

Chapter 10

Data Analytics, Machine Learning, and IoT for Environmental Governance

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ABSTRACT

Effective environmental governance is crucial for addressing complex & interconnected environmental challenges of the 21st century. It requires collaboration of multiple sectors & integration of diverse perspectives to create resilient & sustainable societies. Organizations, governments, and NGOs need to adopt a collaborative approach to implement sustainable solutions for environmental governance. While governments are responsible for policymaking, NGOs excel in implementing these policies due to their strong connections with grassroots communities. Corporations play a critical role by leveraging their capital, technological resources, and research and development capabilities to address existing environmental challenges with sustainable solutions. The book chapter presents theoretical & practical insights regarding the use of Data Analytics, ML and IoT for environmental governance.

INTRODUCTION

Environmental monitoring and management are crucial for safeguarding the health and sustainability of our planet. Environmental monitoring involves the systematic collection, analysis, and interpretation of data to assess the condition of natural

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resources and ecosystems. As the urgency for environmental protection grows, the demand for innovative solutions becomes increasingly clear. Technology, especially data science along with technologies like Artificial Intelligence (AI), Machine Learning (ML) & Internet of Things (IoT), play a vital role in this effort. With rising environmental concerns, data science has proven to be a powerful tool capable of analyzing large datasets and providing insights into complex ecological dynamics.

Simultaneously, environmental management uses this information to make informed decisions and proactively address environmental risks while promoting sustainable practices. Organizations and governments are increasingly adopting advanced technologies to enhance individual well-being, protect wildlife and ecosystems, and achieve sustainable development goals. Key technologies driving this transformation include Artificial Intelligence (AI), the Internet of Things (IoT), and Big Data, all of which enable data-driven decision-making to support sustainable business solutions. These advancements allow organizations to optimize resource management and improve services in unprecedented ways.

Innovations in machine learning and data analytics have the potential to significantly impact various aspects of Environmental Science (ES) (Hajjaji et al, 2021). The integration of big data and IoT technologies presents exciting opportunities for smart environmental applications focused on monitoring, protecting, and enhancing natural resources. Big Data analytics encompasses a variety of data resources defined by their diversity, speed, accuracy, and volume. It plays a critical role in ES applications such as weather forecasting, energy sustainability, and disaster management, supported by techniques like remote sensing and information and communication technologies.

In light of increasing environmental challenges, the integration of data science with environmental monitoring has emerged as a transformative solution. This collaboration enables more effective monitoring of ecosystems and endangered species, supports predictive modeling and early warning systems, enhances air and water quality assessments, and is essential for disaster management (Tharsanee et al, 2020). Given this context, it is vital to deepen our understanding of how technologies like data analytics, AI, machine learning, and IoT contribute to the development of effective strategies for environmental protection and facilitate comprehensive analyses of environmental data.

REVIEW OF LITERATURE

Recent literature (Anonymous, 2024) underscores growing concerns about the potential impact of big data analytics on corporate sustainability strategies, highlighting the vast and diverse benefits of this tool. Rashid et al. (2024) found that Big

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