International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2020 IJSRCSEIT | Volume 6 | Issue 3 | ISSN : 2456-3307
DOI : https://doi.org/10.32628/CSEIT2063107

Earthquake Prediction using Seismic Information

Madhushree N[1], Dr. R. Thirukkumaran[2]
[1]M. Tech Scholar, New Horizon College of Engineering, Bangalore, Karnataka, India
[2]Associate Professor, New Horizon College of Engineering, Bangalore, Karnataka, India

ABSTRACT

Earhquake is one of the most hazardous, devasting natural calamity and yet a very least predictable natural disaster that occur. Prediction of earthquake has been a challenging research for many researchers. With the increasing amount of earthquake dataset collected, many researchers try to solve the task of predicting the earthquake in future time. Even though many data mining techniques are been used, the prediction rate is not still accurate due to lack of feature extraction technique. The proposed methodology enhance the performance of earthquake prediction. As obtained precursory pattern features along with Random forest regression is used to get prediction of the magnitude of future earthquakes.

Keywords : Earthquake, Precursory Pattern, Magnitude, Time Range, Random Forest Regression

I. INTRODUCTION

Earhquake is one of the most complex, hazardous natural calamity. Usually an earthquake is the shaking of the surface of the earth which produce or release energy over the earth's lithosphere that form the seismic waves. The seismicity or seismic activity of an area is termed as frequency, type and size of earthquake which is taken over a period of time.

The scale of measuring the earthquake magnitudes was developed by Charles F. Richter in the year 1935. Even though the media reports of earthquake magnitude as Richter magnitude or Richter scale, standard practice by most of the seismological authorities express as an earthquake strength on the moment magnitude scale, which is usually based on actual energy released by the earthquake.

An overall estimation is about 500,000 earthquake that occur every year, about 100.000of these can be felt minor earthquakes occur in places like California and Alaska in USA as well as Iran, Chile, Turkey, Japan, Greece, Italy, Mexico, India, Nepal, Pakistan etc.

As the data set of earthquake collected is increasing many researchers are trying to solve the prediction of earthquake which is used to count time, magnitude, places of the future earthquake.

With data mining techniques a numerous research scholars discovered patterns of earthquake from seismic time series, but the prediction is not accurate, due to lack of feature extraction.

Feature Extraction is a method of enhancing machine learning by finding out the characteristics in the data which tries to help the particular problem. While

features can be obtained or taken by set of sequence comparison techniques followed which are like dynamic time wraping and also by subsequent discovery technique.

Features usually contain the properties of the data set. Extracting data mining techniques cannot be used on time series data. Thus, a dimension reduction is required through feature extraction technique which map each and every time series.

While, the project here proposes a precursory pattern based feature extraction technique for predicting the With data mining techniques a numerous research scholars discovered patterns of earthquake which is capable of predicting the magnitude of the occurance of earthquake and also the effective time range of earthquake.

A precursor pattern of earthquake represent the part involved in seismic records before activating the main shock this is considered as precursory pattern of earthquake. In order to obtain, at first a seismic data is divided into a fixed day time period from the magnitude occurred by the largest earthquake of each time period it involved is known as main shock. The set of sequence involved of the last events during last time that has occurred before the present time is here considered as precursory pattern. Seismic indicators are considered from the precursory patterns. At the end prediction is done of magnitude of earthquake using Random forest regression.

OBJECTIVES

1. Feature extraction (Precursory pattern based) feature extraction ie, the characteristics of earthquake, it can be used to improve the prediction results.
2. Applying machine learning algorithm random forest regression on the extracted features to predict the magnitude.

II. LITERATURE SURVEY

Gutenberg, had made use of statistical feature method approach and forned a seismic indicators. Likewise, magnitude, energy, acceleration of the earthquake and so on.

Nuannin, made use of sliding time and space window which is eventually based on seismic events to gain the indicators of earthquake.

Florido, from the above obtained seismic events eventually considered a few number of fixed seismic events which formed before the main earthquake happened, like a precursory pattern in order to extract the necessary features but the proposed method was in efficient to determine the magnitude of the earthquake of the main shock.

Narayana kumar, had extracted the seismic features indicating the fixed number of events that occurred in prior to main shock, using BP neural network, The results demonstrate that accuracy is better for medium and large earthquakes.

Adeli, proposed a new feature extraction where it solved the problem of magnitude and an effective time range of prediction. The author used the probabilistic neural netwok (PNN) which provided with good prediction results of earthquake whose magnitude lies in between 4.5 to 6.0 Richter.

Mirrashid, had established the prediction of earthquake with the magnitude 5.5 and more by making use of ANFIS (adaptive Neuro Fuzzy Interface System). The obtained results claimed best results.

Asencio, proposed a clustering method mainly for the seismogenic zone and then perform machine learning algorithm to make the prediction of earthquake, which included ANN, KNN, NB, decision tree, SVM.

Mart, in order to obtain the relevant feature selection redundant features were to be eliminated, the author used information gain of each one of the seismic indicators for the selection,

Asim proposed a hybrid embedded feature selection method where precise prediction was established.

Hamze- Ziabari, recently build on bagging ensemble model and CART (classification and regression tree) algorithm were used to predict the ground acceleration.

