

Segmentation of Digitized Mammograms Using Self-Organizing Maps in a Breast Cancer Computer Aided Diagnosis System

Túlio César Soares dos Santos André
Antônio Carlos Roque da Silva Filho

1. Purpose

The objective of this work is to develop a digitized mammograms' feature extraction approach using Kohonen's Self-Organizing Maps (SOM). Once developed, the SOM network will be used as the first processing stage in a breast cancer computer aided diagnosis (CAD) system. Its role will be to offer segmented data as input to a second stage dedicated to the diagnosis task, which will be implemented via a multi layer perceptron (MLP) trained by the backpropagation algorithm.

2. Novel Aspects of Work

Several efforts have been devoted to the improvement of breast cancer detection in the population. For example, via screening campaigns, breast self-examination orientation, clinical examinations, etc. The results of several years of research indicate that mammography is the best procedure for early detection of breast cancer [1]. However, the diagnosis based solely on the visual analysis of the mammograms is not efficient, with only between 15% and 30% of the mammographic suspicious nonpalpable breast cases presenting malignancy when submitted to biopsy [2]. On the other hand, the fraction of real cancer cases not detect in screening mammography is also significant [3]. These results indicate that there is room for improvement in the interpretation methods of mammographic images. One of these methods is based on the use of computer-aided systems to serve as a second opinion to help the radiologist in his/her decision task.

3. Methods.

Two possible structures of the SOM network were chosen for a comparative study. One of them has a layer with 3x2 neurons and the other has a layer with 3x3 neurons. In the two cases, the inputs to the network are vectors with dimension of 2601. These input patterns are vectors containing the pixel values 51x51 square areas that sweep a mammogram, taken from the mammograms training set. The SOM was trained by the standard algorithm [4]. This algorithm tends to cluster groups of areas with similar characteristics in the same class, represented by a given neuron [4].

4. Results.

After the SOM with the 3x3 architecture was trained, we presented new mammograms to it and observed the segmentation results. Figure 1 gives an example. In this figure, a color code scheme was used to identify each one of the 9 neurons in the SOM layer. The figure shows that each small square area of the mammogram was associated to a SOM node.

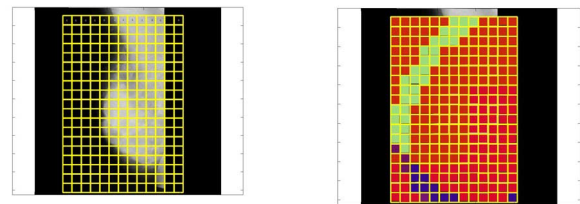


Figure 1. Left: original mammogram divided in small square areas with 51x51 pixels. Right: the mammogram as seen by the SOM network.

4. Discussions and Conclusions.

The results obtained in this study indicate that the use of a SOM to segment digitized mammograms is possible. This was also observed in another work which used a SOM network as the first processing stage of a CAD system for breast cancer diagnosis [5].

6. References.

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