An Analytical Method for CNN Template Schema Discovery Using Dynamic Approach

Ahmed I. Sharaf

Abstract

Cellular Neural Network (CNN) is defined as a parallel paradigm of computation which depends on spatial arrangement of analogue non-linear processors known as cells.Each cell is connected to its local neighbors that belongs to the sphere of influence S_r such that

Keywords: CNN, Rough set, Attribute Reduction

1. Introduction

Cellular Neural Network (CNN) is defined as a parallel paradigm of computation which depends on spatial arrangement of analogue non-linear processors known as cells.Each cell is connected to its local neighbors that belongs to the sphere of influence S_r such that

$$S_r(i,j) = \{C_{k,l} := max(|k-i|, |l-j|) \leq r; 1 \leq k \leq M, 1 \leq l \leq N\} \tag{1}$$

$$U_{x'}/C = \left\{X_1, X_2, .., X_{p1}^{'}, .., X_{p2}^{'}, ..., X_m\right\} \tag{2}$$

Cellular Neural Network (CNN) is defined as a parallel paradigm of computation which depends on spatial arrangement of analogue non-linear processors known as cells. Each cell is connected to its neighbors, therefore only the adjacent cells can interact directly with each other. For a CNN array with M rows and N columns on a two dimensions , the dynamic state of each cell can be described by the following:

$$\dot{x}_{ij}(t) \ = -\dot{x}_{ij}(t) \ + \sum_{kl \in N_r(i,j)} A\left(i,j;k,l\right) y_{kl}\left(t\right) + \sum_{kl \in N_r(i,j)} B\left(i,j;k,l\right) u_{kl}\left(t\right) + I_{ij} \tag{3}$$

2. Problem Statement

The most important key point of CNNs application is how to find the optimal template schema to achieve CNN stability. In recent years , the problem of CNN design for image processing , has attracted considerable attention and the promising potential of CNN has resulted in the development of several templates design methods. Researches proposed various studies to determine the optimal values of the template values such as analytical , evolutionary and hybrid approaches. From a particular point of view , the cells which belongs to r which represents the radius of the sphere of influence $C\left(i,j\right)$ are arranged in

matrix of $(2r+1), (2r+1)$ grid whose center cell is $C(i,j)$. In order to design optimal and robust CNN template a careful feature selection approach is required. Rough Set theory is used to select a subset of features that is most suitable for a given problem.The generated subset of attributes is called reduct, many researches proposed various reduction algorithms and techniques. However, most of these algorithms can only applied to static data sets. Classic Attribute Reduction could be applied to CNN template design as shown by many researches, but it is time consuming approach to recompute the reduction algorithm every time an object changes.

This paper focus on attribute reduction of dynamical data sets based on information entropy measure among cells. Information entropy is very important measure of uncertainty for a given data set, which have been widely applied to devise heuristic attribute reduction algorithms.

Appendix A. Section in Appendix

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References