

Role of Artificial intelligence and machine learning in Indian System of medicine.

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Submission : 25.04.2024

Publication : 31.05.2024



In this 21st century, technology is being rapidly reaching the zenith. Artificial Intelligence and Machine learning has been a boon to mankind in every field of education and research.⁽¹⁾ AI has increased the opportunity and challenges in different sectors. India is currently developing the potential to automate multiple tasks and expecting more human interventions, especially in health sectors, by taking initiatives such as accessible applications and mobile healthcare facilities in rural and urban areas.⁽²⁾ Government of India has also taken various efforts and initiative in establishment of Machine learning and AI. AI technology has been helpful in COVID-19 period from day one.⁽³⁾ In the same way, AI can be most beneficial in healthcare sectors in different domains such as hospitals, pharmaceuticals, diagnosis of diseases, online or phone consultation, supply of medicines, planning line of treatment, research and statistics, etc.⁽⁴⁾

The Indian System of medicine is gaining more and more importance as many people now a days are adopting traditional medicine and wants holistic approach towards treatment.⁽⁵⁾ According to WHO around 80% of total Indian population are using traditional medicine in some or the other way. The Indian system includes Ayurveda, Yoga, Unani, Siddha, Sowa- Rigpa and Homeopathy. AYUSH being the oldest system of medicine, some of our manuscripts, Vedic books, evidence are lost or very rarely available. In such cases, there is lack of strong scientific evidence like modern science. AI and machine learning can bring the data in just a click. Ayurveda which is the oldest system of medicine is itself an ocean of knowledge and various principles where there can be a constant research and advancement. AI has made Ayurveda reach to every person which is as simple as opening a book.

AI, and database systems have a promising role in the field of Ayurveda. This tool allows for precise knowledge searches utilizing any number of search string combinations to hunt for information related to diseases, causative factors, symptoms, treatment protocols, therapeutic interventions, lifestyle changes, and different treatment modalities.⁽⁶⁾ AI and ML can assist to in a new era of efficient, rational, and competent drug development in the sector of Ayurveda pharmaceuticals.

AI also has a massive platform in the field of research. Accurate and systematic data collection is a tedious task.

More ethical and deep the data is, more reliable is the research. AI and machine learning has ocean of database, which can also be used in clinical trials, data amplification, invention of any new drug, re-evaluate the effect of different herbs, its identification, statistical data analysis, etc.⁽⁷⁾

AI has adopted advancement and a major role in education and academics such as,

Teleconferences

E-CMEs

e-lecturing

Research

Remote or robotic surgery⁽⁷⁾

Various research has been conducted for Ayurveda-based disease diagnosis using ML. There is a wide range of applications in the market for Dosha evaluation example,

- **Nadi parikshan** etc. for assisting Ayurveda physicians in appropriate evaluation of clinical information to make accurate diagnosis and treatment, it is a non-invasive procedure. It helps in quantitative detection of characteristics of the pulse that may be forceful or weak which in turn helps in measuring the variation between normal and abnormal pulse patterns.⁽⁸⁾ If one is going through persistent health issues, Nadi Nidan will help in finding out the imbalance and will also give warning signals about potential health issues one may face in the near future.⁽⁸⁾

- **Prakruti Parikshan:** In Ayurveda, body works on VAT, PITTA and KAPH doshas, they are only responsible for different prakruti. Trividha Pariksha is a method to identify the Prakruti and the disease. By combining Prakruti assessment with genetic data, research in Ayurgenomics aims to provide better-individualized treatment protocols.⁽⁴⁾ Studies have shown a correlation between specific genotypes and Prakruti types. Expert systems and help design effective treatment strategies.⁽⁹⁾ Such clinical decision support systems are bridging technology with the wisdom of Ayurveda for precise, individualized solutions. Also, with an ample number of journals, e-books, and indexing units such as Digital Helpline for Ayurveda Research Articles (DHARA), AYUSH Research portal, Traditional Knowledge Digital Library (TKDL), PubMed, e- library resources become easily available and accessible.

• **Manuscripts Translation:** There are more than 2000 manuscripts in Ayurveda which are yet to be worked on. With the help of AI manuscripts can be translated in several languages to expand this successful ancient pathy. This also provides a firm base to ayurveda to develop as an evidence-based treatment. The Ministry of Ayush's digital efforts have been crucial in reforming these traditional medical systems by enhancing education, research quality, and accessibility of Ayush healthcare services.

• **AI in Rasa-shastra:** To overcome the issues of quality control, safety and efficacy it is possible to formulate standard study protocols wherein use of new machineries will help us to understand the complex processes. Quality Control and standardization have always been issues regarding Bhasmas and Rasaushdhis due to lack of standard protocols.⁽²⁾

• **Drug discovery acceleration:** AI learning models scanning molecular structures and anticipate potential drug candidates, depleting the time and cost related with discovery of the new drug. Identification of classical drugs with their Sanskrit nomenclature and different varieties available of same plant family.

2. Detailed description of drugs including botanical information and Rasa, Guna, Virya, Vipaka, Prabhava along with its standardization across the globe.

3. After identification and description of drugs, it enables us to directly use the drug in the disease.

4. For drug discovery aspect- Data from sources such as research articles, patents, clinical trials, patient records, and Samhitas will be fed into an AI platform, which will provide both practical usage and medications that are already known and described in classical writings.⁽²⁾

• **The “Ayush Grid”,** an Digital Health Platform launched by the Ministry of AYUSH in 2018, works in line with the Ayushman Bharat Digital Mission. Its prior deal is to transform the AYUSH sector to provide efficient, holistic, accessible, affordable, and quality services through a safe and interoperable digital ecosystem leveraging AI and other digital tools.⁽⁶⁾

• AI is always a gamewinner by automatic identification and classification of Indian medicinal plant species using methodology like neural networks, support vector machines, and deep learning.

• Integrating machine learning methods or AI to extract valuable information from Ayush datasets, paving the way for future research on drug discovery, ethno pharmacology, pharmacodynamics, and drug precision.⁽⁶⁾

The technology should not only be used to maximize the potential of Ayurveda but also to respect and preserve

physicians' integrity and ability, as the core principles of Ayurveda give utmost importance to *Bhishaka* (~physician) in the ethical principle for treatment protocol.⁽¹⁰⁾ One of the main motives of introducing the modern medical technology with Ayurveda is to save amount of time people spend during the diagnosis process and allowing for effective diagnosis and treatment without changing the principle of Ayurveda. But yes, the authentic knowledge and principle should not be negotiated and one must maintain the roots.⁽¹¹⁾

Research plays a crucial role in modelling the responsible integration of AI into the Ayush healthcare ecosystem while considering ethical aspects such as algorithmic bias etc.

Overall, the integration of AI and machine learning into Ayurveda and traditional systems of medicine holds tremendous promise for enhancing patient care, improving treatment outcomes, and preserving the rich heritage of these ancient healing traditions. In these upcoming days, the bridge between Ayurveda has AI has brought drastic changes and improvement. The modern era has taken a U turn towards traditional system with advancement of knowledge, this will not only help to grow Ayurveda but will also expand the market and economy.

Acknowledgments : Dr. Sneha Sunil Tanpathak
Department of Rachana Sharir. Dr. G.D Pol Foundation's
YMT Ayurvedic Medical College, Kharghar, Navi Mumbai

Conflict of Interest: Nil

Source of Support: Nil

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