Ethical Implication Of Artificial Intelligence And Robotics In Healthcare

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ABSTRACT

The integration of AI and robotics in healthcare has revolutionized medical practice, driven by artificial neural networks (ANN), deep learning (DL), and machine learning (ML). AI enhances diagnostic precision, streamlines clinical operations, and improves patient data management.

In medical imaging, AI ensures more precise, consistent, and efficient reporting, with cloud-based DL applications like Arterys transforming medical image interpretation. AI identifies lesions, provides diverse diagnoses, and generates automated medical reports, benefiting healthcare professionals. It also predicts medical conditions like cardiovascular risk, Alzheimer's disease, and drug therapy responses. In healthcare, robotics extends beyond patient care, including tasks like surgery, training, and non-patient roles like cleaning and medication delivery. Robots operate autonomously, ensuring consistent, error-free performance, particularly in hazardous settings. Ethical considerations emphasize accountability, data privacy, and bias mitigation. India has made significant progress in adopting AI in healthcare, enacting policies for data privacy, security, and standardization. Ethical principles are pivotal, focusing on accountability, autonomy, safety, trustworthiness, data quality, privacy, accessibility, equity, inclusiveness, validity, and ethical committees. Globally, AI and robotics in healthcare rapidly evolve with technological advancements and ethical standards. The United States and Europe have embraced AI, emphasizing ethical frameworks. India actively participates, aligning healthcare with AI, promising personalized, efficient, and effective global healthcare.

Key words: ethical implications, artificial intelligence, healthcare, robotics, ethical guidelines.

INTRODUCTION

Artificial intelligence and robotics are not new to existence; artificial intelligence was first introduced as early as 1950. [1] The pioneering advancement and development of artificial intelligence in various sectors, including healthcare, machinery, computer science, and industries Artificial intelligence has various subsidies. This encompasses AI technologies, AI applications, AI models, AI offerings, and AI-driven solutions. [2]

Machine learning (ML) is a subset of artificial intelligence that concentrates on developing algorithms and models enabling computers to acquire knowledge from data and improve their performance in specific tasks. Deep learning is a subfield within the broader domain of machine learning that takes its suggestions from the neural networks that make up the human brain's structure and operation. Deep neural networks are utilised within the domain of deep learning to acquire hierarchical data representations. These representations are formed by the implementation of algorithms, resulting in the creation of an artificial neural network (ANN). The ANN thereafter possesses the ability to autonomously learn and make decisions, akin to the cognitive processes of the human brain. An abbreviation CNN signifies convolutional neural networks. Convolutional neural networks (CNNs) are a kind of deep learning neural network specifically engineered for the purpose of handling visual data, including but not limited to image and video analysis. Convolutional neural networks (CNNs) have demonstrated notable efficacy in several tasks, including but not limited to picture categorization, object identification, and image recognition. [3]

Medical AI is being utilised in various domains within the medical field, such as medical image analysis, disease screening and prediction, clinical decision support, surgical robotics, health management, virtual medical assistants, and drug target screening. Over time, medical AI has progressed from initial rule-based algorithms to more advanced techniques like machine learning (ML) and deep learning (DL). [3,4,5,6] However, the majority of today's medical AI speeds up and assists humans in diagnosing, rather than replacing human doctors. (7) Along with the technology's rapid development, there are numerous threats and difficulties. Experts are now increasingly agreeing that the unfavourable effects of AI pose ethical problems. [8]

Instances of artificial intelligence governance include guidelines like the Asilomar AI Principles, the European Union's Ethical Guidelines for Reliable AI, China's Principles for Responsible AI in the Next Generation, and the World Health Organisation's Guidelines on Ethics and Governance in the Use of Artificial Intelligence for Health. [9, 10, 11, 12, 13]

In India, the Indian Council of Medical Research (ICMR) periodically provides ethical guidelines to encourage ethical and high-quality research. The Indian Council of Medical Research (ICMR) issued the National Ethical Guidelines for Biomedical and Health Research Involving Human Participants in 2017 and has also released updated ethical guidelines in 2023. [14] In 2019, the Central Drug Standard Control Organisation (CDSCO) released guidelines for the evaluation of new drugs and the conduct of clinical studies. These recommendations have been incorporated into India's new regulations related to clinical trials and pharmaceuticals, thereby granting them legal status. [15].

