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Natural Disaster Prediction System using Cloud-based Application

Aaron Rodrigues[1], Cassandra Rodrigues[2], Royce Dcunha[3]

[1-3]UG Student, Department of Computer Engineering, St. Francis Institute of Technology, Mumbai, India

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Abstract - *Natural disasters are extremely dangerous and occur frequently around the world. Natural disasters frequently result in injuries, property damage, and other physical and mental health effects. In India, detection is one of the most active remote sensing research areas today because saving human life is our top priority once a disaster has occurred. Disaster has a significant negative impact on society. Artificial Intelligence may be used to analyze data and provide warnings for future occurrences, as well as raise awareness of the problem. Random forest regression is a machine learning concept that is used to predict correct results when compared to other modules. Based on the results, we have suggested a model for natural catastrophes detection to save lives for humans and animals.*

Key Words: **Natural disasters, floods, cyclone, random forest regression, earthquake**

1.INTRODUCTION

The disaster is the result of both natural and man-made events that have an impact on our lives and the environment in which we live. Any catastrophe can be characterised as "natural" or "man-made." Very strong floods, earthquakes, cyclones, volcanic eruptions, and droughts are the most prevalent natural catastrophes that inflict property and life damage.

1.1 Earthquakes

One of the most dangerous natural catastrophes is an earthquake. Earthquake vibrations have a wide range of frequencies and speeds. For a big earthquake, the actual earthquake process may last only a few seconds. Earthquakes are recorded in seismograph networks. A seismograph is an instrument that measures the moment of an earthquake. Each seismograph measures the movement of ground vibration and records the vibrations on a graph sheet. These vibrations measure the magnitude depth at various levels based on a certain/average level of magnitude.

1.2 Cyclone

A cyclone is caused by a zone of low air pressure and high temperature over a water body or rivers. Cyclones are cloud rotations in a water body, and cyclones are events with various names in different places/locations. Cyclones may be found in the Indian Ocean and the South Pacific. Cyclones are classified in 3 types majorly:

1) Tropical Cyclone: Cyclones which occurs at the speed of less than 74 miles per hour

2) Severe Cyclone: Cyclones which occurs at the speed of between the 75 to 120 miles per hour

3) Super Cyclone: Cyclones which occurs at the speed of greater than 120 miles per hour

1.4 Artificial Intelligence and Machine Learning

Artificial intelligence (AI) is the demonstration of human intelligence processes by machines and the feeding of human experience to machines in the form of data, which greatly aids in the identification of emergency and disaster management efforts not only in India but also around the world, particularly in computers. Learning thinking and self-correction are among the features of these machines.

Examples of AI technology:

1) Machine Learning

2) Natural language processing (NLP)

3) Robotic

4) Self-driving cars

Machine learning and Artificial intelligence, when combined they can help responders track and predict disaster trajectory

2. DATASET COLLECTION

A. Flood Dataset

The floods dataset comes from Kerala and contains average rainfall for all districts. We also acquire the data from India's Regional Meteorological Centre.

Temperature, cloud cover, wind speed, and humidity conditions were obtained from https://mausam.imd.gov.in/.

The rainfall index for Kerala from 1900 to 2018 is included in the dataset, as well as details of whether or not floods occurred during that month. [17]

B. Earthquake Dataset

The Government of India's principal agency for monitoring earthquake activity in the nation is the National Center of Seismology.

The National Center for Seismology maintains a National Seismological Network of 115 stations around the nation, each with state-of-the-art technology. The National Center for Seismology keeps track of earthquakes all around the nation [10].

https://seismo.gov.in/

C. Cyclone Dataset

Every tropical cyclone in the northern hemisphere, which we name hurricanes, and the southern hemisphere, or Indian Ocean, which we call cyclones, is subjected to a post-storm investigation by the National Hurricane Center (NHC). https://www.kaggle.com/noaa/hurricane-database

3. METHODOLOGY

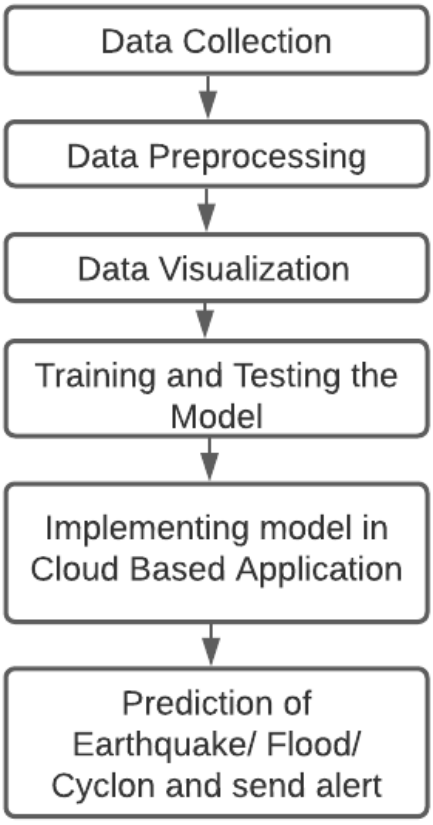

Fig-1: Methodology for predicting Natural Disasters

The Natural Disaster application is designed to anticipate floods, cyclones, and earthquakes. To do so, we must first gather pre-disaster datasets in order to forecast future catastrophes if they match specific criteria.

