



Artificial Intelligence In India: A Perspective

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ABSTRACT

The recent developments in Artificial Intelligence (AI) offer the potential for significant opportunities for industry, governments and society. Within the education sector, AI can be deployed to improve teacher effectiveness and student engagement by offering capabilities such as intelligent game-based learning environments, tutoring systems and intelligent narrative technologies. Artificial intelligence can be described as system's ability to learn and interpret external data via software/algorithms or machines/devices for problem solving by performing specific roles and tasks currently executed by humans. The term AI has been used interchangeably with other closely related terms such as expert systems, decision-support system, knowledge-based systems and text mining.

KEYWORDS : Artificial Intelligence (AI), Data, Ethics, Challenges, Education.

Introduction

The origin of the term AI can be traced back to early 1950s, the relatively recent advancement in information technology such as big data, improved computing, storage capability and super-fast speed of data processing machines and robotics has enabled AI to gain significant momentum in terms of its development, application and used within public and private sector organizations.

The recent developments in AI offer the potential for significant opportunities for industry, governments and society, but there are many challenges and subsequent risks as AI-based systems are adopted for an ever increasing range of tasks and duties.

AI Applications

A multitude of opportunities have been presented for the application and use of AI-based systems in various domains particularly to assist where structured decision making is needed. The ability of AI to overcome some of the computationally intensive, intellectual and perhaps creative limitations of humans opens up new application domains within manufacturing, law, medicine, healthcare, education, government, agriculture, marketing, sales, finance, operations and supply chain management, public service delivery and cyber security.

AI technology can be used within several other sectors for enhancing both efficiency and effectiveness. Dwivedi et al. has elaborated on how AI-based systems can help in achieving United Nations Sustainable Development Goals (SDGs). Specifically, AI can help in achieving good health and well-being goals within rural and remote areas in developing countries where access to medical care is limited. In such scenarios, AI-based systems can be utilized for conducting remote diagnosis supporting doctors to help improve health service delivery. AI-based systems can also help to achieve the “Zero Poverty and Zero Hunger” by assisting in resource allocation for predicting adverse environmental conditions, diagnose crop diseases and identify pests in timely manner to mitigate the risk of catastrophic agricultural events. Similarly, AI-based systems can be used to predict energy and utility demand to help in achieving SDGs such as “Clean water, sanitation” and “Affordable clean energy”

National Strategies for AI

Even to promote innovation in AI, a streamlined national policy framework is necessary. In this regard, by recognizing AI’s potential to transform the Indian economy and the need for India to build a comprehensive strategic framework to harness it, NITI Aayog released a National Strategy for Artificial Intelligence #AIforAll in June 2018. The paper lays out the roadmap for India to leverage the coming-of-age technologies to ensure inclusive growth and social development. #AIforAll aims at enhancing and empowering human capabilities to address challenges of access, affordability, and efficiency in endeavoring to scale Made-in-India artificial intelligence solutions for the benefit of the developing and emerging economies. Here, ‘solve for India’ means to ‘solve for 40 percent for the world’ In doing so, the paper identifies five priority sectors that are envisioned to gain the most incremental value from the adoption of these transformative technologies in solving societal needs : a) a healthcare – increasing access to quality and affordable healthcare, b) agriculture – enhancing crop yield, ensuring food security, and increasing farmers’ incomes, c) education – enhancing the quality of education and human resource productivity, d) smart cities and infrastructure – ensuring efficient connectivity and promoting intelligent urban planning, and e) smart mobility and transportation – enabling efficient and safe transportation. The National Strategy aims to support and enable India’s AI ecosystem through grants, product and solution development, collaboration with industry, and mentorship support and startups. Since the release of this report, NITI Aayog has launched several initiatives such as the Atal Innovation Mission, Empowered group-6, RAISE-2020 summit, etc. The flagship AI initiative of NITI Aayog has been the Responsible AI Approach Documents published in collaboration with the World Economic Forum Centre for the next AI Industrial Revolution. The Documents seek to establish broad ethics and principles for the design, development, and deployment of AI in India.

