

论文

土壤环境质量支持向量机预测模型初探——以湖南长沙、株洲、湘潭地区为例

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摘要:

针对土壤环境质量时序连续监测数据缺乏的现状以及城市建设发展需要,笔者试图通过建立土壤环境质量影响因素预测模型,实现利用影响因素对土壤环境质量进行预测评估。基于支持向量机相对传统经验模型除了更适合样本少情况以外,还具有泛化力强、精确度较高的优势,尝试建立基于支持向量机的土壤环境质量预测模型。研究选择时序连续的9个土壤环境质量影响因素,如国内生产总值、有害废水、废气、固体废物产生量、人口总数、年降雨量、植被覆盖面积等作为土壤环境质量预测评价因子,以长沙、株洲、湘潭地区1986年和2003年的879个土壤样品的Cu、Pb、Zn、Cd、Co、Ni、Cr、Mn含量和17年的51个影响因素样本数据作为学习和预测检验样本,采用遗传算法优选并确定了高斯核函数参数(γ)、损失函数不敏感度(ϵ)以及惩罚因子参数值(C),它们分别为1.021、0.000416和1012。优化逼近了土壤环境质量与影响因素的关系隐函数,获得基于支持向量机的土壤环境质量预测模型,检验结果显示了模型的有效性。

关键词: [土壤环境质量](#); [影响因素](#); [预测模型](#); [支持向量机](#)

A preliminary study of soil pollution assessment model based on SVM—a case example from Changsha, Zhuzhou and Xiangtan districts, Hunan Province.

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Abstract:

Considering the fact that a very limited amount of data of soil pollution are available and the demand of the urban development, the authors try to develop a model of soil pollution using impact factors that affect the quality of soil environment for the assessment and prediction of the soil pollution. The study employs the support vector machine (SVM) method, a fairly new pattern recognition tool, the advantages of which are the good adaptation to the case of limited samples, the effective generalization ability and the higher accuracy. The 9 impact factors including GDP, the amount of waste water, gas and solid waste, population, rainfall, vegetation, etc. are chosen as the input variables of the model and the percentages of the concentrations of Cu, Pb, Zn, Cd, Co, Ni, Cr, and Mn in polluted soil are taken as the output variables. The SVM model was trained and tested on 879

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soil samples collected in 1986 and 2003, and 51 impact factor samples spanning 17 years. For

optimizing and approximating the implicit performance function, we employed a Gauss kernel

function and calculated the value kernel (γ), loss function insensibility (ϵ) and punish

function parameters (C) by genetic algorithm methods; the corresponding values are 1.021,

0.000416 and 1012, respectively. Eventually we thus obtained the SVM based explicit

performance functions of soil pollution with impact factors, and the model has shown its

effectiveness.

Keywords:

Key words: soil pollution; impact factors; assessment model; support vector machine (SVM)

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