A Digital Image Restoration Algorithm based on RBF NN and Filling in Technique

Gagandeep Kaur, and Paramjit Kaur

***Abstract*—**Image restoration is known as recovery of images. Generally with operation such as noise and transmission of images make it corrupted and it is difficult to recover. Color image restoration algorithm is put forward based on filling in technique and RBF neural network. Firstly, the input image is trained by the RBF neural network. Many restoration methods are available and implemented for recovery of the corrupted images. Filling in technique gives the valuable impact for restoration of images. Filling-in of missing information is a very important technique in image processing. While segmentation of image if some blocks of image are lost then instead of using common retransmission query protocols, reconstruction of the lost data using correlation between the lost block and its neighbors has been used. Removing a target object and filling the missing regions of an image is the key technology generally applied to image restoration. The basic idea is fill-in the missing block with the information propagating from the surrounding pixels. Filling in technique consider the corrupted portion of the image as the lost part of the image. Filling with use of surroundings some time degrade the quality of recovered image. In this paper, we used HSV methods to restore the image after applying filling in technique.

***Keywords*—**Filling In Technique, HSV Method, Image Restoration, RBF NN.

I. Introduction

IMAGE processing is a wide area including various applications in it. Since the early days of art and photography, filling-in and in painting has been done by professional artist. Imitating their performance with semi-automatic digital techniques is currently an active area of research. The filling-in of missing information with applications including image coding and wireless image transmission (e.g., recovering lost blocks), special effects (e.g., removal of objects), and image restoration (e.g., scratch removal) is a very important in image processing Image processing basically includes the following three steps. One is importing the image with optical scanner or by digital photography. Second one is analyzing and manipulating the image which includes data compression and image enhancement and restoration. And finally the third one is output is the last stage in which result can be altered image or report that is based on image analysis. The basic idea is fill-in the missing block with the information propagating from the surrounding pixels. The main aim of filling in technique is to fill-in the gap of missing data in a form that is non-detectable by an ordinary observer. This technique provides a means to restore damaged region of an image, such that the image looks complete and natural after restoration.

Gagandeep Kaur is a student of Master of Technology with Indo Global College of Engineering, Abhipur, and Punjab (INDIA); (e-mail: gagan_khz@yahoo.com).

Paramjit kaur is an Assistant Professor with Indo Global College of Engineering, Abhipur, and Punjab (INDIA) (e-mail: gagan_khz@yahoo.com).

II. RBF Neural Network

The term neural network was traditionally used to refer to a network or circuit of biological neurons. A Radial Basis Function (RBF) neural network has an input layer, a hidden layer and an output layer. The neurons in the hidden layer contain Gaussian transfer functions whose outputs are inversely proportional to the distance from the centre of the neuron. RBF is the activation function of the hidden nodes, which is a local distributive center symmetrical nonlinear function. The Gaussian function is usually be used. The topological structure of the RBF neural network is shown in Fig.1.

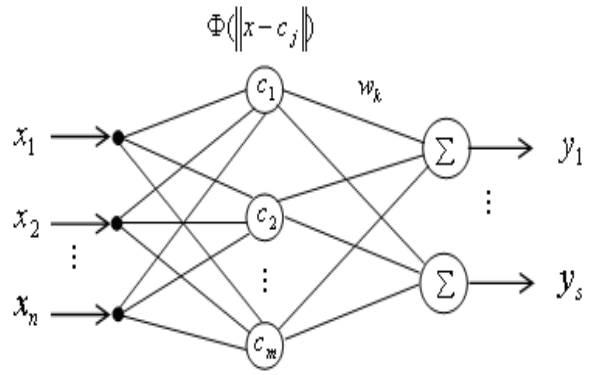


Fig.1 Topological structure of RBF NN

III. HSV Model (Hue, Saturation, Value)

Hue-saturation based color spaces were introduced when there was a need for the user to specify color properties numerically. Hue defines the dominant color (such as red, green, purple and yellow) of an area; saturation measures the colorfulness of an area in proportion to its brightness. The"intensity","lightness" or"value" is related to the color luminance.