India sees AI and machine learning as the next transformative process to reform its economy and give it greater depth, and weed out irregularities. This process has already started with the digitization of citizen identity and financial transactions, but the use of AI will give it a whole new dimension and depth.

AI and machine learning are particularly suited for India because the country is the world’s largest generator of democratic data or data which is being generated and analysed under the democratic rule of governance.

India is building the world’s largest citizen pool of data from citizens which is managed transparently, and upon such ‘stacks’, applications of various kinds can be built. Each such application, in turn, ‘talks’ to one another, thus providing the citizen with a seamless experience.

It is also building quantum computing capability and chip-making prowess to align and integrate these systems on the front-end and back-end. India is one of the largest smartphone manufacturers in the world, it has a new semiconductor programme, and its drone and robotics industries are some of the most exciting parts of its economy. AI and machine learning, and blockchain, along with other such technologies are the analytical softwares that complement the hardware. India is also a world-leading destination for Software as a Service(SaaS) companies, and the growing use of AI and associated technologies can only boost India's exiting tech prowess.

In India, AI and machine learning are starting to be used in governance to give depth to the country's democratic processes. From education to defence, health to e-commerce, there is hardly any area where this impact is not starting to become rapidly visible.

AI in Education

Artificial intelligence uses the ability of the computer or computer-enabled system to process the information and produce outcomes similar to the human rational behavior for solving the problem and for decision making. Machine learning is a subset of AI, which allows a machine to automatically learn from past data without programming explicitly. The goal of AI is to make smart computer system to solve complex problems. This technology can be applied in the education system.

AI and machine learning are used to enhance the quality and speed of the work with a minimum requirement of human efforts. It is most suitable for performing repetitive and mundane tasks, which are also present in the education system. Nowadays, many queries relating to the academic field are answered by virtual assistance with AI capabilities like Google Assistant, Alexa, and Siri. Our education system desperately requires quality and wide geographical coverage, which can be made possible with the help of incorporating AI technologies.

Robot Teachers

AI can be used in education with the help of humanoid robot teachers that can assist human teachers in delivering their lectures to students. Robot teachers can make teaching more interesting for students using their AI capabilities. They complement human teachers in imparting lessons and replying to frequently asked questions (FAQs) of students.

Personalised Education

AI can help in personalizing the teaching pattern for an individual student as per his/her potential in the learning. Various "AI software-based programmes can analyse the knowledge gaps, preferences, and learning ability of each student.

Tutoring

AI can play a great role in tutoring students and taking the doubts of students outside the classrooms. Chatbots and other AI-enabled tools can assist students in solving their additional problems or queries.

Automated Grading System

AI-powered grading software uses machine learning techniques by replicating human teachers' grading patterns with the help of past data to evaluate the answer papers of students. It helps in removing biased evaluating patterns of human teachers in subjective papers. The automated grading system is most popularly used in Optical Mark Recognition (OMR) criteria for evaluating objective type or multiple-choice questions by reading the shaded areas in the examination papers.

Natural Language Processing

In the educational context, the Natural Language Processing (NLP) can assist students in making necessary corrections and providing meaningful comments in relation to their documents or reports. Various NLP software tools that help in translating on language to another include Google Translate, Microsoft Translator, and Facebook Translation App.

Administrative Tasks

AI can help teachers in performing their repetitive and mundane administrative tasks, such as scheduling, rescheduling classes, curriculum and content development, making attendance, grading papers, sharing report cards of students automatically to the parents, etc. AI has made the performance of administrative tasks easier and improved teachers' or instructors' efficiency and effectiveness in providing instructions and guidance to students.

Creation of Smart Content

AI-based software tools help in the creation of smart content that can range from digital text books, study guides, videos, etc., that create customized environments for the students. AI can also help in generating and updating the contents of the lessons, Keeping the information up to date and customizing it for different learning curves.

