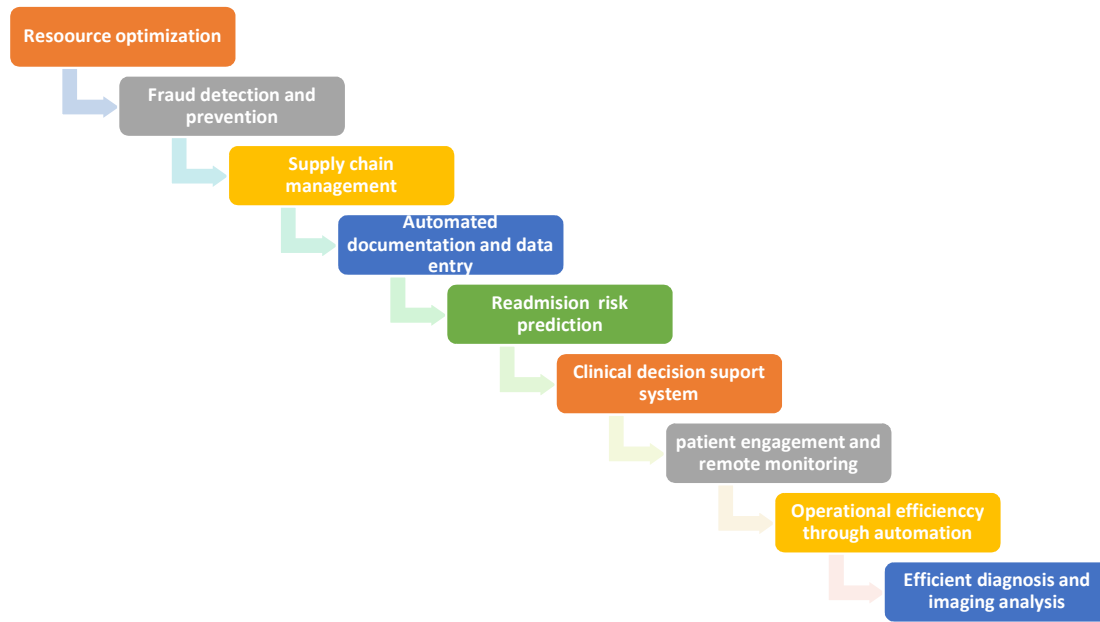


Figure 1. Machine Learning (ML) algorithm

Moment of convergence

There is increasing availability of multi-modal data (genomics, economic, demographic, clinical and phenotypic), coupled with technology innovations in mobile, internet of things (IoT), computing power and data security. It heralds a moment of convergence between healthcare and technology to fundamentally transform models of healthcare delivery through AI-augmented healthcare systems, in particular, Cloud Computing.

AI provides

- Real-time feedback,
- Accurate evaluation, and
- Can be used to monitor teaching quality.

Economic impact

In 2021, AI in the healthcare market was worth around 11 billion US dollars worldwide. It has been forecast that the global healthcare AI market will be worth

almost 188 billion US dollars by 2030, increasing at a compound annual growth rate of 37% from 2022 to 2030 [2]. Satya Nadella's statement aligns with the widespread recognition of AI's transformative impact on various industries, particularly in healthcare. The ability of AI to analyze large datasets, identify patterns, and assist in decision-making processes has made it a valuable tool for improving medical outcomes and optimizing healthcare systems [3].

The statement made by Tim Cook, the CEO of Apple, about healthcare being a business opportunity and its significance in the economy. However, it's not uncommon for tech leaders, including those from companies like Apple, to express interest in the intersection of technology and healthcare. The statement attributed to Google Health aligns with the general sentiment within the technology and healthcare industries regarding the transformative potential of AI. Google

Health, as part of Google's broader efforts in healthcare and life sciences, has been actively exploring ways in which AI and machine learning can contribute to advancements in medicine.

It is important to note, that, statements from companies like Google Health reflect their strategic vision and commitment to leveraging technology for the betterment of healthcare. The actual impact and implementation of AI in medicine may vary, and ongoing research and development are crucial for addressing challenges and ensuring the responsible and effective integration of AI technologies into healthcare practices.

Current limitation

A possible reason why AI has not yet been applied widely to practical teaching may be the disciplinary gap between developers and end-users.

The National Board of Examination in Medical Sciences (NBEMS) is examining ways on the modalities of convergence between AI-ML & training in medicine.

Conflict of interest

The authors declares that they do not have conflict of interest.

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