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Towards Improving the Efficiency of the Fuzzy Cognitive Map Classifier

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Abstract

Fuzzy Cognitive Map (FCM) is a model that combines selected features of fuzzy sets and neural networks. FCM is usually applied as a decision support tool or as a predictive model for time series forecasting. It is less well known as a classifier. To perform the classification, numeric data produced by the FCM must be assigned to class labels. To accomplish this task, we propose a new algorithm for generating thresholds for the discrimination of FCM outcomes. The thresholds resulting from the proposed algorithm are determined after the learning of the FCM, and, then they are applied when classifying new data. The results of the experiments conducted with publicly available data provide evidence that the application of the proposed algorithm leads to improved efficiency of the FCM classifier. Comparative experiments showed that the proposed approach makes the FCM a very competitive alternative to other state-of-the-art classifiers.

Keywords: fuzzy cognitive maps, data mining

1. Introduction

Classification is one of the most important issues in data mining [1, 2]. The problem of classification with detailed descriptions of different classification techniques is presented in the literature [3, 4]. Different groups of classifiers can be distinguished such as: nearest neighbor, Bayesian, decision trees, neural networks, support vector machines, rule-based, random forests and others. Numerous existing classification techniques provide excellent performance, but none of them can be selected as the best technique for all datasets [5]. Many of classifiers are based on supervised learning of the classification model, using historical data for that purpose. The trained model is applied to the classification of new data. One such model-based classifier is the Fuzzy Cognitive Map, but it is not as well known as several others [6, 7].

FCM is a kind of neuro-fuzzy system [8, 9, 10]. It has been proposed as a signed, weighted digraph consisting of nodes with arcs between them [11, 12]. The nodes (concepts) are fuzzy sets that describe the modeled problem, and the

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