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Abstract—Image enhancement and restoration is pre-request of computer vision. The distortion and degradation of image suffered the process of pattern matching and quality of image. Wavelet is very important transform function play a role in image enhancement and image de-noising. The concept of wavelet used as soft thresholding and hard thresholding. A processing of data through wavelet is very efficient in process of neural network. In this paper we discuss the proposed algorithm for image enhancement based on self organized map network and wavelet transform. Basically self organized map network is unsupervised training mechanisms of pattern, due to this reason the processing of network is very fast in compression of another artificial neural network method. And the combination of wavelet and self organized map network have great advantage over conventional method such as histogram equalization and multi-point histogram equalization and another conventional technique of image enhancement.

Keywords- *Image Enhancement, Wavelet, Neural Network, AMBE, PSNR, SOM, RBF,Histogarm, BPDHE, Entropy.*

I. INTRODUCTION

The goal of image enhancement techniques is to improve a quality of an image such that enhanced image is better than the original image. Several image enhancement techniques have been proposed in both spatial and transform domains. In the spatial domain techniques, intensity values of images have been modified whereas in the transform domain techniques, transform domain coefficients are modified, typically, scaled [2].The main objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and a specific spectator. Enhancement is basically improving the perception of details in images for human visualization and providing better input for many existing automated image processing methods. For the duration of this process, one or more characteristic of the image are customized. The alternative of attributes and the way they are customized are specific to a given problem. Moreover, observer-specific factor, such as the person visual system and the observer's experience, will bring in a great deal of subjectivity into the choice of image enhancement methods [4]. There exist many methods that can enhance a digital image without spoiling it. Image enhancement improves the quality (clarity) of images for human presentation. Eliminating blurring and noise, increasing contrast, and enlightening details are examples of enhancement operations. For example, an image might be chosen of an endothelial cell, which may be of low contrast and little blurred. Decrementing the noise and blurring and incrementing the contrast range could enhance the image. The real image might have areas of very high and very near to the ground intensity, which facade details [6]. An adaptive enhancement algorithm unhides these details. Adaptive algorithms correct their operation based on the image information (pixels) which is processed. In this scenario the mean intensity, contrast, and sharpness (amount of blur removal) could be adjusted based on the pixel intensity statistics in various areas of the image. A very popular technique for contrast enhancement of images is Histogram Equalization (HE), which is simple and has good performance compared to nearly all types of images [10].Histogram Equalization is one of the most popular, computationally fast and simple to implement techniques for contrast enhancement of digital images. The histogram of a discrete gray-level image represents the frequency of occurrence of all gray-levels in the image. An image histogram is an estimation of the probability distribution of discrete gray-level which provides a graphical representation of the total distribution of the gray values in a digital image. The re-assignment of gray levels in the image can be performed with the Histogram Equalization techniques in order to uniformly distribute intensities of pixels in output image. It is a process of flattening the histogram and using cumulative density function of the image, the dynamic range of the gray-levels is stretched over the complete range. On the other hand this method tends to suffer from brightness saturation and hence it is never used in real applications such as TV. The main applications of HE are found in Medical Image Processing and Radar Image Processing [3]. Histogram Equalization performs its operation by remapping the intensity levels of the image based on the probability distribution of the input intensities. Various researches have been performed on Histogram Equalization, and many methods have already been proposed [10]. The techniques are divided into 2 principle categories that are global and local histogram equalization techniques. The global histogram equalization (GHE)

technique uses the histogram information of the whole input image for its transformation functions. Though this worldwide approach is appropriate for overall enhancement, it fails to adapt the local brightness features of the input image and shifts the mean intensity to the middle intensity level, apart from the input mean intensity [11]. Thus it appears to be unsuitable for consumer electronic goods. Local HE (LHE) can remove the local brightness problem; however the overlapping sliding mask mechanism makes the LHE computationally expensive. With the technical advancements in processing power, the speed is not a problem. The Local Histogram Equalization still faces trouble with amplified noise and an unnatural output due to over-enhancement. Other approach is to apply a partially- overlapped or non-overlapped block based Histogram Equalization. The wavelet transform breaks an image in to different layers the decomposed layers are differentiate by the horizontal, vertical and diagonal. The soft thresholding decide the parameter of enhanced of noised image quality. One of these methods is wavelet thresholding developed first by Donoho and Johnstone. This method removes the noise in an image by removing the wavelet coefficients that are too noisy and preserving or shrinking the coefficients that contain important image signals. The success of the method depends heavily on the choice of the threshold parameters. As a result, various wavelet thresholding methods have been evolved, which use different approaches to determine the threshold parameters, have been reported Wavelet transforms are multi-resolution representations of signals and images. Artificial neural network play important role in image enhancement and for preserving brightness and contrast of digital image. The nature of neural network is adaptive and variant; this nature sustained a pervious value of image pixel and set the desired target for enhancement of image. Some enhancement approaches utilize single layer and some other are used multilayer of artificial neural networks. Such as ART network for binary image enhancement [15]. A general approach for implementation of morphological image operations by a modi1ed feed-forward ANN using shunting mechanisms, i.e., neurons acting as switches. Self organized map network (SOM) artificial neural network used for the process of image enhancement in frequency domain of digital image. The rest of paper is organized as follows. In section II discuss related work of image enhancement. The section III proposed method. The section IV Methodology to be adopted Followed by a conclusion in Section V.

