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DIGITAL IMAGES: NEURAL NETWORK BASED STUDIES ON SPECTROSCOPIC ANALYSIS

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Abstract

Introduction: The variation of the neural network output with the number of hidden layer neurons, the input weight initialization and number of iterations is discussed. These are not only the factors that have to be considered for design of an efficient neural network. The performance of the neural network is affected by the variation of the activation function, the selection of the input data given for training, the selection of proper training algorithms etc.

Methodology: First the numbers are sorted vertically i.e. sort elements of each column in the ascending order, Numbers are sorted horizontally i.e. sort elements of each row in the ascending order and Sort the cross diagonal elements and pick up the middle element as the median element of the window. Minimum is the first and maximum is the last element in the window of the nine elements.

Objectives: its massively parallel distributed structure and its ability to learn and therefore to generalize. Generalization refers to the neural network producing reasonable outputs for inputs not encountered during training (learning).

Result: Neural Network is a very effective computational tool. It finds applications in almost every field of signal processing. In this thesis, two applications of neural network arc dealt with. In the field of spectroseopic analysis, neural network is found to be very effective.

Keywords: *Neural Network, Spectroseopic and Parallel Distributed Structure*

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1. Introduction

It is apparent that a neural network derives its computing power through, (i) its massively parallel distributed structure and (ii) its ability to learn and therefore to generalize. Generalization refers to the neural network producing reasonable outputs for inputs not encountered during training (learning). These two information processing capabilities make it possible for neural networks to solve complex problems that are currently intractable **(Haykin,2003).**

The use of neural networks offers the following properties and capabilities **(Hagan et. aI., 2002).** An artificial neuron can be linear or nonlinear. A neural network, made up of an interconnection of non linear neurons, is itself non linear. Another capability of the neural network is its input-output mapping property **(Haykin, 2003).** The neural network learns from the examples by constructing an input-output mapping for the problem. Neural networks have a built in capability to adapt their synaptic weights to change in the surrounding environment. In particular, a neural apod: trained to operate in a specific environment can easily be retrained to deal with minor changes in the operating environmental c: oaditions. Another property of neural network is its evidential response. lacdre context of pattern classification, a neural network can be designed infonnation not only about which particular pattern to select, MIt also about the confidence in the decision made. This latter information May be used to reject ambiguous patterns and thereby improve the classification performance of the network **(Haykin,2003).**

2. Problem Statement

The variation of the neural network output with the number of hidden layer neurons, the input weight initialization and number of iterations is discussed. These are not only the factors that have to be considered for design of an efficient neural network. The performance of the neural network is affected by the variation of the activation function, the selection of the input data given for training, the selection of proper training algorithms etc. Here an attempt is done to illustrate the performance variation of the neural network with these parameters. Also the capability of the neural network in image restoration with discrete cosine transform is mentioned.

A comparison of the performance of neural network with other image interpolation techniques is also done.

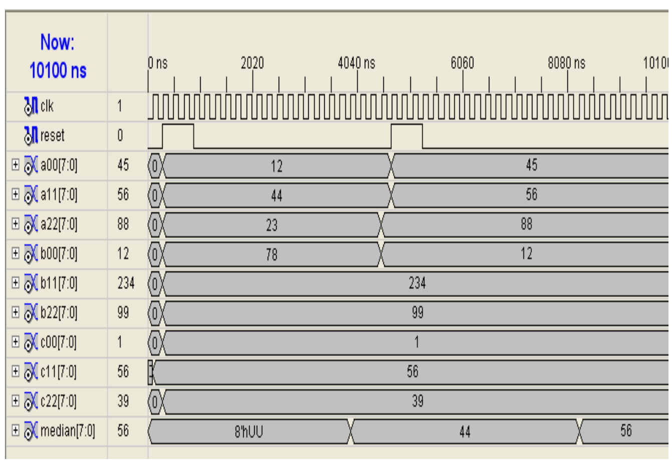
3. Algorithm

Step I: First the numbers are sorted vertically i.e. sort elements of each column in the ascending order.

