



L2-SVM Problem and a New One-layer Recurrent Neural Network for its Primal Training

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Abstract

This paper presents a brief review on Support Vector Machine (SVM) and L2-SVM problems and a new one-layer Recurrent Neural Network (RNN) for L2-SVM learning. The L2-SVM problem is first converted into a new reformulation, which has some advantage over its original form, then a neural network for its primal is proposed. The proposed neural network is guaranteed to obtain solution of L2-SVM. Moreover, this neural network can converge globally to the optimal solution of L2-SVM and the rate of the convergence is dependent to a scaling parameter, not to the size of data set. Simulation examples based on Iris and Fisher-Iris problems are discussed to show the excellent performance of the proposed neural network.

Keywords: Support vector machine, L2-SVM problem, Primal SVM training, Recurrent neural network, Convex programming, Lyapunov function.

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1 Introduction

In recent machine learning problems, Support Vector Machine (SVM) has a great role in binary classification. The main feature of this problem is to classify data in two disjoint classes and its range of application is expanded in manifold fields. As a result, different kind of SVMs such as L2-SVM, Least Square Support Vector Machine (LS-SVM) and so forth are introduced. These problems are modeled as convex optimization problems and dealing with them are based on convex programming methods. For instance, SVM and L2-SVM are modeled as a quadratic optimization problem and different methods for solving them are presented [1, 2].

On the other hand, Recurrent Neural Networks (RNNs) have been received an extreme attention for optimizing problems in recent decades. A great number of RNNs are presented to solve convex, non-convex, smooth and non-smooth problems with different structures [3, 4].

Implementing the structure of RNNs, many engineering problems are solved by RNNs. In [5], Xia and Wang have proposed a one-layer RNN for SVM dual problem. In this paper,

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