Earthquake Location Forecasting In Map Using XGBOOST Algorithm

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Abstract

Earthquake is one of the most threatening natural disasters which is caused due to the shaking of the earth's surface. Common cause of earthquake is due to ground shaking, underground volcanic eruption. Here, XGBoost Algorithm is used to predict the location of the earthquake. In this paper, a earthquake location prediction method is proposed, which is based on the composition of a known system whose behaviour is administered according to the evaluation of more than two decades of seismic events and is designed as a time series using Machine learning. By analyzing the parameters such as Latitude, Magnitude, Depth, Longitude, Depth error, Gap, Time etc.

Keywords: XGBoost Algorithm; earthquake; magnitude; earth surface; ground shaking; seismic events; time series

1. Introduction

An earthquake is a sudden movement of the earth caused by release of strain over a long time and it's a shaking surface of the earth. Earthquake are caused mostly by the seismic wave of geological fault in most general form the word earthquake is used describe any seismic occurrences whether it's caused by nature or caused by humans that generates seismic wave and it arises due to the volcanic activity, Landslide, Mine blast, and Nuclear test. The earthquake is more challenging and uncontrollable hazard of life. Earthquake can cause huge damage to life and properties, however, some earthquakes are weak in nature. It can lead to death of human and animal. Huge wave caused by undersea earthquake weak driven adore causing coastal damage. Due to earthquake, masses of people have suffered great losses, some have died and even the survivors lose their homes and relative and suffer psychological humans. The effects of an earthquake terrible and devasting and its affects the mental health and emotional health of people. In this the XGBoost Algorithm is used to predict the earthquake location. XGBoost (Extreme Gradient Boosting) is an algorithm for supervised learning. It has the ability to efficiently handle the missing data and large datasets. XGBoost can assist both the regression and classification predictive modeling problems. The speed and execution performance of the XGBoost algorithm is high compared to other algorithms. It trains the data on new data and repeats this process until the model stops improving. In this work, the whole observation period is divided into non-overlapping windows of 1h duration and consider only the largest magnitude which occurred in hourly window.

2. Related Work

The characteristic behaviors of the surface and the atmospheric parameters clearly shows the signals associated with earthquake and the dust storm event. The multiple parameters at different pressure levels provides clear proof to find the anomalous signals correlated with an earthquake, which could be able to minimize the false seismic alarms. The changes in the surface, atmosphere, meteorological, and ionosphere parameters are found to be associated with earthquakes in the different parts of the globe and show a strong coupling. The result shows the atmospheric disturbances caused by other natural hazard occurences could mask the thermal anomalies

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caused by tectonic activities, which cannot be neglected when finding the abnormal surface and atmospheric signals associated with earthquake activities. Generally, the removals of long-term (annual) and short-term (seasonal) background changes have been considered to extract the abnormal signals caused the earthquakes. That makes it important to minimize the false seismic alerts by differentiating the characteristic behaviors related to earthquakes from non-seismic anomalous behaviors

3. Proposed System

In this research we will use the XGBoost Algorithm, which will take the parameters as features and from that we will try to classify the damage made by the earthquake in a particular region. Earthquakes can have a large effect on human as well as environment. Due to earthquakes, people suffer from huge financial loss, psychological as well as physical traumas. Hence if we can know the location of the earthquake in advance then we can be prepared to face the effects of the earthquake. At initial we will have parameters such as Magnitude, Latitude, Time, Depth, Place, Longitude etc. of historical data. We will have hidden nodes and hidden layers as study is still on the process to find the exact value of k and h. We will have three nodes as output Low damage, Moderate damage and High damage. There are two approaches to predict the earthquakes, precursors based and trend based. Precursors are anomalous phenomena that might signal an forecoming earthquake such as radon gas emissions, unusual animal behaviour, electromagnetic anomalies etc. Trend based methods involve identifying patterns of seismicity that precede an earthquake. In this paper, a Trend-based approach is adopted and the XGBoost is used to capture the trend involving statistical techniques. Predicting earthquakes well in advance can alert the public in saving lives as well as resources at the right time. Here, we will be studying the impact of earthquakes which have happened in the past through the historical data and predict the future earthquakes. The traditional processes like preprocessing of data, training he neural network, weight adjustments, testing of data are done.

