

Chapter 13

Harnessing AI and GIS Technologies for Climate-Resilient Agriculture and Environmental Sustainability

Muhammad Zakwan Hadeed

University of Veterinary and Animal Sciences, Lahore, Pakistan


Aitzaz Ali

Asia Pacific University of Technology, Malaysia

Abdul Malik

University of Agriculture, Faisalabad, Pakistan

Aamir Raza

 <https://orcid.org/0009-0001-1867-2660>

University of Agriculture, Faisalabad, Pakistan

Muhammad Shoaib

University of Narowal, Pakistan

ABSTRACT

Climate change poses a significant threat to global food security and environmental sustainability. Traditional agricultural practices often struggle to adapt to increasing

DOI: 10.4018/979-8-3693-6336-2.ch013

Copyright © 2024, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

weather variability and extreme events. This chapter explores the potential of AI and GIS technologies to build climate-resilient agriculture and promote environmental sustainability. AI algorithms can analyze vast datasets, including weather patterns, soil characteristics, and crop productivity data, to identify vulnerabilities and recommend strategies for farmers to adapt to changing conditions. Some applications that can help improve agricultural production are mapping climate risk, predicting drought, and finding the best places to put different crops. The chapter explores the context-specific solutions that combine technological innovation with traditional practices, fostering collaboration among farmers, researchers, developers, and business leaders to optimize resource use, enhance crop yields, and mitigate environmental impacts despite challenges like data availability and equitable access.

1. INTRODUCTION

Climate change poses a significant and immediate threat to agriculture, with escalating global temperatures, shifting precipitation patterns, and an increased frequency of extreme weather events already having profound impacts on agricultural productivity and sustainability (Syed et al., 2022). This introduction delves into the intricate relationship between climate change and agriculture, highlighting the complex interplay of factors such as temperature rise, altered rainfall patterns, and extreme weather events that disrupt farming practices. The pressing need for adaptive strategies and innovative technologies is underscored to ensure the resilience and sustainability of agricultural systems. The following image encapsulates these challenges and showcases the integration of modern technologies like AI, GIS, and IoT in mitigating the adverse effects of climate change on agriculture. Figure 1 shows an illustration depicting the multifaceted impacts of climate change on agriculture: drought-stricken areas with cracked soil, flood-damaged fields, and healthy crops supported by advanced technologies like drones, IoT sensors, and AI-driven decision support systems.

30 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/harnessing-ai-and-gis-technologies-for-climate-resilient-agriculture-and-environmental-sustainability/355517

Related Content

Issues for the Evaluation of Ambient Displays

Xiaobin Shen, Andrew Vande Moere, Peter Eades and Seok-Hee Hong (2009).

International Journal of Ambient Computing and Intelligence (pp. 59-69).

www.irma-international.org/article/issues-evaluation-ambient-displays/3880

A Survey on Information Technology and Artificial Intelligence Among Youth in the Digital Age in Selangor, Malaysia

Nur Raihan Che Nawati, Mohd Mursyid Arshad, Ismi Arif Ismail, Nor Wahiza Abd

Wahat, Jeffrey Lawrence D'Silva, Mohd Faiq Abd Aziz, Hayrol Azril Mohammed

Shaffriland Dzulhailmi Dahalan (2024). *Exploring Youth Studies in the Age of AI* (pp. 251-262).

www.irma-international.org/chapter/a-survey-on-information-technology-and-artificial-intelligence-among-youth-in-the-digital-age-in-selangor-malaysia/351971

Assessing the Appeal Power of Narrative Performance by using Eyeblick Synchronization among Audience

Ryota Nomura and Takeshi Okada (2016). *Computational and Cognitive Approaches to Narratology* (pp. 304-321).

www.irma-international.org/chapter/assessing-the-appeal-power-of-narrative-performance-by-using-eyeblick-synchronization-among-audience/159631

A Multi-Stage Fuzzy Model for Assessing Applicants for Faculty Positions in Universities

Raghda Hraiz, Mariam Khader and Adnan Shaout (2019). *International Journal of Intelligent Information Technologies* (pp. 1-33).

www.irma-international.org/article/a-multi-stage-fuzzy-model-for-assessing-applicants-for-faculty-positions-in-universities/221353

Tokenization of Real Estate Assets Using Blockchain

Shashank Joshi and Arhan Choudhury (2022). *International Journal of Intelligent Information Technologies* (pp. 1-12).

www.irma-international.org/article/tokenization-of-real-estate-assets-using-blockchain/309588