II. RELATED WORK FOR IMAGE ENHANCEMENT

A. Claudia Nieuwenhuis, Michelle Yan entitled [13]" Knowledge Based Image Enhancement Using Neural Networks", In this the author have combine the concept of adaptive filters with neural networks in order to include intense level knowledge about the details of the image in the filtering procedure. The Adaptive enhancement algorithm for images generally consumes low level knowledge like gradient information etc to guide the filtering parameters for enhancement. The benefit in these filters is that they does not need any specific knowledge and can thus be applied to a large spectrum of picture. But, in many conditions this low level information is not upto the mark to gain a good result. For an instinct in the medical imaging it is generally very necessary that some features are stored while others are suppressed. Generally these features cannot be differentiated by a low level info. So for this author proposed a method to consider high level knowledge in the filtering process by which they can manipulate the parameters of any filter by creating a guided filter likewise. We present a scheme for acquiring this high level knowledge which allows us to apply our method to all kinds of images using pattern recognition and special pre-processing techniques. The design of the guided filter itself is easy as for the high level knowledge only some sample pixels including their neighbourhood and the desired parameters for these pixels are necessary.

B. Vinod Kumar, and Rahul Raj Choudhary entitled [3] "A Comparative Analysis of Image Contrast Enhancement Techniques based on Histogram Equalization(HE) for Gray Scale Static Images" Contrast enhancement of digital images is conveniently gained by distributing o intensity values all over the total range of values this procedure is known as histogram equalisation. The enhancement of image is elaborated as the processing of an input image to achieve more suitable image than original image, as it is basically application dependent and well proved with the analysis of simulation results of the various enhancement techniques. Authors evaluated the performance of different HE techniques existing for gray scale static images improvement. Result are analysed on the basis of AMBE, PSNR and Entropy metrics values. Authors illustrated that Brightness Preserving Dynamic Histogram Equalization (BPDHE) is suitable procedure in terms of mean brightness preservation as it has least average values. While in PSNR the MPHEBP is the more suitable procedure as it has the highest average PSNR value. On the other hand the Entropy, BBHE and RSIHE(r=2) are the best techniques as it have the highest average Entropy value. And as per author performance of BPDHE is not upto the mark in terms of Entropy values.

C. S. Chitwong, T. Boonmee, and F. Cheevasuvit entitled [15] "Local area histogram equalization based multispectral image enhancement from clustering using competitive hop-field neural network" problem of clustering or segmenting in image enhancement is discussed. One of important issues for enhancing image based on local area histogram equalization (HE) is a clustering or segmenting technique. It means that more accuracy of classification of image into specified classes is needed, results into better performance in enhancement. As mentioned objective, in this paper, the competitive Hopfield neural network (CHhW) is then proposed for clustering the LHE based image enhancement. By using simulated image, standard image and multi-spectral image from Land-sat 7 satellites, experimental results are shown in both accuracy of clustering and variance of the enhanced image. The criteria for a good enhancement algorithm are that if can give high variance in detail area, low variance in smooth and edge areas. when comparing the values of variance of the image which is enhanced by both LHE and global area histogram equalization (GHE) technique results that one from LHE outperform. In addition, the enlarged image the frame is small area is shown clearly by visualization. Equalizing histogram from the local area classified by such the clustering methods, CHNN show that not only the accuracy of clustering is clearly better exact in the simulated image but also the performance enhancement outperforms when comparing with FCM in all clusters for standard image. For TM image, not only in detail area the variance of FCM is more than that of CHNN, but also in the smooth and edge areas it is still higher. Thus, CHNN bas better trended as mentioned reasons.