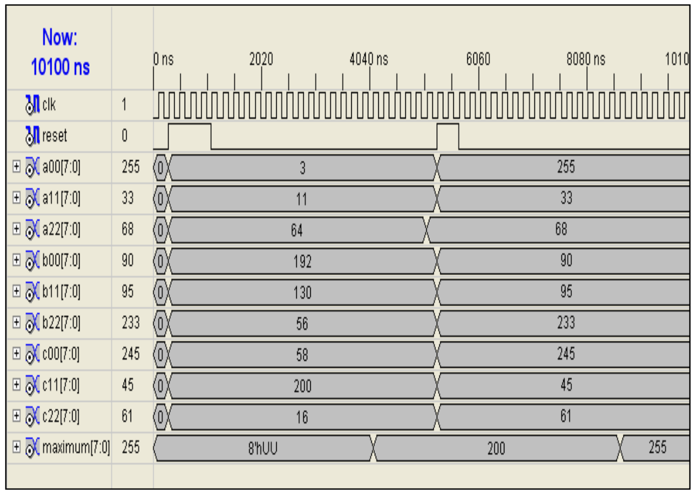
Step II: Numbers are sorted horizontally i.e. sort elements of each row in the ascending order.

Step III: Sort the cross diagonal elements and pick up the middle element as the median element of the window. Minimum is the first and maximum is the last element in the window of the nine elements.

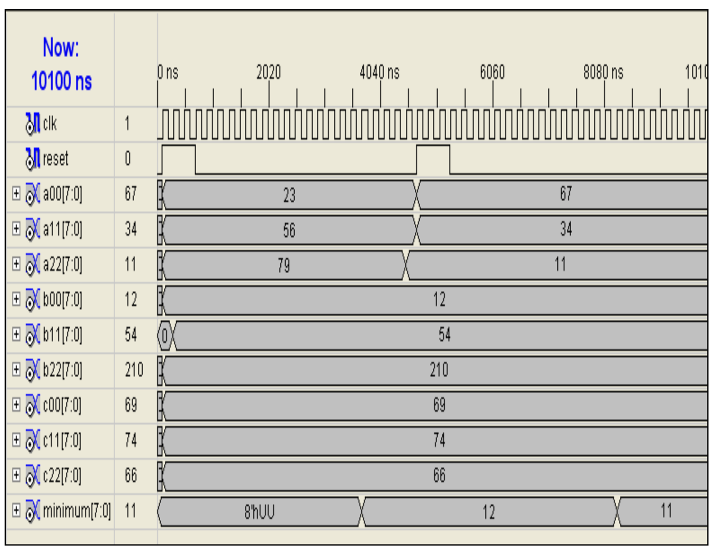
Step: 1 - Simulation result of median Filter.



Step: 2 - Simulation result of Dilation.



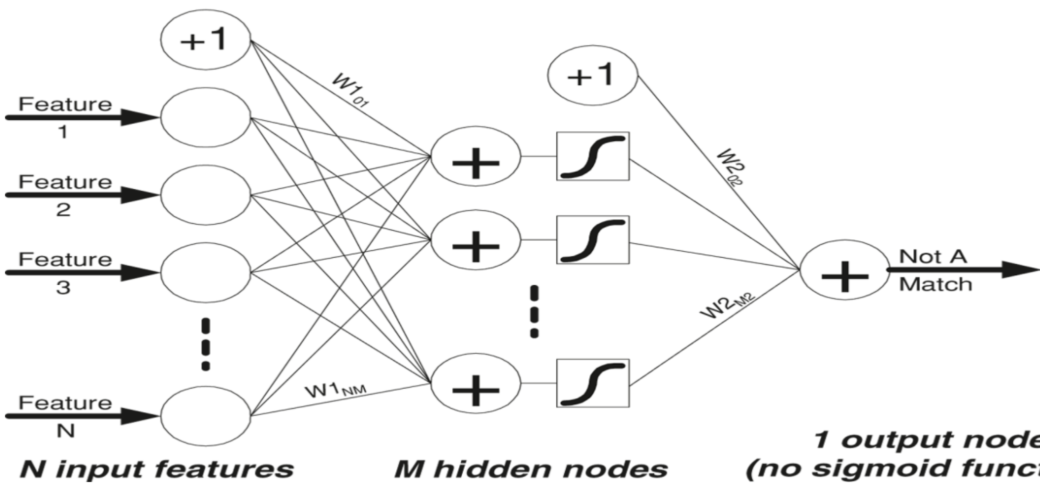
Step: 3 - Simulation result of Erosion.



