Chapter 1
Application of Artificial Intelligence in Disaster Management and Their Challenges

Rishav Chandra
VIT Bhopal University, India

D. Lakshmi
https://orcid.org/0000-0003-4018-1208
VIT Bhopal University, India

ABSTRACT

Natural disasters have demolished infrastructures and destroyed livelihoods for a long time, and orthodox disaster management methods have proved to be effective only to a certain extent. Governments and concerned authorities have started integrating artificial intelligence-based systems into traditional frameworks, as they have proved to be effective in multiple domains before. This chapter reviews some of the major approaches and models that have been developed and published in recent times, where artificial intelligence techniques have been used to facilitate disaster management in every stage, namely, mitigation, preparedness, response, and recovery. Most of the papers discussed have even been implemented in real crises and have proven to be effective. Further, some of the most prominent tools and platforms have also been discussed in this chapter, which leverage the power of artificial intelligence to provide disaster management services depending on their specific use cases and parameters.

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1. INTRODUCTION

Natural disasters are harbingers of turmoil, as they have the potential to cause colossal damage to the well-being and economic conditions of the societies affected. They come in various forms, from common earthquakes and floods to infrequent but devastating volcanic eruptions. The world has witnessed many such calamities in the past, where thousands lost their lives, properties were destroyed and communities were disrupted. The Haiti earthquake (2010), the typhoon Haiyan in the Philippines (2013), and the Sulawesi earthquake and tsunami in Indonesia (2018) are some recent examples. With time, several ideas were generated and methodologies were worked upon by various governments and individuals to safeguard people against these disasters. The techniques that demanded a lot of manual intervention were effective, and the focus was laid on good management practices without the use of technology for a long period, but only to a certain extent (Specht, 2006). As the number of natural disasters occurring throughout the globe followed an increasing trend, the need for more efficient and effective solutions rose. For this purpose, artificial intelligence (AI) was soon integrated into the field of disaster management. AI is a field of Computer Science that is concerned with the development of methodologies and procedures to impart certain abilities to computers, which help them to mimic the human brain and solve complex problems that would otherwise take a copious amount of time for humans to solve. With the help of AI models, disasters could be managed in a much more efficient manner and all kinds of losses could be minimized. There are several tasks involved in disaster management, including pre-disaster planning, preparedness, adoption of prediction and early-warning systems, evaluation of post-disaster conditions, and relief operations (Rao & Rao, 2008). Over the years, many AI models have been built to help people efficiently manage natural disasters and decrease the risk factors associated.

AI models rely on the data they are trained upon, which exists in huge amounts in the form of historical data, social media, and texts, satellite images, geospatial data, data collected from sensors, simulation data, demographic data, emergency response logs, and multi-modal data. Historical data, containing information about the natural calamities that have occurred in the past, such as their magnitude, region, death toll, and solutions used, is the most basic form of data that can be used to train AI models that can detect patterns and forecast disasters in the future. As soon as a calamity strikes, social media platforms get flooded with news and details about it, including ground reports and real-time footage, which can be utilized in Natural Language Processing (NLP) models that can be used for multiple purposes including event classification, request extraction, and misinformation detection. Certain disasters such as wildfires and hurricanes witness extensive use of satellite imagery for monitoring the spread of the disaster, the areas affected, and population migration

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