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Earthquake Prediction using WSN Data and Machine Learning

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***Abstract*—** Earthquake is sudden shaking of the ground surface caused by the movement of seismic waves through Earth's rocks. Earthquakes are one of the major disasters and their unpredictability causes even more destruction in terms of human life and financial losses. The aim of the project is to predict the chances of earthquake using wireless sensor network data and machine learning and to alert people before the disaster occurs and save their lives. In the project a simpler way of detecting the occurrence of earthquake has been introduced. It is based on collecting WSN data using the API's and Machine learning algorithms where weather information API is used to fetch live weather details. The collected live weather data and the previous details of the weather in a particular place are passed to Machine learning algorithms i.e. SVM, KNN, Random Forest, Decision tree and the algorithm which gives more accuracy is chosen and is applied on it to predict the current chances of disaster occurrence. If there is a chance of occurrence of the disaster (Earthquake) then an alert message is sent to the concerned authority to create awareness among people.

***Keywords*—** *WSN, SVM, KNN, Decision tree.*

I. INTRODUCTION

Monitoring of environmental disasters in real time is one of the basic requirements in the world. Different technologies have been developed for this purpose. Wireless sensor network (WSN) is one of the major innovations that can be utilized for real-time observing. Wireless sensor organize (WSN) refers to a group of spatially scattered and devoted sensors for checking and recording the physical condition information at a central area. WSN has capability of huge scale arrangement, low maintenance, versatility, flexibility for distinct scenarios etc. WSN has its confinement such as low memory, control, transfer speed etc, but its capability to be spent in threatening environment, and low maintenance necessity made it one of the leading suited innovation for real-time observing. Wireless sensor Networks (WSN) refers to a group of spatially scattered and devoted sensors for checking and recording the physical condition information at a central area. WSNs degree natural conditions like temperature, sound, contamination levels, stickiness, wind, and so on. These are similar to remote ad hoc networks in the sense that they depend on wireless network and spontaneous formation of network so that sensor information can be transported wirelessly.

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly. Disaster monitoring is a very important task in the world for which the different technologies have been introduced. WSN plays a major role because it is scalable and adaptable to the various scenarios.

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In this paper section I presents the introduction of the project, Section II contains outline of the related work, Section III contains the methodology used in the project, Section IV outlines the results and discussion and section V concludes research work with future directions.

II. RELATED WORK

According to authors Mr. R S Prasanna kumar, Shazia Anjum M S[1]. WSN and linear regression algorithm is used for landslide prediction

According to authors Maneesha V. Ramesh [2] landslide detection in Idukki, Kerala(dist) is a major problem. Wireless sensors can be used for disaster prediction by placing them under the ground from which the live weather data is fetched based on current time and place. The

information fetched from the wireless sensors is used to predict the occurrence of the disaster.

According to authors Khawaja M. Asim et.allsixty [3] seismic features are computed through employing seismological concepts, such as Gutenberg-Richter law, seismic rate changes, foreshock frequency, seismic energy release, total recurrence time. Further, relevant features are extracted using Maximum Relevance and Minimum Redundancy (mRMR) criteria. A classification system is built based on Support Vector Regressor (SVR) and Hybrid Neural Network (HNN) to obtain the earthquake predictions.

According to authors Jilani Z et.all [4] the emission of radioactive gas named 'radon' before the earthquakes is a potential earthquake precursory candidate. The study aims to monitor and to analyse the radon in relation to seismic activity in Northern Pakistan. For this purpose RTM-2200 has been used to monitor the changes in radon concentration.

According to authors Nayak DR, Mahapatra A, Mishra [5] a survey of different methodologies used by different researches to predict rainfall using ANN is discussed.

III. METHODOLOGY

In the project a simpler way of detecting the occurrence of earthquake has been introduced. It is based on collecting WSN data and using the API's and Machine learning algorithms. Selectk best algorithm is used to select the input parameters. Feature selection is a technique where the features in data that contribute most to the target variable is selected.

In other words the best predictors for the target variable are chosen. The classes in the **sklearn.feature_selection** module can be used for feature selection/dimensionality reduction on sample sets, either to improve estimator's accuracy scores or to boost their performance on very high-dimensional datasets. Latitude, longitude, depth, nst , gap, rms values are chosen as input from datatset using select k best algorithm and passed to earthquake prediction function. Output is the magnitude. The live weather fetched using OpenWeather API is passed as input to machine learning algorithms i.e. SVM, RANDOM FOREST, DECISION TREE,KNN. The algorithm with more accuracy .i.e. KNN is chosen and the occurrence of the disaster is predicted and alert message is sent to the concerned authority. The different modules are:

(a) Earthquake

Earthquakes are one of the most destructive mother-nature disasters in the world. An earthquake is defined as quake or tremor which there will be a slipping or movement of earth`s crust as a result of a sudden release of energy, accompanied and followed by a series of vibration on the ground that causing damages. The series of vibrations is known as seismic waves and can be measured using seismometer, a device which also records the seismic waves known as seismograph. This disaster may happen naturally or caused by human activities and very difficult to predict.

