Generation of Enhanced Image Using Neural Network Based On Abstraction

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ABSTRACT

Image abstraction is a method of enhancing or high lighting the visualization of main information contents of image and smoothing the other portion. It is quite important for many multimedia applications like cartooning and animation where symbolic presentation matters; hence it is an important part in the field of image processing. In this thesis we are proposing a neural network based approach which not only abstract the image but also avoids the enhancement of noise. This particular task is performed by empirically training the neural network for noise patterns on images by mixing the plane image with noise finally the algorithm is simulated on MATLAB and results showing that the proposed technique is fast and efficient in performing the particular task. This thesis presents a hybrid technique for image enhancement with ability of de-noising it integrates two different processing aspects into one. The proposed algorithm uses the image abstraction technique for detecting the information density in different parts of image then accordingly operates the smoothing filter and after filtering the information's of edges are recombined with the filtered image. The proposed technique also utilizes the Neural Network for filtering noise generated edge patterns. Hence the approach not only enhances the image but also avoids the enhancement of noise. The simulation of algorithm shows that it improves the perception; remove noise while maintaining the structure information intact it is also found that the proposed technique is quite fast. [7]

Keywords-
Image enhancement, Neural Network, empirical analysis.

1. INTRODUCTION

There are many definitions available for the term image enhancement one of them is "Image enhancement is basically improving the interpretability or perception of information in images for human viewers and
providing `better' input for other automated image processing techniques".

On other words the objective of image enhancement is to modify its features according to the requirements of processing space. While considering the above mentioned things it is clear that enhancement techniques are very relevant to the field where the processed image to be used, because of this several techniques are available for enhancement of image depending upon the use (like human perceptions, medical imagery or very complex radar systems). Another problem with enhancement techniques is that most of the method required a properly de-noised image otherwise the noise generated artifacts could also get enhanced hence de-noising is often a necessary and the first step to be taken before the images data is analyzed. It is necessary to apply an efficient de-noising technique to compensate for such data corruption. Because of the characteristics of noise Image de-noising still remains a challenge for researchers because of nature of noise. This paper describes methodologies for noise reduction (or de-noising) giving an idea to soft computing algorithm to find the reliable estimate of the noise pattern in given degraded image[17].

As discussed above the noise modeling in images is greatly varies depending upon capturing instruments, data transmission media, image quantization and discrete sources of radiation.[9] It is difficult to design a single mathematical model for all types of noise instead a soft computing based black box model could be a much better solution for noise model. This paper also considers information based processing depth for each part of image which not only reduces the processing time but also protects the information loss.

2. OVERVIEW OF PREVIOUS WORK

Previous work in image-based stylization and abstraction systems varies in the use of scene geometry, video-based vs. static input, and the focus on perceptual task performance and evaluation. Among the earliest work on image-based NPR was that of Saito and Takahashi [1990] who performed image processing operations on data buffers derived from geometric properties of 3D scenes. Our own work differs in that we operate on raw images, without requiring underlying geometry. To derive limited geometric information from images, Raskar et al. [2004] computed ordinal depth from pictures taken with purpose-built multi-flash hardware. This allowed them to separate texture edges from depth edges and performs effective texture removal and other stylization effects. Our own framework does not model global effects such as repeated texture, but also requires no specialized hardware and does not face the technical difficulties of multi-flash for video. Several video stylization systems have been proposed, mainly to help artists with labor-intensive procedures [Wang et al. 2004; Collomosse et al. 2005]. Such systems extended the mean-shift based stylization approach of DeCarlo and Santella

