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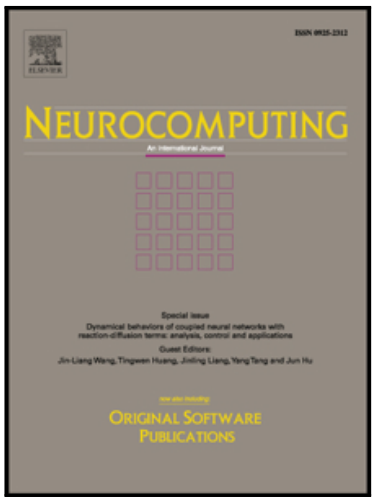

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Dynamic Extreme Learning Machine for Data Stream Classification☆

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Abstract

In our society, many fields has produced a large number of data streams. How to mining the interesting knowledge and patterns from continuous data stream becomes a problem which we have to solve. Different from conventional classification algorithms, data stream classification algorithms have to adjust their classification models with the change of data stream because of concept drift. However, conventional classification models will keep stable once models are trained. To solve the problem, a dynamic extreme learning machine for data stream classification (DELM) is proposed. DELM utilizes online learning mechanism to train ELM as basic classifier and trains a double hidden layer structure to improve the performance of ELM. When an alert about concept drift is set, more hidden layer nodes are added into ELM to improve the generalization ability of classifier. If the value measuring concept drift reaches the upper limit or the accuracy of ELM is in a low level, the current classifier will be deleted, and the algorithm will use new data to train a new classifier so as to learn new concept. The experimental results showed DELM could improve the accuracy of classification result, and can adapt to new concept in a short time.

Keywords: data stream; classification; concept drift; extreme learning machine; online learning

1. Introduction

With the development of big data society, many domains such as stock exchange, telephone communication, online shopping, traffic flow monitoring and other fields have produced huge amounts of data streams. Different from conventional static data, data streams always have characteristics including unlimited number, arrival with a fast speed and concept drift which make the methods mining data stream are different from mining knowledge from static data [1-4]. In order to mining valuable knowledge and patterns from massive data, data stream classification has been widely concerned by scholars. Many valuable algorithms have been proposed in recent years [5-8]. Li et al. proposed a random decision tree model called EDTC [9]. The algorithm is on the basis of VFDT [10], and N subtrees are constructed. In the subtrees, split attribute values are randomly selected. In order to avoid excessive consumption of space, EDTC uses a pruning strategy; every once in a while, the algorithm scans all the decision trees and removes the highest error rate of K trees. Soares et al. proposed an ensemble algorithm called OWE[11]. The algorithm updates and adjusts the weights of the classifiers by the accuracy of the classification results. Farid et al. proposed an ensemble classification algorithm with a weighted instances mechanism [12]. In this algorithm, the weights of the instances which are classified correctly are reduced and the weights of the instances classified wrongly are increased. In order to detect the anomalies in the data, a clustering process is also

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