APPLICATION AND ROLE OF AI AND ROBOTICS IN HEALTHCARE

With the advent of cutting-edge AI technologies like machine learning (ML), deep learning (DL), and artificial neural networks (ANN), the field of artificial intelligence in medicine has flourished. By changing medicine, which was previously solely based on algorithms, better individual treatment is possible.

It improves diagnostic accuracy, efficiency in clinical operations, and workflow by assisting in data monitoring and providing recorded patient data, therapeutic monitoring, and the overall outcome of the individual. [16]

THE USE OF AI IN IMAGING APPLICATIONS

AI implies improving reliability, uniformity, and productivity in reporting medical imaging. Arterys is the first clinical cloud-based deep learning (DL) application approved by the Food and Drug Administration in the United States. CardioAI, introduced by Arterys in the medical industry in 2017, analyses cardiac MRI scans in seconds to yield data like cardiac ejection fraction. Further, it has advanced in imaging studies of liver, lung, chest, musculoskeletal X-rays, and non-contrast head CT

images [17].

APPLICATION OF AI IN CLINICAL CONDITIONS

Lesions may be recognised, differential diagnoses can be performed, and automated medical reports can be prepared using deep learning (DL). In 2017, Gargeya and Leng used DL to screen for diabetic retinopathy, with a sensitivity of 94% and a specificity of 98% using 5-fold cross-validation. [18] Similar results were found when Esteva et al. trained a convolutional neural network (CNN) to distinguish between melanoma and non-melanoma skin cancers. [19] Weng et al. showed that cardiovascular risk may be predicted using a convolutional neural network (CNN) in a cohort study.

When compared to the gold-standard methodology recommended by the American College of Cardiology, AI has been shown to improve cardiovascular risk prediction accuracy.[20] Drug therapy responses in Alzheimer's disease can also be correctly predicted using AI by analysing amyloid imaging data. [21, 22]

APPLICATION OF ROBOTICS IN HEALTHCARE

Laparoscopic surgery, surgical rehabilitation, and personal care assistance are just a few of the many clinical uses for medical robots. Medical cleaning, automated drug delivery, and equipment transfer are just a few examples of the non-patient-facing uses for robots in the healthcare industry. [23]

Robots' ability to operate independently of humans enables them to expedite formerly laborious tasks. [24] They are useful in conditions that are dangerous for people (e.g., ionising radiation or airborne illnesses). [25] Additionally, a robot's performance can be standardised to assure regular, error-free operation independent of factors like stress, exhaustion, and hunger. Particular tasks, such as monitoring one's blood pressure, may be more appealing to humans if they can perform them with the help of a robot. [23, 26]

The effectiveness of the robots in ensuring patient safety, data protection, and confidentiality to prevent breaches is necessary. The necessity of personal data for the analysis and working of the robots without the consent of the individual may remain unethical. [27, 28, 29, 30]

AI ETHICS IN HEALTHCARE AND BIOMEDICAL RESEARCH IN INDIA

The Indian government has undertaken initiatives to include artificial intelligence (AI) in diverse domains, such as healthcare. The primary objective of the National Health Policy (2017) is to emphasise the incorporation of digital health practices and the creation of a National Digital Health Authority to effectively utilise digital health technologies. The user's text does not contain any information to rewrite in an academic manner.

The National Digital Health Blueprint (NDHB 2019) expands upon the efforts to create a framework for electronic health records (EHRs) that adhere to global standards. It also aims to establish clear paths for data ownership while including ethical considerations such as data anonymization and de-identification.

