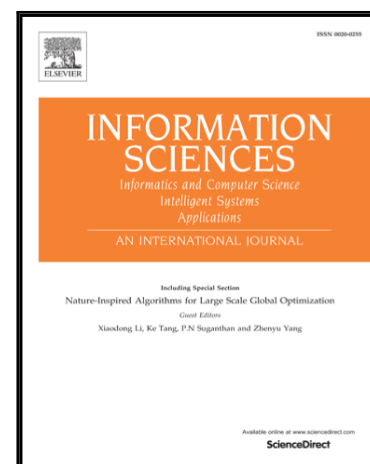


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Remote Sensing Image Classification Based on the Optimal Support Vector Machine and Modified Binary Coded Ant Colony Optimization Algorithm

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Abstract

Support vector machine (SVM) is one of the most successful classifiers for remote sensing image classification. However, the performance of SVM is mainly dependent on its parameters; in addition, for remote sensing images with high-dimensional features, feature redundancy will have a major influence on the classification efficiency and accuracy. Feature selection and parameter optimization are two important factors for improving the performance of SVM and are traditionally solved separately. In fact, these two issues are affected by each other, so to obtain the better classification performance, selection of the optimal feature subset and tuning of SVM parameters should be considered simultaneously, as they both belong to the combinatorial optimization problem and could be handled with evolutionary algorithms and swarm intelligence algorithms. In this paper, a remote sensing image classification technique based on the optimal SVM is proposed, in which the parameters of SVM and feature selection are handled integrally by a modified coded ant colony optimization algorithm combined with genetic algorithm. The results are compared with other evolutionary algorithms and swarm intelligence algorithms, such as genetic algorithm (GA), binary-coded particle swarm optimization (BPSO) algorithm, binary-coded ant colony optimization (BACO) algorithm, binary-coded differential evolution (BDE) algorithm, and binary-coded cuckoo search (BCS) algorithm. It is demonstrated that the proposed method is robust, adaptive and exhibits the better performance than the other methods involved in the paper in terms of fitness values, so could be suitable for some practical applications.

Keywords: Remote sensing image classification, Support vector machine, SVM parameter optimization, Feature selection, Modified binary-coded ant colony optimization, Genetic algorithm

1. Introduction

Computer remote sensing image classification [23] is a method for identifying object types on the Earth's surface with machine vision. It is a specific application of pattern recognition in the field of remote sensing technology and has been the subject of extensive attention in a large number of applications. Many approaches have been put forward in this field and commonly used remote sensing image classification methods could be divided into two categories: unsupervised classification methods and supervised classification methods. For unsupervised classification methods, many techniques have been utilized in this field, such as fuzzy clustering algorithm [13, 22], random forests theory [32], Iterative

Self-Organizing Data Analysis Techniques Algorithm (ISODATA) [9], and so on. Commonly, unsupervised classification methods do not apply any a priori knowledge, which blindly make classification only with the characteristics of the dataset itself, and only obtain satisfactory classification results under certain circumstances. Among the supervised classification methods, Stumpf [38] utilized active learning (AL) algorithm for remote sensing applications, which developed region-based AL heuristics to guide user attention toward a limited number of compact spatial batches rather than distributed points. Ruiz [34] exploited Bayesian modelling and inference paradigm to perform remote sensing image classification and could quickly obtain

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