D. Mdtyh Brendel and Tantcis Roska entitled "Adaptive image sen sing and enhancement using the Adaptive Cellular Neural Network Universal Machine" a method for image enhance using pixel equalization and neural network[16]. The method can be used for the adaptive control of image sensing and for subsequent image enhancement. This technique uses intensity and contrast content also. Proposed technique is fully executable on the Adaptive Cellular Neural Network Universal Machine (ACNN-UM) architecture as well. Both methods use basically the same technique for equalization as they apply the intensity and contrast information of the basic image. The equalization masks are computed by using the diffusion template via the CNN-UM. The algorithm is ideal for the ACNN-UM the most time consuming task is the diffusion. Accordingly, the use of the currently available CNN-UM chip speeds up the process significantly. On the other hand, the presented methods are of acceptable quality as this is shown by the sample images. In the algorithms the radius of the adaptation can be controlled by the time or gain of diffusion, thus all intermediate cases between full global and local equalization are dynamically available.

E. Her-Chang Pu, Chin-Teng Lin, Sheng-Fu Liang and Nimit Kumar entitled [14] "A Novel Neural-Network-Based Image Resolution Enhancement" a novel HVS-directed neural network- based adaptive interpolation scheme for natural image is proposed. The fuzzy decision system internally made from the characteristics of the human visual system (HVS) as it is proposed to classify pixels of the inserted image into human perception insensitive class and sensitive class. The High-resolution images with supervised learning algorithms can be used to automatically train the author's neural network. Simulation results demonstrate that the proposed new resolution enhancement algorithm can produce higher visual quality of the interpolated image than the conventional interpolation methods. The fuzzy decision rules inspired by human visual system (HVS) are proposed to analyze the sensitivity of human eyes to the image for interpolation. According to the experiment results, the proposed HVS-directed neural-network-based interpolation is superior to conventional methods such as the bilinear and bi-cubic interpolations in some aspects of visual quality such as the clarity and the smoothness in edge regions as well as the visual quality of the interpolated images. In addition, the proposed fuzzy decision rules combined with the neural network can balance the trade-off between speed and quality for different applications by just adjusting a threshold parameter.

III. PROPOSED METHOD FOR IMAGE ENHANCEMENT (SOM AND WAVELET)

In this section, we discuss image enhancement framework based on a two-stage neural network model comprised of Kohonen's self-organizing map (SOM). The image features are extracted from the image using wavelet transform function. SOM acts as a clustering mechanism that projects N-dimensional features from the wavelet transform into an M-dimensional feature space. The resulting vectors are fed into an SOM that categorizes them onto one of the relearned noise classes. The proposed scheme is a good example of how different neural network models can be cascaded to reduce the complexity of image enhancement. The technique behind is that to map the features from every frame of the word onto the SOM output to create a trajectory of the winner nodes for a given word. The SOM learns this trajectory for each enhancement scheme is comprised of a hierarchical

organization of SOM and SOM. SOM receives inputs from the Wavelet transform function bank and maps onto an M-dimensional space where M is the dimensionality of the SOM output node distribution. The transformed feature vectors are fed into the SOM, which classifies them. We call the feature space generated from the Wavelet transform function output as primary feature space and M-dimensional feature space from SOM output as secondary feature space. The vectors from the secondary feature space are called secondary feature vectors. The concept behind the use of SOM as an intermediate stage is that it can perform and enhanced it. Topology preserving feature mapping from its input space to output space, and these mapped features, which are of reduced dimension, can represent the necessary information in the input features. Thus, the training and enhancement of the upper stage (SOM) can be done in a reduced dimension compared to the higher dimension of the primary feature space.

