Image processing by using Self Organizing Neural Network

[1]B. Susheel Kumar, [2]G. Sarvani
[1]*Academic Consultant, Department of Computer Science & Technology, Yogi Vemana University, Kadapa, Andhra Pradesh.*
[2]*Faculty in Department of Computer Science, Sri Vivekananda Degree College for Women, Kadapa, Andhra Pradesh*

Abstract **- In image segmentation it is not able to recognize the whole image directly as a consequence of inefficacious and impractical. For that reason, a variety of image segmentations algorithms has been proposed to recognize the image. Image segmentation classifies an image into various parts according to the feature of the image which is pixel value. Until now number of image segmentation algorithms are subsisted and have been applied in the field of computer science and everyday life. In this paper we will discuss about the artificial neural network technique. The artificial neural network technique is a dominant technique and still measured as complex problem in the image processing method. From the Artificial intelligence Kohonen Self Organizing Neural Network algorithm has been used for the image segmentation. The proposed algorithm improves the performance of the artificial neural network so that we can achieve the quality output.**

Index Terms **- Image segmentation, Neural networks, self-organising neural networks.**

1.INTRODUCTION

In research area image processing has a salient role occasionally. The complication of image processing has been classified into number of research areas. Hall divides the main problem into number of applications, Three-dimensional reconstruction, Description and segmentation, Restoration and image enhancement, Recognition and scene management.

In the medical field image processing has been using different applications such as X-Ray, Ultrasound, Magnetic Resonance, and computer aided Tomography. The result of these techniques is image of a particular patient's body. It helps the doctors to scrutinize distinguish without meet up with the surgery.

Several techniques are in existence that can be used for the image segmentation. Each and every technique has its own recognition in image segmentation process. All these techniques are comes under the two basic approaches namely Edge based approach and region based approach. Every single technique can be applied on images to act segmentation process as required. All these techniques also be categorized into three kinds of Structured segmentation techniques, Stochastic segmentation techniques Hybrid segmentation techniques respectively.

Most of the popular techniques used to perform the segmentation are as follows:

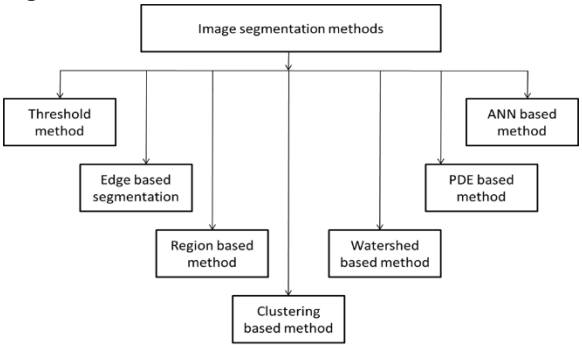


Fig 1. Types of image segmentation

2.RELATED WORK

Artificial Neural Networks:

An artificial Neural network is an information processing system. The artificial neural networks are evaluated based on the human brain. This neural network works just like a biological human brain. The artificial neural networks contain the neuron which process the information. This artificial neural network takes the information as input from the outside world in the form of pattern and images in vectors. Each of

the input is calculated by its correlate weight. In the artificial neural network, a single perceptron or neuron can be treated as a logistic regression.

Neural networks are designed to work just like a human brain does. The goal of machine learning is to take a training set to minimize the loss function.

Perceptrons: Perceptrons the objects that do the calculations. They adjust themselves to minimize the loss function until the model is very accurate.

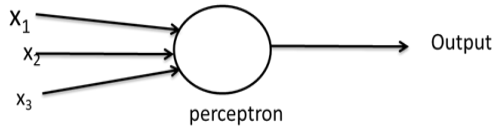


Fig 2. Perceptron

Simple neural network:

A simple neural network designed with input layer output layer and the hidden layers. Input layer takes the information from the outward then hidden layer process the information finally output layer presents the output data.

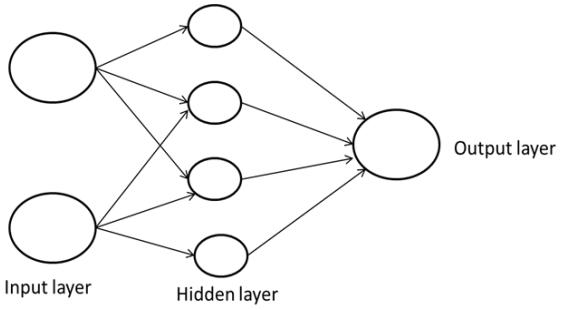


Fig 3. Simple neural network

A simple neural network has been used in several applications such as Function approximation, Regression analysis, Time series prediction, Classification, Pattern, Novelty detection, Data processing, Filtering, Clustering, Compression, Blind signal separation.

Self-organizing neural network:

The visual recognition of transitive actions made up of human objects interactivity is a basic component for artificial system operating in natural environment. This challenging task requires jointly the recognition of segmented body actions as well as the extrication of semantic elements from the sense such as the identity of the manipulated objects. We present the self-organizing neural networks for the recognition of human objection interaction.

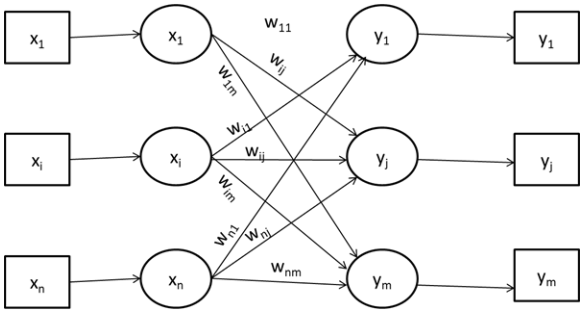


Fig 4. Self-organizing neural network

Steps for Self-organizing neural network:

Step 0: Initialize the weight wij, random values will be presumed. Denote the learning rate α.

