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EDITORIAL

Impact of Artificial Intelligence in Indian Health Sector — Training and Economy

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It is indeed significant news that India is taking over the chair of the Global Partnership on Artificial Intelligence (GPAI). This international initiative aims to promote the responsible and human-centric development and use of Artificial Intelligence (AI), which is a rapidly growing field with enormous potential to transform various sectors and industries.

AI has been catalyzing the tech landscape worldwide and pushing the envelope of human possibilities. Its application ranges from healthcare to finance to transportation, and it has the potential to improve efficiency, accuracy, and productivity across various sectors.

For India, AI is a kinetic enabler for the growth of the technology ecosystem, and it can be a force multiplier in achieving its goal of becoming a $1 Trillion Digital Economy by 2025. With India's diverse talent pool and a growing number of startups, the country has the potential to become a leading hub for AI development and innovation [1].

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As the chair of GPAI, India will have a significant role in shaping the international discourse on AI governance and ethics. It will be crucial to ensure that AI is developed and used responsibly, with the protection of human rights and dignity at its core. Additionally, India can use its position to drive collaborations and partnerships among member countries to promote the development of AI solutions that address global challenges.

Overall, India's leadership in GPAI can be a significant step towards harnessing the full potential of AI for the betterment of humanity while ensuring its responsible and ethical use.

Artificial Intelligence (AI) has the potential to transform the Indian health economy by improving access to healthcare, reducing costs, and increasing the efficiency of healthcare delivery. India is home to a large population, and the healthcare sector faces significant challenges in providing quality care to all citizens. AI can help address some of these challenges by providing innovative solutions and enhancing the capabilities of healthcare providers.

One of the significant applications of AI in healthcare is predictive analytics, which can help in early detection and prevention of diseases. AI-powered algorithms can analyze patient data and identify patterns that can help doctors diagnose diseases at an early stage, reducing the chances of complications and improving patient outcomes. AI can also help in the development of personalized medicine, where treatments are tailored to the specific needs of individual patients.

AI can also be used to improve the efficiency of healthcare delivery in India. For instance, telemedicine, which involves providing remote medical consultations, can help patients in remote areas access healthcare services. AI-powered chatbots and virtual assistants can also be used to provide patients with basic medical advice, reducing the burden on healthcare providers.

Moreover, AI can help in the management of healthcare resources and the reduction of healthcare costs. For example, AI-powered predictive maintenance can help hospitals maintain medical equipment, reducing the chances of breakdowns and downtime. AI-powered supply chain management can also help in the efficient management of medical supplies, reducing wastage and ensuring that healthcare providers have the necessary resources to provide quality care (Fig. 1).

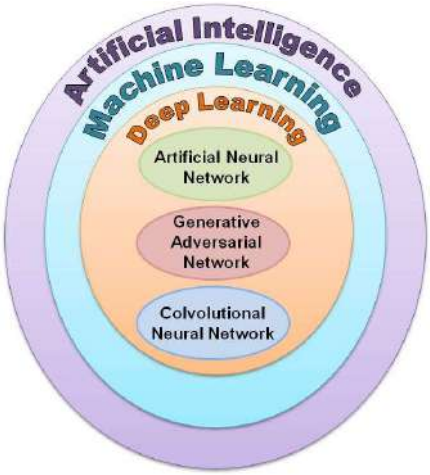

Fig. 1. AI & ML — Structure

AI is expected to add USD $967 Bn to Indian economy by 2035 and USD 450–500 billion to India's GDP by 2025, accounting for 10% of the country's USD 5 trillion GDP target.

It works in collaboration with partners and international organisations, leading experts from industry, civil society, governments, and academia to collaborate to promote responsible evolution of AI and guide the responsible development and use of AI, grounded in human rights, inclusion, diversity, innovation, and economic growth.

Artificial Intelligence (AI) and Machine Learning (ML) are rapidly emerging fields in India, with significant potential to transform various sectors, including healthcare, finance, education, and agriculture [2].

- **In healthcare,** AI and ML can be used for disease diagnosis, medical image analysis, drug discovery, and personalized medicine. Several Indian companies and startups are developing AI-powered healthcare solutions, such as remote patient monitoring, telemedicine, and health chatbots.
- **In finance,** AI and ML can be used for fraud detection, risk assessment, and investment analysis. Several Indian banks and financial institutions are using AI and ML-powered tools for credit scoring, fraud detection, and customer service.
- **In education,** AI and ML can be used for personalized learning, student assessment, and educational research. Several Indian edtech companies are developing AI-powered learning solutions that adapt to individual students' needs and preferences.
- **In agriculture,** AI and ML can be used for crop monitoring, yield prediction, and pest management. Several Indian startups and organizations are developing AI-powered tools for precision

agriculture, such as crop monitoring using drones and satellite imaging.

