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Artificial Intelligence Use in Disasters Management

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Abstract:- The growing in-stability of our environmental climate and the rising occurrence of natural disasters, the contribution of AI in disaster management is not only advantageous – it is indispensable. Artificial intelligence is extensively used in forecasting and preparing for disasters conditions, as well as for alerting events, identifying resources and reducing damage after disaster. And its response to effectively in better and more rapid preventive help in disasters management. The purpose of this paper is to identify the uses of artificial intelligence technologies in reducing the impact of disasters on the lives and to investigate the possibility, recovery solutions by artificial intelligence technologies. That based on information and communication technology and reducing the effects of disasters on lives as well as on nature. Also, the paper includes the advantages and challenges in AI. The AI application in forecasting, mitigating, and responding to disasters has brought significant changes. AI's capacity to analyse large volumes of data, identify trends, and generate forecasts has been used to predict a range of natural disasters, including earthquakes and wildfires.

Keywords:- *Artificial Intelligence, Disaster Management.*

I. INTRODUCTION

Artificial Intelligence (AI) is a new branch of computer science in which technology is used to enables computers and machines to work with human intelligence and power of problem-solving capabilities.

AI is used in the field of disaster management, where it is important for minimising, predicting and managing of disasters conditions from the forecasting of disaster events and the development of hazard plans to detect events in real-time and to make required decisions accurately.

Now, artificial intelligence technology has been widely used in all the fields like education, agriculture, commerce, entertainment and service industries, science, business etc... and we can say that the golden era of artificial intelligence has arrived.

On the other hand, our earth has natural disasters, like hurricanes, earthquakes, floods, tornadoes, wildfires, tsunamis, volcanic eruptions, and droughts. Each of these events can have devastating effects on communities and ecosystems. But we cannot completely control it or not giving any prediction about it. So, we can use the new technology and innovation to minimise the impact of these disasters.

Artificial Intelligence (AI), with its power of capabilities, is arising as a potential tool in disaster prevention and recovery. But before that we understand that the nature of these disasters.

The Natural disasters are broadly classified into geological, meteorological, hydrological, and climatological phenomena. Earthquakes, volcanic eruptions, and tsunamis fall under geological disasters, while meteorological disasters include hurricanes, tornadoes, and blizzards. Hydrological disasters involve floods and landslides, and climatological disasters encompass droughts, heatwaves, and wildfires.

The human safety and well-being, environmental conservation like habitat destruction, pollution, and ecosystem disruption and the social stability that all need ways of the disaster prevention.

II. AI IN DISASTER PREVENTION

Fig.1 AI in Disaster Prevention

Artificial intelligence can play a significant role in disaster management and early warning systems.

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In **Data analysis** the AI algorithms can analyse vast amounts of data from various sources, including satellite imagery, weather sensors, social media feeds, and historical records. By identifying patterns and anomalies, AI can help to forecast the disaster conditions and range of disasters such as hurricanes, floods, wildfires, and earthquakes.

In AI **early warning systems** can detect potential disasters in real-time or even predict them before they occur. For example, AI algorithms can analyse seismic activity to provide early earthquake warnings or monitor weather patterns to forecast storms and floods. These warnings enable authorities to alert communities, evacuate residents, and implement emergency response plans accurately.

During a disaster, AI can optimize response efforts by analysing real-time data and coordinating resource allocation. For example, AI-powered systems can route emergency vehicles more efficiently, identify areas where the actual help needed, and predict the spread of wildfires or floods to deploy resources effectively. Equipment like Drones used with AI algorithms can monitor forests for a reason of potential file sources, such as lightning strikes or campfires. AI can also analyse weather conditions to predict the reason for spreading fires, informing firefighters for emergency services. So that the firefighter gives their performance more effectively.

To give prediction about nature disaster the AI models can process data from rainfall gauges, river levels, and soil moisture sensors. It can give information that when and where floods are likely to occur. Also, AI-driven flood modelling system can help to design better infrastructure and urban side planning to reduce flood risk condition and damage.

AI can assess the vulnerability of infrastructure, buildings, and communities to various types of disasters. By analysing factors such as building materials, terrain elevation, and population density, AI algorithms can identify high-risk areas and prioritize mitigation efforts.