Step 1: Determine the square of Euclidian distance for each j=1 to m.

$D(j) = \sum \sum (Xi - Wij)2$

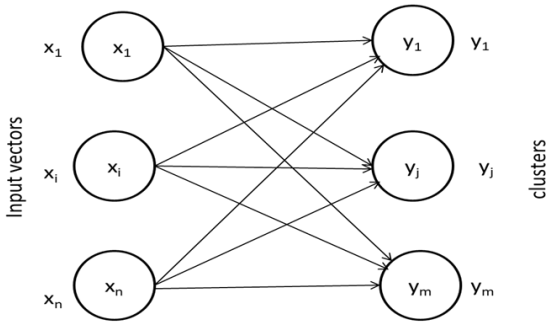
Step 2: Find winning unit index j, so that D(j) is minimum.

Step 3: For all units j within a specific neighbourhood of j and for all i, calculate new weights.

$Wij = Wij(old) + \alpha [Xi - Wij (old)]$

Step 4: Update learning rate α using the following formula

$\alpha (t) = 0.5 \alpha (t)$



3.PROPOSED SCHEME

Algorithm To train the neural network:

Step 1: Assume the M weight vectors. Set the topological parameters and learning rate α(1)

Step 2: For step k=1,2,----- do steps i-iv by cycling through training set until weight vector coverage.

i. place input vectors X = S(q) one of the training vectors.

ii. Calculate for each cluster unit j=1,---M the Euclidean distance

$dj = \sum(Wij(k) - xi)2$

iii. Find the index j1 such that dj1 is minimum.

iv. For all cluster units j within the specified neighbourhoods of j1 update the weight vectors.

$Wij(k+1) = Wij(k) + \alpha[Xi – Wij(k)]$ i=1,2,...N

v. May reduce the learning rate

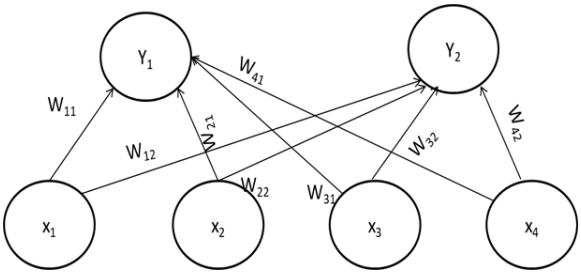
vi. May reduce the radii define the topological neighbourhood.

Example:

Consider as number of input vectors n = 4

Number of clusters m = 2

Learning rate α=0.5



Initialize weights randomly between 0 to 1

$W_{ij} = \begin{pmatrix} 0.2 & 0.9 \\ 0.4 & 0.7 \\ 0.6 & 0.5 \\ 0.8 & 0.3 \end{pmatrix}$

Vectors

$x_1 = \begin{pmatrix} 0 & 0 & 1 & 1 \end{pmatrix}$

$x_2 = \begin{pmatrix} 1 & 0 & 0 & 0 \end{pmatrix}$

$x_3 = \begin{pmatrix} 0 & 1 & 1 & 0 \end{pmatrix}$

$x_4 = \begin{pmatrix} 0 & 0 & 0 & 1 \end{pmatrix}$

Training with first vector:

First input vector $x_1 = \begin{pmatrix} 0 & 0 & 1 & 1 \end{pmatrix}$

$Dj = \sum(W_{ij} – X_i)^2$

$D_1 = (0.2-0)^2 + (0.4 – 0)^2 + (0.6-1)^2 + (0.8 – 1)^2$

$D_1 = 0.4$

$D_2 = (0.9 – 0)^2 + (0.7 – 0)^2 + (0.5 – 1)^2 + (0.3 – 1)^2$

$D_2 = 2.04$

Hence $D_1 < D_2$

So D_1 is the winning cluster, therefore update the weights on winning cluster unit j=1

$W_{ij}(new) = W_{ij}(old) + \alpha [X_i – W_{ij}(old)]$

$W_{11}(n) = W_{11}(0) +0.5[x_1-W_{11}(old)]$

$W_{11}(n) = 0.1$

In the same way $W_{21}(n) = 0.2$

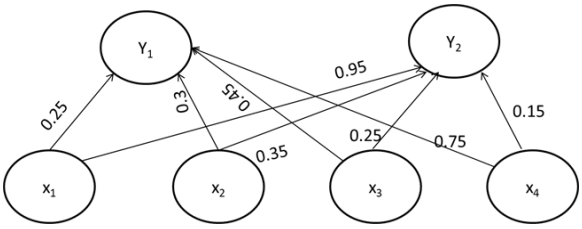
$W_{32}(n) = 0.8$

$W_{41}(n) = 0.9$

Updated weights matrix cluster 1

$W_{ij} = \begin{pmatrix} 0.1 & 0.9 \\ 0.2 & 0.7 \\ 0.8 & 0.5 \\ 0.9 & 0.3 \end{pmatrix}$

By using the above method, we have computed the remaining values also. The final neural network will be as follows



4.CONCLUSION

A self-organized neural networks are designed to produce the output by learning methods. In this proposed paper the input vectors are assumed with some values by using the suggested formula we calculate the output values. This self-organizing neural

network algorithm has played a key role in the image segmentation process. And this is the effective method to train the neural networks.

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