

A HYBRID ARTIFICIAL NEURAL NETWORKS AND PARTICLE SWARM OPTIMIZATION FOR FUNCTION APPROXIMATION

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ABSTRACT. *In this paper, the weights of the Artificial Neural Networks (ANN) are trained by Particle Swarm Optimization (PSO). Because PSO has the probabilistic mechanism and multi-starting points, hence the PSO can avoid getting into the local optimal solutions. The demonstrated examples are presented to illustrate the better performance of the proposed methodology (PSO-ANN) than other existing methods.*

Keywords: Artificial neural networks, Particle swarm optimization, Function approximation, Feedforward network

1. Introduction. In many engineering disciplines a large spectrum of optimization problems has grown in dimensions and complexity. In some instances, the solution to complex multidimensional problems by means of classical optimization techniques is extremely difficult and/or computationally expensive. This realization has led to an increased interest in a special class of searching algorithms, namely, heuristic algorithms. In general, they are referred to as “stochastic” optimization techniques and their foundations lie in the evolutionary patterns and behaviors observed in living organisms. Recently, some new heuristic algorithms have been combined (or hybridized) among themselves and with knowledge elements, as well as with more traditional approaches, to solve extremely challenging problems.

The role of artificial neural networks in the present world applications is gradually increasing and faster algorithms are being developed for training neural networks. In general, back-propagation is a method used for training neural networks. Gradient descent, conjugate gradient descent, resilient, BFGS quasi-Newton, one-step secant, Levenberg-Marquardt and Bayesian regularization are all different forms of the back-propagation training algorithm. For all these algorithms storage and computational requirements are different, some of these are good for pattern recognition and others for function approximation but they have drawbacks in one way or other, like neural network size and their associated storage requirements. Certain training algorithms are suitable for some type of applications only, for example an algorithm that performs well for pattern recognition may not for classification problems and vice versa, in addition some cannot cater for high accuracy/performance. It is difficult to find a particular training algorithm that is the best for all applications under all conditions all the time. In this paper, we propose a new learning algorithm combined Artificial Neural Networks (ANN) to determine the optimal weights.

Particle Swarm Optimization (PSO) is a relatively new family of heuristic algorithms that could be used to find optimal (or near optimal) solutions to numerical and qualitative problems. Particle Swarm Optimization was first presented by James Kennedy and Russell