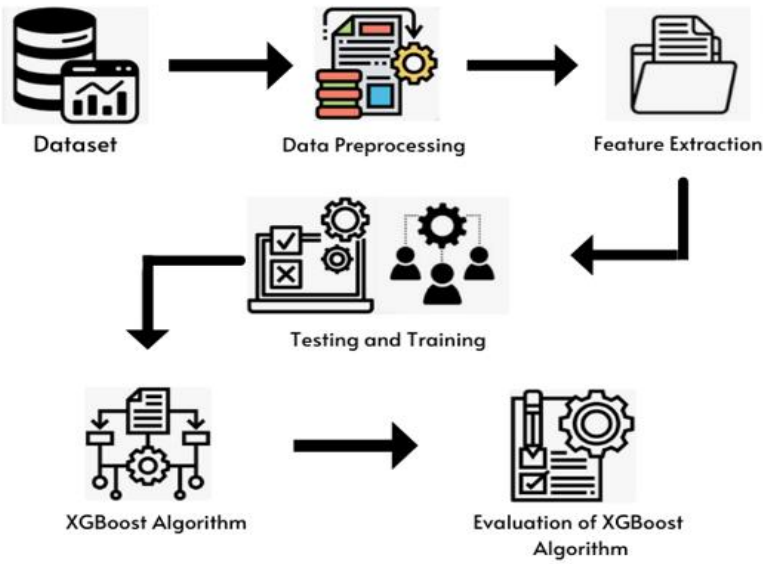

Figure 1: Proposed System

4. Experimental Results

The result of the work finds the impacts of earthquake, distance from the epicenter and scale magnitude. We have used the XGBoost Algorithm to predict the location of the earthquake. We are successfully able to find out the impact of the earthquake. Here, in this work, we have splitted the whole observations into non-overlapping windows of 1 hour duration and measured only the event with the largest magnitude which took place in each hourly window. Some windows have magnitude 0, which means that no earthquakes has been occurred.

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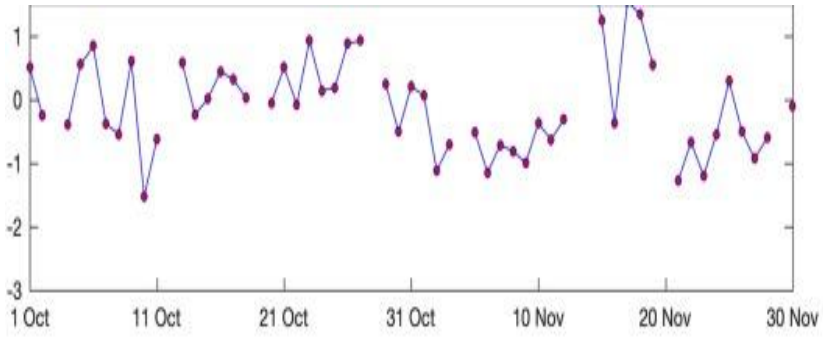

Figure 2: Performance Analysis Graph

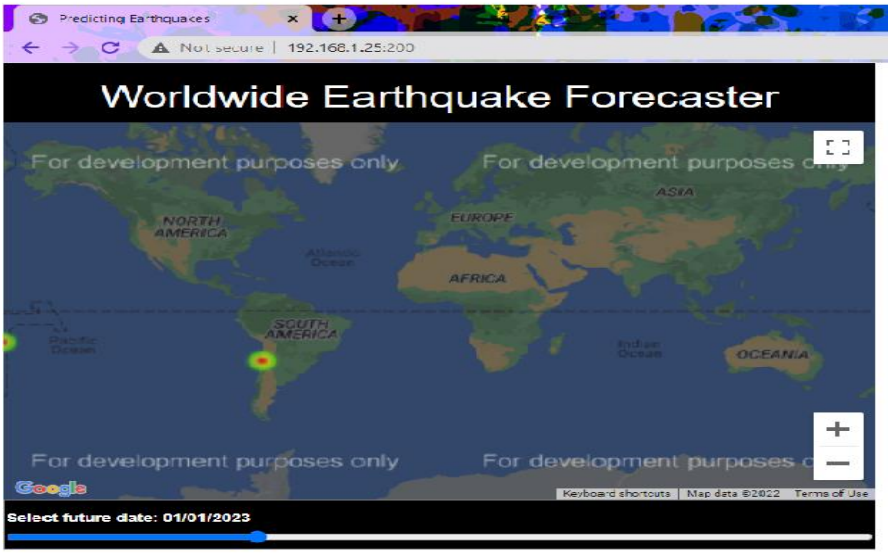

Figure 3: Output Screen shot

5. Conclusion

In this work, we have proposed a new earthquake location prediction system from the Spatio-temporal perspective. Specifically, we have designed an XGBoost Algorithm with a two-dimensional input, which can find the Spatio-temporal associations among earthquake occurrences and take advantages of these associations to make accurate earthquake predictions. The proposed decomposition method for improving the effectiveness and efficiency of the XGBoost Algorithm has been shown to be able to significantly improve the system performance. Simulation results also demonstrate that the system can make accurate predictions with different temporal and spatial prediction granularities.

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