

基于SVM的煤与瓦斯突出区域预测研究

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摘要 支持向量机是20世纪90年代中期兴起的基于结构风险最小化原理的机器学习技术, 各项技术性能尤其是泛化能力具有明显优势。基于支持向量机构建了煤与瓦斯突出预测模型。首先, 按SVM的二类划分最优分类面和样本混杂区的边界将特征空间细划为3个区域, 由此建立了可将突出危险性划分为突出危险、突出威胁、安全3个级别的煤与瓦斯突出的SVM模型。再将SVM的二类划分最优符号函数改为距离函数, 用这个距离函数和混杂区尺寸 u_1 和 u_2 建立了突出危险性等级指标函数, 在突出区侧的混杂区边界取值为1, 在非突出区侧的混杂区边界取值为-1。用此指标预测函数对潘一矿13-1煤层的26次实例突出样本和34个非突出样本作了分析研究, 对大量参数和学习算法进行了学习和检验, 获得了用于潘一矿13-1煤层的突出预测指标函数, 结果表明用此方法可大大提高预测准确率, 是一个科学可行的解决途径, 具有广泛的应用前景。

关键词 [采矿工程; 支持向量机; 煤与瓦斯突出; 区域预测; 突出危险性等级指标函数](#)

分类号

COAL AND GAS OUTBURST AREA PREDICTION USING SUPPORT VECTOR MACHINES

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Abstract

Support vector machines (SVM) is a machine learn technique sprang up in the middle 90 s of the 20th century based on the structural risk minimization theory. It has many distinct advantages of each technique capabilities, in particular of the generalization ability. This paper presents a development method for coal and gas outburst area forecast on the basis of the SVM technique. Firstly, the character space is divided into three regions according to the optimal classification face of the SVM model and the boundaries of the mixed sample space. The levels of danger, threat, and safety

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of coal and gas outburst are then constructed with SVM algorithms. In addition, the optimal symbol function of the SVM is converted into the distance function together with the dimension of mixed u_1 and u_2 levels. The value -1 and $+1$ are specified on the boundaries of the outburst and no-outburst boundaries of mixed regions, respectively. The danger level index values vary linearly with the $D(x)$ function. This technique was applied to 26 outburst events and 34 no-outburst events from 13-1 coal seam in Panyi coal mine, and a number of parameters and learning arithmetic are achieved. The results indicate that this method can greatly increase the forecast accurate rate compared with the traditional approaches of D and K indexes. This technique has extensive application in future as a scientific and feasible forecast approach.

Key words [mining engineering](#); [support vector machines](#); [coal and gas outburst](#); [prediction](#); [outburst classification index function](#)

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