

A SURVEY OF RISK TAKING ANALYSIS AND PREDICTION OF MAGNITUDE AND TIME OF EARTHQUAKE IN SAN FRANCISCO BY ARTIFICIAL NEURAL NETWORK

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Keywords: Risk Analysis, Earthquake Prediction, Artificial Neural Network, Earthquake Occurrence Time, Earthquake Magnitude

As artificial neural network showed its efficiency in prediction of time series and temporal-spatial series, in recent years, some efforts are made to use artificial neural network in prediction of temporal and spatial distribution of earthquakes. In this research, by the study of the history of activities and previous movements of dynamic faults in 121 to 123 longitude and 37 to 39 latitude with very complex dynamic system in earthquake-field regions of San Francisco, a simplified image of fault is made by artificial neural network and we can determine the efficiency of artificial neural network by this model. By the analysis result, the released energy of earth is determined to a definite date.

The databases include 950 data including occurrence time, distance from fault plane, focal depth and earthquake magnitude. The total data were separated into network training and network test after normalization by STATISTICA software. The present study applied 782 data in terms of occurrence time, 30% of data (232 data) were used as test and 70% of data (549 data) were used as training. Each series had real input and outputs and finally the network could predict output and a suitable prediction network is the one with the least difference of real output and predicted output.

By artificial neural network, the earthquake occurrence and magnitude are predicted. The results showed that proposed method is good for earthquake prediction. The maximum error value of test is 0.0466 or 4.66% and it indicated the validity of prediction.

The national research council of US predicted earthquake as: Earthquake prediction includes a great interval of earthquake, the geographical region in which earthquake is occurred, the time interval in which earthquake is occurred by high precision (Kossobokov et al., 2002). Thus, prediction of earthquakes is divided into the followings, in terms of their time zone:

1- Long term (one decade time)

- 2- Midterm (for some years)
- 3- Short-term (for some weeks)
- 4- Moment (for some days or less)

Figure 1 compares the magnitude of the occurred earthquakes in Richter with the predicted earthquakes. In this figure, the magnitude of earthquakes is calculated by the cumulative released energy of earth. The comparison of the values showed that earthquake prediction had acceptable consistency with the occurred values.





Figure 1. The results of prediction of the time of earthquake occurrence to the origin time (1973)

Probable date of earthquake occurrence	Cumulative energy from source time (1911)(Millions Erg)	Cumulative energy of prediction time (Millions Erg)	The amount of released energy at any time	Magnitudeof probable earthquake With the assumption of the lack of earthquake before that (Richter)	Magnitude of probable earthquake with the assumption of occurrences of earthquake before it (Richter)
June 2012	49243.26	-	-	-	-
July 2012	49335.96	92.70	92.70	3.56	3.56
August 2012	49345.86	102.60	9.90	4.63	3.07
September 2012	49383.60	140.34	37.74	4.84	3.96
October 2012	49402.44	159.18	18.84	4.92	3.50
November 2012	49430.94	187.68	28.50	5.03	3.78
December 2012	49522.80	279.54	91.86	5.30	4.56
January 2013	49541.40	298.14	18.60	5.34	3.49
February 2013	49569.48	326.22	28.08	5.40	3.77
March 2013	49660.08	416.82	90.60	5.57	4.55
April 2013	49678.38	435.12	18.30	5.59	3.48
May 2013	49706.10	462.84	27.72	5.64	3.76

Table 1. The results of	prediction of magnitude an	d released energy from Ju	ine 2012 to May 2013
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