[2002] to computationally expensive three-dimensional video volumes. Difficulties with contour tracking required substantial user correction of the segmentation results, particularly in the presence of occlusions and camera movement. Our framework does not derive an explicit representation of image structure, thus limiting the types of stylization we can achieve. In turn, we gain a framework that is much faster to compute, fully automatic, and temporally coherent. Fischer et al. [2005] explored the use of automatic stylization techniques in augmented reality applications. To make virtual objects less distinct from the live video stream, they applied stylization effects to both virtual and real inputs. Although parts of their system are similar to our own, their implementation is limited in the amount of detail it can resolve, and their stylized edges tend to suffer from temporal noise. Recently, several authors of NPR systems have defined task-dependent objectives for their stylized imagery and tested these with perceptual user studies. DeCarlo and Santella [2002] use eye tracking data to guide image simplification in a multi-scale system. In follow-up work, Santella and DeCarlo [2004] found that their eye-tracking-driven simplifications guided viewers to regions determined to be important. They also considered the use of computational salience as an alternative to measured salience. Our own work does not rely on eye-tracking data, although such data can be used. Our implicit visual salience model is less elaborate than the explicit model of Santella and DeCarlo's later work, but can be computed in real-time. Their explicit image structure representation allowed for more aggressive stylization, but included no provisions for the temporal coherence featured in our framework. Gooch et al. [2004] automatically created monochromatic human facial illustrations from Difference-of-Gaussian (DoG) edges and a simple model of brightness perception. We use a similar edge model and evaluation study to Gooch et al. but additionally address colour, real-time performance and temporal coherence.

Many people proposed algorithms to reduce time on the basis of reduced search, which reduces the compatible block search using some type of grouping but this can reduce only a part of time which is involved in searching of blocks but the time to calculate error matrix does not change. So the way is to neglect the error matrix which saves time but causes degradation in image quality because in reduced level domain image, it is not always possible to find exact matching block matching blocks. Hence at that case it will produce an image of quality inferior than normal methods

3. PROPOSED ALGORITHM

3.1 Implementation

The proposed algorithm works on detection and enhancing the important information of an image while suppressing the noise generated false information contents this method has advantage that it does not dissolve the impulsive noise but eliminate it. this is particularly useful where the original image having possibility of being distorted by noise. The proposed algorithm can be divided into two parts described in following steps.

3.1.1 Training of Neural Network

Step1**.** Generate the initial noisy patterns of selected size (like 16X16, 4X4 etc.) by Gaussian distribution of different mean (from 0 to 0.8) and variance (0 to 0.8).

Step2. Generate the edge image from above generated image by using 'Sobel' operator and 'Roberts' operator.

Step3. Divide the original image into non-overlapping blocks of selected size (like 3X3, 5X5, 7X7 etc.).

Step4. Now train the neural network using image pixels of selected block as training vectors (by converting that block into row vector) and corresponding edge value (0 or 1) as label. For example if in fig1 we take a block of 3X3 and placed it on upper left corner then corresponding edge value will be E_{22}.

3.1.2 Generating Enhanced Image

Step1**.** Generate the smoothed image by filtering the given image using median filter.

Step2 Find out the edges using 'Sobel' and 'Roberts' operator.

Step3**.** Now from the edge image find out the points of edges and extract the pixels around that pixel location from given image according to windows size. Example let the E_{12} be the edge then extracts the pixels from upper left corner by 3X3 windows size here windows size is considered 3X3.

Step4**.** Now pass this vector to previously trained neural network.

Step5**.** If the neural network predicts an edge then remove the edge information from edge image else keep it intact.

Step6**.** Apply the median filter to all blocks of image except the blocks which contains the edges.

3.2. Process Of Abstraction of An Image

Flowing steps are Enhance the image abstraction.

1. Generate the noise pattern of specific size using Gaussian distribution with different mean and variance.
2. Divide the image according to specified window size.

3. Calculate the edges by using "Sobel" and "Roberts" Filter.
4. Convert each window into single row vector.
5. Store all vectors and their corresponding edge value as label.
6. Train the Neural Network using above data.
7. Read the image to be abstracted.
8. Separate all three planes of image.
9. Calculate the edge of each plane using the same filters used for training.
10. Crop the image around the edge points of specified windows size.
11. Convert the window into single row vector as done during training.
12. Apply the generated vector to the trained neural network.
13. If neural network predict an edge for given vector remove that edge from edge image.
14. Else remained it unchanged.
15. Now filter the corresponding block in image using median filter.
16. Multiply the image planes with corresponding edge planes using Pixel by Pixel multiplication.
17. Combine all three image planes generated above to make color image.