The Indian government is also taking initiatives to promote the adoption and development of AI and ML in the country. The government has launched the National AI Portal to promote research, innovation, and development in AI and ML. Additionally, the government has also established the Centre of Excellence in AI and Robotics, which aims to promote research and development in AI and Robotics.

AI and ML have significant potential to transform various sectors in India, and there is a growing interest and investment in these fields in the country.

AI and ML in Medical Science

AI and ML are rapidly emerging fields in medical science in India, with significant potential to transform various aspects of healthcare delivery, including diagnosis, treatment, drug discovery, and patient care.

- One of the key applications of AI and ML in medical science in India is medical imaging analysis. AI and ML-powered tools can help radiologists and other healthcare professionals to analyze medical images, such as X-rays, CT scans, and MRIs, with greater accuracy and speed. Several Indian startups and companies are developing AI-powered medical imaging solutions that can assist in the diagnosis of diseases such as cancer, tuberculosis, and cardiovascular diseases.
- Another area where AI and ML are being increasingly used in medical science in India is drug discovery. AI and ML-powered tools can help in the identification of potential drug candidates, prediction of drug efficacy, and optimization of drug development processes. Several Indian companies and startups are developing AI-powered drug discovery platforms that can accelerate the drug discovery process and reduce costs.
- AI and ML are also being used in patient care in India. AI-powered chatbots and virtual assistants can help patients to access healthcare services, such as appointment scheduling, medication reminders, and health monitoring. Several Indian startups are developing AI-powered healthcare platforms that connect patients with healthcare providers and provide personalized care.
- In addition, AI and ML are being used in medical research in India. AI-powered tools can help researchers to analyze large datasets, such as genomics data and clinical trial data, with greater efficiency and accuracy. This can lead to the development of new treatments and therapies for various diseases.

AI and ML in Pharmacy

AI and ML are emerging fields in pharmacy in India, with significant potential to transform various aspects of the

pharmaceutical industry, including drug discovery, development, and manufacturing.

- One of the key applications of AI and ML in pharmacy in India is drug discovery. AI and ML-powered tools can help in the identification of potential drug candidates, prediction of drug efficacy, and optimization of drug development processes. This can help in the development of new drugs and therapies for various diseases. Several Indian companies and startups are developing AI-powered drug discovery platforms that can accelerate the drug discovery process and reduce costs.
- Another area where AI and ML are being increasingly used in pharmacy in India is drug development. AI and ML-powered tools can help in the design of clinical trials, prediction of drug safety, and optimization of drug dosage. This can help in the development of safer and more effective drugs. Several Indian companies are using AI and ML to optimize drug formulations and dosage regimens.
- AI and ML are also being used in drug manufacturing in India. AI-powered tools can help in process optimization, quality control, and supply chain management. This can help in the production of high-quality and cost-effective drugs. Several Indian pharmaceutical companies are using AI and ML to improve the efficiency and effectiveness of their manufacturing processes.
- In addition, AI and ML are being used in pharmacovigilance in India. AI-powered tools can help in the detection and reporting of adverse drug reactions, drug interactions, and medication errors. This can help in the prevention of drug-related harm to patients. Several Indian companies and startups are developing AI-powered pharmacovigilance platforms that can improve drug safety and patient outcomes.

AI and ML — Economy booster

AI and ML have significant potential to boost the economy in India in several ways, including increasing productivity, driving innovation, and creating new jobs.

- One of the key ways in which AI and ML can boost productivity in India is through process automation. AI-powered tools can help automate repetitive and time-consuming tasks, such as data entry and processing, customer service, and inventory management. This can help businesses to streamline their operations, reduce costs, and improve efficiency.
- Another way in which AI and ML can boost the economy in India is by driving innovation. AI-powered tools can help businesses to develop new products and services, improve existing ones, and enter new markets. This can help businesses to

stay competitive and grow their market share.

- AI and ML can also create new jobs in India. As businesses adopt AI and ML technologies, there will be a growing demand for skilled professionals, such as data scientists, machine learning engineers, and AI researchers. This can create new employment opportunities for Indians and help to reduce unemployment in the country.
- In addition, AI and ML can have a significant impact on various sectors of the Indian economy, such as healthcare, education, agriculture, and transportation. AI-powered solutions can help in the delivery of high-quality and personalized healthcare services, improve access to education, increase agricultural productivity, and enhance transportation safety and efficiency.

