Image Enhancement using Neural Model Cascading using PCNN

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ABSTRACT
Image Enhancement is one of the most powerful Techniques to process low level and high level images receive form various sources like remote sensing, medical image, local images. We Proposed Novel approach to Enhance the image using model cascading. Images that come from a variety of microscope technologies provide a wealth of information. The limited capacity of optical imaging instruments and the noise inherent in optical imaging make image enhancement desirable for many microscopic image processing application.

1. INTRODUCTION
Image enhancement is the process of enhancing the appearance of an image or a subset of the image for better contrast or visualization of certain features and to facilitate subsequently more accurate image analysis. With image enhancement, the visibility of selected features in an image can be improved, but the inherent information content cannot be increased. The design of a good image enhancement algorithm should consider the specific features of interest in the microscopic image and the imaging process itself. In microscopic imaging, the images are often acquired at different focal planes, at different time intervals, and in different spectral channels. The design of an enhancement algorithm should therefore take full advantage of this multidimensional and multispectral information. A variety of image enhancement algorithms have previously been developed and utilized for microscopy applications. These algorithms can be classified into two categories: spatial domain methods and transform domain methods. The spatial domain methods include operations carried out on a whole image or on a local region selected on the basis of image statistics. Techniques that belong to this category include histogram equalization, image averaging, sharpening of important features such as edges or contours, and nonlinear filtering. The transform domain enhancement methods manipulate image information in transform domains, such as Fourier and wavelet transforms. Often, interesting image information cannot be separated out in the spatial domain but can be isolated in the transform domain. For example, one can amplify certain coefficients in the Fourier domain and then recover the image in the spatial domain to highlight interesting image content. The wavelet transform is another powerful tool that has been developed in recent years and used for image enhancement.

2. RESEACH OBJECTIVES
Image enhancement the image to a form better suited for analysis by a human or machine processes consist of a collection of techniques that seek to improve the visual appearance of an image or to convert the image to a form better suited for analysis by a human or machine utilizing our novel approach of Image enhancement using Model Cascading.

3. BRIEF REVIEW OF WORK / LITRATURE SURVEY

4.1Histogram Equalization
Histogram Equalization is a technique that generates a gray map which changes the histogram of an image and redistributing all pixels values to be as close as possible to a user –specified desired histogram. HE allows for areas of lower local contrast to gain a higher contrast. Histogram equalization automatically determines a transformation function seeking to produce an output image with a uniform Histogram. Histogram equalization is a method in image processing of contrast adjustment using the image histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. Histogram equalization automatically determines a transformation function seeking to produce an output image with a uniform Histogram.

1. The Histogram Equalization method does not take the mean brightness of an image into account.

2. The HE method may result in over enhancement and saturation artifacts due to the stretching of the gray levels over the full gray level range.
3. Histogram equalization can be found on the fact that the brightness of an image can be changed after the histogram equalization.
4. Nevertheless, HE is not commonly used in consumer electronics such as TV because it may significantly change the brightness of an input image and cause undesirable artifacts.
5. It can be observed that the mean brightness of the histogram-equalized image is always the middle gray level regardless of the input mean.

4.2 Brightness Preserving Bi Histogram Equalization

The Brightness preserving bi histogram equalization firstly decomposes an input image into two sub images based on the mean of the input image. One of the sub image is set of samples less than or equal to the mean whereas the other one is the set of samples greater than the mean. Then the BBHE equalizes the sub images independently based on their respective histograms with the constraint that the samples in the formal set are mapped into the range from the minimum gray level to the input mean and the samples in the latter set are mapped into the range from the mean t the maximum gray level. Means one of the sub image is equalized over the range up to the mean and the other sub image is equalized over the range. From the mean based on the respective histograms.

Consequently, adaptive histogram equalization is considered an image enhancement technique capable of improving an image's local contrast, bringing out more detail in the image. However, it also can produce significant noise. A generalization of adaptive histogram equalization called contrast limited adaptive histogram equalization, also known as CLAHE, was developed to address the problem of noise amplification. CLAHE operates on small regions in the image, called tiles, rather than the entire image. Each tile's contrast is enhanced, so that the histogram of the output region approximately matches the histogram specified by the 'Distribution' parameter. The neighboring tiles are then combined using bilinear interpolation to eliminate artificially induced boundaries. The contrast, especially in homogeneous areas, can be limited to avoid amplifying any noise that might be present in the image.

