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Machine Learning for Disaster Management

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Abstract

Background: Disaster management is a systematic mechanism for engendering policies and administrative decisions that involve functional activities and emergency resources, which encompass various actors and technologies, to combat different stages of disaster at all levels. There are four phases in the disaster management cycle i.e. mitigation, preparedness, response and recovery [1]. Prevention or mitigation is more about minimising the effects of a disaster. Preparedness entails pre-disaster activity pertaining to infrastructure development with the objective of providing an optimum response during a disaster. Response is the appropriate implementation of various emergency based activities to search and rescue people and provide immediate relief. Recovery includes rehabilitation, reconstruction and redevelopment of the areas affected by a disaster. With advancement in technologies, IoT's and sensor devices are generating data related to disasters at a rapid rate. Availability of such data provides an opportunity to gain insights therefrom to mitigate, prepare, respond and recover from disasters. One way to analyse such data is by using machine learning [2, 3, 4]. Machine learning is a branch of artificial intelligence that enables computing machines to automatically learn and improve from existing knowledge and the experience gathered from the past.

Objective: This paper aims to identify application of machine learning to different tasks for disaster management. Issues, challenges and opportunities related to application of machine learning in disaster management have been highlighted.

Methodology: In this paper, existing literature related to use of machine learning in disaster mitigation, disaster preparedness, disaster response and disaster recovery have been reviewed.

Results and discussion: *ML* based disaster risk reduction models are evaluated and compared on various performance parameters like accuracy, precision, recall, *f1*-score and AUC-ROC.

Conclusion: Machine learning techniques have been widely and successfully used in providing effective and efficient solutions to complex problems and, thus, can appropriately be used for disaster management. Machine learning techniques can be used to analyse the accumulated disaster related data in suitable ways that enable vulnerable individuals, communities and other stakeholders to mitigate, prepare, respond and recover without suffering harm or loss of life and property.

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