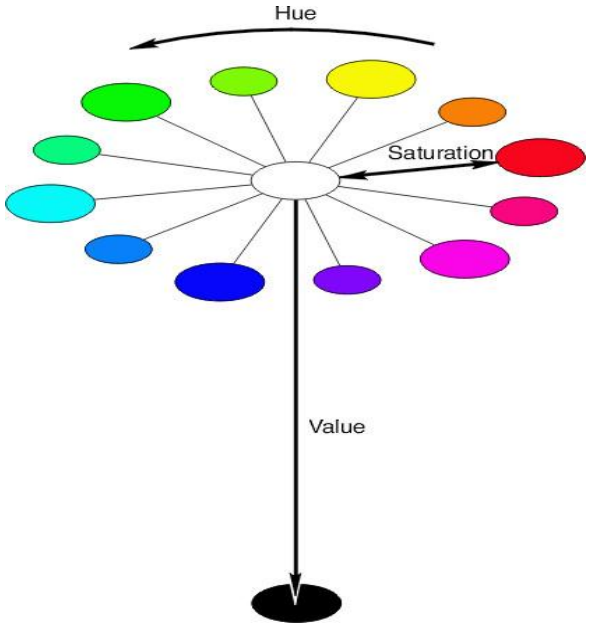


Fig.2 Structure of HSV Model

IV. Proposed Work

In this paper we will restore the blurred image by applying various filling in technique procedure and methods. For the sake of this, firstly we take an input image as per our consideration and upon which we will perform overall process of our proposed work. So, initially the input image is trained through various RBF neural network procedures. Furthermore, we have added Gaussian noise to make the image blurred. Now, we have blurred image. Now, we have to further continue the process by applying the filling in procedure of segmentation. In simple words, segmentation is the process for the identification of the images on the basis of their regions. The segmentation process contains various procedure which we will do and explain as follows. We use entropy filter which returns an array where each output pixel contains the entropy value of the 9-by-9 neighborhood around the corresponding pixel in the input image. Again, we have created rough mask for the input image for the top and bottom texture one by one and filled the associated region entirely one by one as per related procedure and rules. Now, as we are using HSV Model for restoration of image. So, HSV model first defines the associated hue, saturation and value for the requisite color image and calculated its pixel as per their regions to be filled and finally restore and de blurred the input image by applying the associated function using in it. Here, we are using PSNR as our metrics for performance evaluation and compare the results of this parameter for blurred and de blurred image or after image restoration.

Start

Collect a set of data set for input

Train the input image with RBF NN

Blurred the image using noise and get the results for PSNR as a metric

Applying segmentation and filling in technique for the blurred image

Apply HSV model for image restoration and filling process

Get the de blurred image and evaluate the result for requisite metric like PSNR

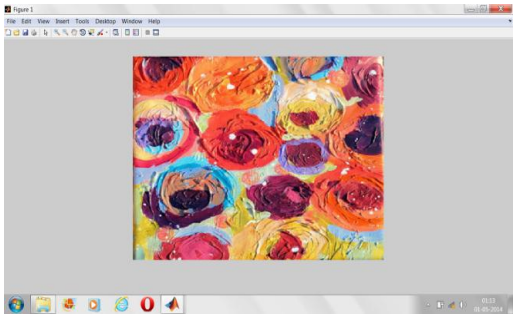
Result Analysis and comparison for blurred and de blurred image

End

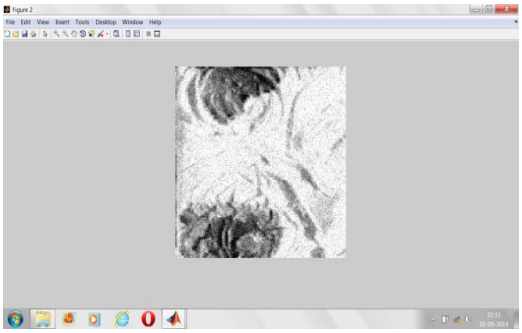
Fig.3 Methodology for the proposed work

V. Experimental Results and Performance Analysis

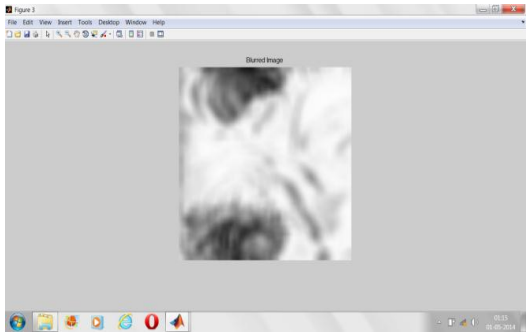
The experimental results of the proposed work was carried out in various steps which includes data training, blurred image, segmentation and filling in procedure and finally image restoration and de blurred the input image. The following screenshots are the experimental evaluation steps for the input image.



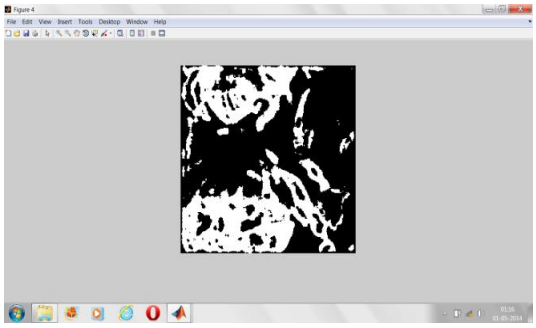
a) Input Image



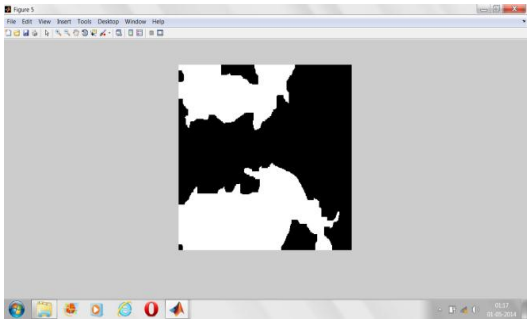
b) Trained data image after grey scale conversion