AI — Virtual assistance to healthcare professionals

Artificial intelligence gives healthcare professionals ease when it comes to monitoring, understanding and analyzing the 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 diagnosis and management. The use of Machine Learning-based deep-learning algorithms can provide valuable insights to healthcare providers in deciding the course of action and strategies for patients. It can also aid in the early detection and prevention of diseases by capturing the vitals of patients. NLP-based virtual personal assistants can help in appointment scheduling, monitoring, understanding the needs of patients [2] (Fig. 2).

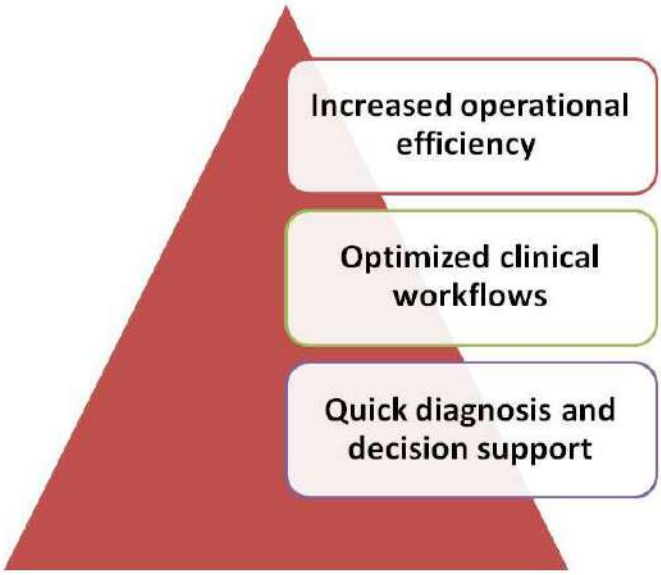

Fig. 2. AI – Virtual Assistance to Health Care Professionals

India has the potential to become a global leader in health science AI if it can develop a comprehensive strategy to leverage its strengths in health care, technology, and AI. Here are some key steps that could help India achieve this goal (Fig. 3):