4. RESULT & DISCUSSION

4.1. Simulation Results

For better analysis of proposed algorithm it is simulated in MATLAB with different images and results are presented here.

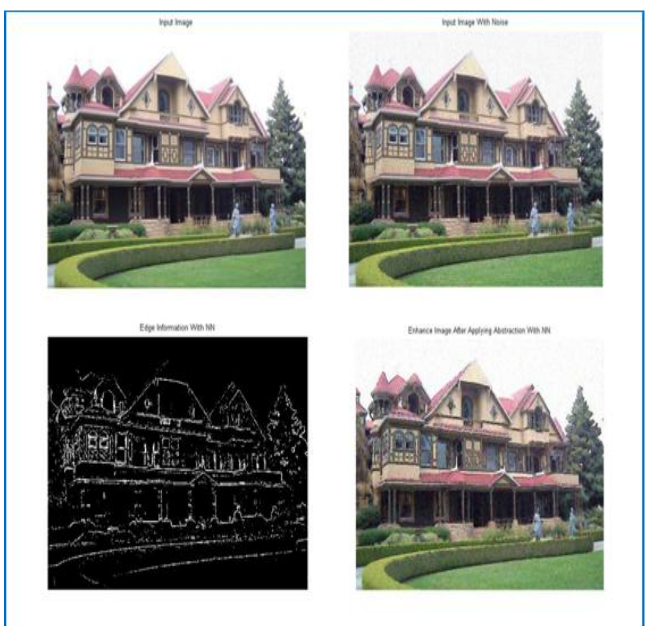

Fig: 4.1

Fig 4.1 shows the input image 1 House (up left). This colour full house present input image. Second (up right) image shows the same image noised by Gaussians distribution of different mean 0 to .08 And variances 0 to 0.8. Next image (down left) shows the Edge information with Neural network. In This image Edge generate by Sobel filter, last image (down right) how the Enhance image after applying Abstraction with Neural Network.

