A Study of Earthquake mining using Support Vector Machine

D.Sakthivel[1], M.Premkumar[2]

Assistant Professor, Department of Computer Science
Sree Saraswathi Thyagaraja College (Autonomous)
Pollachi – 642 107, INDIA

Abstract) — *An Earthquake is more important for geophysics and economy problems. The Support Vector Machine of data mining techniques with cluster analysis is used to predict impact of earthquake [2]. The historical data are collected which has follow the time series methodology, combine the data mining for pre-processing and finally apply the SVM to predict the impact of earthquake. Earthquake prediction has done by historical earthquake time series to investigating the method at first step ago. Huge data sets are pre-processed using data mining techniques. Based on this process data prediction is possible [1]. This paper is focused on statistics and soft computing techniques to analyze the earthquake data.*

Keywords — *Earthquake liquefaction; seismic subsidence; building settlements; support vector classification*

I. Introduction

The seismic subsidence is a vertical residual deformation of soil caused by the earthquake.

It has a very complicated process for the occurrence and development of building settlements , which is also one of the main indicators measure whether the engineering structure loss of function, moreover, settlement is mostly caused by the liquefaction, therefore, it has very important practical significance for the forecast of liquefaction settlements [1].

At present, the prediction methods has been put forward basically has the two classes as follows:

. It is a kind of new algorithm based on structural risk minimization , which can overcome the problem of traditional machine learning method in the aspects of local minima, curse of dimensionality, weak promotion, and it has the advantages of automatic design of complex model and strong generalization ability[2].

The characteristics of the model is decided by the choice of kernel function , as a new type of kernel function , the mixed kernel can improve the accuracy of SVM model , it is combined by the global polynomial kernel with local Gaussian kernel. This paper uses the mixed function improved support vector machine (SVM), in order to provide more comprehensive technology support for the forecasting of building settlements due to earthquake liquefaction.

II. REVIEW OF LITERATURE

"SUPPORT VECTOR IDENTIFICATION OF SEISMIC ELECTRIC SIGNALS" [3] Traditional pattern recognition approaches usually generalize poorly on difficult tasks as the problem of identification of the Seismic Electric Signals (SES) electro telluric precursors for earthquake prediction. This work demonstrates that the Support Vector Machine (SVM) can perform well on this application. The a priori knowledge consists of a set of VAN rules for SES signal detection. The SVM extracts implicitly these rules from properly pre-processed features and obtains generalization performance founded upon a robust mathematical basis[4]. The potentiality of obtaining generalization potential even in feature spaces of high dimensionality bypasses the problems due to overtraining of the conventional machine learning architectures. The paper considers the optimization of the generalization performance of the SVM. The results indicate that the SVM outperforms many alternative computational intelligence models for the task of SES pattern recognition. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it [5].

III. METHODOLOGY

A. Support Vector Machine

SVM algorithm is the creative machine learning method [11-14] based on VC theory, and it is mainly used for data forecasting and classification processing[3], Set the training sample set $\left\{(x_i, y_i)\middle| x_i \in R^n, i = 1, 2 \ldots l\right\}$ *, is n-dimensional input vector, is the one-dimensional input value, l are the number of samples. For the nonlinear mapping:, where, is high-dimensional feature mapping* $\varphi : R^n \to H$ *, H is high dimensional feature space. In the feature space H, fitting sample sets[5]:*

$$y(\mathrm{x}) = <\omega\varphi(\mathrm{x})> + \mathrm{b} \quad (1)$$

In the formula: is weight vector, b is offset item. ω

At the same time, introduce the relaxation factor $\xi_i \geq 0$ *and* $\xi_i^* \geq 0$ *into it, thus, the error minimization expression can be obtained as follows.*

$$MinJ(\omega,\xi,\xi^*) = \frac{1}{2}(\omega.\omega^T) + c\sum_{i=1}^{l}(\xi_i + \xi_i^*) \quad (2)$$

In the formula: c is the penalty function.

The constraint condition as follows.

$$\left.\begin{array}{l} y_i - \omega.\varphi(\mathrm{x}_i) - \mathrm{b} \leq \varepsilon + \xi_i \\ \omega.\varphi(\mathrm{x}_i) + b - y_i \leq \varepsilon + \xi_i^* \end{array}\right\} \quad (3)$$

The mixed kernel should meet the Mercer condition. Set the k1 and k2are the kernel of, is the real function of .thus, the following function is still the kernel function: $K(\mathrm{X},\mathrm{Z}) = p(\mathrm{K}_1(\mathrm{X},\mathrm{Z}))$, ② $K(\mathrm{X},\mathrm{Z}) = \mathrm{K}_1(\mathrm{X},\mathrm{Z}) + \mathrm{K}_2(\mathrm{X},\mathrm{Z})$.

IV. CONCLUSIONS

There is a high dimensional complex nonlinear relationship between the seismic subsidence and the influencing factors, it doesn't has good effect to predict and fit the subsidence value with the traditional modeling method, project instance analysis shows that SVM model can well deal with the relationship. Since the modeling of this method is directly based on real measured seismic settlement samples, it has the advantage of stronger objectiveness, through the diversity of training samples and improves the relevance of test samples; it will be conducive to further improve to predict the reliability and applicability of the predicted result. Owing to many highly nonlinear problems unsolved in geotechnical engineering, therefore, LS-SVM method will have good application prospects in geotechnical engineering.

REFERENCES

[1] Yuao He, Yadong He, (1999) A neural networks based on method for evaluation building settlements due to earthquake liquefaction. China Civil Engineering Journal, 32(1):71-74.

[2] 2. Zhenzhong Zhang, Dongli Zhang, Hongmei Liu, (2005) Comprehensive study on seismic subsidence of loess under earthquake [J]. Northwestern Seismological Journal, 27(1):36-41.

[3] 3. Wei Wang, Donghui Ma, Jingyu Su. (2009) Study on predicting method for earthquake damage to underground pipelines system based on rough set and support vector machine [J]. Journal of Basic Science and Engineering, 17(2): 274-280.

[4] 4. Hongbo Zhao, Xiating Feng. (2003) Application of support vector machines function fitting in slope stability evaluation [J]. Chinese Journal of Rock Mechanics and Engineering, 22(2): 241−245

[5] 5. Jingyi Du, Yuanbin Hou, (2006) Parameters selection of support vector regression by genetic algorithms [J].Systems Engineering and Electronics, 28(9):1430-1433. Std. 802.11, 1997.