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A SINGLE PARAMETER DYNAMIC SEARCHING ALGORITHM FOR MULTI-LAYER NEURAL NETWORKS (PART II)

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Abstract. *This paper discusses the computational complexity the convergence rate and the stability of the single parameter dynamic searching algorithm. The results show that the computational complexity of the SPDS algorithm in every searching process is only relative to the amount of samples and the neurons of the output layer, so the SPDS algorithm can effectively reduce the computational complexity. We select three kinds of samples to make comparative study for different training algorithms. These samples include the N-hypercube vertexes samples, the Archimedes spirals samples and the binary nonlinear continuous mapping samples. We use different algorithms to train these samples, and these algorithms include the proposed SPDS algorithm, and Traingdx, Traincgf and Trainlm which are provided by Matlab. Results of numerical experiments show that the convergence rate and the stability of the SPDS algorithm are satisfactory.*
Keywords: Multi-layer neural networks, Training algorithm, Coordinate rotation method, SPDS algorithm

1. **Introduction.** This paper is the subsequence of the paper 'A single parameter dynamic searching algorithm for multi-layer Neural Networks (part I)'. In part I, a single parameter dynamic searching algorithm (SPDS algorithm) was proposed for multi-layer neural networks, the expressions of error function and its first-order and second-order derivative were deduced, and the implementation of SPDS Algorithm was also given. The SPDS algorithm uses large array to record dynamically the information of each sample getting through each neuron. This kind of treatment is one of the technical features of the SPDS algorithm. The second feature is the adoption of the single variable rotating searching strategy, which can reduce the computational complexity greatly. The third feature of the SPDS algorithm is to use the Newton iteration method for searching.

The main content of this paper is the analysis on the computational complexity of SPDS algorithm and the comparison analysis on different samples and different training algorithms. The second section of this paper quotes the expressions of error function and its first-order and second-order derivative for the four categories of parameters, and the amount of calculation for each formula was also given. The complexity of computation is discussed in the third section, and the computational complexity needed by different parameters in each step during the realization of algorithm is given out as well. In the fourth section, several typical samples are provided accompanied by numerical experimental results. Utilizing SPDS algorithm and the training algorithms provided from Matlab, samples are trained and information obtained from training these samples are analyzed. Furthermore, several defects of SPDS algorithm are pointed out. The final part is the conclusion.