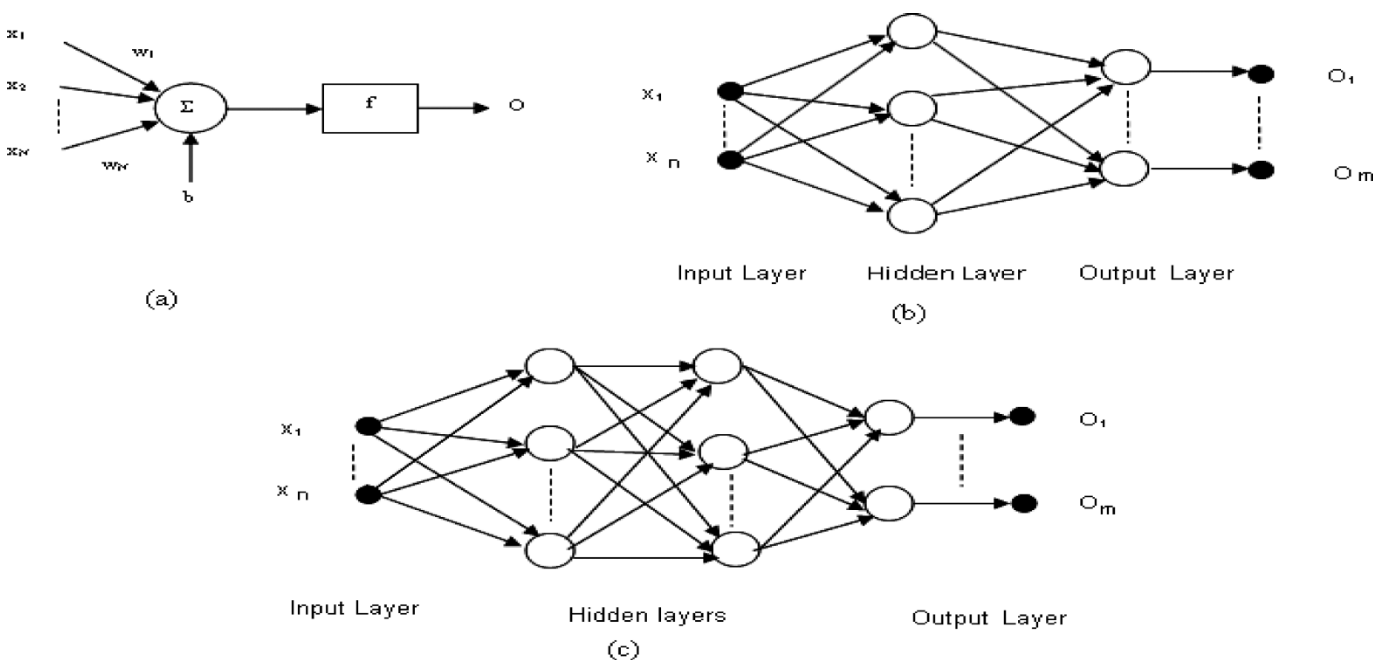
4. Methodology and Results

A neural network is trained to restore the image to twice its original size. The quality of the restored image is comparable with that obtained with the existing interpolation methods. The trained neural net can be used to restore any image to double its size. irrespective of the size of the image used for training. The same network can be used to enlarge. The image to 4 times its original size. The results of the investigation are promising to consider neural networks as candidate for image restoration applications.

