


Chapter 15


The Role of Artificial Intelligence in Sustainable Ecology: Monitoring and Managing Environmental Health

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ABSTRACT

The use of Artificial Intelligence (AI) in ecology for sustainability has given a new face to jungle and environmental health monitoring, management, and conservation. AI is used to manage resources and control the processes connected with water, energy or biodiversity which contributes to a circular economy. AI applications are related to environmental risks through their predictive abilities in climate modeling, and pollution management. It illustrates the potential of AI in decision-making for ecological conservation immediately through cases such as smart air and water quality monitoring, intelligent farming activities and species/preservation. AI is recognized as having many advantages but there are also concerns around data privacy, ethical dimensions and the fact current algorithms would not work well to predict environmental impacts. The future possibility of AI to address global sustainable development goals and environmental health governance is becoming evident.

DOI: 10.4018/979-8-3693-8532-6.ch015

1. INTRODUCTION

The world-wide ecological crisis due to climate change, biodiversity loss, pollution and resource scarcity has spurred the search for new ways of insuring maintenance or restoration of long-term environmental health. Emerging as a key technology to address these critical environmental issues, artificial intelligence (AI) can tackle huge data sets and predict potential results. AI will allow governments, industry and environmental organizations to monitor as well manage ecosystem health in a more efficient and predicative manner.

Sustainable ecology refers to an ecosystem that is preserved and used carefully for the benefit of the new generation. Yet mainstream environmental monitoring and management approaches have fallen short of meeting the ever more complex nature of these systems, or indeed dealing with rapid ecological decline. However, the AI itself, which seems to be quick in evaluating large-scale environmental data constantly released (such as pollution indexes of certain areas) is perceived as a hope. However, AI can also be incredibly useful in monitoring air and water quality changes, extreme weather events predictions etc., thanks to work being done on remote sensing (using drones), IoT networks or by using machine learning based algorithms.

One of the most talked-about issues right now is sustainable development. Industry experts recommended using pollutant control equipment to reduce and manage pollutants. Computers are aggravating both pollution and power consumption. The flip side is that scientists are constantly coming up with new innovations that are more eco-friendly, smaller, and use less power. Among these, Raspberry Pi stands out. The Raspberry Pi is a tiny computer with a powerful processor and minimal power requirements; it's about the size of a credit card (S Alex David et al, 2018).

New studies have revealed that artificial intelligence may be able to revolutionize monitoring of the environment, particularly in areas like climate change modeling and pollution detection and wildlife protection. For example, AI-enhanced remote sensing enables more accurate identification of deforestation and land-use change via satellite imagery (Lary et al., 2022) leading to potential interventions by governments or organizations prior to the process taking place. Equally, AI-enabled IoT sensors that provide instant data on the quality of air or water as well as soil health versus environmental hazards also aid in providing an advanced solution to environment threats (Chen and et al., 2023).

Applications of AI have proven beneficial in resource management spaces like irrigation in agriculture and efficient energy distribution through smart grid operation for integration with renewable sources by employing intelligent tools (Jiang et al, 2023). AI is also advancing the circular economy by optimizing waste management operations and recycling techniques.

Here we look at the impact of AI and ML on cloud security, shedding light on their key achievements, challenges, and possibilities. Standard methods of cloud security offer better identification of threats, real-time monitoring, and adaptive defenses. More conventional forms of security would be vulnerable to these technological advancements because of their prowess in handling massive amounts of data (IE Berna et al, 2024)

To build smart governments, one must use artificial intelligence (AI) systems that rely on big data sets, which are often accessible through the internet of things (IoT). In numerous crucial sectors of smart government, AI technologies provided by the Internet of Things can be utilized to raise the quality of life for individuals and the efficiency of governance. AI and its related advances can address numerous organizational shortcomings, enabling the government to effectively carry out its tasks (P Samuek et al, 2023).

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