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Robust technique to restore and enhance image for edge detection

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ABSTRACT

To recover the degraded image, image restoration needs. There are different formats for pixel noise like salt & pepper, Gaussian noise, etc. which cause the image degradation and may become the main reason to miss the pixel regions during capturing, transmissions, processing, etc. So for better processing, these missing pixel must be restored, in this process single pixel, multiple pixel (spatial) models are used for the restoration of the missing or bad pixels. In this paper, the proposed model is designed for the recovery of the pixel by using adaptive methods and the image is enhanced by using an automatic enhancement technique. The proposed model has been analyzed with the improved results in context with the existing models, which shows the robustness of the proposed model.

Keywords— Image restoration, Image enhancement, Adaptive pixel restoration, Non-linear pixel restoration

1. INTRODUCTION

Image processing is defined as the technique that involves the processing of input such as images with the help of mathematical operations and signal processing; output may be an image or certain parameters of the image. Generally, the image is regarded as a two-dimensional signal, and standard signal processing techniques are applied. There are three different types of image processing namely digital, optical and analogue image processing. However, digital image processing is generally considered in imaging science. In this article, various techniques that are applied normally in image processing will be discussed. Main techniques of image processing are computer graphics and computer vision. Computer graphics is mostly used in animated movies in which images are made manually from various physical models of environment and objects. In contrast, computer vision is a highly standardized form of image processing and that involves the decipherment of physical contents of the image via machine/computer/software (for instance, 3D full-body magnetic resonance scans). In the modernized technology world, enhanced importance of scientific visualization has resulted in broader scope for images. To exemplify, microarray data in genetic research. Computer graphics is an easy process that involves quality improvement of digital image through manipulation with the use of software (e.g. to make an image lighter or darker). Images are altered with the use of various advanced image enhancement software such as image editors.

2. LITERATURE REVIEW

Alex Stark, J. (2000) He nominated a strategy to boost an adaptive image contrast rely on a generalization of histogram equalization (HE). It was a valuable method for elaborating image contrast. However, the properties of this technique were a “commutation function,” which used to generate a grey level mapping from the local histogram. Consequently, one achieved a change into one or two parameters, the resulting process can produce a range of degrees of contrast enhancement, at one extreme leaving the image unchanged, while another yielding full adaptive equalization.

Guo, D. (2013), Ultrasonic images were proposed for the first time which involved unclear frame balancing frequency compounding, persistence and spatial compounding. This created subtle electronic noise which leads to creating fog in photographic images. Presentation of dehazed photographs was done which used an improved dark channel model for enhancing the contrast of an ultrasound image. This method was proved better for the improved quality of ultrasonic images.

Vij, K. This paper focused on improving the appearance of pictures by selecting few features to be dominant or by decreasing ambiguity between different regions of the stipulated image. The collection of techniques under image enhancement processed helped in improving the visual appearance of the images and to increase the permeability by a human as well as machines. There were some images that suffered poor contrast such as medical images, remote sensing images, real-life photographic images, microscopy images etc. Thus it was important to improve the contrast. The details and deceivability of images need to be increased by the enhancement methods, therefore, maximum efforts were made. Improved image provided clarity to the eyes of

human as well as machines and assisted the processing of feature extraction in the computer vision system. Though there were many methods for enhancement of the images there were some factors that were considered before selecting any method for the specific image processing application. The factors were:

- Enhancement efficiency
- Computational requirements
- Noise amplification
- User intervention
- Application suitability

3. EXPERIMENTAL DESIGN

To recover the image and enhance the image following algorithms are used:

Algorithm 1

Hybrid noise removal algorithm

1. Take the image and change the name of the image to Img.
2. Calculate wavelets and divide the Img into various components $\rightarrow \{ca, cd, ch, cv\}$
3. Use component ca in which decomposition is applied.
4. Form the matrix estimate the adaptive components
5. Apply high-pass filter over ca wavelet
6. Run the iteration for all pixels
 - a. Calculate the value of the current pixel by estimating the surrounding pixel using the Gaussian elimination
 - b. Give the new value to current pixel according to the computed value

Algorithm 2

Special constraint pixel recovery

1. Calculate the covariance of the pixel by setting the direction for calculation of covariance from neighbours pixel
2. Run iteration of all of the pixels one after one
 - a. With the help of a neighbour, pixel find the covariance value
 - b. Set that value to present pixel
 - c. If this missing pixel is not last
 - d. Go to 2 (a)
 - e. Else
 - f. Go to (6)
3. From this estimated values regenerate the image.
4. Return the image matrix.
5. Then sharpen the edges of the outcome image.

Algorithm 3

1. Take upper and lower limit.
2. Calculate the standard deviation of the image
3. Subtract the value of standard depiction from the taken limit
4. Recreate image from the matrix
5. Then we use this enhanced image for edge detection to get better edge detection

4. RESULT ANALYSIS

The proposed model is using a combination of various image operations, de-noising filters, and enhancement. The results have been obtained in the form of normalized SSIM and PSNR respectively. The inspiration behind the obtained parameters is the base paper, where the authors have used pixel level pixel regeneration and restoration for the image. The restoration algorithm in the proposed model has been compared with the existing restoration algorithm to get the real difference between the results.

Table 1: Result obtained from the proposed algorithm

Image	PSNR	SSIM	Previous SSIM
Washington	44.13	0.998	0.959
Lena	45.18	0.98	

Table 1 displaying the value of PSNR and SSIM. The SSIM is compared with the existing algorithms. The proposed algorithm has proved that the proposed algorithm is better than SSIM calculated for the base model.

4.1 Edge detection

Here we find the edges of enhanced image:

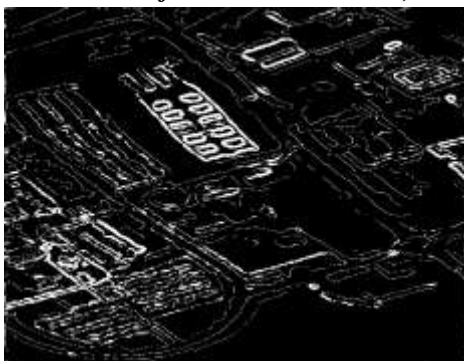


Fig. 1: Washington DC mall hyperspectral image 2 with enhanced

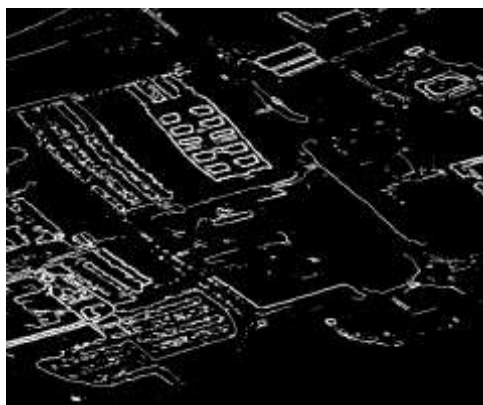


Fig. 2: Washington DC mall without enhance

5. CONCLUSION

Hybrid image text enhancement method is used for image restoration in this proposed model. It consists of edge restoration non-reference pixel restoration and total variance-based methods. All of these above methods are combined for a better quality of the image and the quality of the image is better than the previous method. The various test has been done on the proposed model for a better result. The result has been obtained in form of PSNR and SSIM. In this research work, PSNR and MSE are used to measure the quality of image peak signal to noise ratio(PSNR) and SSIM have been used in this model for better results. It is better than the previous work. The edge detection also shows that after enhancement the edge detection is better.

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