We need to install the model in a cloud platform for real-time catastrophe prediction, a weather crossing visual platform that delivers real-time data like temperature, humidity, cloud cover, and so on, and a geocode API that converts the location to latitude and longitude numbers. After that, we built a model and implemented it on the Heroku platform.

A. Data Preprocessing

Noises, missing values, and mistakes are common in real-world data, and they can't be utilized directly in machine learning models. Data preprocessing is necessary for cleaning the data and preparing it for a machine learning model, as well as increasing the model's efficiency and accuracy.

B. Importing Libraries

We need to import several predefined Python libraries to do data preparation in Python. These libraries are used to do tasks.

C. Splitting the Dataset into Training and Testing sets.

There are two sets of data in our dataset: a train set and a test set. We can improve the performance of our machine learning model by doing so. The train set is used to train our model, while the test set is used to see if it is performing properly.

D. Building the Model

Following the completion of data pre-processing, dataset training, and testing, we must construct the model utilizing algorithms. Judgment trees are classified as supervised machine learning since they build a model for predicting or making a decision on a given record. The decision-making process is quick and precise. The method of linear regression is used to determine the relationship between the independent and dependent variables.

Random forest regression takes the average of all decision trees because it is a composite of multiple decision trees. Random forest enhances the model's accuracy and eliminates overfitting difficulties by doing both classification and regression.

4. RESULTS

4.1 Earthquake Prediction

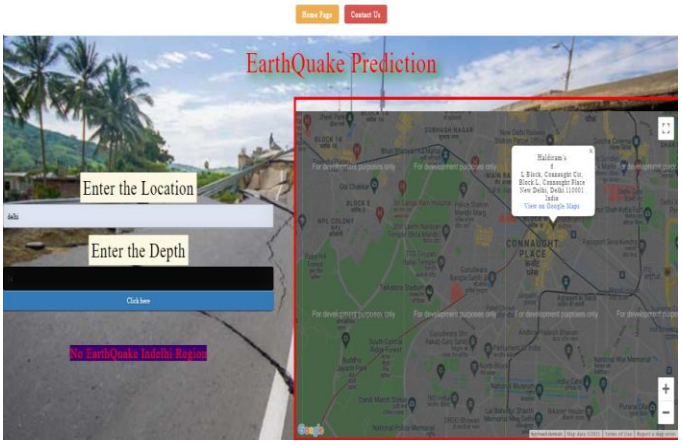

Fig-2: Model for Earthquake Prediction

If we enter the location and depth of the earth's surface, our model will forecast whether or not an earthquake will occur.

4.2 Cyclone Prediction

Fig-3: Model for Cyclone Prediction

If we provide the location, which will be converted to latitude and longitude using geo-code API, as well as the pressure and windspeed from the northern and southern hemispheres, the model predicts the presence of cyclones in the region; otherwise, no cyclones are predicted.

4.3 Flood Prediction

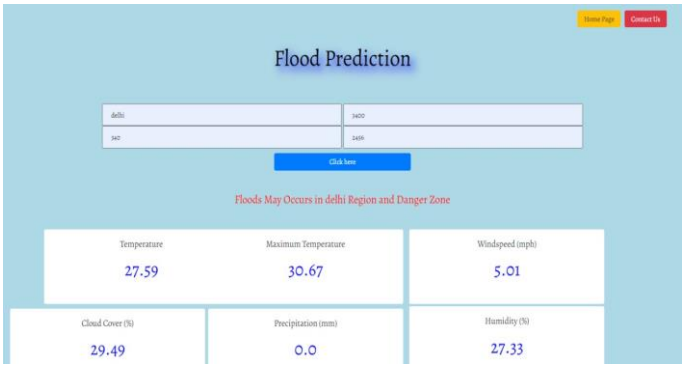

Fig-4: Model for Flood Prediction

Similarly, if we enter the location and rainfall, we utilize the weather crossing visual API to get real-time data such as temperature, cloud wind speed and pressure, and so on. The model then predicts if there is a likelihood of real-time flood prediction.

5. CONCLUSIONS

The development of modern technology such as cloud computing, artificial intelligence, and machine learning will aid in natural catastrophe prediction. This study provides an overview of machine learning approaches for natural catastrophe prediction. We created a model that forecasts a natural catastrophe using a machine learning method; our model employed the notion of random forest regression, and we also observed that random forest regression algorithm delivers better results/accuracy than other machine learning algorithms.

Furthermore, the datasets analyzed by AI-powered systems can aid in understanding the magnitude and other parameters of natural disasters such as windspeed, depth, temperature, and so on from a variety of natural disasters such as floods, earthquakes, and tsunamis, which may aid in the prediction of the model's accuracy in the future/upcoming days.

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