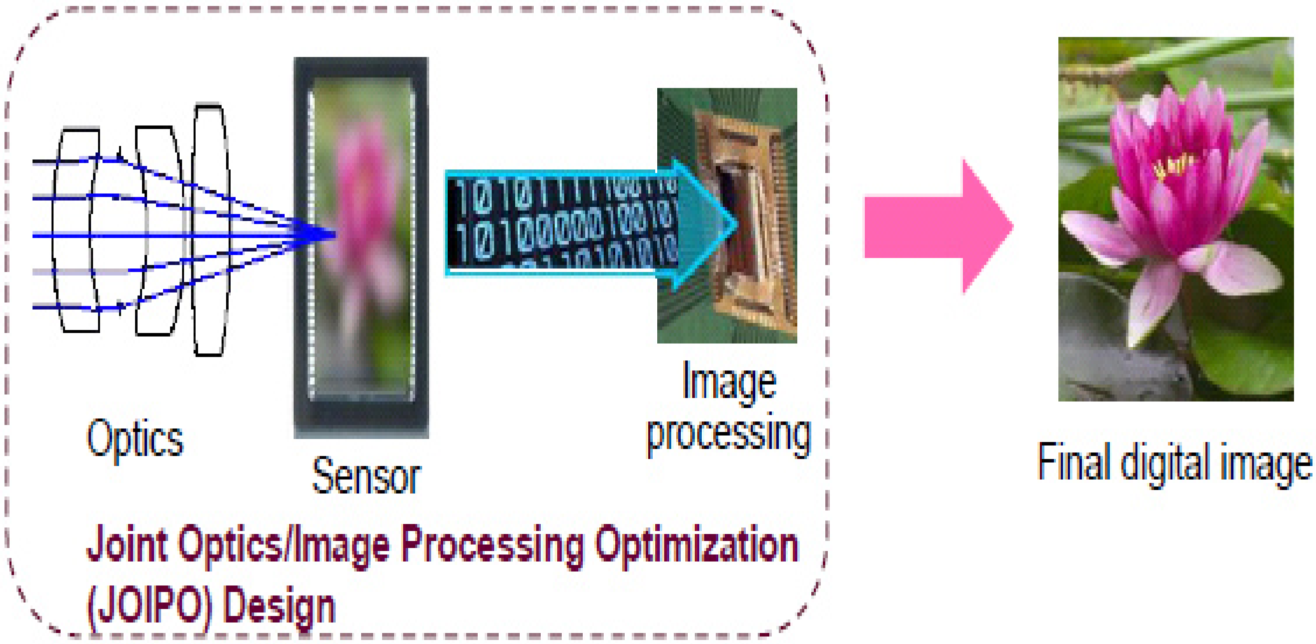
Step: 1



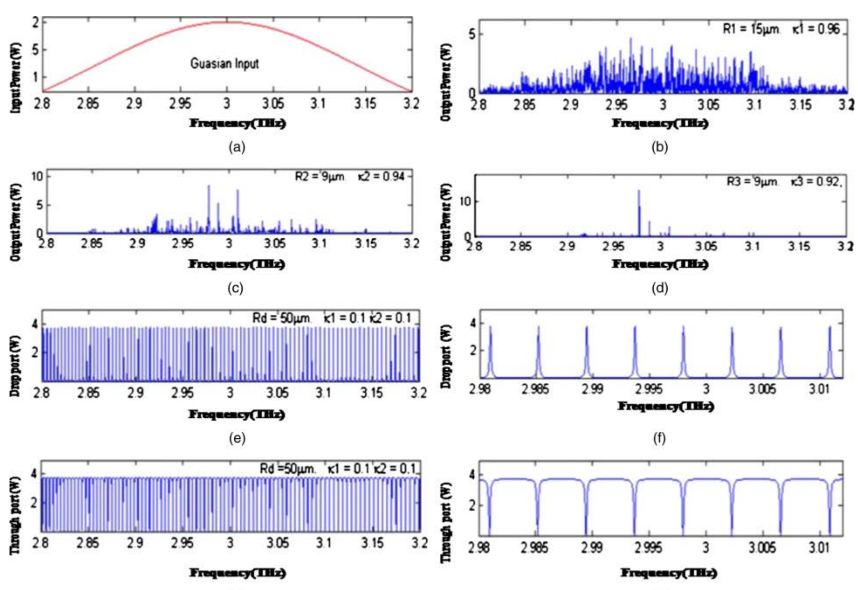
Step: 2



Step: 3



5. Conclusion



Neural Network is a very effective computational tool. It finds applications in almost very field of signal processing. In this thesis, two applications of neural network arc dealt with. In the field of spectroseopic analysis, neural network is found to be very effective. As a filcher development, a neural network is trained to identify the elements present in a sample irrespective of the spectra taken by any type of spectromcter. Also a neural network can be trained to find the concentration of the each element present in the sample. The number of spectral lines obtained will depend on the concentration of each element. Only the persistent lines arc obtained with low concentrations.

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