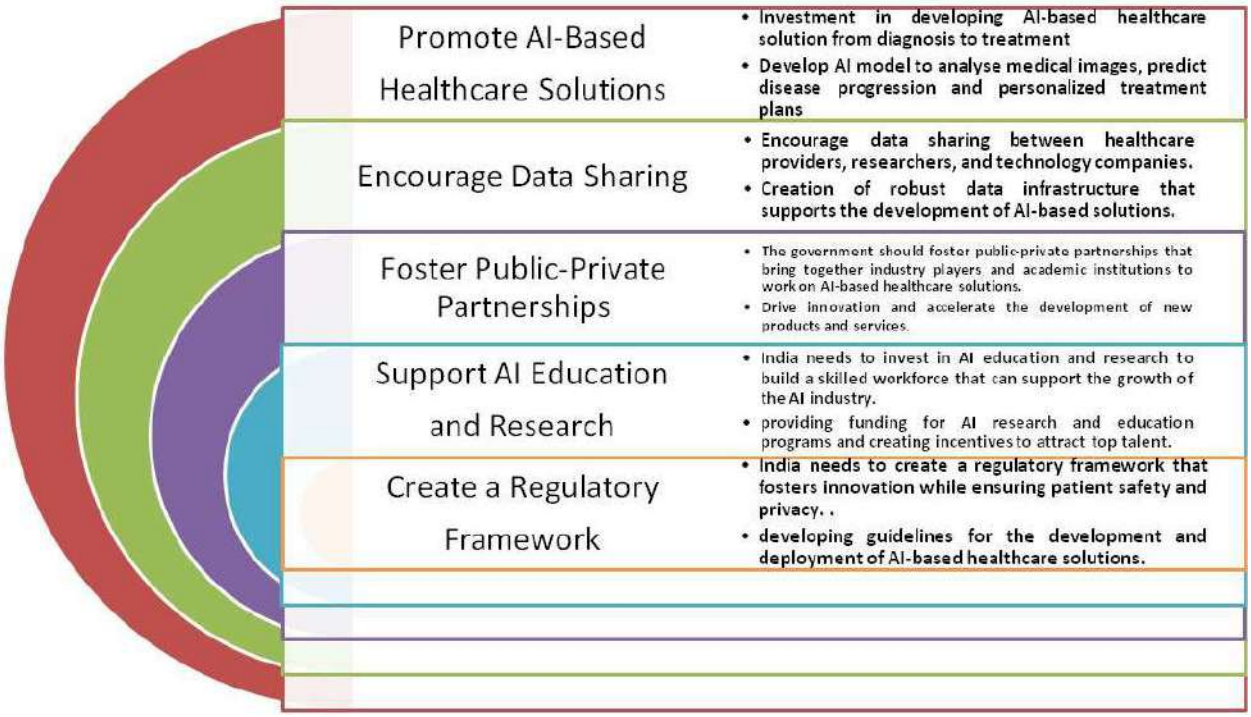

Fig. 3. Steps can be taken to promote AI in Medical Sciences

By following the step mentioned in Fig. 3, India can create a thriving AI ecosystem that supports the development of innovative healthcare solutions and establishes it as a global leader in health science AI (Figs. 4 and 5).

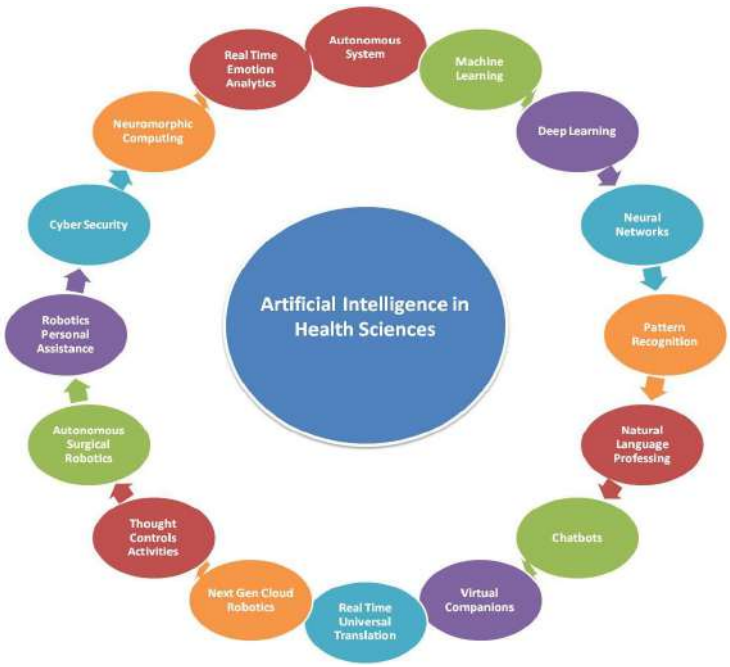

Fig. 4. Spectrum of AI in Medical Sciences

Fig. 5. Applications of AI in Medical Sciences

Role of National Board of Examination in Health Sciences (NBEMS) in promoting AI in post-graduate training

- The formation of NBEMS was established by the Government of India to standardize postgraduate medical education and examination in the country.
- In recent years, with the growing importance of artificial intelligence

(AI) in the field of medicine, there has been a significant increase in the demand for postgraduate courses in AI in medical sciences.

- In this context, the role of the NBE can be significant in running postgraduate courses in AI in medical sciences (Fig. 6).

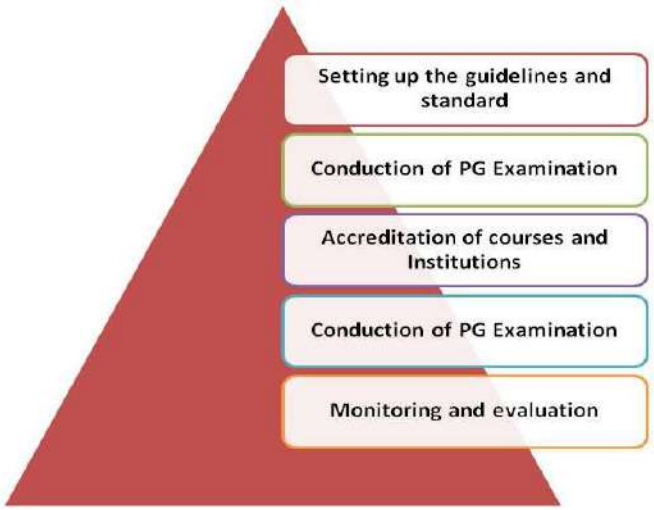

Fig. 6. Some possible roles of the NBE in running postgraduate courses in AI in medical sciences.