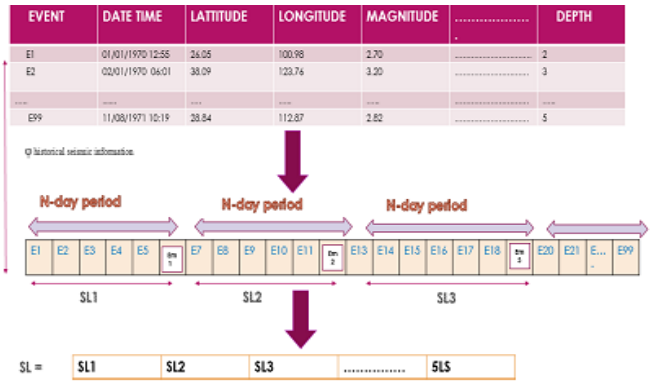
III. PROPOSED METHODOLOGY

This project proposed a precursory pattern a feature extraction technique along with the Random forest regression algorithm, to predict the magnitude of the earthquake.

IV. METHODLOGY

In order to form the learning sample, initially the raw seismic data time period while the magnitude formed of the longer earthquake including with each time period termed as the main shock. Sequence which contain of prior events in the due of prior time period before the present time and events usually are prior the main shock of present time period is considered as the earthquake precursory pattern.

From this the seismic indicators obtained based on precursory patterns with random forest regression algorithm which in turn leads to the prediction of magnitude of future earthquake.
While to predict the magnitude as well as obtain the good time range of the upcoming earthquake, we are using the precursory pattern feature extraction method. Initially the seismic records obtained is divided into a N day time period, while the magnitude of the higher earthquake equivalent to the time period will be considered as an systematic seismic indicators.



The following figure represent the pictorial representation on how the methodology works as shown in the below fig: 1.

Fig 1 : Pictorial Representation

SEIISMIC INDICATORS:

- The time span denoted as ΔT
- The mean magnitude
- The mean square deviation
- The maximum difference of seismic magnitude
- The bvalue

STEPS INVOLVED:

- Loading data from seismic wave data servers.
- Extracting seismic information and preprocessing.
- Extraction of feature which is formation of precausory pattern
- Use precausory pattern to form statistical feature called as seismic indicator.
- Once this is formed input these feature with labels will be a input to decision tree algorithm.

- Pruning will be performed for generalization of model heuristically.
- Feature importance scores will be formed to understand effect of the seismic indicators.

RANDOM FOREST REGRESSION:

A Random Forest defined as an ensemble method which is worth in performing regression and classification with the use of many decision tree. This method is known as bagging. Th main form is to combine many decision trees in determining the end results instead of just finding the result in a single decision tree. In general random forest is a collection of decision treed.

Viewpoint:

- By training set pick a k random data points.
- From the k data points which is formed build a decision tree
- Find a num Ntree of a trees that you need to form the tree and restart step 1 and 2.
- As obtained a new point ,it has to predict Y by making use of Ntree trees. Finally it has to give the obtained point as an average to all the Y predicted.

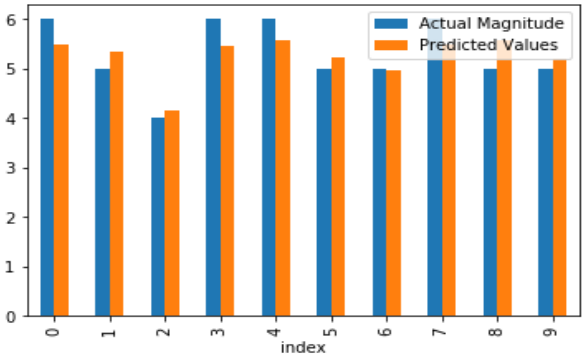
V. CONCLUSION

In this project, proposed a precursory pattern a feature extraction method along with random forest regression for the accurate prediction. By analysing the results of algorithm along with precursory pattern will provide the best performance, to solve the task of earth quake prediction for predicting magnitude and an effective time range.

VI. RESULTS

After extracting the features and applying the Random forest regression algorithm magnitude of the earthquake is predicted. Below represent the snapshots obtained of the predicted magnitude of the earthquake.

	index	Actual Magnitude	Predicted Values
250	0	6	5.477836
181	1	5	5.341877
3742	2	4	4.145990
2848	3	6	5.455570
2109	4	6	5.568846
262	5	5	5.238799
3172	6	5	4.980557
3099	7	6	5.495529
3663	8	5	5.562380
171	9	5	5.185821



VII. REFERENCES

[1]. Lei Zhang, Langchun Si, Haipeng Yang, Yuanzhi Hu, Jianfeng Qiu. Precursory pattern based feature extraction technique for earthquake prediction. Citation information: DOI 10.1109/ACCESS.2019.2902224, IEEE Access

[2]. B. Gutenberg and C. F. Richter, "Earthquake magnitude, intensity, energy, and acceleration (second paper)," Bulletin of the Seismological Society of America, vol. 46, no. 2, 1956.

[3]. P. Nuannin, O. Kulhanek, and L. Persson, "Spatial and temporal b value anomalies preceding the devastating off coast of nw

sumatra earthquake of december 26, 2004," Geophysical Research Letters, vol. 32, no. 32, pp. 339–357, 2005.

[4]. H. Adeli and A. Panakkat, "A probabilistic neural network for earthquake magnitude prediction," Neural Networks, vol. 22, no. 7, pp. 1018–1024, 2009.

[5]. L. Breiman, J. H. Friedman, R. A. Olshen, and C. J. Stone, "Cart: Classification and regression trees," Encyclopedia of Ecology, vol. 40, no. 3, pp. 582–588, 1984.

[6]. S. Narayanakumar and K. Raja, "A BP artificial neural network model for earthquake magnitude prediction in himalayas, india," Circuits and Systems, vol. 07, no. 11, pp. 3456–3468, 2016.

Cite this article as :

Madhushree N, Dr. R. Thirukkumaran, " Earthquake Prediction using Seismic Information", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 6, Issue 3, pp.554-558, May-June-2020. Available at
doi : https://doi.org/10.32628/CSEIT2063107
Journal URL : http://ijsrcseit.com/CSEIT2063107