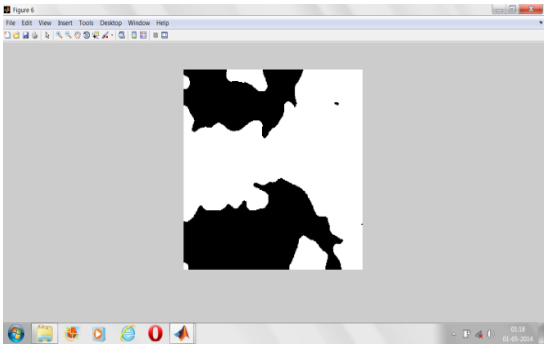
c) Blurred Image



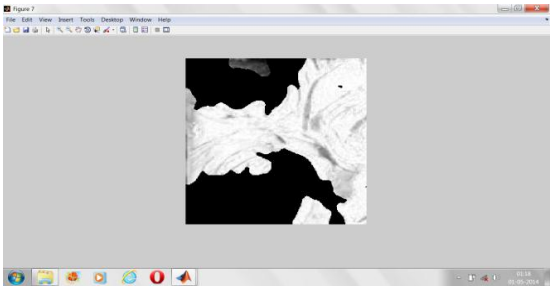
d) Segmentation Process



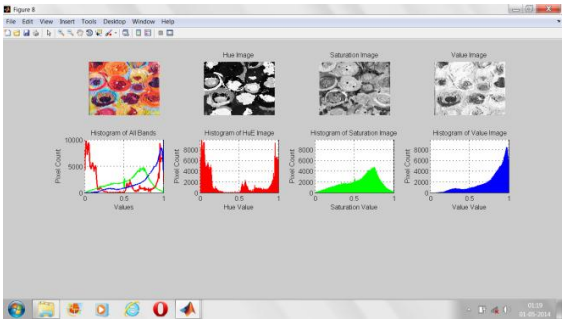
e) Segmentation and Filling in process



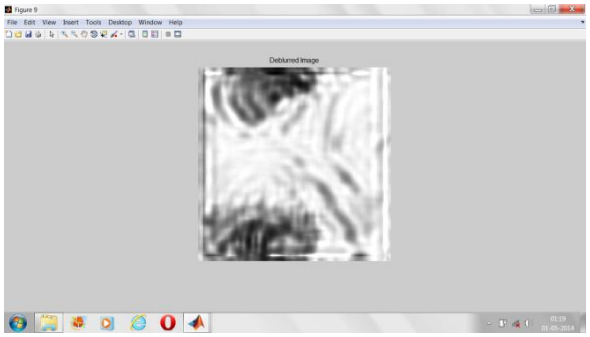
f) Segmentation and Filling in process



g) Segmentation and Filling in process



h) Restoration process using HSV Model



i) De-blurred image after restoration

VI. Parameters Used for Comparison

PSNR is generally used to analyze quality of image, sound and video files in dB (decibels). In other words, PSNR is to measure the quality of reconstructed images that have been compressed.

Mathematically, the PSNR values will be calculated using following formula:

$$PSNR = 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$

$$= 20 \cdot \log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$

$$= 20 \cdot \log_{10}(MAX_I) - 10 \cdot \log_{10}(MSE)$$

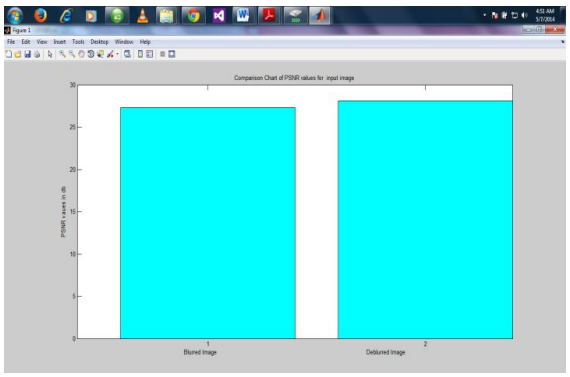


Fig.4 Comparison for blurred and de blurred image for PSNR

The above Fig.4 clearly depicts that the PSNR values for De blurred image for the requisite image is high as compare to blurred image which is quiet good and tangible.

In the above figure and result, the PSNR for blurred image is 27.3139 db and for de blurred image is 28.0849 db respectively.

VII. Conclusion & Future SCOPE FOR Comparison

In this paper we have worked over various filling in procedure for restoration of digital image. We have calculate various performance analysis and results for the desired parameters and finally concluded that the results for the metrics like PSNR etc is quite scalable and optimist as compare to the blurred image. The results depicts that the proposed work is quiet good and reliable for various image on different scale. In this thesis research we are going to use neural networks and filling in techniques to achieve fast restoration of an image. Moreover, for future work neural networks are combined with some other technique which may be worked over stiil or moving images for various input images like jpg, dicom format etc. Image restoration is a very wide area of research so we can recover images by using any other techniques for better results.

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