Multilingual Teaching

India is a country with varied regional languages where NLP tools have AI capability can break down the barriers of communicating between the various regional areas by using deep learning networks to translate speech and text into different languages. In this way, access to quality education and sharing of knowledge can be processed at a wider level.

The use of AI in the education field can bring efficiency and accuracy to various educational activities that would eventually result in the improvement of the quality of the education system. Robot teachers can act as independent instructors with the help of any human operator having some knowledge to operate robots. These technical persons can be hired in educational institutions just to operate humanoid robot teachers. Teachers can focus on giving guidance to students on their critical issues relating to mentorship, moral education and career opportunities.

AI-Driven Agricultural Advisory Systems : Securing Livelihoods and Social Protection

AI-powered agricultural advisory platforms are rapidly becoming a lifeline for rural communities, offering timely, location-specific guidance on crop selection, pest control, and climate adaptation. These

systems not only boost farm productivity but also act as an informal form of social protection by safeguarding farmers' incomes against unpredictable weather and market shocks (FAO, 2023). Initiatives like Digital Green's AI chatbot and Krishi AI leverage machine learning to provide smallholder farmers – many of whom are women-with low-data, voice-enabled advisories in local languages (NITI Aayog, 2023). For example, AI models can now predict pest infestations weeks in advance, enabling farmers to take preventive measures and reduce crop loss by up to 30 percent (World Bank, 2024). This AI-driven knowledge access also reduces the reliance on costly middlemen, allowing farmers to directly connect with markets through e-NAM and other digital platforms.

Challenges and Shortcomings

There exists a number of challenges and limitations of successfully implementing and utilizing AI in both public and private sector organizations. Some of the key challenges are briefly outlined here.

Lack of explainability

Generally AI operates effectively as a black-box-based systems that does not transparently provide the reasoning behind a particular decision, classification or forecast made by the systems. This is a major limitation of this technology as it has direct impact on transparency, hence trust and confidence of using decisions made.

Lack of contextual awareness and inability to learn

AI-based systems are good at performing with given parameters and rules. However, they still have major limitations in terms of making decisions where context plays a critical role. Unlike human, AI-based systems cannot learn from their environment.

Lack of Standardisation

AI based systems that may have utilized different types of technologies/techniques are increasingly being embedded in variety of products and services(for example, smart assistants, modules for enterprise products, widely available cloud libraries and bespoke data-science-driven applications).

Job Losses

Increasing automation will lead to significant job losses particularly at operational and lower skill levels for repetitive tasks. This critical consequence of AI use will continue to impact all sectors and countries across the world but particularly developing countries where employment opportunities are already limited.

Lack of competency and need for re-skilling and up-skilling workers

A large number of organizations still lack in-house competency to successfully develop and implement AI-based systems. In such a scenario, organizations utilize specialized consultancy firms which can be very resource intensive. But this restricts organizations having limited resources in using such systems. AI based systems requires workers to be equipped with a new and advanced set of skills.

Lack of trust and resistance to change

Due to above mentioned issues and negative media coverage on the consequences of AI, people are generally apprehensive about its implementation. This poses a major challenge on how to establish trust among workers and stakeholders in the management of resistance to change in adopting AI systems.

Public policy is facing unprecedented uncertainty and challenges in this dynamic world of AI. The velocity and scale of impact of AI is so high that it creates an interesting dynamics in terms of the need to predict its impact and inability to draw boundaries.

Ethics

Ethics for machines has been an area of immense interest for the researchers. However, defining has proved to be problematic and difficult to make it computable. To tackle this, we need to deal with ethics purely form an AI : (i) Privacy and data protection and (ii) Human and environmental values.

