EARTHQUAKE PREDICTION BASED ON SPATIO TEMPORAL DATA MINING: A LSTM NETWORK APPROACH

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ABSTRACT:

Seismological research is extremely important all around the world. As a result, new tools and algorithms are needed to anticipate magnitude, duration, and geographic location, as well as to identify relationships that will help us better comprehend this phenomenon and so save countless lives. However, given the highly unpredictable character of earthquakes and the difficulty in developing an effective mathematical model, current efforts are insufficient, and new ways to help solve this problem are required. This paper proposes a new earthquake magnitude prediction approach based on the composition of a known system whose behaviour is dictated by measurements from more than two decades of seismic occurrences and is modelled.

KEYWORDS: Earthquake, Prediction, Geohazard, Disaster Management, Mathematical Model, And Spatial Connection.

1.INTRODUCTION:

Earthquakes are major natural disasters that strike all over the world, wreaking havoc on infrastructure and killing people. Land Deformations, Tectonic Movement, Seismic Activity, Differences In Seismic Wave Velocities Of Different World Regions, Geomagnetic And Geo-Electric Phenomenons are some of the current methods of prediction. Based on the Spatial Connections Theory, which Extreme Events, Such As High-Magnitude Earthquakes

2. OBJECTIVE:

This study, we divided the whole observation period into non-overlapping 1-hour windows and only considered the largest event that occurred in each hourly window. For instance, take a look at the first 100 hours of our Magnitude Time Series. Some windows have a Magnitude of 0, indicating that there have been no earthquakes.

3. LITERATURE REVIEW

1. N. Xiong, A. V. Vasilakos, L. T. Yang, Y. Pan, C.-X. Wang, andA. Vandenberg, ‘‘Distributed explicit rate schemes in multi-input–multi-output network systems,’’ IEEE Trans. Syst., Man, Cybern. C, Appl. Rev.,vol. 40, no. 4, pp. 448–459, Jul. 2010..

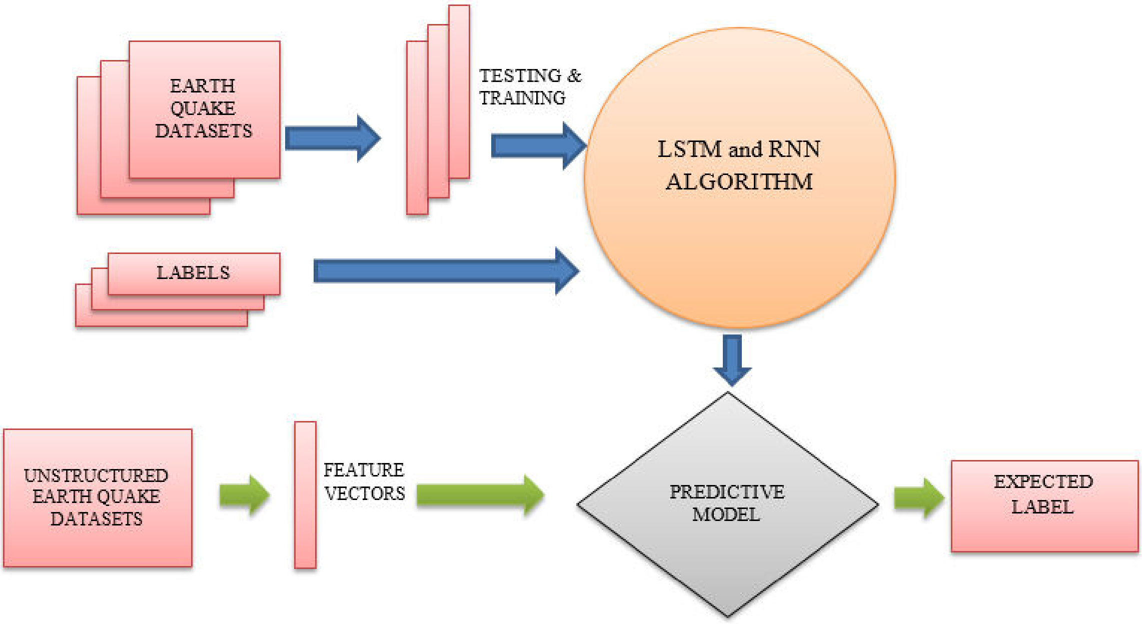
Earthquake prediction is an important and complex task in the real world. Although many data mining-based methods have been proposed to solve this problem, the prediction accuracy is still far from satisfactory due to the deficiency of feature extraction techniques. To this end, in this paper, we propose a precursory pattern-based feature extraction method to enhance the performance of earthquake prediction. Especially, the raw seismic data is firstly divided into fixed day time periods, and the magnitude of the largest earthquake in each fixed time period is labeled as the main shock. The precursory pattern is a part of the seismic sequence before the main shock, on which the existing mathematical statistic features can be directly generated as seismic indicators.

