RESEARCH PAPER | Engineering | Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

Image Restoration Algorithms Through Nearest Neighbour Method

KEYWORDS: Image restoration, image processing, good pixel, noisy pixel, nearest neighbor pixel.

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ABSTRACT *The technique of image processing has society made tremendous advances in last two decades . Its applications including medical image processing , remote sensing. Images captured by various digital Processes can easily be manipulated by a variety of dedicated image processing algorithms. Image restoration is one of the important part of image processing technique. Image restoration has proved to be an active field of research in the present days. The basic objective of image restoration is to enhance the quality of an image by removing defects and make it to look with more clarity. In this paper, we propose an image restoration algorithm which is based on the nearest neighborhood pixel property nearer to blurred area.*

1. INTRODUCTION

Image processing has several algorithms are basically developed to overcome different problems. Some of these include image restoration, image enhancement, image segmentation and the list goes on. In this paper, a novel approach for image restoration has been explained. Images captured by various digital devices may be corrupted due to several reasons. To carry out any further processing on these images, restoration has to be done. Image restoration is the task of minimizing the degradation in an image i.e. recovering an image which has been degraded due to presence of noise and the original scene is not clear. Image restoration assures good insights of image when it is subjected to further techniques of image processing. Image restoration is a field of engineering that deals with the methods used to recover an ideal image from its degraded version. Due to certain imperfections in the imaging or capturing process, the captured image is a degraded version of the original scene. The imperfections in the images captured could be due to camera misfocus, motion blurs i.e. whenever there is a relative motion between camera and the scene being captured, the image captured is degraded, and the aerial photographs produced for remote sensing purposes have blurriness introduced because of atmospheric turbulences. As a result, the undoing of these imperfections is crucial for many of the image processing tasks. The idea of restoration of such degraded images has become an important tool for many technological applications such as space imaging, medical imaging and many other post-processing techniques. There are many different approaches in solving this problem. However, the most universal approach is that of the statistical approach. In this approach, the statistical data associated with an image is made use of in undoing the effects of degradations. In the proposed paper, we use the mean filtering technique to compute mean of a particular neighbourhood window and then replace the central pixel by the mean value of its neighbours. The prime objective of the algorithm is that the restoration is confined to a particular window size and all the pixels in that window are used for restoration. The experimental results obtained show that the mean filtering algorithm brings about restoration of the givesto a good level. The NXN Method (N=1) entails the use of distance transform to determine the N'th nearest good pixel to every good pixel. In the Nearest Neighbour Method for N=1, results were obtained for two different distance transforms, viz, City-block and Chessboard distance transforms. The grey-scale input image seemed to be restored to a good level for Chessboard distances. The proposed algorithm was implemented on several standard test images and the results were observed.

The main objective of this paper is to introduce a novel method for image restoration, whose basic aim is to make an image noise-free. Image restoration happens to be one of the pre-processing tasks during many image processing techniques. Image restoration plays a pivotal role for tasks like Edge Detection, Image Segmentation etc. Hence, the undoing of all the degradations of an image is an indispensable part for obtaining better results in all the other image processing techniques. The entire paper is organized in the following sequence. In section 2, the idea of restoration has been proposed. In section-3, the result obtained for the implementation of algorithm in MATLAB has been Presented and was analysed

2. METHOD OF RESTORATION

Digital images are corrupted by various kinds of noise during the process of acquisition and/or transmission. The detection and removal of this noise plays a crucial role in restoration. Estimating the noise level from a single image seems like an impossible task, and due to this we need to recognize whether local image variations are dude to color, texture, or lighting variations from the image itself or due to the noise. It might seem that accurate estimation of the noise level would require a very sophisticated prior model for images. However, in this piece of work, we use the mean filter to compute the mean of all the neighbours and further replace the centre pixel by the mean value. This ensures restoration of a noisy image to a very good extent.

Image restoration is usually the first step of the whole image processing process. It increases the quality of the image by getting rid of noisy pixels. The restoration of an actually degraded image can be done by writing algorithms, which go on for identifying a noisy pixel in the entire image. The image restoration technique appears in many fields. These include- astronomy, military, medicines to name a few. Photo processing labs may also find restoration techniques a valuable tool in touching up special photographs. These fields have diverse aims for image restoration, but certain fundamentals are common to all im-

Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

age restoration problems.

The degradations may have many causes, but the two types of degradations that are often dominant are noise and blurring, each of which introduces peculiar problems in image restoration. In the algorithm mentioned, the degradation introduced due to blurring is nullified. This blurring can be caused due to relative motion between the camera and the original scene, or by an optical system that generates out of focus images. When aerial photographs are produced for remote sensing purposes, blurs are introduced in the images due to atmospheric turbulences, aberrations in the optical systems and relative motion between the camera and the ground. Hence, with all these possibilities, we need to carry out restoration of images produced by the devices. Also, when all this happens, some amount of information contained in the original scene is lost or hidden due to blurring of image. Image processing method should deal with the basic fact that information has been lost or obscured. The main obstruction in restoration technique could be the lack of knowledge about degradations. In most of the cases, the degradation actually destroys the information in an image, and the knowledge of degradation can be insufficient to counteract the degradation. On the other hand, most restoration algorithms require some amount of prior information in order to get a restored image. This information can be provided in many ways. The best source of information can be obtained by making an assumption that the original scene is smooth i.e. there is a degree of correlation between the various neighboring points in an image or say, all the pixels in an image are somehow related to each other. Therefore, we compute the mean value in a filtering window and replace the corrupted pixel by mean of its neighbors. This holds true for every real-life image, but, the degree and the type of correlation may vary significantly from one image to other.

