Evolution-Based Tabu Search Approaches to Clustering and Vector Quantization Problems and Their Applications to Biopsy Image Analysis

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ABSTRACT

The purposes of this dissertation are to develop two evolutionary tabu search based systems for the classification of liver biopsy images and the identification of the excited auditory neurons of rat's brain tissue image, respectively. The liver biopsy image classification system is an improved probabilistic neural network (PNN) classifier that has a smaller network size and better classification performance than those of traditional probabilistic neural networks. This proposed system contains two main parts. One is to extract the varied fractal dimension features in the liver biopsy images and then determine the best pair of fractal dimension features. Based on the selected pair of features, the second part is to construct an improved PNN classifier using a new vector quantization technique called the ETSA-I. The ETSA-I is better than some other proposed algorithms in terms of distortion and robustness measures. In the excited auditory neuron identification system, the first task is to extract the features of excited auditory neurons. Then, in the feature space, the optimal number of classes for the excited auditory neurons is investigated using the proposed automatic clustering algorithm called the ETSA-II. The ETSA-II can effectively determine the optimal number of clusters and at the same time construct a clustering structure with good validity. In this study, 20 normal and 20 cancerous liver biopsy images are used to test the liver biopsy image classification system. For the training pattern set, the accuracy of the classification system is 96.0% at least. For the testing pattern set, the accuracy is 88.5% at least. On the other hand, for the identified 238 auditory neurons the cluster analysis using the ETSA-II shows that the optimal number of classes of the excited auditory neurons is three.
REFERENCES


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