2.Q. Zhang and C. Wang, ‘‘Using genetic algorithm to optimize artificialneural network: A case study on earthquake prediction,’’ in Proc. 2nd Int.\Conf. Genetic Evol. Comput., Sep. 2008, pp. 128–131.

Predicting the time, location and magnitude of an earthquake is a challenging job as an earthquake does not show specific patterns resulting in inaccurate predictions. Techniques based on Artificial Intelligence (AI) are well known for their capability to find hidden patterns in data. In the case of earthquake prediction, these models also produce a promising outcome. This work systematically explores the contributions made to date in earthquake prediction using AI-based techniques. A total of 84 scientific research paper

4. SYSTEM DESIGN:

System testing ensure that the entire integrated software system meets the requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.



our work is to find the impact of earthquakes using MMI , Earthquake depth, distance from the epicentre and richer scale magnitude. We have successfully completed our research and are able to find out the impact of the earthquake. We have occuracy of by using naive Bayes algorithm and using LSTM network. The depicts the predicted and actual values on naïve Bayesian model explains the loss graph of train and test data.

5.IMPLEMENTATION :(USING ALGORITHMS)

Input: The time series {X(i),i=1,2,,N}

1: reconstruct the data into a m-dimension phase space,

with time delay equals 1.

```
for j = 1:M

for i = 1:m

X(i, j) = data((i − 1)*1 + j);

end

end
```

2: Establish the training set and use the model to predict.

```
a = 1; b = 162;

x = X(:, a:b); y = X(:, a + 1:b + 1); st = 3; pre = []; tr =

[];

Re = data(b + 1:b + m + st);

for step = 1:st

tt1 = y(:, end);

tt1 = tt1';

p1 = x(:, 1 + step-1:end)';

errgoal = 10−8

;

sc = 3;

net = newrb(p1, tt1, errgoal,sc, 200, 1);
```

Using the training model to predict

```
p2 = y(:, 1 + step-1:end)';

tr1 = sim(net, p1); %Training results

tr = [tr; tr1];
```

ty = sim(net, p2); %Testing value

add = [tt1(2:end)’; ty(end)];%Predicted value

x = [x, tt1’];%extended training set for muti −

step prediction

y = [y, add];%extended testing set

pre = [pre, ty’]; %prediction results

end

Output: Return predicted values

5.TESTING:

Since the error in the software can be injured at any stage. so, we have carry out the testing process at different levels during the development. The basic levels of testing are

- Unit Testing
- Integration Testing
- System Testing
- Acceptance Testing.

6.MODULES:

1. Data collection.

2. Data cleaning.

3.Exploratory data analysis (EDA).

4. Implementation of LSTM.

5.Time series modeling.

7.CONCLUSION:

In this paper we have proposed a new earthquake prediction system from the Spatio-temporal perspective. Specifically, we have designed an LSTM network with two-dimensional input, which can discover the Spatio-temporal correlations among earthquake occurrences and take advantage of the correlations to make accurate earthquake predictions. The proposed decomposition method for improving the effectiveness and efficiency of our LSTM network has been shown to be able to significantly improve the system performance.

8.FUTURE ENHANCEMENT:

We describe in detail our proposed earthquake prediction algorithm using an LSTM network with two dimensional input. The main idea of our algorithm is to develop an LSTM network with two-dimensional input to predict the next system status based on a number of the most recent system statuses. This is achieved by learning the correlations among earthquakes in *different* locations at different times. In the following, we will first introduce the fundamentals of the LSTM architecture and then explain how we devise an LSTM with two-dimensional input to develop our earthquake prediction algorithm. take advantage of information in the past time. Particularly, in an RNN, the output not only depends on the current input, but also depends on previous inputs. Denote the input vector at time t by xt. Then, the RNN network updates the hidden layer states h1 t ; ... ; hK t and computes the output yt based on the input xt and the hidden layer statuses at the past time instance. hk t denotes the kth hidden layer's state at time t, which is essentially a vector with the number of the elements representing the number of nodes at the kth hidden layer. we can see that the past input information would be propagated horizontally in each layer through weight matrices and nonlinear Function, and hence can be used for prediction.

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