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AN ALGORITHM OF CHAOTIC DYNAMIC ADAPTIVE LOCAL SEARCH METHOD FOR ELMAN NEURAL NETWORK

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Abstract. *In this paper, we present an efficient algorithm for the prediction of sunspot-related time series, namely the Chaotic Dynamic Adaptive Local Search (CDALS) algorithm. This algorithm is based on exploiting partially recurrent Elman Neural Network (ENN) and it can be divided into two main steps: the first one is the basic model of the Adaptive Local Search (ALS) proposed in our previous work. After that, a hybrid local search method is proposed by introducing the chaos signals into ALS. Thus, ALS and chaos are hybridized to form a powerful CDALS algorithm, which reasonably combines the searching ability of ALS and chaotic searching behavior. Simulation results show that the CDALS algorithm can eventually reach the global optimum or its good approximation with high probability, effectively enhance the searching efficiency and quality within reasonable number of iterations.*

Keywords: Elman neural network (ENN), Sunspot-related time series prediction, Adaptive local search (ALS), Chaotic dynamic

1. **Introduction.** As we know, Elman Neural Network (ENN) consists of a two-layer back propagation network with an additional feedback connection from the output of the hidden layer to its input. The advantage of this feedback path is that it allows the ENN to recognize and generate temporal patterns and spatial patterns. This means that after training, interrelations between the current input and internal states are processed to produce the output and to represent the relevant past information in the internal states. As a result, the ENN has been widely used in various fields, in which prediction is an important application direction [1-5].

Since the ENN usually uses the Back-Propagation (BP) based algorithms to deal with the various signals, it has been proved that it is difficult to overcome the weakness or inherent characteristics of the BP algorithm which suffers from slowness of convergence speed and easily gets stuck into the local minima. In contrast to the past learning algorithms employed by the ENN, we have found that all these learning algorithms, either the error BP based algorithms or the non error BP based algorithms employed by the ENN such as genetic algorithm [6,7] and simulated annealing algorithm [8] are difficult to achieve the satisfied learning solutions that is far from the optimal solution. So these problems call for the development of alternative training algorithms for ENN.

As a novel optimization technique, chaos has gained much attention and some applications during the past decades. For a given energy or cost function, by following chaotic ergodic orbits, a chaotic dynamic system can eventually reach the global optimum or