Privacy and Data Protection

Privacy is possible the top-most concern while using AI systems. Users' sensitive and highly granular data is likely to be stored and shared across the AI network (for example, a Person's location for the day based on face recognition and CCTV feeds, food habits, shopping preferences, movies, music etc.)

Human and Environmental Values

Any AI system has to conform to human value system and the policy makers need to ask : Has the AI system been sensitized to human values such as respect, dignity, kindness, compassion, equity or not? Does the system know that it has a preferential duty towards children, elderly, pregnant women, sick and the vulnerable ? An important aspect which needs to be built into AI systems is the overall cost of their decisions on the society.

Transparency and Audit

In the future, many of the AI-based systems could be interacting with humans in fields such as finance, education, healthcare, transportation and elderly care. The technology providers must explain the decision-making process to the user so that the AI system doesn't remain a black box. There exists a legal need to explain the decision take by such systems in case of litigation.

Digital Divide and Data Deficit

Since the entire AI revolution has data at its foundation, there is a real danger of societies being left behind. Countries and governments having good quality granular data are likely to derive maximum benefit out of this disruption. Countries where the data is of poor quality or of poor granularity would be left behind in harnessing the power of AI to improve lives of its citizens adversely affecting low-resource communities.

Fairness and Equity

AI can disrupt social order and hierarchy creating new social paradigms, which could damage the social fabric exposing people lower in the bargaining hierarchy with a real threat of exploitation and unfair treatment. This could lead to commoditization of human labour and chip away human dignity. An AI system designed with equity as a priority would ensure that no one gets left behind in this world.

Misuse Protection

A case in point – how internet proliferated across the globe benefitting billions but also carried along with it a wave of cybercrime, malware, viruses and violent online game which resulted in loss of innocent lives of teens around the world. Autonomous AI systems must be designed for misuse protection. It cannot be an afterthought.

Responsible AI

Artificial intelligence (AI) is here to stay. Most businesses are evolving with the advent of AI and same shall be the case for learning as well which includes for government as well as private enterprises. AI is transforming creative, legal, technical, educational, language, and medical sectors and as young people grow up in an AI-driven world, educators, mentors are uniquely positioned to equip the next generation of leaders with the skillset and mindset to use the build AI responsibly.

Responsible AI in the education sector involves creating systems that are fair, transparent, and prioritize student welfare. There is also an element of data privacy where organizations have to ensure compliance as enormous data gets shared to build customized AI models. To maintain ethical standards, regular interventions from the government are necessary. It is important that educators and policymakers in India continuously monitor AI applications across the globe and build policies and standards that take into account what is best for India.

Conclusion

Artificial intelligence or AI is transforming e-learning in India, making education more personalized, interactive and accessible. Increased opportunities for generating ideas and receiving instant feedback, which can support and empower students to analyse topics they are passionate about, is increasing their interest in global platforms like ChatGPT, Gemini and other.

Enhanced availability of assistive technologies to meet the needs of each student, including students who may not have fully participated in education due to geographic, political, technological, or personal constraints. AI gives students greater access to adaptive technologies, which empower young people with disabilities, language barriers, or other challenges through speech recognition, text-to-speech options, the ability to set their own pace and more. In addition just as the internet has opened borders and deepened opportunities for global fellowship, AI promises to enable international collaboration unhampered by language, cultural and geographic differences.

Through initiatives like the India AI Mission, investments by global tech giants and the efforts of innovative startups, AI is bridging educational gaps and democratizing access to quality education. While challenges remain, the future of AI in e-learning is bright, with endless possibilities for innovation and improvements.

AI as a technology holds tremendous potential for a country like India, which is data rich and has the requisite technological capability to create AI solutions for many of its problems. AI systems at scale for addressing some of the key challenges in health, education and agriculture sectors. Public roll-out of AI systems needs to address issues of ethics, transparency, audit, fairness, equity, accountability and misuse prevention. An effective public policy framework for AI along with a practical scorecard would be needed to make this AI revolution work towards an equitable prosperity.

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