Sai Teja Bandaru

Ms. Sarah Sowden

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The Role of Ethical Data in Disaster Prediction and Management

In today's data-driven society, ethical considerations related to data usage are gaining paramount importance. This prominence is especially noticeable in the field of disaster management and prediction, where handling data ethically has significant effects on both the environment and human lives. In addition to helping with disaster preparedness and response, ethical data use advances the larger objectives of environmental preservation and community resilience.

Countless individuals are affected by natural disasters each year. Whether it's wildfires, floods, tornadoes, or volcanic eruptions, the list is seemingly endless. While certain disasters are brief, others can extend for weeks. But their effects can be felt for years or even longer, and impact the global economy, infrastructure, agriculture, and human health. The worst part is that future impact of disasters will grow dramatically due to climate change. Some regions that previously rarely suffered floods or wildfires now regularly overcome the effects of these natural disasters.

To save lives and reduce destruction, the aim of disaster forecasts is to give timely warnings and essential information. To achieve this objective, data will play a key role in providing insight for people preparing and responding to disasters. Yet we often miss the chance

to save as many lives as possible despite technological progress and vast amounts of information at our disposal.

There are several factors which contribute to this discrepancy. Sometimes we're not using the information effectively, Ethical considerations, technology limitations can be a barrier to our response. The objective of the present paper is to examine these issues, which emphasize the importance of data practices in realistic disaster scenarios to enabling the protection of a maximum number of people, the prediction of disasters in advance, and better preparedness to manage their consequences.

EARTHQUAKES

Earthquakes are hard to predict unlike other natural disasters in that they don't have a specific mechanism for predicting them. There are very high rates of earthquakes lethal and destructive. The total number of deaths for the last decade is higher than 1.5 million. Earthquakes cause insured losses of millions a year in the United States alone.

Movement of the tectonic plates causes the appearance of earthquakes. There are huge tectonic plates on our planet's crust. In places of their connection, there's a lot of stress. The stress gets high during the earthquake, there's a lot of strong elastic energy released. That energy causes destruction and fault ruptures of rocks. There's a part of the energy that is turning into vibrations, which are called seismic waves.

Earthquakes are random. There are massive amounts of seismic data collected by researchers in various regions. Though, modern models can describe earthquakes, but they are not capable of predicting them. The analysis of large volumes of seismic data is being carried out using deeper learning systems. To assess the size and pattern of earthquakes, such data can be used by

artificial intelligence. These data can be used to predict the occurrence of earthquakes. Google and Harvard, for example, are working on an AI system that can forecast seismic aftershocks. Scientists have been examining more than 131,000 earthquakes and aftershocks for the purpose of creating a network of neurons. In a trial of 30,000 events, the neural network was able to predict where aftershocks are located more accurately than standard methods. Similarly, software for earthquake and aftershock predictions is being developed by researchers around the world.

In conclusion, the utilization of seismic data is ethical, coupled with its in-depth analysis, offers the potential to enhance our ability to predict future earthquakes. We can strengthen our capacity to anticipate major events that may be occurring in the future by taking advantage of this information and making it subject to a thorough examination.

WILDFIRES

Uncontrolled fires in rural areas pose a threat to most countries around the world. We can even say that something is always burning on Earth. Of course, there are parts of the country which are more susceptible to fires. There are seasons of fire in their climate dynamics. The consequences can be terrible if we do not take account of this. In a lot of ways, wildfires are very destructive.

The forecasting and control of wildfire spread is difficult because it depends on a variety of factors, such as winds, terrain, humidity etc. are laid out. Moreover, fires may turn out to be headed in unexpected directions because of abrupt weather changes. A lot of real time data, which is a big computing challenge, are needed by researchers to predict how the fire will behave.

Data from meteorological stations, satellites and individual cameras are collected using current technologies. To identify the fire, a predictive model is based on satellite images and individual cameras. The predictability of these systems depends on ML approaches, the complexity of a weather scenario and regions' specifications. For instance, FireCast-(a deep learning model) system has an accuracy level of 87.7% and is recalled at a rate of 91.1%. Another new method to detect wildfires involves placing sensors in specific areas to detect chemical traces, smoke particles, gases in the air, and record temperature information. A cloud-based system then processes this data, aiding in the identification of wildfires.

To conclude, there are data from sensors that help to identify the onset of wildfire whereas satellite imagery and analysis models aid in identifying which direction and at what rate a fire is spreading. This information will enable an effective response to these fires in a timely and focused manner.

