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Image Enhancement using Frequency and Spatial Technique using Alpha Rooting with Bi – Histogram Equalization

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Abstract: Image Processing deals with analysis of image using different techniques for different purpose. Image Processing deals with the any action to change a image. Image processing has different methods like optical, analog and digital image processing. Digital image processing is a part of signal processing where we processes digital images using computer algorithms. The computer algorithms can be modified so that we can also change the appearance of the digital image easily and quickly. Many images such as medical images, remote sensing images, electron microscopy images and even real life photographic pictures, suffer from poor contrast. Therefore it is necessary to enhance the contrast. Today there are many image enhancement techniques are available. There are some drawbacks of these techniques. Adaptive histogram produces blurred and washed out images especially at the edges. Whereas alpha rooting produces over-graying enhanced images so to overcome all these drawbacks. In this proposed method we are combining the frequency domain and spatial domain techniques for image enhancement by using alpha rooting techniques with Bi-Histogram Equalization in order to enhance the quality of the image. There are many histogram equalization based methods have been introduced, many of these methods are relatively complicated in implementation, and most of Techniques require a high computational time. Bi - Histogram Equalization with Plateau Level (BHEPL) as one of the options for the system that requires a short processing time image enhancement.

Keywords: Image enhancement, spatial domain technique, Bi-Histogram Equalization technique, alpha rooting (key words)

I. INTRODUCTION

Image enhancement techniques are used to improve the image quality so that the resultant image quality is better than the original image for a specific application or set of objectives. Image enhancement is the task of applying certain alterations to an input image like as to obtain a more visually pleasing image. The alteration usually requires interpretation and feedback from a human evaluator of the output resulting image. The principal objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and a specific observer. During this process, one or more attributes of the image are modified. The choice of attributes and the way they are modified are specific to a given task. Moreover, observer-specific factors, such as the human visual system and the observer's experience, will introduce a great deal of subjectivity into the choice of image enhancement methods. There exist many techniques that can enhance a digital image without spoiling it. The enhancement methods can broadly be divided in to the following two categories:

A. Spatial Domain Methods:

Spatial domain techniques directly deal with the image pixels. The pixel values are manipulated to achieve desired enhancement. Spatial domain techniques like the logarithmic transforms, power law transforms, histogram equalization, are based on the direct manipulation of the pixels in the image. Spatial techniques are particularly useful for directly altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in many cases produces undesirable results.

a. ***Contrast Stretching:*** - Contrast stretching enhances image by enhancing contrast between various parts of the original image. The basic idea is to improve the image quality by increasing the dynamic range of gray levels.

b. ***Grey Level Slicing:*** A grey level slicing technique enhances all the gray levels in the range of interest using high values and all other gray levels using low values. This function is particularly useful to enhance flaws in X-ray images and enhancing features such as masses of water in satellite image.

c. ***Histogram Equalization (HE):*** Histogram equalization is a technique by which the dynamic range of the histogram of an image is increased. It flattens and stretches the dynamic range of the image's histogram and resulting in overall contrast improvement. Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains uniform distribution of intensities. It improves contrast by obtaining a uniform histogram [7].

B. Frequency Domain Methods:

The convolution theorem is the foundation of frequency domain techniques. Consider the following spatial domain operation [6]:

$$g(x,y) = h(x,y) * f(x,y)$$

The convolution theorem states that following frequency domain relationship holds:

$$G(u,v) = H(u,v)\, F(U,v)$$

G, H and F are the Fourier transforms of g, h and f respectively. H is known as the transfer function of the process. Many image enhancement problems can be

expressed in the form of the above equation. The goal is to select a transfer function that changes the image in such a way that some feature of the image is enhanced.

a. ***General Concept:***The frequency filters process an image in the frequency domain. Application of this type of filtering is easy [8]:

a) Transform the image into the Fourier domain
b) Multiply the image by the filter
c) Take the inverse transform of the image

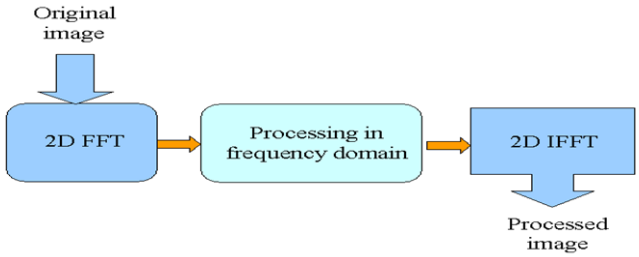


Figure:1

Frequency domain enables us to view the frequency content of the image. In this frequency domain image enhancement has been done via Fourier transform on image and then get the appropriate transform function for image enhancement and manipulating the image with transform function and finally taken the inverse transformation on the Transformed image.