The Digital Information Security in Healthcare Act (DISHA) 2018, which was introduced by the Ministry of Health and Family Welfare under the Government of India, represents an initiative aimed at ensuring the protection of electronic health data through measures such as privacy, confidentiality, security, and standardisation. Additionally, the act seeks to establish National Data Health Authorities and Health Information Exchanges to facilitate the effective management and exchange of health information.

The primary objective is to establish a set of standards and protocols governing the collection, organisation, communication, and utilisation of electronic medical

data. This is done with the aim of ensuring the accuracy, privacy, security, and confidentiality of digital health data. The user's text is not sufficient to be rewritten in an academic manner. Regulatory frameworks establish standards for evaluating the potential benefits and dangers of a product while also creating a conducive climate for its development and implementation. The Medical Device Rules of 2017, together with subsequent revisions in 2020, have broadened the scope of what constitutes a medical device. This now encompasses software and accessories that are specifically designed for medical use. Nevertheless, it is imperative to undertake further efforts in order to enhance and establish standardised protocols for the examination and verification of software as a medical device (SaMD) in the context of India.

ETHICAL IMPLICATIONS OF AI FOR BIOMEDICAL RESEARCH AND HEALTHCARE:

RESPONSIBILITY AND LIABILITY

It is stated as the requirement of an individual or organisation to account for its activities, accept responsibility for its acts, and publish the consequences honestly. Human in the Loop (HITL) is a notion more applicable to healthcare because it puts humans in a supervisory role. Responsibility can be distributed more fairly among team members working on AI for Health if they adhere to the Human in the Loop (HITL) principle as the project progresses. AI-based solutions may fail, underperform, or be wrong if left unsupervised, which could potentially hurt the recipient. [36]

AUTONOMY

The use of AI in healthcare has the potential to place decision-making in the hands of automated systems. Despite this, healthcare AI systems and human medical decision-making should remain under human control. The Human-in-the-Loop (HITL) model of AI technology allows for monitoring of system operation and effectiveness [37].

SAFETY AND RISK MINIMIZATION

The risks of using AI in medical studies and treatment depend on the specific model or approach taken. Humans in the loop (HITL) make supervised AI more effective than unsupervised AI. Patients' and participants' rights to privacy and autonomy, as well as their physical and emotional well-being, must be guaranteed at all times.

TRUSTWORTHINESS

The desirable characteristic of any diagnostic or prognostic tool intended for use in AI healthcare is to possess this quality. In order to enhance the effectiveness of AI utilisation, it is important for physicians and healthcare professionals to possess a straightforward, structured, and dependable method for assessing the accuracy and consistency of AI technology. The requirement is that it must be in accordance with the law. That is to say, it is imperative for the entity to conform to all relevant legal statutes and regulations in order to guarantee compliance with ethical concepts and values upheld by society.

Artificial intelligence (AI) ought to establish and foster confidence throughout the broader public by embracing ethical standards across all phases of its development. The need is for the information to possess both reliability and validity. AI technologies that are produced outside of India should have an ethical obligation to exhibit explicit transparency akin to technologies developed within the country, as well as adhere to legal requirements.

OPTIMIZATION OF DATA QUALITY (BIAS)

The data is utilised to train and test the AI. When the data is insufficiently large, it might lead to concerns such as data bias, discrimination, and so on. Data bias is seen as the most serious challenge to data-driven

technologies, such as AI for health. The researchers must ensure the quality of the data. Bias must be taken into account, identified, and extensively examined.

There must be no sampling bias in the training data. Poor data quality, as well as unsuitable and inadequate data representations, can result in biases, discrimination, and unsatisfactory AI technology performance. [38]

DATA SAFETY

Data and privacy should be safeguarded throughout the whole lifecycle of any AI-based technology. For AI to be widely used, it is essential that users' personal information be protected at all times. According to Section 43A of the Information Technology Act of 2000, corporations are liable to pay damages as compensation to affected persons if they are negligent in implementing security practices to protect sensitive data and information stored in computer resources under their ownership, control, or operation.

