Adaptation Of Vigilance Factor And Choice Parameter In Fuzzy ART System

M. R. Meybodi **P. Bahri**

Soft Computing Laboratory
Department of Computer Engineering
Amirkabir University of Technology
Tehran, Iran
email:meybodi@ce.aku.ac.ir

Abstract

In adaptive resonance theory network, the choice of vigilance factor (VF) and choice parameter (CP) affects the performance of the network, such as the number of classes into which the data are classified. These parameters are typically chosen and adapted using human judgment, experience, and heuristic rules. Rather than choosing and optimizing these parameters manually, we use learning automata to automatically adapt these parameters. In an earlier paper [Bahri99] we examined the ability of P-model learning automata to only adapt the vigilance factor of fuzzy art network. In this paper we further study the effectiveness of LA in adaptation of VF and CP. This time we try to adapt both VF and CP simultaneously using different models of learning automata: P-model, Q-model, and S-model. The feasibility of the proposed method is shown through simulation on three problems: the circle in the square, nested spirals, and gaussian distributed two groups.

Keywords. Neural Networks, Fuzzy ART, Vigilance Factor, Choice Parameter, Learning Automata.

1. Introduction.

Fuzzy ART is a self organizing neural architecture which is capable of fast learning its tasks in any non-stationary environment. The architecture combines neural network and fuzzy logic and achieves excellent operation properties. One of the properties of the network is that it learns its tasks in an unsupervised mode, at the same time it can be trained in an supervised mode to adapt to the input /output environments.

In our implementation of fuzzy ART the network has three layers, as well as an orienting subsystem. The nodes in these layers process input, and the orienting subsystem guides the search for the fittest category that represents the input. The identity of the category of the input is determined by the third layer nodes whose prototypes best fit the input.

Two of the critical entities that determine the dynamics of the network are vigilance factor and choice parameter. The appropriate selection of these two parameters have large effect on the convergence of the algorithm. For example, if the vigilance parameter is too small, too much data compression may result and too broad classification made, and if it is too large, too many nodes will be generated and good classification may not result. If the choice parameter is too small, the network may converge too early, and if it is too large, too many nodes will be generated resulting in slower operation.