b. ***Alpha rooting Technique****:* - Alpha rooting is a simple but effective technique of image enhancement in the transform or frequency domain. The technique is applied on the orthogonal transforms of images. It is used to augment the high frequency content in the image. The method is based upon the fact that after applying an orthogonal transform, high frequency coefficients of an image, will have smaller magnitudes than low frequency coefficients. By raising the magnitude of an image to some value, α, where $0 < \alpha < 1$, the higher valued lower frequency components of an image can be reduced more in proportion to the lower valued high frequency components[1].

II. PROPOSED METHODS

There are so many image enhancement techniques are available. They have some drawbacks on those Techniques. Adaptive histogram produces blurred and washed out images especially at the edges. Whereas alpha rooting produces over-graying enhanced images so to overcome all these drawbacks. In this proposed techniques we are combining the frequency domain and spatial domain for image enhancement. For this we are using alpha rooting techniques with Bi-Histogram Equalization in order to enhance the quality of the image. There are many histogram equalization based methods have been introduced, many of these methods are relatively complicated in implementation, and most of Techniques. Require a high computational time. For fast processing we are using BHEPL techniques [3]. Bi-Histogram Equalization with a Plateau Level (BHEPL) as one of the options for the system that requires a short processing time image enhancement [5].In proposed technique we first apply the Alpha rooting algorithm on image. It is a simple but effective technique of image enhancement in the transform or frequency domain. Alpha Rooting holds the flexibility of a parameter aided operation which is highly appreciated for experimenting with different levels of enhancement. We first separate magnitude and phase coefficients from Fourier Transform Output then Apply Alpha Rooting and combine the Magnitude and Phase coefficients. This Alpha Rooting produces over-graying enhanced images. Output of the Alpha rooting is passed as a input for the Bi-Histogram Equalization with a Plateau Level (BHEPL). This BHEPL method is enhanced the images without producing unwanted artifacts. The method also is able to maintain the mean brightness better than some well-known mean brightness preserving histogram equalization methods.

III. PROPOSED METHODS CONSISTS FOLLOWING STEPS

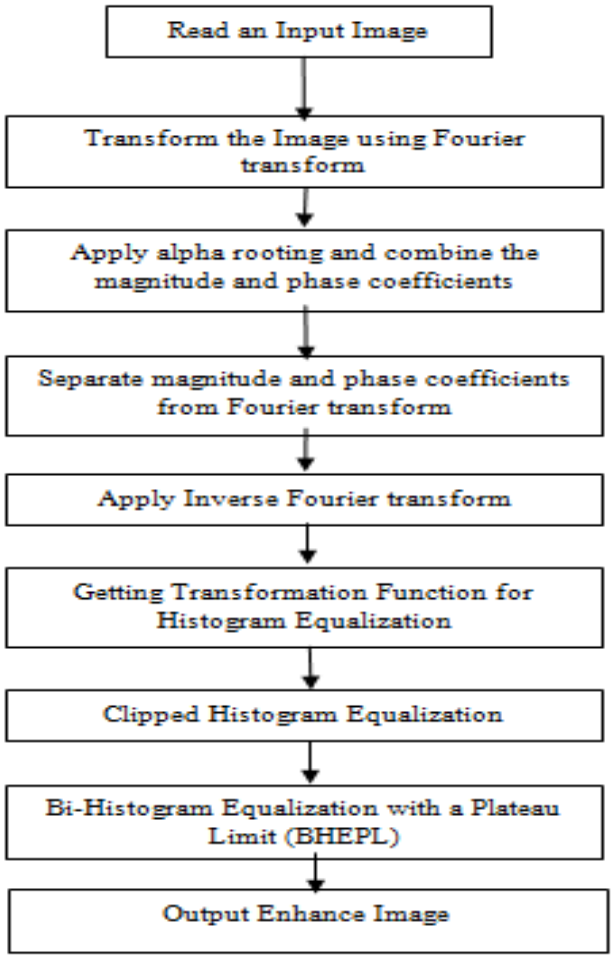
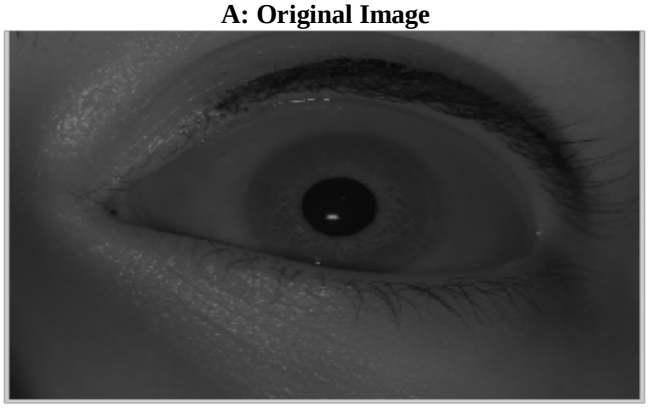