4.3 Proposed Work and Methodology

The proposed work of the research is to develop a novel approach of digital image enhancement using model Cascading .This model will utilize histogram equalization and PCNN, algorithm which was formed and developed in the 1990's, is a new type of neural network different from what we generally mean by artificial neural networks. To enhance the image. In this novel approach we first pass the image through, a image filter which results in noise reduction , then the image is again passed through cascading PCNN, model/ algorithm, to enhance the image. The study shows that the contrast, the age and blurring of the image is enhanced efficiently and more in comparison n to the enhancement done by separate PCNN and image filtering techniques. The performance evaluation after applying this particular model cascading approach to enhance the image will be shown in the research .Presently we are using two models in cascade but in future it can be extended to three or more models in this approach for further research purposes. In this novel approach we utilize the histogram equalization methods in addition to our proposed model.

In our novel approach, we use MATLAB 7.6 Software to implement our simulation model to get the image enhancement parameters' / data's and also the resulting image. In this work we will also compare the enhancement performance of our model and conventional. It is based on Elkhorn's model, and derives from the phenomena of synchronous pulse bursts in mammals' (cats, monkeys, etc.) visual cortex When PCNN is used in image processing, it is a monolayer two dimensional array of laterally linked neurons. The number of neurons in the network is equal to that of pixels in the input image. One-to-one correspondence exists between image pixels and neurons. Each pixel is connected to a unique neuron and each neuron is connected with its surrounding neurons.

4. THE ALGORITHM DESCRIPTION

In order to give a more accurate description to the incomplete and uncertain problems which may appear in image enhancement, and improve the effect of image processing, we come up with an image enhancement algorithm based on PCNN time matrix and Rough Set indiscernibility relation in this paper.

There is certain correlation between each pixel's intensity and that of its neighborhood. Generally, if one pixel is polluted by noise, the correlation will be destroyed. Therefore, we can judge whether a pixel is noisy depending on PCNN time matrix. The method is: If the value of element in time matrix is different from its neighborhood, then the corresponding image pixel is noisy .In this algorithm, we first adopt PCNN time matrix to detect noise, apply in discernibility relation to partition original images roughly, then denoise using the noise reduction method based on PCNN, complete sub-images, and finally enhance the images. When enhancing the image, we adopt the following method: to the bright sub-image, histogram exponential transformation is used to make its histogram exponential distributing, dynamic range compressed, and the contrast of bright and dark areas be controllable; histogram-equalize the dark sub-image, and the result is that the histogram of object area becomes smooth, the image is much more clearer, more details are preserved, and the processed image is convenient for subsequent processing. Simulation results indicate that the algorithm not can only enhance image commendably, but also can restrain noise efficiently. In many cases, for the gray images, it is likely that their bright regions are background while dark regions are objects because of low illumination, low contrast between objects and background, and noise pollution. To the question, special enhancement algorithm is needed. The image enhancement algorithm based on PCNN time matrix and Rough Set indiscernibility relation, a nonlinear intensity transformation, can enhance the detail information in dark areas efficiently, increase images' contrast, and is very useful to the images with plentiful information in low gray levels. Thereby, the algorithm proposed in this paper is of significant application value for the low contrast images degraded by noise.

Step 1: Partition the original image to get sub images, i.e. apply the indiscernibility relation in Rough Set to partition the original image according to condition attribute C. And then determine which pixel sets need enhancement.

Secondly, partition the image according to noise attribute c2. Let y represent a noisy pixel detected by PCNN, then equivalence relation Rc1 can be defined as: all the noisy pixels are Rc2 indiscernible. Rc2(y) represents the set composed of those pixels and its supplementary represents the set composed of the pixels without noise.

Step 2: Image noise reduction.

