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# Earthquake Prediction Based on Spatio-Temporal Data Mining: An LSTM Network Approach

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**ABSTRACT** Earthquake prediction is a very important problem in seismology, the success of which can potentially save many human lives. Various kinds of technologies have been proposed to address this problem, such as mathematical analysis, machine learning algorithms like decision trees and support vector machines, and precursors signal study. Unfortunately, they usually do not have very good results due to the seemingly dynamic and unpredictable nature of earthquakes. In contrast, we notice that earthquakes are spatially and temporally correlated because of the crust movement. Therefore, earthquake prediction for a particular location should not be conducted only based on the history data in that location, but according to the history data in a larger area. In this paper, we employ a deep learning technique called long short-term memory (LSTM) networks to learn the spatio-temporal relationship among earthquakes in different locations and make predictions by taking advantage of that relationship. Simulation results show that the LSTM network with two-dimensional input developed in this paper is able to discover and exploit the spatio-temporal correlations among earthquakes to make better predictions than before.

**INDEX TERMS** Earthquake prediction, spatio-temporal data mining, LSTM

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## I. INTRODUCTION

Earthquakes are one of the most destructive natural disasters.

Even animals' abnormal behavior has been taken into account in this kind of study [9]. The third type of work mainly