Some possible roles of the NBE in running postgraduate courses in AI in medical sciences could include:

- Setting up guidelines and standards: The NBE could set up guidelines and standards for the curriculum, teaching, and assessment methods for postgraduate courses in AI in medical sciences. This could help ensure that the courses are of high quality and meet the requirements of the medical profession.
- Conducting entrance examinations: The NBE could conduct entrance examinations for admission to postgraduate courses in AI in medical sciences. This could help ensure that only qualified candidates with a certain level of knowledge and skills are admitted to the courses.
- The NBE could play a crucial role in standardizing and regulating postgraduate courses in AI in medical sciences, which could help ensure that these courses are of high quality and produce qualified professionals who can contribute to the field of medicine.

Significant steps taken by the Govt. of India and Ministry of Health and Family Welfare (MOHFW) to promote AI in Medical Sciences

The Government of India and MOHFW have taken several significant steps to promote the use of Artificial Intelligence (AI) in medical sciences.

Here are some of the key initiatives:

1. **National Digital Health Mission (NDHM):** Launched in August 2020, NDHM is a comprehensive initiative aimed at creating a digital health ecosystem in India. One of its key components is the development of a National Health Stack, which includes a data exchange platform that can be leveraged to build AI-based applications and services.
2. **National AI Portal:** The National AI Portal, launched in 2020, is an online platform that aims to promote collaboration and innovation in AI development. It includes a dedicated section on healthcare, which provides resources and information on AI-based healthcare solutions.
3. **AIIMS-Wadhwani Institute for Artificial Intelligence:** The All India Institute of Medical Sciences (AIIMS) has partnered with the Wadhwani Institute for Artificial Intelligence to establish a research center dedicated to AI in healthcare. The center will focus on developing AI-based solutions for cancer screening, drug discovery, and other healthcare applications.
4. **Atal Innovation Mission:** The Atal Innovation Mission is a flagship initiative of the Government of India aimed at promoting innovation and entrepreneurship in the country. Under this program, several incubation centers have been established that focus on AI-based solutions for healthcare.
5. **National Cancer Tissue Biobank:** The National Cancer Tissue Biobank is an initiative launched by the Department of Biotechnology to collect and store tissue samples from cancer patients. The initiative aims to create a repository of samples that can be used for research purposes, including the development of AI-based solutions for cancer diagnosis and treatment.
6. **National Digital Health Blueprint (NDHB):** The NDHB, launched in 2019, outlines a comprehensive framework for the implementation of digital health initiatives in India. The blueprint includes provisions for the development and deployment of AI-based healthcare solutions.
7. **National Health Stack:** As part of the NDHM, the National Health Stack aims to create a digital infrastructure for healthcare data exchange. The stack includes provisions for the development of AI-based healthcare solutions, including predictive analytics and personalized medicine.
8. **Ayushman Bharat:** Ayushman Bharat is a national health protection scheme launched by the government in 2018. Under this scheme, the government aims to provide health insurance to over 100 million families in India. The scheme includes provisions for the development and deployment of AI-based healthcare solutions, such as telemedicine and predictive analytics.
9. **National Biomedical Resource Indigenization Consortium (NBRIC):** The NBRIC is an initiative launched by the Department of Biotechnology to promote the development of indigenous biomedical

resources in India. The consortium includes provisions for the development of AI-based healthcare solutions, such as drug discovery and personalized medicine.

10. **National Cancer Grid:** The National Cancer Grid is a network of cancer centers and research institutions in India. The network includes provisions for the development of AI-based solutions for cancer diagnosis and treatment.

Some possible steps that can be taken by Govt. of India and MOHFW to promote AI in Medical Sciences

- The development of AI and ML applications in medical sciences in India would benefit from government incentivization.
- There is still a need for more government incentives to promote the development of AI and ML applications in medical sciences in India. For example, the government could provide tax incentives or funding for companies and startups that are developing AI and ML-powered solutions for healthcare. This could encourage more investment in these technologies and help to accelerate their development and adoption.
- The government could also provide training and education programs to help healthcare professionals and researchers to develop the skills needed to work with AI and ML technologies. This could help to address the skills gap that currently exists in India and ensure that healthcare professionals are able to use these technologies effectively and safely.

Conclusion

India has the potential to become a global leader in health science AI if it can develop a comprehensive strategy to leverage its strengths in health care, technology, and AI. AI and ML have significant potential to transform various sectors in India, and there is a growing interest and investment in these fields in the country. India's leadership in GPAI can be a significant step towards harnessing the full potential of AI for the betterment of humanity while ensuring its responsible and ethical use. The initiatives taken by the MOHFW demonstrate its commitment to promoting the use of AI in healthcare. By supporting research and development in this area, the ministry aims to improve healthcare outcomes, reduce costs, and enhance the overall quality of care in India.

Conflicts of interest

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

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