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An Effective Image Enhancement Method using Binary Morphology

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Abstract: **Image Enhancement is one of the most significant and challenging techniques in image research. The goal of image enhancement is to increase the visual appearance of an image, or to deliver an "enhanced transform representation for forthcoming automated image processing. Many images like medical images, satellite images, aerial images and even real life photos suffer from poor contrast and noise. It is necessary to enhance the contrast and remove the noise to increase image quality. One of the most significant stages in medical images detection and analysis is Image Enhancement techniques which increases the quality of images for human viewing, eliminating blurring and noise, increasing contrast, and revealing details are examples of enhancement operations. The present paper gives the detail of various noise effects on the images and also discourses the approaches to remove the noise by using Gaussian filter and to improve the image quality using bilateral filtering method. The Experimental outcomes achieved on a set of standard test images for a wide range of noise corruption levels.**

Keywords: **Frequency based domain, Image Enhancement, Spatial based domain, Morphological Operator**

I. INTRODUCTION

Image enhancement problem can be formulated as follows: given an input low quality image and the output high quality image for specific applications. It is well-known that image enhancement as an active topic in medical imaging has received much attention in recent years. The aim is to improve the visual appearance of the image, or to provide a "better" transform representation for future automated image processing, such as analysis, detection, segmentation and recognition. Moreover, it helps analyses background information that is essential to understand object behavior without requiring expensive human visual inspection. Carrying out image enhancement understanding under low quality image is a challenging problem because of these reasons. Due to low contrast, we cannot clearly extract objects from the dark background. Most color based methods will fail on this matter if the color of the objects and that of the background are similar.

The survey of available techniques is based on the existing techniques of image enhancement, which can be classified into two broad categories: Spatial based domain image enhancement and Frequency based domain image enhancement. Spatial based domain image enhancement operates directly on pixels. The main advantage of spatial based domain technique is that they conceptually simple to understand and the complexity of these techniques is low which favours real time implementations. But these techniques generally lacks in providing adequate robustness and imperceptibility requirements. Frequency based domain image enhancement is a term used to describe the analysis of mathematical functions or signals with respect to frequency and operate directly on the transform coefficients of the image, such as Fourier transform, discrete wavelet transform (DWT), and discrete cosine transform (DCT). The basic idea in using this technique is to enhance the image by manipulating the transform coefficients. The advantages of frequency based image enhancement includes low complexity of computations, ease of viewing and manipulating the frequency composition of the image and the easy applicability of special transformed domain properties. The basic limitations including are it cannot simultaneously enhance all parts of image very well and it is also difficult to automate the image enhancement procedure.

The existing techniques of image enhancement like spatial domain methods can again be classified into two broad categories: Point Processing operation and Spatial filter operations. Traditional methods of image enhancement are to enhance the low quality image itself. It doesn't embed any high quality background information. The reason is that in the dark image, some areas are so dark that all the information is already lost in those regions. No matter how much illumination enhancement you apply, it will not be able to bring back lost information. Frequency domain methods can again be classified into three categories: Image Smoothing, Image Sharpening, Periodic Noise reduction by frequency domain filtering. In this paper, the detail of various noise effects on the images and also discourses the approaches to remove the noise by using Gaussian filter and to improve the image quality using bilateral filtering method.

II. RELATED WORK

Morphology is a set theory approach, developed by J.Serra and G.Matheron, process the digital image based on geometrical shape i.e. by applying a structuring element. It has various applications in bio-medical imaging, Geo-science, Remote sensing, Quality control, Document processing and Data analysis. The value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbors. The extraction and enhancement of shape information from

images is one of the important tasks of mathematical morphology. Basic operations of morphology are dilation and erosion. More complicated morphological operators can be designed by means of combining Erosions and Dilations. Dilation adds pixels to the boundaries of objects in an image. The spatial correlation filter [1] is used to remove the noise from color image which is simple and powerful method of smoothing image.

