

Artificial Intelligence in Environmental Sustainability: The Indian Scenario

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Abstract

Environmental sustainability is a serious global challenge, and Artificial Intelligence has emerged as a cutting-edge technology in addressing this issue. In India, a country with rapidly growing economy, diverse ecological habitats and different environmental conditions, the role of AI can be significant in enhancing environmental sustainability. AI can be very helpful in combating different environmental challenges such as pollution, resource depletion, and climate change, etc. Thus, it is pertinent to study the role of AI in addressing the environmental sustainability issue in India along with the opportunities and challenges associated with the application of AI in dealing this issue.

Introduction

India faces a complex array of environmental challenges, including air and water pollution, deforestation, and the effects of climate change. As the country continues to industrialize and urbanize, the need for innovative solutions to manage and mitigate these issues becomes increasingly critical. Sustainable development aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. Environment sustainability concerns with the ability to maintain an ecological balance in natural environment. It aims to conserve the natural resources in order to support the wellbeing of both current and future generations. Out of the 17 sustainable development goals (SDGs), clean water and sanitation, affordable and clean energy, sustainable cities and communities, responsible consumption and production and climate action are directly related to environment sustainability. Climate change itself presents a variety of complex environmental and economical challenge for countries across the globe. In the last few decades, the rise in global temperatures, extreme weather conditions, destructive wildfires and increased floods are the main consequences of climate change. As ecosystems and humans are experiencing the devastating impacts of climate change, it is critically important to prioritize environmental sustainability in order to conserve the natural resources for the wellbeing of present and future generations.

Artificial Intelligence (AI), with its ability to process vast amounts of data presents a promising approach in enhancing environmental sustainability. Artificial intelligence is actually the ability of machines to perform complex tasks associated with intelligent beings. The role of AI in environmental sustainability is substantial. AI can be very advantageous in solving different environmental sustainability problems like resource management, pollution control, climate change mitigation and biodiversity conservation. Different types of AI models are currently in use in India which are helpful for solving these sustainability issues. Thus, this article provides an insight of how

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AI is being used in India to address environmental sustainability issues and also addresses the challenges associated with the application of AI.

Applications of AI in Environmental Sustainability

1. Management of energy resources: The optimization of energy consumption can be accomplished with the help of AI technology. The National Smart Grid Mission in India incorporates the use of AI for increasing the reliability and efficiency of the energy grids. These smart grids manage energy distribution more efficiently. The use of AI in managing the renewal energy sources also plays significant role in increasing their efficiency.
2. Management of water resources: Depletion of water resources is a serious issue in India. Water scarcity is a pressing issue in India, exacerbated by pollution, inefficient usage and over-extraction. AI can enhance water resource management through smart irrigation and flood predictions. The level of contamination of water sources, water levels and shortages can be easily predicted with the help of AI technologies.



3. Air Quality Monitoring: Air quality, weather forecasting and analysis of pollution levels in different cities of India are predicted by the System of Air Quality and Weather Forecasting and Research (SAFAR). This is done with the aid of AI-driven systems.
4. Waste Management: The rapid urbanization of Indian cities poses a significant challenge of waste management. AI applications can transform waste management strategies through automated sorting, collection and recycling processes. The smart bins can efficiently segregate recyclables from non-recyclables and can also help in reducing the contamination and operational costs.

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5. Climate Change Mitigation

Climate change poses significant challenges to environmental sustainability. The proper utilization of AI models can improve the accuracy of climate models. By processing important data, it may help the policymakers to make informed decisions.

The Indian Space Research Organisation (ISRO) utilizes AI tools to process satellite data thereby giving important information about carbon emissions from various sources. This might also be helpful in the development of important climate policies. Different AI models can also be helpful for the development of early warning systems and proper emergency responses.

6. Biodiversity Conservation

AI algorithms can monitor deforestation and land usage by the analysis of satellite imagery. Different habitat conservation strategies can be planned with the aid of data obtained from these algorithms. In India, the agriculture sector has a very significant impact on environment, AI applications might be helpful in increasing productivity along with maintaining the fertility of land.

AI technologies might also be employed to protect the endangered species and to monitor wildlife by helping in understanding the animal behaviour and needs.

Usage of AI tools in environmental sustainability

In recent times, a number of AI tools and initiatives are being used in India to promote environmental sustainability across various sectors. Some of the examples are as follows-

1. Agriculture and Precision Farming:

Kisan e-mitra: Kisan e-mitra is an AI powered chatbot. It assists farmers with queries about PM Kisan Samman Nidhi Scheme. This program supports multiple languages and proved to be very helpful for the farmers.

AgroStar: “AgroStar is one of India’s foremost AgTech start-ups, working on the mission of #HelpingFarmersWin”. AgroStar uses AI to provide farmers with tailored advice on crop management, pest control, and weather forecasts. It creates a very good impact on the lives of farmers by helping them in variety of ways like by increasing their production, reducing their expenditure, help them grow better quality output and access global and domestic markets to fetch the best rate for their output while minimizing environmental impact.

