

AN EFFICIENT NEURAL FUZZY NETWORK BASED ON IMMUNE PARTICLE SWARM OPTIMIZATION FOR PREDICTION AND CONTROL APPLICATIONS

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Received May 2007; revised October 2007

ABSTRACT. *This paper proposes a functional-link-based neural fuzzy network (FNFN) with immune particle swarm optimization (IPSO) for solving prediction and control problems. The proposed FLNFN model uses functional link neural networks (FLNN) as the consequent part of the fuzzy rules. This study uses orthogonal polynomials and linearly independent functions in a functional expansion of the functional link neural network (FLNN). The FNFN model can generate the consequent part of a nonlinear combination of the input variables. An efficient learning algorithm, called immune particle swarm optimization (IPSO), is also presented. The proposed IPSO learning algorithm combines the immune algorithm (IA) and the particle swarm optimization (PSO) to perform the parameter learning for the FNFN model. The IPSO employed the advantages of PSO to improve the mutation mechanism of immune algorithm. Illustrative examples were conducted to show the performance and applicability of the proposed FNFN model with IPSO learning.*

Keywords: Neural fuzzy networks, Entropy, Functional link network, Immune algorithm, Particle swarm optimization, Prediction, Control

1. Introduction. In the field of soft computing, neural networks [1,2] are essentially low-level computational structures and algorithms that offer good performance when they deal with sensory data. However, it is difficult to understand the meaning of each neuron and each weight in the networks. Generally, fuzzy systems [3,4] are easy to appreciate because they use linguistic terms and if-then rules. However, they lack the learning capacity to fine-tune fuzzy rules and membership functions. Therefore, neural fuzzy networks combine the benefits of neural networks and fuzzy systems to solve the problems they are given [5,7].

Recently, neural fuzzy networks have been demonstrated in lots of research [5-13]. Neural fuzzy network owns the advantage of fuzzy system and neural network simultaneously: one is the inference characteristic of the fuzzy system; the other one is the system according to the learning ability of the neural network which can do the adjustment of the fuzzy rule. Therefore, the neural fuzzy network becomes a popular research target progressively, and applies on various problems, such as control, prediction, classification