HURRICANES

Low pressure systems with organized thunderstorm activity that develop in coastal or subtropic waters are called hurricanes, the generic name of which is Tropical Cyclones. They're making use of the warmer ocean waters for energy. The surface winds are moving in a continuous circle as storm systems strengthen and become hurricanes. Meteorologists are referring to this pattern as a closed circulation. Depending on where a storm is situated, there are two opposite directions of circulation: clockwise in the north and counterclockwise in the south hemisphere. The rotating winds lead to the development of a hurricane's characteristic eye, its calm and clear center. The eye is surrounded by the eyewall, where winds are strongest.

For the forecast of hurricanes, two factors are included firstly, historical data on past hurricane seasons to predict how many storms there will be and their intensity. Estimated wind speeds and intensity of sustained winds can be reported using statistics methods. In particular, none of these forecasts is very accurate. Secondly, satellites responsible for monitoring the current hurricane. Every five minutes, satellites, such as GOES, the Geostationary Operational Environmental Satellite, record images of the Hemisphere. These pictures of the current hurricanes give us information about their activity. Then technology detects the eye of a hurricane by the above data we can find the direction and speed of the hurricane. Over time, these predictions become less reliable.

To improve the accuracy of hurricane forecasts, it is also important to collect a number of vital data such as seabed oceanographic and airborne data, detailed wind information near the surface or developing storms, high resolution weather maps in remote areas. It is, however, technically challenging to obtain this data but they can give a clear indication of hurricanes' intensity and direction in advance. Which would allow the affected areas to be evacuated as soon as possible, and thereby save more lives.

FLOODS

Floods are a natural disaster, like any other. There are many reasons for floods, such as rivers that burst through heavy rains or storm surges. The ecological effects of these disasters can last for decades or more, as is often the case with natural disasters.

Several types of data like the amount of rainfall are required to predict flooding events. In addition, information on flood risks is obtained from real time monitoring of rainfall. It shall be noted that the rate of change in river and sea level is helpful to indicate the severity and urgency

of a disaster. Satellite images as well as aerial photographs gives proper data of floods. Through image processing, knowledge of flooded areas is obtained, e.g., how much water runs out where it flows into an area, how extensive and dynamic the flooding can be and the strength of the river's flow must also be known.

Enhancing the precision of flood prediction requires the collection of crucial data, including information on river gauges, water levels, groundwater, floodplain mapping, hydrological and hydraulic models, and real-time data in remote regions. Advanced technology is essential for acquiring these data points. These valuable datasets will undoubtedly play a significant role in identifying and facilitating rescue efforts during future flood events.

Ethical theory: Utilitarianism in Disaster Management

Disasters, whether floods, earthquakes, hurricanes, or fires, often have a devastating effect on communities and the environment. In the interests of minimizing impact, and saving lives, efficient disaster management is essential. Utilitarianism is an ethical framework which can guide decision making in the field of disaster management. The objective of this ethical outlook is to maximize overall happiness and wellbeing by adopting choices that benefit the majority.

Earthquakes. Utilitarianism is promoting the strict construction codes and earthquake resistant infrastructure with a view to minimizing casualties and damage. Areas with the greatest chance of finding survivors will be prioritized by search and rescue operations, increasing chances for saving lives.

Wildfires. Utilitarianism is beneficial both for people and the environment because it supports efforts to combat wildfire risks by controlling burnings and forest management. Areas with the

greatest immediate threat to life and property are placed first in priority for allocation of firefighting resources and evacuation orders.

Hurricane. Evacuation decisions in the path of hurricanes are guided by utilitarian principles. The most densely populated and at-risk areas are prioritized. Areas with the most pressing needs, such as food, shelter, and medical care, are allocated resources for post hurricane recovery and distribution of aid.

Floods. Utilitarianism focuses its efforts on flood mitigation in areas prone to flooding. This involves the construction and maintenance of effective levees as well as flooding barriers to protect those communities at greatest risk. To save the most lives, priority will be given to areas where there is a high population density in evacuation plans and emergency response resources.

CONCLUSION

In conclusion, the paper highlights the critical importance of ethical data utilization in disaster prediction and management, recognizing that despite technological advancements, we often fall short of saving as many lives as we could due to various factors, including limitations in data acquisition and analysis. The exploration of different disaster types, such as earthquakes, wildfires, hurricanes, and floods, demonstrates the potential of advanced techniques in enhancing prediction and response capabilities. Additionally, the application of utilitarianism as an ethical framework in disaster management underscores the paramount goal of minimizing suffering and saving lives by making decisions that benefit the majority. Ethical data practices in disaster scenarios offer a promising path to better preparedness, resilience, and ultimately, the protection of a maximum number of people from the impact of these natural calamities.

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