International Journal of Innovative Computing, Information and Control
Volume **2**, Number **2**, April **2006**

 ISSN 1349-4198
pp. **411–426**

INTERACTIVE ADAPTATION/CORRECTION BEHAVIOR BY INVOLVING SOM INTERNAL STRUCTURE IN LEARNING PROCESS

Kirmene Marzouki

Graduate School of Computer Science and Systems Engineering
Kyushu Institute of Technology
680-4 Kawazu, Iizuka City, Fukuoka 820-8502, Japan
kirmene-marzouki@edu.brain.kyutech.ac.jp

Takeshi Yamakawa

Department of Brain Science and Engineering
Graduate School of Life Science and Systems Engineering
Kyushu Institute of Technology
2-4 Hibikino, Wakamatsu-ku, Kitakyushu City, Fukuoka 808-0196, Japan
yamakawa@brain.kyutech.ac.jp

Received June 2005; revised August 2005

Abstract. *In this paper we address the two major limitations of standard Self Organizing Maps algorithm: i) The standard SOM finds different similarities among the sample vectors each time the initial conditions are changed. ii) As the input space can be complicated with a dimension larger than that of the feature map, the dimension reduction in SOM often generates a folded feature map. To cope with these limitations, we propose the following: 1. Extend the neighborhood concept on the unit space by combining Kohonen's neighbors with a new set of units that we select in a fashionable manner; 2. Introduce a complementary learning rule that involves the information acquired by the net during training, and which involves the network internal structure; 3. We make Kohonen's neighborhood function interactive with the learning progress according to the training instant needs by assigning to each unit of the feature map a pseudo-neighborhood function, which is a customized version of Kohonen's one; 4. We establish an interactive training procedure in which learning is not performed the same way during the whole training process, as in standard SOM. The established novel learning algorithm makes the resultant mapping not only invariant to the initial conditions, but also free of all folding that may occur during learning.*

Keywords: Self organizing maps, Neighborhood function, Initial conditions, Border effect, Folding effect

1. **Introduction.** Kohonen formulated the Self Organizing Map algorithm as a mathematical model of the self-organization of topographic maps, which are found in brains of higher animals [1]. SOMs accomplish two things: they reduce dimensions and display similarities [2]. The way SOMs go about reducing dimensions is by producing a map of usually one or two dimensions plotting the similarities of the data by grouping similar data items together.