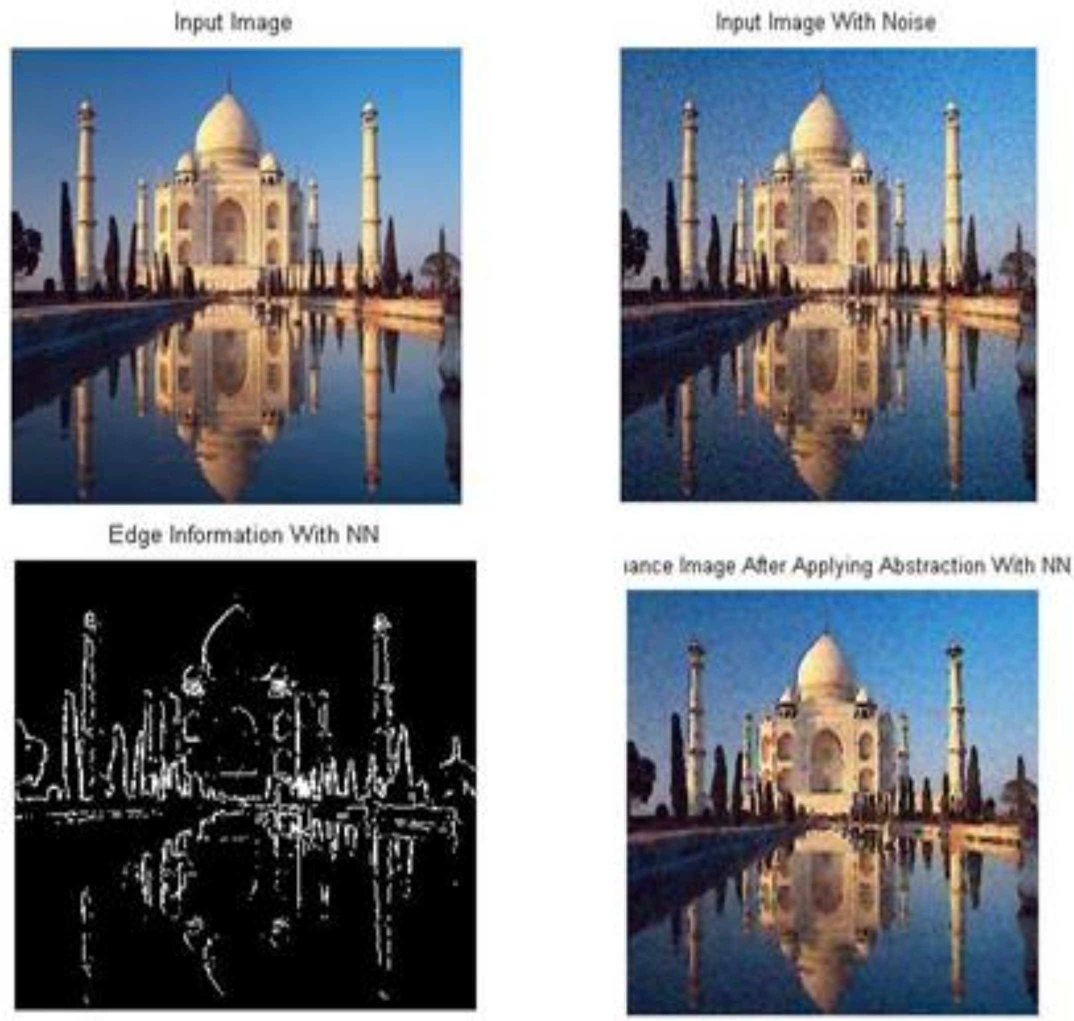

Fig: 4.2

Fig 4.2 shows the input image 4 Tajmahal (up left). This beautiful Tajmahal present input image. Second (up right) image shows the same image noised by Gaussians distribution of different mean 0 to .08 and variances 0 to 0.8. Next image (down left) shows the Edge information with Neural Network. In This image Edge generate by Sobel filter, last image (down right) how the Enhance image after applying Abstraction with Neural Network.

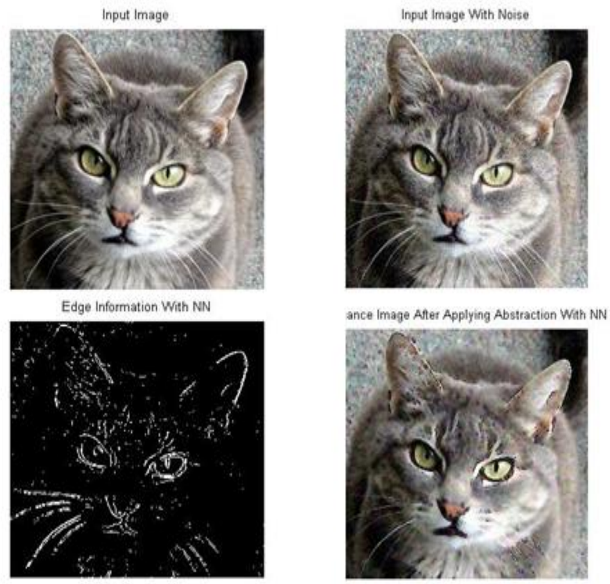

Fig: 4.3

Fig 4.3 shows the input image Cat 4. This image cat present input image. Second image generate noisy pattern select size (16 X 16) by Gaussians distribution of different mean 0 to .08 and variances 0 to 0.8. Next image shows the Edge information with Neural Network. In This image Edge generate by Sobel & Robert filter. Now train the Neural Network using image pixels select block as training vectors and corresponding edge value 0 or 1as level. Last image how the Enhance image after applying Abstraction with Neural Network.

