


Chapter 3


AI-Based Disaster Prediction and Early Warning Systems

Ajay N. Upadhyaya

 <https://orcid.org/0000-0002-7583-6430>


SAL Engineering and Technical Institute, India

Pranoy Debnath

 <https://orcid.org/0000-0001-6269-3867>


Indian Institute of Technology, Bombay, India

Poonam Rani

 <https://orcid.org/0009-0004-4506-7871>


Chandigarh Group of Colleges, India

P. Selvakumar

 <https://orcid.org/0000-0002-3650-4548>

Department of Science and Humanities, Nehru Institute of Technology, Coimbatore, India

T. C. Manjunath

 <https://orcid.org/0000-0003-2545-9160>

Rajarajeswari College of Engineering, India

Sumanta Bhattacharya

 <https://orcid.org/0000-0003-2563-2787>

Maulana Abul Kalam Azad University of Technology, India

ABSTRACT

Disaster management systems. This introduction explores the role of disaster management technologies, focusing on their evolution, current applications, and future potential, particularly in the context of AI-based solutions. Historically, disaster management relied heavily on manual processes and rudimentary tools for assessment and response. This often resulted in delayed reactions and inadequate resource allocation during emergencies. Geographic Information Systems (GIS), remote sensing, and telecommunications have all played crucial roles in improving situational awareness and enabling faster decision-making. ICT facilitates real-time data sharing among stakeholders, including government agencies, NGOs, and the public. This connectivity enhances coordination and ensures that critical information reaches affected populations promptly. For instance, mobile technology has empowered communities to report incidents and receive alerts, thereby improving early warning systems. Moreover, data analytics has emerged as a key component in disaster management.

DOI: 10.4018/979-8-3693-9770-1.ch003

INTRODUCTION TO DISASTER MANAGEMENT TECHNOLOGIES

Disaster management systems. This introduction explores the role of disaster management technologies, focusing on their evolution, current applications, and future potential, particularly in the context of AI-based solutions. Historically, disaster management relied heavily on manual processes and rudimentary tools for assessment and response. This often resulted in delayed reactions and inadequate resource allocation during emergencies. Geographic Information Systems (GIS), remote sensing, and telecommunications have all played crucial roles in improving situational awareness and enabling faster decision-making. ICT facilitates real-time data sharing among stakeholders, including government agencies, NGOs, and the public. This connectivity enhances coordination and ensures that critical information reaches affected populations promptly. For instance, mobile technology has empowered communities to report incidents and receive alerts, thereby improving early warning systems. Moreover, data analytics has emerged as a key component in disaster management. By leveraging big data, agencies can analyze historical patterns, predict future occurrences, and assess vulnerabilities within communities. Predictive analytics, in particular, has shown promise in forecasting disasters like floods, hurricanes, and earthquakes, allowing for preemptive actions to minimize risks. The use of land use that may indicate an increased risk of wildfires, enabling timely interventions. Similarly, AI-powered chatbots and virtual assistants can provide essential information to communities during crises, ensuring that individuals have access to guidance and resources when they need it most. The application of drones and unmanned aerial vehicles (UAVs) has also gained traction in disaster management. Drones can conduct aerial surveys of disaster-stricken areas, providing real-time imagery that helps assess damage and plan recovery efforts. They are particularly useful in reaching areas that are inaccessible to ground teams due to debris or unsafe conditions. Drones can also deliver supplies to remote locations quickly, improving response times and reducing reliance on traditional logistics. For example, flood sensors placed in vulnerable areas can provide immediate alerts when water levels rise, triggering early warning systems and allowing residents to evacuate before a disaster strikes. Training and capacity building are essential to empower individuals and organizations to leverage these technologies effectively. In conclusion, disaster management technologies have evolved significantly, particularly with the integration of AI and data analytics. These advancements offer immense potential to enhance disaster preparedness, response, and recovery efforts. However, realizing this potential requires

TYPES OF DISASTERS AND THEIR IMPACT

Historically, disaster management relied heavily on manual processes and rudimentary tools for assessment and response. This often resulted in delayed reactions and inadequate resource allocation during emergencies. Geographic Information Systems (GIS), remote sensing, (Alwindawi, A. F., et al., 2022) and telecommunications have all played crucial roles in improving situational awareness and enabling faster decision-making. This connectivity enhances coordination and ensures that critical information reaches affected populations promptly. For instance, mobile technology has empowered communities to report incidents and receive alerts, thereby improving early warning systems. Moreover, data analytics has emerged as a key component in disaster management. By leveraging big data, agencies can analyze historical patterns, predict future occurrences, and assess vulnerabilities within communities. Predictive analytics, in particular, has shown promise in forecasting disasters like floods, hurricanes,

18 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/ai-based-disaster-prediction-and-early-warning-systems/376625

Related Content

Analytics for Noisy Unstructured Text Data I

Shourya Royand L. Venkata Subramaniam (2009). *Encyclopedia of Artificial Intelligence* (pp. 99-104).

www.irma-international.org/chapter/analytics-noisy-unstructured-text-data/10232

Experimenting with Proxy Agents in Online Combinatorial Auctions

Soumyakanti Chakraborty, Anup Kumar Senand Amitava Bagchi (2014). *International Journal of Intelligent Information Technologies* (pp. 56-75).

www.irma-international.org/article/experimenting-with-proxy-agents-in-online-combinatorial-auctions/114959

Cross-Layer Distributed Attack Detection Model for the IoT

Hassan I. Ahmed, Abdurrahman A. Nasr, Salah M. Abdel-Mageidand Heba K. Aslan (2022). *International Journal of Ambient Computing and Intelligence* (pp. 1-17).

www.irma-international.org/article/cross-layer-distributed-attack-detection-model-for-the-iot/300794

Reworlding Inclusion: Speculative Futures of STEM Education in the Age of Generative AI

Masud Ahmmedand Janine Aldous Arantes (2026). *Shaping Inclusive Educational Policies and Practices With Generative AI* (pp. 79-104).

www.irma-international.org/chapter/reworlding-inclusion/398301

The Satiation of Natural Curiosity

Felix Schoeller (2016). *International Journal of Signs and Semiotic Systems* (pp. 27-34).

www.irma-international.org/article/the-satiation-of-natural-curiosity/185499