Application of an INSGA-Based Optimization SVM Method on Financial Risk Premonition

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Abstract: Financial risk premonition is an important and widely studied topic since it may exert a significant impact on enterprises' survival and development. The financial risk premonition models could fall into two categories: the tradition statistical model and the AI approach. At present, the hybrid model has become increasingly the hot corporate financial risk premonition model . On one side, SVM has yielded excellent generalization performance that is significantly better than that of competing methods. In financial applications, time series prediction such as stock price indexing and classification such as credit rating and bankruptcy are main areas with SVM. These research prove that SVM has even better performance in generic capability than other classification methods such as traditional statistical methods, CBR and neural network, etc. On the other side, genetic algorithms are gradually mixed with other artificial intelligence methods such as neural networks and Case-based reasoning in application of financial risk premonition. And hybrid genetic algorithms and support vector machine for **f**inancial risk premonition studies have begun to gradually receive great attention. Simple algorithm was frequently used in hybrid financial risk premonition model. However, the rate of convergence had a weak performance in optimization of multi-objective function. The main goal for research on MOEAs is to make the algorithm converge rapidly, and gain solutions that are widely and uniformly scattered in the non-dominated feasible areas of the problem. Chennan proposes a new mutation operator on the basis of NSGA-Ⅱ. The operator which improves the efficiency of the algorithm has a good local search capability.

Based on this, the financial risk premonition model based on improved non-dominated sorting multi-objective genetic algorithm and support vector machine (INSGA-SVM) is proposed. INSGA is used to optimize both a feature subset and parameters of SVM simultaneously for financial risk premonition. Finally the proposed model validation is tested by experiment in financial risk premonition of Property Insurance Company of China, compared with the hybrid simple genetic algorithm and support vector machine model (GA-SVM), a pure support vector machine approach(PSVM), the traditional multivariate statistical methods and other neural network methods . The results show that INSGA-SVM model outperforms other models not only in prediction accuracy but also in type 1 error and type 2 errors. Moreover, the speed of the model has excellent performance. The model can be extended to multi-classification of financial risk premonition in future studies.

The rest of this paper is organized as follows: The next section presents the proposed model. Then Sections 2 explains the experimental design and the results of the evaluation experiment. The final section presents the summary and future research issues.

Keywords: financial risk premonition; improved non-dominated sorting multi-objective genetic algorithm; support vector machine

基于 INSGA 优化的 SVM 方法在财务风险预警中的应用

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摘要：国内外学者研究的企业财务风险预警模型基本可归为两大类:传统统计模型、人工智能模型。传统统计模型由于需要大量的样本，故大大制约了它的有效运用，而人工智能的方法恰恰弥补了这个缺点，相对来讲具有更大的实用价值。目前，混合模型越来越成为研究的热点 。常用的混合模型之一是遗传算法。遗传算法被逐渐的连同其它人工智能算法像神经网络和推理法等一起应用,遗传算法和支持向量机的结合问题研究也开始逐步得到重视。还有研究表明 SVM 在泛化的表现方面，比得上甚至超过了其它的分类方法如传统统计方法、案例推理方法以及其他神经网络方法。总的来说，使用 SVM 进行财务风险预警的研究表明，支持向量机优于神经网络和统计方法。

目前涉及遗传算法与支持向量机相结合的预测模型中，遗传算法基本上采用的是标准算法。但是在对多目标函数的优化中，一般的遗传算法收敛速度较慢。本文提出基于改进的非支配排序多目标遗传算法和支持向量机的财务风险预警模型（INSGA-SVM），通过使用改进的非支配排序多目标遗传算法，来优化特征子集和参数，提高模型的运算速度，从而进一步提高财务风险预警模型的预测准率、降低第一类及第二类分类错误率。一般来说，为了达到更佳的预警效果，需要对 SVM 的特征子集和参数同时进行优化。混合遗传算法进化了一系列的种群。每个种群由一些具有特定的特征子集和参数组成。基于 SVM 的输出得到种群个体的适应度。通过变异和重组来选择合适的父代，产生每一代的新个体并加入到种群中。不断重复这一过程，直到满足终止条件。实证研究表明，提出的模型 INSGA-SVM 比其它模型具有更好的风险预警效果。

本文内容安排如下：首先介绍研究原理，第二部分给出模型，第三部分实证研究，最后给出总结并展望未来研究内容。

关键词：财务风险预警；改进的非支配排序多目标遗传算法；支持向量机

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