Chi-Farn Chen, Hung-Yu Chang, Li-Yu Chang [4] developed a fuzzy based approach to contrast enhancement of the remote sensing image data to partition the image pixel values into dissimilar degrees of associates in order to reimburse the local brightness lost in the dark and bright areas. The algorithm includes three steps: primarily, the satellite image is distorted from gray-level space to membership space by Fuzzy c- Means clustering. Secondly, suitable stretch model of each cluster is constructed based on corresponding memberships. Third, the image is changed back to the gray-level space by merging stretched gray values of each cluster. Eunsung Lee [5] proposed the method which uses dominant brightness level of Image for decomposing the Image in different three layers and then these layers are used for appraisal of adaptive intensity transfer function. This predictable adaptive intensity transfer function is used for image contrast enhancement subsequently these layers are fused to get enhanced image.

Muti-scale Image Enhancement Based on Properties of Human Visual System [6] utilized the LIP(logarithmic image processing) model and considered the characteristics of the human visual system (HVS) to propose a new multi-scale enhancement algorithm.

III. EXISING SYSTEM

In existing system, a spatially variant destructions/ enlargements and openings/closings approach is used. Structuring elements (SE) can locally adapt their shape and orientation across the direction of the structures in the image. The process of extracting shape and orientation of the SE at each pixel from the image is under study. This method is useful in the enhancement of anisotropic features such as coherent, flow like structures. There are several noises that may degrade the quality of an image

- Amplifier noise (Gaussian noise)
- Salt-and-pepper noise
- Quantization noise (uniform noise)

IV. PROPOSED SYSTEM

In our proposed work we have considered the effect of Gaussian noise and we have proposed a method to reduce the noisy image using Gaussian filter. The proposed work also considers the enhancement of the image using bilateral filtering method. Binary morphology is extremely important for fast, low-level image matching operations. Every commercial ‘machine vision’ system has it because of its usefulness. The basic binary morphology operations are dilation and erosion. In a binary image, to refer the foreground (black) pixels variously as ‘black’, ‘foreground’, ‘ON’ or ‘1’. To refer the background (white) pixels variously as ‘white’, ‘background’, ‘OFF’ or ‘0’.

A. Gaussian Filtering

The Gaussian filtering is an important space for the weighted mean filter. It is based on the shape of the Gaussian function to select the right value of linear smoothing filter. It usually uses the Gaussian function of discrete two-dimensional by zero-mean to be smoothing filter. The following equation as below:

$$g(x,y) = \frac{1}{M}\sum f(x,y)\exp[-((x-i)^2+(y-j)^2)/2\sigma^2]$$

In our proposed work we have used Mathematical morphological operator for the manipulation of the images. We have considered the above said point in our approach to enhance the captured images. Further we have also considered the power law transformation technique for the result analysis.

V. SIMULATION RESULTS

Figure 1. Original Image

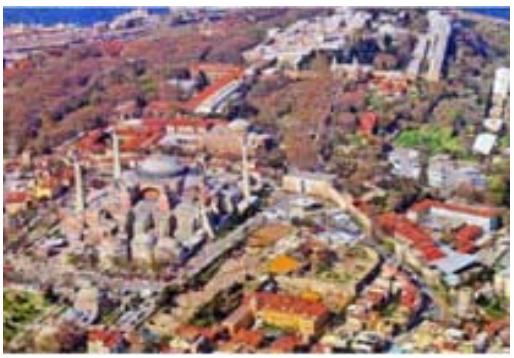

Figure 2. Noise stimulated noise

Figure 3. Image stimulated by Gaussian noise

Figure 4. Recovered image

VI. CONCLUSION

In our proposed work transformation function is defined to enhance the image and algorithm is proposed which is based on binary morphology. The proposed algorithm is implemented in MATLAB. This proposed algorithm is able to overcome the drawbacks of previous methods like thresholding, histogram equalization and fuzzy methods. For future prospective the work can be extended using Neural network. The images can be tested with different noise with different parameters. Further the work can be included the part of mathematical calculations including different parameters.

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