III. ADVANTAGES OF AI IN DISASTER MANAGEMENT

As we look on AI advantages in disaster management has become an indispensable asset, it helps as early warning system as well as more important in the support of post-disaster recovery.

AI can assist in post-disaster recovery efforts by analysing damage assessments, coordinating reconstruction efforts, and identifying areas in need of assistance. For example, AI-powered drones can survey affected areas and assess infrastructure damage, helping authorities prioritize repair and rebuilding efforts.

❖ *Let's Take a Closer Look at Some of the Benefits of AI System in Disaster Management:*

Artificial intelligence algorithms play an important role in predicting potential natural catastrophes. These algorithms can manipulate huge data, and identifying types and trends that could indicate future of disaster.

It also allows for the prompt evacuation of areas that are at risk, thereby potentially saving lives and reducing property damage.

➢ *AI for Accurate Weather Forecasting*

AI can enhance model of traditional weather forecasting, which depends on complex mathematical operations to mimic atmospheric behaviour. In this case machine learning techniques can identify patterns that human forecasters might miss, by adding more resources. It provides better response and making accurate predictions for natural disasters.

➢ *AI for Disaster Management Response and Recovery*

During a natural disaster, AI-uses drones and robots, this is the latest technology used in disaster management. It can be used to identify damage, search for survivors, and deliver help to affected areas.

These **autonomous systems** can operate in hazardous environments that may be too dangerous for human responders, such as areas affected by radiation or toxic chemicals.

Additionally, AI can analyse data of the damage area, the needs of affected communities, and the availability of resources that help in optimizing resource allocation during disaster management.

➢ *AI in Post-Disaster Recovery and Rebuilding*

At the time of natural disaster, AI can help in long-term recovery and rebuilding works.

AI algorithms can help the most effective strategies for recover and rebuild infrastructure, restoring ecosystems, and support to the affected lives by analysing data. This ensures that recovery works are targeted and efficient, and thereby minimizing the long-term reasons of natural disasters.

➢ *Challenges Using AI*

When we use artificial intelligence in natural disaster management, it has made significant strides in managing natural disaster risk, its limitations have hindered its regular application in real situation. So here are some challenges of artificial intelligence in disaster management that need to be addressed:

➢ *Data Collection and Handling*

AI require the large amount of data for algorithm, also it require the high- quality data to learn effectively. If the AI get poor quality data or incomplete, inaccurate data, the whole structure gives erroneous conclusions or biased models. So, we can say that lack of data is become a biggest

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challenge. It can significantly impact on the performance of AI models.

- *Computational and Transparency in AI*

As per AI models it is relatable with complex structures, and it became so expensive. For AI algorithms or deep learning process, the computational resources like high performance CPUs or GPUs and large amounts of memory, are more valuable otherwise whole process become more time consuming and expensive.

In AI algorithms, deep learning models can operate internal workings and decision-making processes as black boxes, and making it difficult to understand. Lack of transparency can lead to difficult for adoption of AI systems.

- *Collaboration with AI*

In disaster management human and machine collaboration is most important. Ensuring the collaboration of the human decision and AI system includes the communication between AI recommendation and human judgement and this can be critical.

- *Problems of Infrastructure and Connectivity*

As we know that the disasters can disrupt communication networks and infrastructure, limiting access to data and computational resources. And deploying AI systems that can operate in low-resource or disconnected environments and is very essential for maintaining functionality during disasters.

- *Operational Implementation Challenges*

In case of user notification, the AI model presents Operational implementation challenges.

According to end-user needs, AI model outputs need to be translated and visualized.

In AI deep learning models, we often seen that the black boxes that often arrive, and it is difficult to understand how they arrive in any decision. And the large amount of data makes it complex computation.

IV. CONCLUSION

We concluded that Artificial intelligence improving early warning system, predictive analysis damage assessment, place allocation, awareness, automated response and preparedness activities. By harnessing the power of artificial intelligence, we can improve the ability of future prediction of disaster and prepare for it. Also, can respond to disasters, and saving lives and minimizing the impact of catastrophic events on lives of human as well as animals and ecosystems.

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