Here we use our noise reduction algorithm based on PCNN proposed in reference . Slide a window matrix K (3×3, each element is one) on time matrix T, determine the firing time of the neurons inside the window, and choose proper subsequent operation to process the corresponding pixels. 1) If the element value in the center of the window is the maximum or minimum, then replace the corresponding pixel's intensity of the image by median filtering result; 2) the rest pixels' intensities remain unchanged

Step 3: Implement different enhancing transformations to different sub-images, and obtain the enhancement results. First of all, complete sub-image I1, i.e. fill all dark pixels with P2, fill all noisy ones with de noised results, and process the completed sub-image with histogram exponential transformation.

5. EXPECTED OUTCOME OF THE WORK

This research work will develop a novel approach for image enhancement using Model cascading . Specifically we use image filter for Noise reduction , Noise removal of the image under project, then the resulting image is passed through a Neural net model to enhance the image. Finally we compare the performance and parameters/ characteristics of enhanced image obtained by our model and the image obtained by Neural Network model and image filter separately. In this simulation approach we use and utilize MATLAB Version 7.6 and the image we use of a FLOWER having the pixel characteristics of 200 * 150 Pixels, 32 BIT color image.

6. IMPLEMENTATION AND EXPERIMENTAL RESULTS

For the performance evaluation of image enhancement technique and our cascaded model used MATLAB software package. MATLAB is a software package for high- performance numerical computation and visualization. It provides an interactive environment with hundreds of built-in function for technical computation, graphics and animation. Best of all, it also provides easy extensibility with its own high- level programming language. The MATLAB stands for matrix laboratory. There are also several optional "toolboxes" available from the developers of MATLAB. These toolboxes are collections of functions written for special applications such as symbolic computation, image processing, statistics, control system design, neural networks etc. the list of toolboxes keeps growing with time.

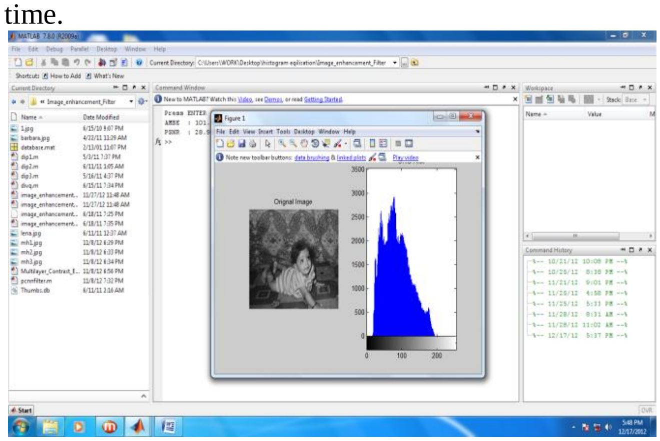


Figure 5.1 shows the input image of baby and its histogram map in given shows that enhanced image by histogram equalization method and equalized histogram map with PSNR value 28.99 and AMBE IS 101.02 The baby image is gray scale image size is 512 * 512. Histogram equalization is basic method for image enhancement. The performance measuring parameter is PSNR and AMBE performance evaluation of histogram equalization method for family image. The family image is gray scale image size is 512 * 512. Histogram equalization is basic method for image enhancement. The performance measuring parameter is PSNR and AMBE.

