

ADVANCES IN COMPUTATIONAL
COLLECTIVE INTELLIGENCE

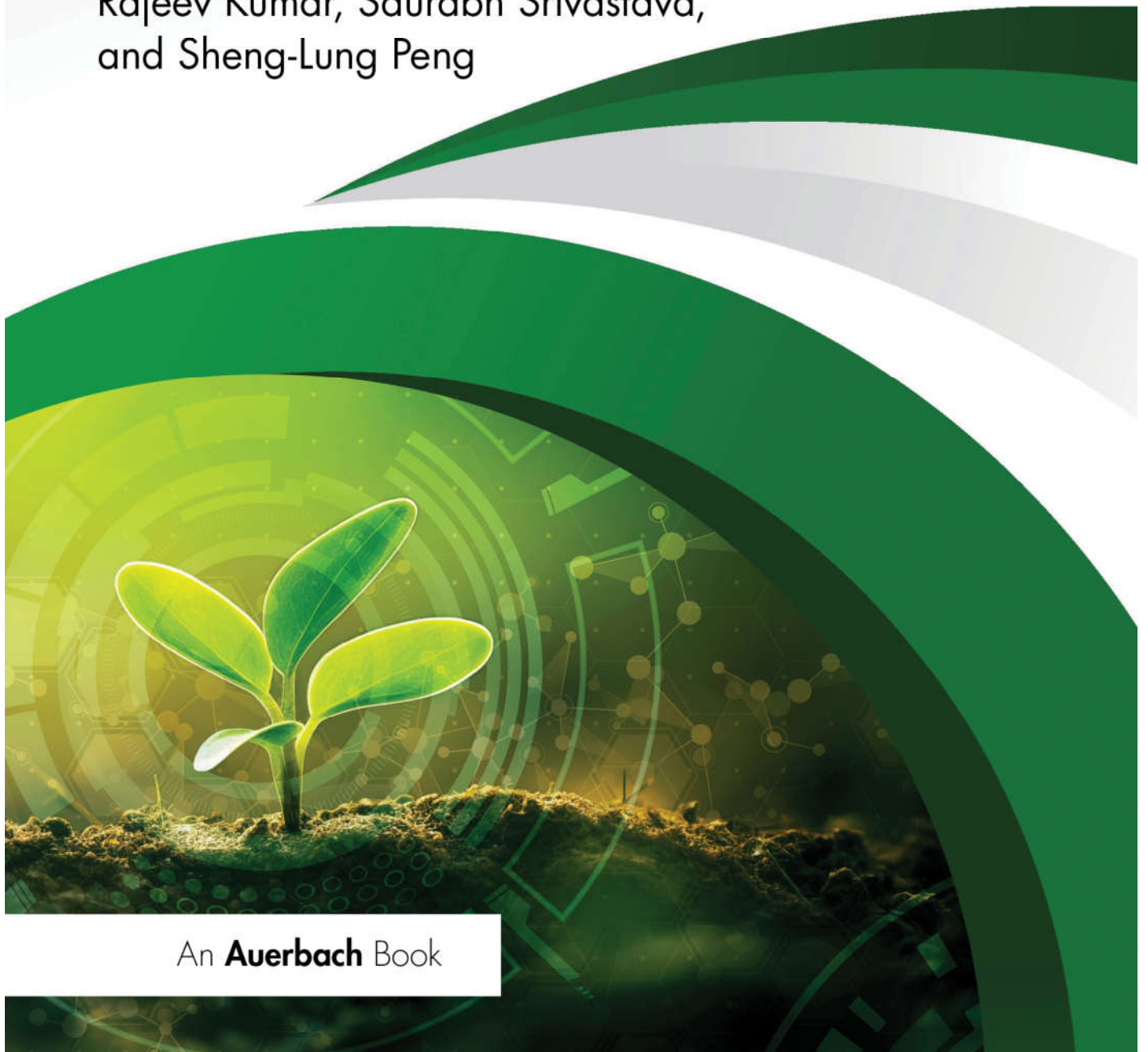


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AI for Environmental Innovation and Stewardship

EDITED BY

Rajeev Kumar, Saurabh Srivastava,
and Sheng-Lung Peng



An **Auerbach** Book

AI for Environmental Innovation and Stewardship

Artificial intelligence (AI) plays a pivotal role in advancing environmental stewardship by enabling innovative solutions to address pressing ecological challenges. Through its ability to process vast amounts of data, AI empowers researchers and policymakers to monitor environmental changes, predict future trends, and develop strategies for sustainable resource management. By integrating AI into environmental efforts, societies can transition toward more sustainable practices, ensuring the preservation of natural ecosystems for future generations. Its transformative potential underscores the importance of leveraging AI as a critical tool in fostering global environmental resilience and sustainability.

AI for Environmental Innovation and Stewardship examines this transformative potential by covering fundamental concepts, innovative methodologies, and real-world applications of AI in environmental contexts. It highlights the role of machine learning, data analytics, generative AI, supply chains, augmented reality, and virtual reality in providing new insights and solutions for managing complex ecological systems. It explains how AI is advancing environmental monitoring, enhancing predictive capabilities, optimizing resource usage, and supporting evidence-based decision-making. Highlights include the following:

- Legal perspectives and challenges of using AI in environmental justice
- Enhancing agricultural supply chains through AI and blockchain integration
- AI innovations in augmented reality and virtual reality for environmental education
- AI to promote responsible consumption and waste management

With its wide-ranging and holistic view of AI in environmental stewardship, the book is a resource for researchers, students, policymakers, and industry professionals, who seek to promote innovation and collaboration at the intersection of AI and the environment.

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ARTIFICIAL INTELLIGENCE (AI) IN RENEWABLE ENERGY SYSTEMS: A BRIEF OVERVIEW FOR CONSERVING AND EFFICIENTLY UTILIZING RENEWABLE RESOURCES

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ABSTRACT

The global energy demand is anticipated to grow at an average rate of 8% per year from 2000 to 2030. Fossil fuels currently supply a significant portion of this energy, having profound impacts. Renewable energy sources are increasingly popular as alternatives to fossil fuels for various reasons. But the transition to renewable energy sources is critical in climate change and reducing dependence on fossil fuels. However, the variability and intermittency of renewable energy present significant challenges for efficient utilization and integration into power grids. Artificial intelligence (AI) and machine learning (ML) are relatively new concepts in the energy sector. The proposed work highlights how AI can optimize the generation and distribution of renewable energy through predictive analytics and machine learning models. This chapter explores the role of artificial intelligence (AI) in enhancing the efficiency and reliability of renewable energy systems, including solar, wind, hydro, and bioenergy. The work explores how contribution of AI to improving energy storage. The proposed work emphasizes the role of AI in improving energy efficiency and conservation. The synergy between AI and renewable energy systems offers innovative pathways to conserve resources and promote sustainable energy practices.

19.1 INTRODUCTION

Renewable energy systems (RES) encompass technologies that generate energy from natural sources. These sources include solar energy, hydroelectric power from water, geothermal energy, wind energy, biomass from plants, wave energy from the ocean, and ocean thermal energy conversion (OTEC). Renewable energy resources (RE) offer vast potential and have the capacity to meet today's global energy demands. They can diversify the energy production industry, ensure a long-term sustainable supply, and reduce both local and global emissions. RE provides economically attractive options for meeting specific power needs, especially in developing nations and rural areas, and offers opportunities for local component manufacturing. AI is used in almost every aspect of renewable energy, including design, development, optimization, operation, distribution, and regulation. From 2008 to 2035, existing hydroelectric power generation is expected to grow more rapidly than other renewable energy sources.