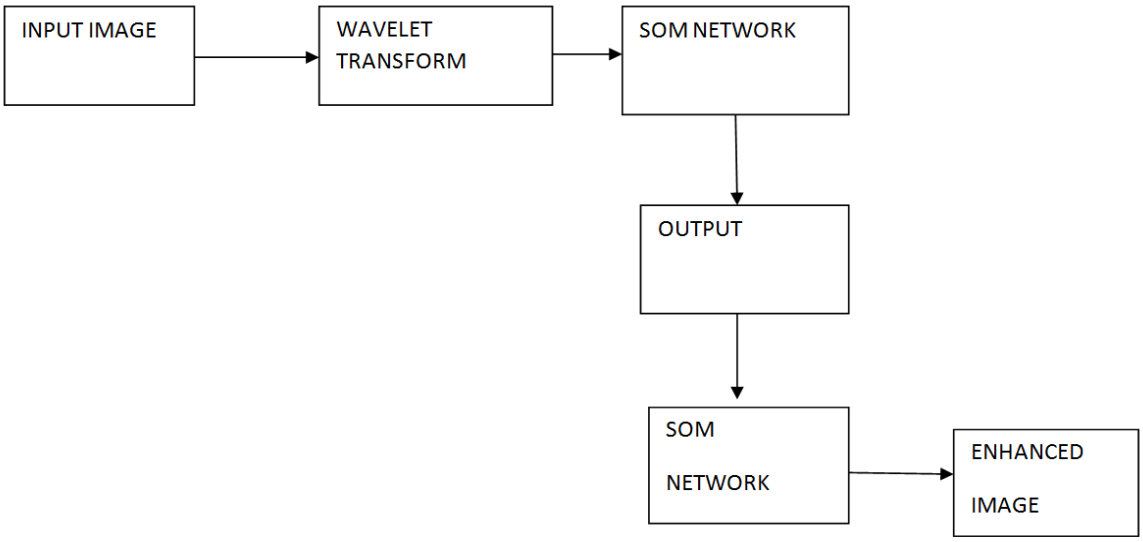

Figure 1. Process block diagram of cascaded SOM network

Proposed algorithm for processing of cascaded SOM network

Step1. Initially input image passes through wavelet transform function and decomposed into two layers approximate and details layer. The part of detail layer work as threshold value for compression of target data.

Step2. The approximate layer of image is converted into horizontal, vertical, and diagonal into the feature vector.

Step3. After conversion of feature vector image data passes through self organizing map network.

Step4. In phase of feature mapping in feature space of SOM network create a fixed cluster according to threshold of details of image part.

Step5. Here are the steps shown for the processing of SOM network [13].

1) Initialize each node's weights.
2) In SOM the input random vectors are chosen the training data.
3) Traverse each node to calculate the BMU (Best Matching Unit).
4) The radius of the neighborhood around the BMU is calculated. The size of the neighborhood decreases with each iteration.
5) Each node in the BMU's neighborhood has its weights adjusted to become more like the BMU Nodes closest to the BMU are altered more than the nodes furthest away in the neighborhood.
6) Repeat from step 5.2 to 5.5 for number of enough iteration until focalize.
7) The concept of the Euclidean distance between Node weights are W1, W2, …….Wn and the input vector's values are V1, V2, … , Vn is used for the calculation of The Best Matching Unit.
    1) Step 5.7 gives a good calculation of how common the two sets of data are to each other among the provided data set.
8) The value adjusted theta is depending on the distance from Best Matching Unit. Updated weight of the node is calculated as the old weight with the addition of a fraction L value which is the the difference between the old weight and the input vector.
9) The rate of learning L, is function of exponential decay.
    1) The step 5.9 gives confidence that the Self Organizing Map will focalize.
10) The Time Step is represented by t where on the other hand he lambda represents a time constant.

Step6. After processing of SOM network out data of image is also passes through SOM two stage network.
Step7. Finally gets enhanced image and calculate the value of PSNR and AMBE.

IV. METHODOLOGY TO BE ADOPTED

For the performance evaluation of image enhancement technique and our cascaded model used MATLAB software package. And some standard images are used for experimental process. The criteria of evaluation of performance are measured by Peak Signal to Noise Ratio (PSNR), and Absolute Mean Brightness Error (AMBE) values these are standard parameter for analysis of image enhancement result.
Performance evaluation of cascaded self organization map method for standard image. The standard image is gray scale image size is 512 X 512. Cascaded self organization map is a neural network based method for image enhancement. The performance measuring parameter is PSNR and AMBE.

V. CONCLUSION AND FUTURE WORK

The enhancement for image is a very versatile field of research using neural network and it cascading with different techniques or with its own. The application of image in different field such as medical diagnosis, satellite image and user application are needed de-noising and enhancement technique of image. The conventional technique such as histogram equalization and multipoint histogram equalization not perform up to mark. Now in this dissertation we proposed a cascading technique for image enhancement, cascading of neural network model play a great role for enhancement of image. In this paper we proposed cascading model of neural network, self organized map network (SOM).The cascaded model of SOM network is expected that it can perform better in compression of H.E and M.H.E method of image enhancement. There can be a increase in performance of cascade model set the value of transform as threshold and process of approximate value for filtration and increases the value of PSNR and enhanced the quality of image. The complexity of this model can be increase due to regression property of SOM network, And also we are looking forward towards the cascading of the RBF neural network which is also talking input from the wavelet transform, as RBF (radial basis function) network is a local Approximation three-layer feed forward neural network. It is much better than the traditional BP network In approximation ability, classification ability and Learning speed as it supervised and single hidden layer in its architecture [1].

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