Figure: 2

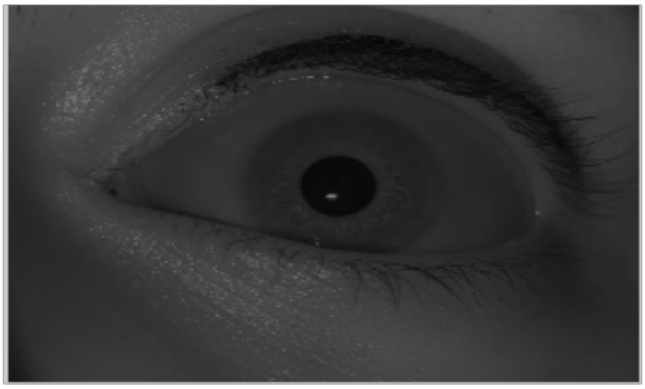
IV. EXPERIMENTAL RESULTS

The objective of the experiments was to establish the algorithm for image enhancement. Experimental result on image by using these proposed techniques of frequency and spatial domain techniques of image enhancement has been shown below.

A: Original Image

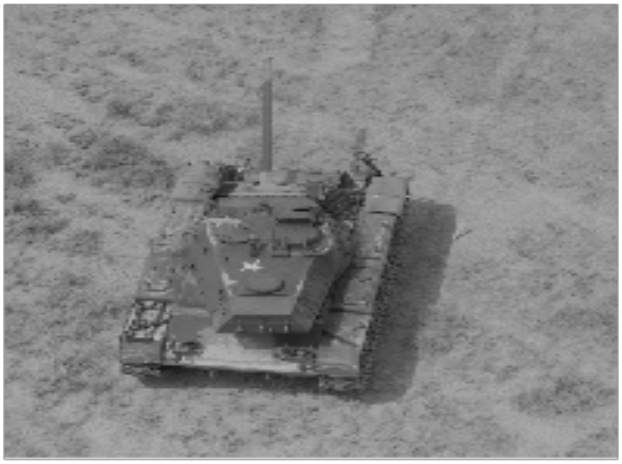


B: Enhanced Image with Alpha Rooting



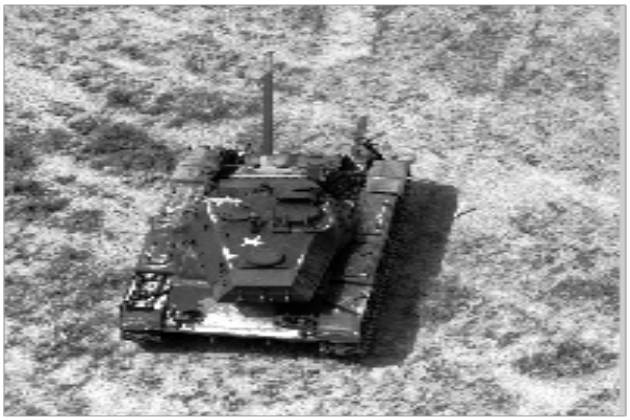
C: Enhanced Image with Propose Technique

D: Another Original Image



E: Enhanced Image with Alpha Rooting

F. Enhanced Image with Propose Technique



V. CONCLUSION

Image enhancement techniques such as spatial and transform domain technique are important techniques. In this proposed method we are combining the frequency domain and spatial domain for image enhancement by using alpha rooting techniques with Bi-Histogram Equalization in order to enhance the quality of the image. The proposed technique will produce highly quality and visually appealing results for a diversity of images with different qualities of contrast and edge information.

VI. REFERENCES

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