Hybrid Technique Using Singular Value Decomposition (SVD) and Support Vector Machine (SVM) Approach for Earthquake Prediction

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Abstract

Most of the existing earthquake (EQ) prediction techniques involve a combination of signal processing and geophysics techniques which are relatively complex in computation for analysis of the Earth's electric field data. This paper proposes a relatively simpler and faster method that involves only signal processing procedures. The prediction of the EQ occurrence estimation using a combination of singular value decomposition (SVD)-based technique for feature extraction and support vector machine (SVM) classifier is presented in this paper. Using the proposed method, the Earth's electric field signal is transformed into a new domain using SVD-based approach. In this approach, the time domain signal is projected on the left eigenvectors of impulse response matrix of the linear prediction coefficient (LPC) filter. Several features have been extracted from the transformed signal. These features are used as input for the SVM classifier in order to predict the location of the forthcoming EQ. Once the location is determined, a similar approach is used to estimate its magnitude. Finally, the time estimation of the forthcoming EQ is estimated based on the statistical observation. The occurred EQs during 2008 in Greece are used to train the classifiers, whereas those occurred from 2003 to 2010 in the same region are used to evaluate the performance of the proposed system. In predicting the location of the future EQs, the proposed system could achieve 77% accuracy. As for the magnitude prediction, the proposed system provides an accuracy of 66.67%. Moreover, the predicted time for the EQ with magnitude greater than Ms = 5 is 2 days ahead, whereas for magnitude greater than Ms = 6 is up to 7 days ahead.

Keywords: Earth, Support vector machines, Feature extraction, Monitoring, Estimation, Databases, Training

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