Both the Digital Information Security in Healthcare Act (DISHA) Bill and the Personal Data Protection (PDP) Act has been introduced by the Indian government to better protect sensitive medical records. [38]

ACCESSIBILITY, EQUITY, AND INCLUSIVENESS

It is imperative for AI developers and other relevant stakeholders to prioritise the accessibility of these technologies for those belonging to lower socioeconomic classes and marginalised communities.

The patient's social, cultural, and economic background affects their perspective on AI technologies. The design of AI systems should prioritise their usability across diverse populations.

TRUTHFULNESS

AI technology in healthcare must undergo rigorous clinical and field validation before being applied to patients or participants. The feedback mechanism is to monitor any such issues and convey appropriate feedback to the developers while keeping the given clinical context for bringing in necessary updates.

ETHICAL COMMITTEE

The responsibility for assessing scientific and ethical principles in health research lies with the ethical committee. It is advisable to consider various aspects while evaluating proposals, such as data source, data quality, data safety, anonymization techniques, data piracy concerns, data selection biases, participant protection measures, and remuneration distribution. The guidelines adhered to in India is the National Ethical Criteria for Biomedical and Health Research Involving Human Participants (2017).

CONCLUSION

The ethical implications of artificial intelligence (AI) and robots encompass a range of effects on several aspects, including safety and transparency, algorithmic fairness and biases, data privacy and protection, cyber security, intellectual property law, patient acceptability, cooperation, and trustworthiness. The involvement of AI developers, technologists, medical professionals, patients, and ethicists is crucial for the advancement of AI devices in healthcare, with the aim of revolutionising and maximising the capabilities of artificial intelligence.

In contrast to other nations, the United States and Europe adopted a free market strategy towards AI products, as shown by the autonomous AI diagnostic system IDx-DR. Consequently, Europe has emerged as a prominent global participant in the realm of AI ethics. The Ethics Guidelines for Reliable AI were created in 2019 by the High-Level Expert Group on AI, under the auspices of the European Commission.

The publication entitled "Ethical Guidelines for the

Application of Artificial Intelligence in Biomedical Research and Healthcare-2023" in India outlines ethical principles and guidelines for conducting ethical research in the field. It encompasses ten principles that serve as a summary of ethical considerations. Additionally, the guidelines provide guiding principles for stakeholders engaged in the development, validation, and deployment of artificial intelligence in biomedical research and healthcare.

The Indian government has implemented measures to optimise the use of artificial intelligence (AI) technologies across multiple sectors, such as healthcare, industry, machines, and various other domains. The primary objective of the National Health Policy (2017) is to emphasise the incorporation of digital health practices and the formation of the National Digital Health Authority. The National Health Blueprint (NDBH 2019) expands upon the efforts to create a framework for electronic health records that adhere to global standards. It also focuses on establishing clear channels for data ownership while including ethical considerations such as data anonymization and de-identification.

The proposed legislation, known as the Digital Information Security in Healthcare Act (DISHA) 2018, put forth by the Ministry of Health and Family Welfare (MOHFW), represents a significant advancement in the realm of safeguarding electronic health data. This legislation aims to establish measures that ensure the privacy, confidentiality, security, and standardisation of electronic health information. Additionally, it is important to further enhance and implement standardised protocols for the examination and verification of artificial intelligence (AI) in the healthcare sector within the context of India.

The ethical considerations and principles that are addressed in this discourse are of utmost importance in the advancement and implementation of artificial intelligence (AI) in the fields of healthcare and robotics. The aforementioned principles are centred on the promotion of accountability, autonomy, safety, trustworthiness, data quality, data privacy, accessibility, equity, inclusion, validity, and the significance of ethical committees. Collectively, these elements constitute the fundamental basis for the conscientious and morally upright integration of artificial intelligence within the realm of healthcare.

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CONFLICT OF INTEREST

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