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A SURVEY OF MACHINE LEARNING APPLICATIONS IN NATURAL DISASTER MANAGEMENT

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***Abstract*-- Data on natural and man-made disasters like earthquakes and tsunamis are included in disaster analysis. An unanticipated occurrence, a natural disaster can have a significant impact on both human life and the environment. The methods of using machine learning to manage disasters are discussed in this article. Disaster management tasks like establishing crowd evacuation routes and analysing social media posts can be assisted by machine learning algorithms, which can also predict disasters. The review process and comprehending the purpose of machine learning in disaster management and natural disasters will be the primary focuses of this study. The aftereffect of this paper is giving understanding and the utilization of machine learning in the field of the natural disaster management.**

Keywords: Machine Learning, AI, Disaster management.

I. INTRODUCTION

Millions of people around the world are affected by natural and man-made disasters each year. Human lives are frequently lost as a result of these occurrences. Besides Disasters result in human casualties as well as major damage to infrastructure and property. Operations for disaster management are carried out before to, during, and following a disaster with the goals of preventing fatalities, safeguarding infrastructure and people, minimising economic impacts, and restoring normalcy. Machine learning can play a crucial role in natural disaster management and response by providing accurate predictions, early warnings and rapid response systems. Machine learning can be used to predict natural disasters by analyzing large amounts of data like it can be historical data, real -time data and satellite images to identify patterns and make predictions.

Disaster operations are vital and complex, and thus necessitates strong decision-making that is aided by information technology, particularly AI. Advances in ML and DL have been utilised in recent years to address the scale and impact of disasters through effective and informed disaster management. Disasters including hurricanes, earthquakes, floods, wildfires, and landslides are among the application fields. Recent technical advancements can also help with the management of man-made disasters like refugee crises. There isn't a single definition of a disaster, though.

In earthquake prediction machine learning algorithms analyze seismic activity data to identify patterns that may indicate an impending earthquake. Also, machine learning algorithms inspect data from satellite images, weather reports and river levels to predict the likelihood of flooding. By figuring out the humidity levels, wind speeds and vegetation cover; machine learning algorithms can predict the likelihood of a wildfire occurring. Similarly, the intensity of hurricane and cyclone can be predicted by analyzing data on weather patterns, wind speeds and ocean currents. The likelihood of landslide occurring can be predicted by investigating the topography, rainfall and soil moisture.

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II. RELATED WORK

Big data and artificial intelligence applications have been the focus of recent research in the field of catastrophe management [1]. Examples of AI applications for disaster management are given in [1], some of which involve hazard risk. allocation of resources, vulnerability assessment, early warning systems, catastrophe detection, event mapping, damage assessment, and disaster rescue and relief. In order to make judgements about disaster management, artificial intelligence is being used more and more to analyse vast amounts of data from a variety of sources. The authors [2] used a total of 26 AI algorithms for disaster management across 17 different applications. [3] examined the use of big data in disaster management. Journal articles published between 2011 and 2018 are included in this review. The authors assert that ML, which also incorporates DL, is a constantly evolving and growing catastrophe management technique. Research undertaken by [4] and the Minneapolis Department of Emergency Medicine supports the significance of dialling 911. This study compares the response times for dialling 911 vs first visiting a hospital or doctor. A paramedic from Kansas City's Truman Medical Centre contributed to this study in [5]. In order to save costs, the authors of article "21" used support vector machines (SVM) to pinpoint the most representative group for fuzzy logic processing. There are several different kernels that can be used in SVMs to model nonlinear decisions. In high-dimensional spaces, overfitting is not a problem for them. [6] employs SVMs in order to validate a catastrophe. SVM can categorise the Edge Histogram's (EH) emergency state using the sensor data. In [7], the support vector machine was shown to be the most effective method for identifying ISPA as it comes to user location verification. SVM has a better level of accuracy as compared to wireless networks, which require information on channel parameters. In order to distinguish flood-affected areas from unaffected areas in aerial photos, SVM is recommended in [8, 9, 10]. SVM was used in [11, 12, 13] to predict the occurrence of disasters. COVID-19 can be identified by deep support vector machines that leverage Internet of Things-enabled convolutional neural networks [14, 15].

There has been numerous research on crawler design. It is ideal to utilise a crawler's resources wisely, including its processing, bandwidth, memory, and storage and keeping. Websites that post news items also offer readers dynamic information, therefore crawlers need to be capable of gathering more than just static data. Online articles that provide information about disasters may contain text, images, videos, and other types of data. Therefore, crawlers must be expandable to enable the handling of any data structure [16]. Most of these are available according to the literature, it is possible to extract relevant data from the Internet. It's not easy. Important information must be identifiable and stored by web crawlers [17], [18]. This type of catastrophe classification was studied by several researchers and they have used Twitter records. The authors Delimayanti et al. classify floods as natural disaster and tweets it. How did the authors compare these methods and algorithms? Flood disasters were classified into three different categories group [19]. Gopal et al. demonstrated a data extraction technique for the acquisition of news items with high-risk content on the Internet, in which crawler software was created and used Machine Learning techniques to filter out important information. To search news reporting pages for hazardous stories, a crawler software has been developed and deployed [20]. Using Machine Learning and the processing of natural languages, Domala et al. created an Automated Identification of Disaster News for Crisis Management. Using Natural Language Processing, this system will scrape NLP and machine learning ideas content from English news websites and detect disaster-related news, which will be presented in a dynamic way during the crisis management [21]. The

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research team has created the internet's distribution network and the incremental crawling system in China, which has crawled information literature, news of disasters, and professional data, such as the current whereabouts of your home and abroad, thunderstorms, and make use of the new concept of knowledge management in the form of a knowledge tree to present this information that integrates the authoritative, worldwide typhoon live maps and orthophotos [22]. After that, the discarded news articles are fed into the machine-learning algorithm.

III. CONCLUSION

One of the main reasons people lose their lives and damage to infrastructure and property is caused by natural disasters. The complexity of disasters has been increasingly managed with the help of advancements in ML and DL. A review study has been done in this paper to find out how ML and DL techniques have been used to help disaster management operations and improve their performance in various areas. Machine learning can help make it better to predict natural disasters by improving the accuracy and speed of predictions. Some ways in which machine learning is helping are like:

1. Improved data collection: advancements in data collection technologies like satellites, drones and sensors to make more accurate predictions.
2. Integration with other technologies: machine learning integrated with other technologies like AI, Blockchain, IOT enabling real-time prediction of natural disasters.
3. Improved Modeling Techniques: more sophisticated modeling techniques can be developed using machine learning for natural disaster prediction.
4. The criticality and intricacy of calamity activities requires strong and approved ML also, DL arrangements. Calamity activities influence human existence; As a result, domain experts and decision-makers should be able to comprehend the developed models. In addition, research ought to concentrate on enhancing the performance of ML/DL-based methods for disaster management operations by enhancing the quality of the data, developing novel methods for data capture, and utilizing crowdsourcing.

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