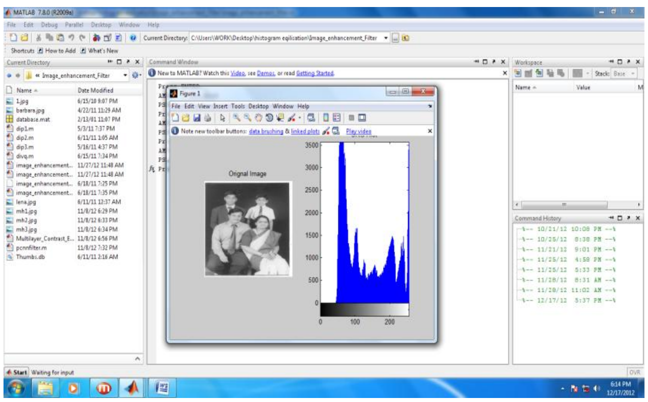
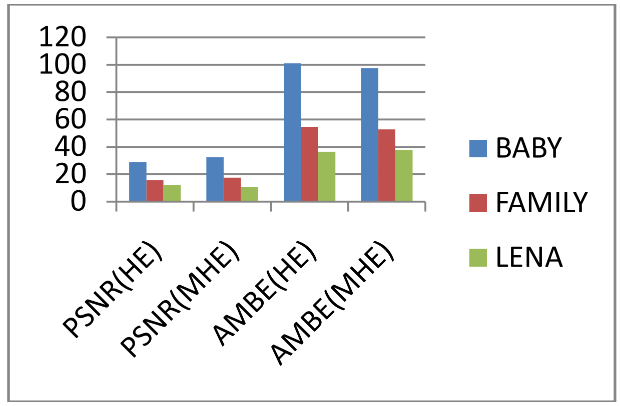


Figure 5.2 shows that enhanced image by histogram equalization method and equalized histogram map with PSNR value 15.65 and AMBE IS 54.53 Figure shows that enhanced image by histogram equalization method and equalized histogram map with PSNR value 17.50 and AMBE IS 52.66

Table 5.1 shows that value of PSNR, AMBE on the basis of method HE and MHE for the image BABY, FAMILY and LENA.

IMAGE	PSNR (HE)	PSNR (MHE)	AMBE (HE)	AMBE (MHE)
BABY	28.99	32.43	101.02	97.56
FAMILY	15.65	17.50	54.53	52.66
LENA	12.10	10.82	36.42	37.71

Figure 5.3 show that comparative analysis of BABY, FAMILY and LENA image for two image enhancement method image histogram equalization and multipoint histogram equalization. Figure shows that enhanced image by Cascaded Some method and equalized histogram map with PSNR value 34.79 and AMBE IS 56.15.performance evaluation of cascaded RBF method for baby image. The baby image is gray scale image size is 512 * 512. Cascaded RBF is a neural network based method for image enhancement. The performance measuring parameter is PSNR and AMBE.



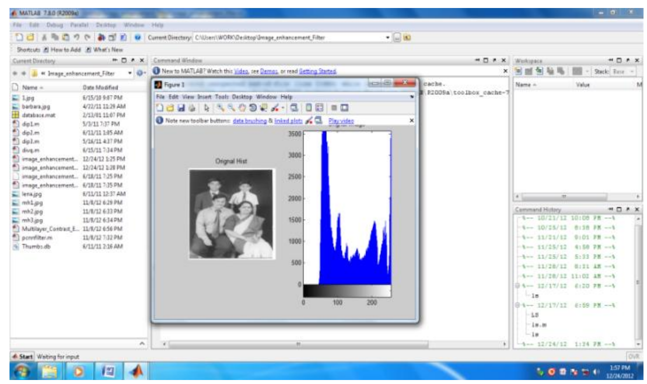
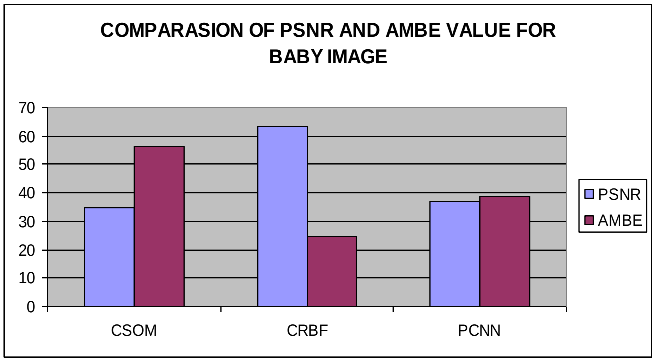


Figure 5.4 shows the input image of family and its histogram map in given figure The Baby image is gray scale image size is 512 512. PCNN based method for image enhancement. The performance evaluation of PCNN method for family image. The Family image is gray scale image size is 512 * 512. PCNN based method for image enhancement. The performance measuring parameter is PSNR and AMBE.