(b) WIRELESS SENSOR NETWORK

Real time events are analysed using Wireless sensor networks (WSN) .It is scalable, adaptable and has less maintenance cost. But it has less power and memory. By using the sensors the live weather information is fetched . The data can be fetched using the API or by using satellite. In the project data is fetched using API.

(c) API

Application Programming interface (API) includes a procedural code using which a new application can be created and accessed. It acts as a messenger. By delivering the requests to providers that we request and responses back .An API is functionalities which are independent of their definitions and implementations and are varied without compromising each other. A good API provides the building blocks and makes the program development easier by.API also enables the developer use the available information to create apps. It can be used repeatedly and reduces the complexity of code.

API's used to fetch weather details:
"http://api.openweathermap.org/data/2.5/weather?q=".$city."&appid=".API_KEY
"http://api.openweathermap.org/data/2.5/forecast?q=".$city."&appid=".API_KEY

Current weather of a location can be called using city name or city id.

(d) Algorithm

K-Nearest Neighbors :

KNN is an algorithm that stores all available cases and classifies new cases based on a similarity measure using the **formula :** $D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

The KNN algorithm assumes that similar things exist in close proximity. In other words, similar things are near to each other;

Steps to implement KNN model:

Step 1: Load the data

Step 2: Initialise the value of k

Step 3: For getting the predicted class, iterate from 1 to total number of training data points

Step 4: Calculate the distance between test data and each row of training data. Here we will use Euclidean

Step 5: Sort the calculated distances in ascending order based on distance values

Step 6: Get top k rows from the sorted array

Get the most frequent class of these rows

Step 7: Return the predicted class

Fig.1. Graph of K-Nearest Neighbors (KNN algorithm).

IV. RESULTS AND DISCUSSION

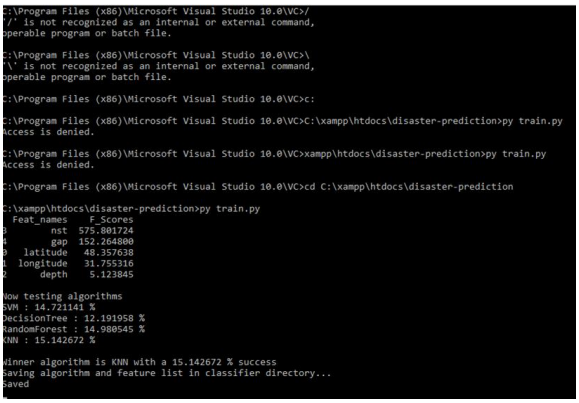

Fig.2. Algorithm selection

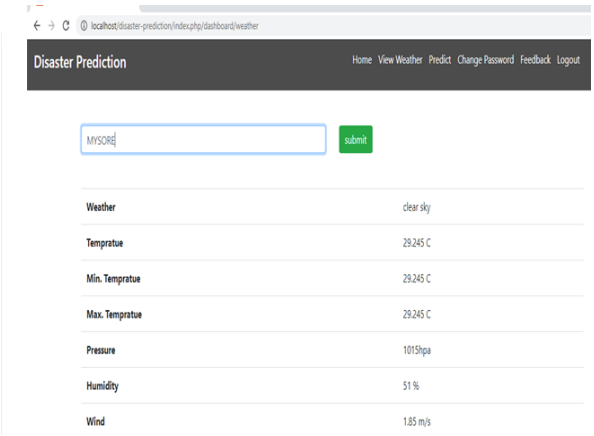

Fig.3. Weather Details

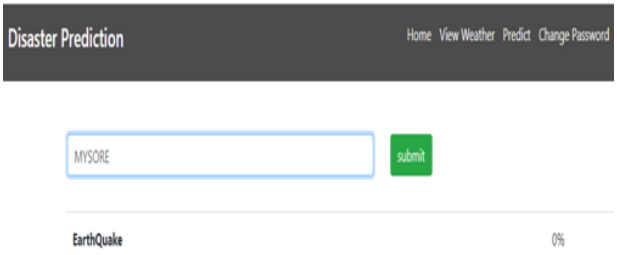

Fig.4. Prediction

Figure 2 shows the output in which the algorithm that gives more accuracy is chosen and considered to be the winner algorithm and is used to predict the occurrence of the disaster. Figure 3 and 4 are the results obtained by using Wireless Sensor Networks data and machine learning algorithm.

V. CONCLUSION AND FUTURE SCOPE

Earthquake prediction using wireless sensor network data and machine learning is a challenging research where in this work the disaster is predicted earlier by considering the various factors to save the nature and alert people. It can be extended by considering various other factors and the live data can be fetched using sensors for accurate results.

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