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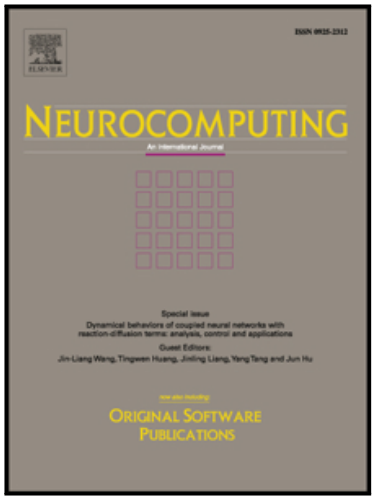

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An Adaptive Mini-Batch Stochastic Gradient Method for AUC Maximization

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Abstract

Due to the wide applications in imbalanced learning, directly optimizing AUC has gained increasing interest in recent years. Compared with traditional batch learning methods, which often suffer from poor scalability, it is more challenging to design the efficient AUC maximizing algorithm for large-scale data set, especially when dimension of data is also high. To address the issue, in this paper, an adaptive stochastic gradient method for AUC maximization, termed AMAUC, is proposed. Specifically, the algorithm adopts the framework of mini-batch, and uses projection gradient method for the inner optimization. To further improve the performance, an adaptive learning rate updating strategy is also suggested, where the second order gradient information is utilized to provide the feature-wise updating. Empirical studies on the benchmark and high-dimensional data sets with large scale demonstrate the efficiency and effectiveness of the proposed AMAUC.

Keywords: AUC Maximization; Mini-batch; Adaptive Updating; High Dimension; Stochastic Learning;

1. Introduction

Area Under the ROC Curve (AUC), as an important metric for measuring the classification performance under imbalanced situation, has attracted many research focuses in the last two decades. Recently, much attention has also been paid on designing the classifiers to directly optimize AUC [1, 2, 3, 4, 5], which can be applied to a large number of tasks, such as information retrieval [6], medical diagnosis [7, 8] and biometric recognition [9, 10] etc. In spite of the promising performance of these AUC maximization algorithms, however, most of them are proposed for batch learning, which means when the data set is of large size, these algorithms are not feasible, since in each iteration, the gradients of all data are calculated, which results in high computational demands.

A natural way to tackle the problem is to develop stochastic (online) AUC maximization

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