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论文

基于粗糙集和支持向量机的标准农田地力等级评价

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摘要:

标准农田是耕地的精华,是确保国家粮食安全的关键。科学评价标准农田地力等级对标准农田培肥和土壤改良有着重要意义。将粗糙集(Rough Set,RS)理论和支持向量机(Support Vector Machine,SVM)相结合,提出了基于RS和SVM的标准农田地力等级评价方法,同时,利用遗传算法的并行搜索结构和模拟退火的概率突跳特性,提出了GASA优化SVM参数算法。该方法首先在确定标准农田地力等级评价指标的基础上,利用地力调查样本数据及传统的指数和法评价结果构建RS决策表,应用RS穷尽算法对决策表进行约简,剔除冗余的评价指标,然后用约简后的评价指标作为SVM的输入,运用GASA优化SVM参数算法对SVM进行训练,建立标准农田地力等级的RS-SVM评价模型。应用该方法对温州市鹿城区标准农田地力等级进行评价,与未用RS约简的SVM模型和BP神经网络模型评价结果进行对比,SVM模型和BP神经网络模型的输入指标数均为15个,其评价正确率分别为100%和90%;RS-SVM模型的输入指标数为14个,其评价正确率分别为100%,结果表明,该方法通过RS约简评价指标后,SVM评价精度并没有降低,但降低了SVM输入向量维数和计算复杂度,提高了训练效率;SVM 用于标准农田地力等级评价,具有比BP神经网络更高的评价精度,可有效用于标准农田地力等级评价,为耕地地力评价提供了新方法。

关键词: 耕地地力评价 标准农田 粗糙集 支持向量机 鹿城区

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Productivity Evaluation of Standard Cultivated Land Based on Rough Set and Support Vector Machine

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Abstract:

Standard Cultivated Land (SCL) is the gem of all cultivated land, which is the key of ensuring China's grain security. Scientific evaluating productivity of SCL has a significant sense for improving soil productivity and improving soil of SCL. Integrated Rough Set (RS) theory with Support Vector Machine (SVM),a productivity evaluation method of SCL based on RS and SVM is proposed. Combining the parallel searching structure of genetic algorithms with the probabilistic jumping property of simulated annealing, a GASA-optimized algorithm is put forward for selecting of SVM parameters. In this new evaluating method, on the basis of determining productivity evaluation indexes of SCL, firstly the decision making table is constructed by using the sample data of productivity surveying of SCL and its evaluation results of traditional integrated productivity factors method, and the redundant indexes are removed through the exhaustive reducer of Rosetta software which was jointly developed by Norwegian University of Science and Technology and Warsaw University, then the reduced indexes are used as the input of SVM, finally, the SVM is trained with the training samples through the GASA-optimized algorithm, and the RS-SVM evaluating model of SCL is built. The method is tested on productivity evaluation of SCL of Lucheng District of Wenzhou City, Zhejiang, and its results are compared with that of the SVM without RS reduction method and the BP networks without RS reduction method. The input indexes of the SVM model and the BP networks model are both 15, With correct evaluating rate being 100% and 90% respectively. The input indexes of the RS-SVM model are 14, whose correct evaluating rate is 100%.

The results indicate that the suggested SVM method is of the same accuracy as the SVM without RS reduction method,but it can reduce the dimensions of SVM input vectors and the computing complexity of SVM,and raise the SVM training efficiency. The results also show that the method which is used SVM can achieve greater evaluating accuracy than the BP networks without RS reduction method. It is concluded that the suggested SVM method is feasible and effective in evaluating productivity of SCL, and this method has explored a new way for evaluating productivity of cultivated land.

Keywords: productivity evaluation of cultivated land standard cultivated land Rough Set support vector machine Lucheng District

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