基于n -SVR算法的边坡稳定性预测

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摘要　　提出基于一种改进支持向量机算法(n -SVR)的边坡稳定性预测方法，直接利用边坡的特征参数快速预测边坡稳定性。为解决算法中模型选择困难的问题，用留一法设计预测模型，用网格搜索法搜索最优参数。留一法可以避免传统方法中根据经验确定预测模型的缺点，较为客观地获取合适的预测模型。网格搜索法可以保证搜索到合适的参数。计算结果显示，联合运用这两种方法可以获得合适的预测模型。利用该预测模型对82个圆弧破坏边坡实例中的71个实例进行学习，对另外11个实例进行推广预测，取得了较好的效果，其预测精度明显优于一种改进BP神经网络算法和常规SVR算法，与GA-BP神经网络算法相近。在此基础上，提出基于n -SVR算法的边坡设计方法，能够快速、准确的获取不同方案下的边坡安全系数，评价其稳定性，为选择经济合理的边坡设计方案提供决策依据。

关键词　　岩土工程；支持向量机；边坡稳定性；n -SVR(support vector regression)预测；边坡设计；模型选择；留一法；网格搜索法

分类号

PREDICTING SLOPE STABILITY BASED ON n -SVR ALGORITHM

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Abstract

 A slope stability predicting model based on n -SVR algorithm，which uses only characteristic parameters of slopes，is put forward. To overcome the difficulty in model selection in the algorithm，leave-one-out method is used to design predicting model；and grid-search method is used to search suitable values of parameters of the predicting model. Leave-one-out method can select appropriate model objectively，avoiding the shortcoming of designing model by experience. The search result shows that with these two methods，the appropriate predicting model can be searched. Applying the predicting model to predict safety factors of 11 slopes after learning with other 71 samples；the result is satisfactory. It is more accurate than a modified BP algorithm and classical SVR；and it shows that the proposed model is effective. Moreover，a new method based on n -SVR algorithm is presented to guide slope design. It can acquire slope safety factors of different schemes by characteristic parameters of slopes quickly and accurately，and evaluate the stability of slope，which will facilitate the determining of an economic and safe slope design scheme.

Key words　geotechnical engineering；support vector machine；slope stability；v -SVR(support vector regression) prediction；slope design；model selection；leave-one-out method；grid-search method

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