Table 5.2 shows that value of PSNR, AMBE on the basis of method Cascaded SOM , Cascaded RBF and PCNN for the image BABY.

BABY IMAGE	PSNR	AMBE
METHOD		
CSOM	34.79	56.15
CRBF	63.31	24.85
PCNN	36.93	38.61



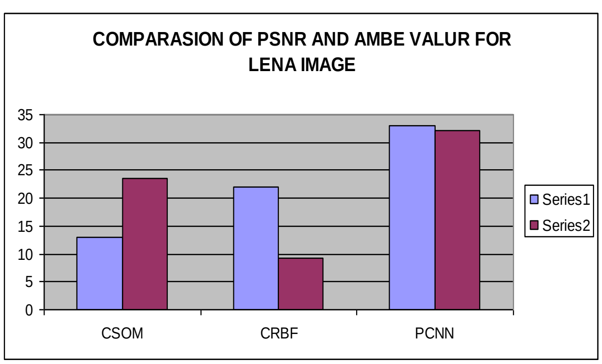
Show that comparative analysis of BABY image for three image enhancement method Cascaded SOM, Cascaded RBF and PCNN.

Table 5.3 shows that value of PSNR, AMBE on the basis of method Cascaded SOM, Cascaded RBF and PCNN for the image FAMILY

FAMILY IMAGE METHOD	PSNR	AMBE
CSOM	18.75	31.93
CRBF	24.17	13.41
PCNN	36.13	38.33

Table 5.4 shows that value of PSNR, AMBE on the basis of method Cascaded SOM, Cascaded RBF and PCNN for the image LENA.

LENA IMAGE METHOD	PSNR	AMBE
CSOM	12.99	23.63
CRBF	22.08	9.27
PCNN	33.02	32.07



comparative analysis of LENA image for three image enhancement method Cascaded SOM, Cascaded RBF and PCNN.

Table 5.5 shows that value of PSNR, AMBE on the basis of method HE, MHE and PCNN for the image FAMILY .Figure show that comparative analysis of FAMILY image for three image enhancement method HE, MHE and PCNN.

FAMILY IMAGE METHOD	PSNR	AMBE
HE	15.65	54.53
MHE	17.50	52.66
PCNN	36.93	38.61

Table 5.6 shows that value of PSNR, AMBE on the basis of method HE, MHE and PCNN for the image LENA.

LENA IMAGE METHOD	PSNR	AMBE
HE	12.10	36.42
MHE	10.82	37.71
PCNN	36.93	38.61

7. CONCLUSION

Image enhancement is versatile field of research using neural network. The application of image in different field such as medical diagnosis, satellite image and user application are needed denosing 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 dissertation we proposed three cascading model of neural network, self organized map network (SOM), radial bias neural network and finally pulse coupled neural network.The cascaded model of SOM network performs better in compression of H.E and M.H.E method of image enhancement. The increased performance of cascade model set the value of transform as threshold and process of approximate value for filteration and increases the value of PSNR and enhanced the quality of image. The complexity of this model is increase due to regression property of SOM network.The cascaded model of RBF network play a good job in compression of SOM cascaded neural network model. The cascading of RBF model has great advantage over SOM network due to single layer hidden processing network. The performance parameter show better result in compression of SOM cascaded model.The cascading model of pulse coupled neural network has better performance in compression of SOM and RBF cascaded model. The PCNN cascaded model work on two different mammal cortex of network. The data processing of PCNN used wavelet transform function and set details of data as threshold and approximation of wavelet as input of raw image. The section of modulation work in details of wavelet transforms. The value of evaluation shows better in other technique of image enhancement.

8. FUTURE WORK DIRECTION

The cascaded model of PCNN neural network gives better result in compression of H.E, M.H.E, cascaded SOM and cascaded RBF neural network model. But some point of noise pixel matrix of PCNN loss some value and loss AMBER value of calculation. Now in future we used 3-stage cascading model and used some heuristic function for optimization of network pixel value. Optimizers are genetic algorithm, ant colony optimization and particle of swarm with cascaded neural network model.

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