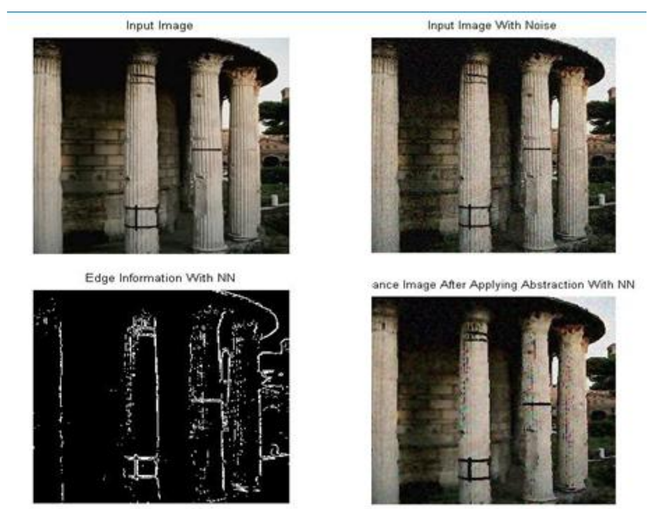

Fig: 4.4

Fig 4.4 shows the historical architecture 3 House (up left). This historical architecture 3 present input images. Second (up right) image shows the same image noised by Gaussians distribution of different mean 0 to .08 and variances 0 to 0.8. Next image (down left) shows the Edge information with Neural Network. In This image Edge generate by Sobel filter, last image (down right) how the Enhance image after applying Abstraction with Neural Network.

image	MSE		PSNR		Training Time	Filtering Time
	Noisy	Enhanced	Noisy	Enhanced		
1	287.2	138.9	23.5	26.7	3.99	5.30
2	317.3	148.4	23.1	26.4	3.99	5.29
3	287.5	186.5	23.5	25.4	3.99	5.39
4	309.9	182.6	23.2	25.5	3.99	5.41

4.2 Plot for the Timimg & Processing-

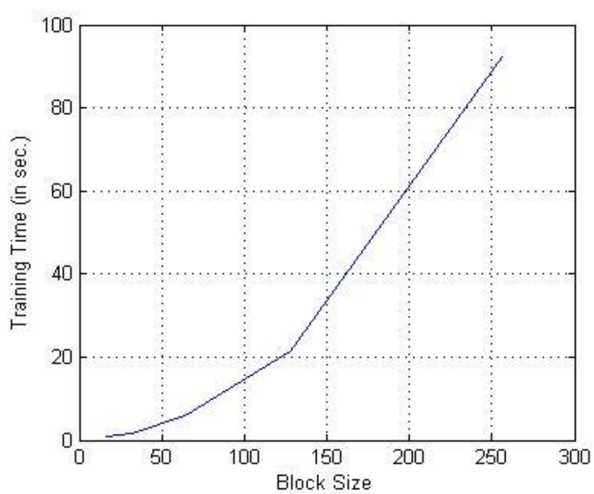

Fig: 4.5

Figure:- 4.5 Shows the Plot of block size vs. training time. Increasing the block size of noise training the training time for the neural network linearly increases since the increased block size provides better noise characteristics hence a trade off should be maintained between training time and filtration quality although the training is required only once so a larger block size can be used if multiple images has to be filtered.

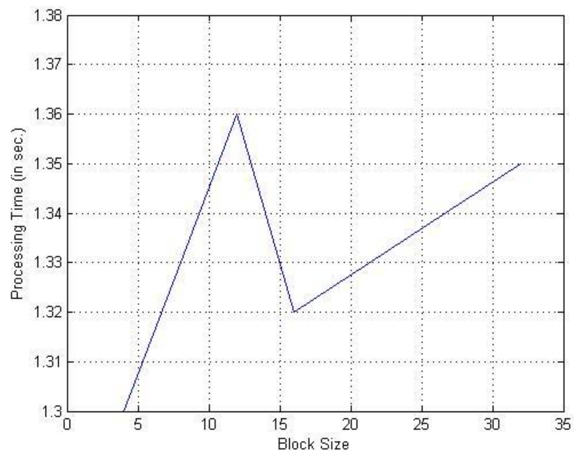

Fig: 4.6

Figure4.6. Show the plot of block size vs. processing time. It shows that the processing time firstly increases then decreases although it may be oscillating in nature (if plotted for larger values) because it need less number of larger size block than small size block for processing the image but the larger block needed more time, the larger block size should be preferred for better filtration.

5. CONCLUSION

After simulating the algorithm with different images and analyzing results it's clear that proposed algorithm sufficiently reduces the effect of noise patterns in the abstracted image, also the proposed technique takes almost same time for processing even with different block size although the training time grows exponentially hence in future it is needed to minimize.

6. REFRENCES

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