2.1 Image Restoration Technique by Nearest Neighbour Method:

As the name says, to carry out restoration, we consider the nearest neighbours of a pixel. In this paper, we consider for N=1, i.e. a total of eight neighbours of each pixel are considered in a filtering window of 3x3.The size of the window can be more than 3x3 . In the 2D grid of picture elements, each element has a certain correlation with its nearest elements. With the aid of this property, We can write an algorithm to replace a blurred pixel with value which is mean of the neighboring pixel values. This gives a good level of restoration.

2.2 Methodology

The algorithm carries a process where intensity of pixel was replaced by mean intensity of neighbouring pixels. Consider an image I of size NxN. Define a pixel position (i.j) in the image. Find the probability of occurrence of each neighbor pixel of (i,j). For a 8-neighbour window, the mean value is

$$M = \Sigma^{N}_{n=1} X_i \; p(x_i) \qquad (A)$$

The value gives mean of all neighbouring pixels of a particular pixel (i,j). This gives correct pixel value at (I,j). This value is replaced at pixel value at (i,j). this ensures restoration of image at (i,j). The process is repeated fpr all pixels and the image is restored. This can be repeated in 2 or 3 iterations which can further increase quality. The same procedure can be done with 4-neighbour window method also.

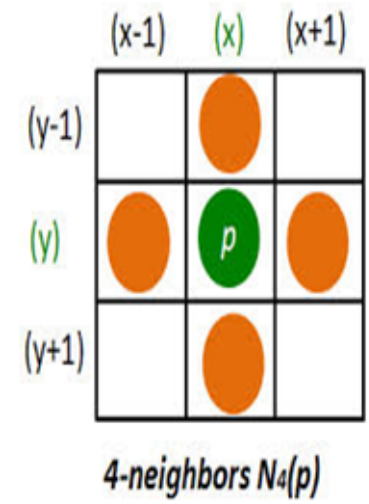

Fig 1 Nearest Neighbour Matrices

2.3 The Algorithm:

The Algorithm is as follows:

STEP1 : Read the image into Buffer

STEP2: Display the image

STEP3: Consider a pixel in image X(i, j) and identify the nearest pixels

(8- neighbors by chessboard method and 4-nighbors by City-block distance)

STEP4: Extract Sub-Matrix containing elements of X(i,j)

STEP5: Calculate mean value of all the neighbours of sub matrix

Volume : 5 | Issue : 4 | April 2015 | ISSN - 2249-555X

STEP6: Approximate mean value

STEP7: Replace pixel at X(i,j) with mean value

STEP8: Repeat the same for all blurred pixels

STEP9: Display the restored image

3. RESULT and ANALYSIS:

Fig 2. Original image

Fig 3. Restored output image

Fig2 represents original image which is noisy one. After applying the algorithm the out put is as shown after 3 iterations. The 4- neighbor technique is not much satisfactory in output when compared to 8-neighbour pixel value i.e., chessboard distance. Fig 3 is output of restored image after 3 iterations. The observation of output image gives an idea that a noisy input image can be restored to a good level. Fig 4 shows restoration % after every iteration on original image.

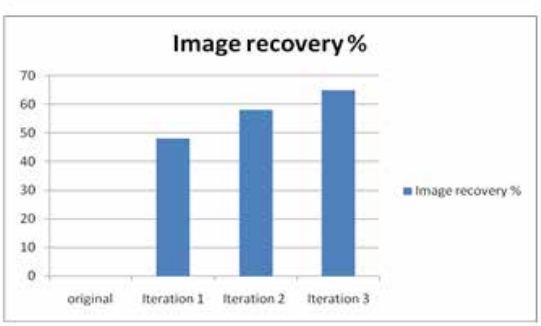

Fig 4 image recovery after every iteration

4. CONCLUSION

In this paper, we proposed a grey-level image restoration method which is based on the intensities of the nearest neighbors of a pixel. . The proposed restoration algorithm works on finding out the mean value of all the neighbors which come in a window (3X3), and thereby calculating the probability of occurrence of each pixel value. The simulation result obtained is a better one as the image seems to be restored to a good level. Different neighborhood size in an image can either worsen or improve the restoration level and due to this, there exists a drawback of the algorithm. The drawback is that it cannot be applied to restore the elements which are at the boundaries. For this, we may have to use certain edge detection techniques like Sobel Edge Detection Technique

As future work, better results can be obtained by increasing the size of the filtering window, using artificial intelligence techniques like fuzzy logic and artificial neural networks. However, the performances of all these filers are not satisfactory. The drawbacks of classical filters can be over come by several fuzzy techniques.Through this , one can implement the same with high restoration quality.

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