Satsure: “Satsure helps in delivering decision intelligence from Space to create an impact”. This company uses AI and satellite imagery to offer insights into soil conditions, crop health, etc. helping farmers make informed decisions.

2. Air Quality Monitoring:

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Breezometer: This AI-powered platform provides real-time street level air quality data and forecasts. It is used in Indian cities to monitor pollution levels and provide street-level air quality information to the policymakers for taking necessary actions. It provides a new and uniform air quality index - the BreezoMeter AQI, or BAQI, which can be read as the measure of air quality of that particular city.

3. Water Resource Management:

The use of AI tools to analyze data on water management provides useful insights on water usage, availability, and management. It helps in managing resources efficiently and formulating better water policies. The WaterAid India project uses AI to model and forecast water demand and supply, enabling more efficient distribution and management.

4. Wildlife Conservation:

Wildlife Conservation Trust (WCT): AI-powered camera is being used by WCT which helps to monitor wildlife and track animal movements thereby helping in several conservation projects.

5. Climate Prediction and Management:

IBM's Weather Company: IBM collaborates with Indian organizations to provide advanced weather forecasting with the use of AI. This helps in predicting extreme weather events and helps in efficient management of climate-related risks.

6. Energy Efficiency:

Luminous Power Technologies: Luminous Power Technologies is India's market leader in power backup systems and home electricals. They use AI-driven solutions to manage energy consumption in buildings and industries and also help in optimizing energy usage.

7. Smart Cities Initiatives:

Delhi's Smart City Project: New Delhi Smart City Planning project utilizes artificial intelligence (AI) technologies to transform the Indian capital into a more sustainable city. AI tools are being used to manage urban services more efficiently, including waste management, water supply, and traffic management, contributing to overall sustainability goals thereby improving the quality of life for its citizens.

Challenges associated with application of AI

The use of AI tools has been so much beneficial for the solution of different environmental sustainability issues but it also presents several challenges for the mankind and for the environment itself. Following are some of the challenges or disadvantages associated with the use of AI tools.

1. High Energy Consumption and electronic waste:

Specialized infrastructure and hardware are needed for the implementation of AI tools which can be challenging in regions with limited resources. Specialized computer setups are must for running these models which in turn demands significant energy inputs. In India, which still relies heavily on non-renewable sources of energies, this can lead to increased carbon emissions, and thereby offsetting some sustainability benefits So, it is of utmost importance to look for the non-renewable

sources of energies for consumption. Requirement of specialized hardware and tools also contribute to increased electronic waste.

2. Problem of data security and privacy

Since AI systems handle and possess large volumes of personal and environmental data, this raises concerns about the protection of sensitive information and their potential misuse. This is a big problem in the country like India where data privacy regulations are not in a very good shape. There are also risk of cyber-attacks on AI systems thereby compromising important information and data.

3. Challenges associated with implementation

The effective implementation of AI tools requires specialized skills which may not be easily available in the rural and backward areas. This poses a challenge for their implementation in remote and underdeveloped regions. The development, installation and management of AI systems can be really expensive. This may limit their accessibility to only well-funded organizations and will in turn widen the gap between the privileged and under-privileged Indian society.

4. Over reliance on technology

Since the use of AI for different environment sustainability goals, makes work very easy. This over-reliance on AI technology might results in the reduction of traditional methods and skills related to environmental conservation. This might results in the loss of critical thinking and decision making capabilities.

5. Impact on employment

The use of AI methods and their automation could displace jobs in sectors like traditional environmental management and monitoring. This could lead to socio-economic issues, particularly in regions where alternative employment opportunities are scarce.

6. Scalability issues

Solutions that work well in specific contexts might not be easily and effectively applicable to other regions or environments due to difference in socio-economic conditions in India. The lack of standardized regulations and policies for the use of AI in environmental sustainability can lead to inconsistent utility of AI tools.

7. Complexity of environmental challenges

Environmental sustainability goals are complex and involve interconnected systems. AI tools might not fully account for these complexities. AI tool addressing any specific issues may not fully address the holistic nature of environmental sustainability goals.

In order to address these challenges associated with the application of AI, a balanced approach is needed which is focussed on investment in infrastructures, equitable accessibility of AI solutions, developing experts in respective fields, making comprehensive policies, etc. This requires careful

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consideration of how AI models are designed, implemented, and managed to ensure that they contribute mostly positively towards the sustainable development of society without introducing significant new challenges.

Conclusion

In the growing world of technology, the role of artificial intelligence for advancing environmental sustainability in India is inevitable and highly significant. With the efficient use of AI, India may experience significant improvement in resource management, biodiversity conservation, pollution control as well as in mitigating climate changes. In order to cope with the challenges associated with the use of AI to its full potential, government agencies and private sector companies should collaborate more to develop and implement AI solutions. Further, investment in the area of AI research and development should also increase for the uniform implementation of AI solutions. Policies made in this regard should address problems like data privacy, equitable distribution and ethical considerations. With collaborative efforts, comprehensive policies and proper investments, AI's potential can be fully harnessed to create more environmentally sustainable India.

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