

## Review Paper on Image Enhancement and Its Techniques

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Abstract – Image enhancement is one of the important technique in image processing field. The main objective of this technique is to improve the quality and information of the image and to provide better visualization to the image. In this paper we have used two techniques to enhance the quality of an image. These two are histogram and fuzzy logic. Histogram and fuzzy techniques can be used to enhance the quality of image. Fuzzy logic can be used to interpret human knowledge in the form of fuzzy if-then rules. Histogram technique is usually used to increase the contrast of an image. This paper presents the review of different histogram and fuzzy techniques used.

Keywords-Image enhancement, histogram equalization, fuzzy image processing, computed tomography(CT).

### INTRODUCTION

Digital image processing is the area where substantial experimental work is done to establish feasible solutions to the given problems. Digital image processing is also used for improving and enhancing the quality of an image. To enhance the quality of an image two techniques are used: Histogram and Fuzzy techniques.

Histogram is graphical representation of tonal distribution of data. It plots the number of pixels for each tonal value. By looking at the **histogram** for a specific **image** a viewer will be able to judge the entire tonal distribution at a glance.

The histogram equalization technique is used to lengthen the histogram of the given image. Greater is the histogram lengthened greater is the contrast of the image. Histogram equalization automatically determines a transformation function that seeks to produce an output image that has uniform histogram. When automatic enhancement is desired, this is a good approach because the results from this technique are predictable and the method is simple to implement. The second technique which has been used in this paper is fuzzy technique.

**Fuzzy logic** is an approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean **logic** on which the modern computer is based. The idea of **fuzzy logic** was first advanced by Dr. Lotfi Zadeh of the University of California at Berkeley in the 1960s. Fuzzy Image processing is kind of method of processing information in which image is taken as input and after processing output is given in the form of image. In this paper computer tomography technique is used in fuzzy logic. Now a days, Computer aided diagnosis (CAD) has become most commonly used tool in the diagnosis and analysis of medical images such as Lung cancer detection. Different types of medical image modalities are used in the diagnosis process by radiologist and physician such as radiographic images, computer tomography (CT)

images, magnetic resonance images (MRI) etc. In all analysis if the image quality is not proper then the performance of the CAD system is adversely effected. This work proposed a new Background suppressed fuzzy contrast enhancement (BSFCE) method to improve contrast of the CT images of lung cancer patient.

## LITERATURE SURVEY

The work done by various researchers for image enhancement are discussed as following:

K.S.Ravichandran et.al(2015)proposed that main aim of image enhancement is to enhance the quality and visual appearance of an image . It improves clarity of images for human viewing, removing blurring and noise. [1]

Rajesh Garg et.al(2011) reviewed that image enhancement is among the simplest and most appealing areas of digital image processing.[2]

Premladha et.al(2015)had given one of the application of image enhancement i.e one of the most important stages in medical image detection and analysis is image enhancement techniques.[3]

Madhu S.Nair et.al (2011) suggested that adaptive histogram equalization produced a better result.[4]

Jinshan Tang Eli Peli et.al(2003) suggested global histogram equalization which adjusts the intensity histogram to approximate uniform distribution.[5]

Oskam Chae et.al(2007) suggested the dynamic histogram equalization (DHE) technique takes control over the effect of traditional histogram equalization so that it performs the enhancement of an image without making any loss of details in it.[6]

Tarun Mahashwari et.al(2013) suggested fuzzy technique to improve the quality of an image i.e enhancing an image. Many kind of fuzzy image enhancement methods have been proposed like fuzzy contrast adjustments, fuzzy image segmentation and fuzzy edge detection.[7]

Sinha et al. (2015) proposed a non-linear method for removing salt and paper noise using modified fuzzy based decision algorithm for gray images only. However fuzzy filter can be design to remove all type of noise from images.[13]

## TECHNIQUES USED

Histogram equalization is one of the image enhancement technique which is most popular because of its ability to provide better performance on all types of images. Histogram equalization is a transform that stretches the contrast by redistributing the gray level values uniformly.

Histogram Equalization Algoritihm:

Let's suppose that  $Z=\{Z(x,y)\}$  denotes a digital image where  $z(x,y)$ denotes the gray level of the pixel at  $(x,y)$  place. The total no. of the image pixels is  $M$  and the image intensity is digitized into  $L$  levels that are  $\{Z_0, Z_1, \dots, Z_{L-1}\}$ . So it is obvious that  $Z(x,y) \in \{Z_0, Z_1, \dots, Z_{L-1}\}$  suppose  $m_k$  denotes the total number of pixels with gray level of  $Z_k$  in the image, then the probability density of  $Z_k$  will be

$$P(Z_k)=m_k/M, k=0,1, \dots, L-1$$

The relationship between  $p(Z_k)$  and  $Z$  is defined as the probability density function (PDF) and the graphical appearances of PDF is known as the histogram. Based on the image's PDF, its cumulative distribution function (CDF) is defined as

$$C(Z_k) = \sum_{x=0}^k p(Z_k)$$

Where  $k=0,1,\dots,L-1$  and it's obvious that  $c(Z_{L-1})=1$ .

Thus the transform function of histogram equalization can be defined as

$$f(Z_k) = Z_0 + (Z_{L-1} - Z_0)c(Z_k), \quad k=0,1,\dots,L-1$$

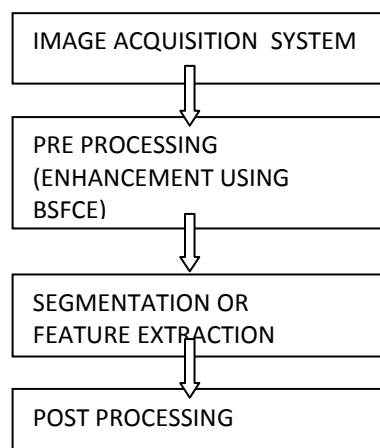
Suppose  $Y = \{Y(i,j)\}$  is defined as the equalized image then

$$Y = f(Z) = \{f(Z(x,y)) \mid Z(x,y) \in Z\}$$

Conventional histogram equalization however results in images that have weird look due to excessive contrast enhancement. Researchers have focused on improvement of the histogram equalization based contrast enhancement and new forms of histograms for contrast enhancement have been developed.

Equalization combines the global histogram, multilevel gray level thresholding to produce an image with improved global and local contrast and minimal distortion.

Second technique used in image enhancing is Background suppressed fuzzy contrast enhancement (BSFCE) to increase the contrast of input CT images. This technique involves the following steps:



The first step to collect lung CT images for preprocessing which is used to improve the image in terms of enhancing contrast, removing noise etc. Segmentation refer to the process of partitioning digital image into different classes such as edge detection, histogram thresholding, ANN and clustering technique. Post processing used to remove many false regions as possible and the nodules are classified as per their properties. CT images of the lungs are often very low in contrast, which is evident from their histograms that are narrow and concentrated only to certain gray level values. However, lung images contain minute details of the get obscured due to limited contrast, and hence, are not easily presented before doctors. This may lead to delayed diagnosis and even wrong treatment. This technique proved very helpful in the field of medical as it produces clear images by enhancing its quality.

## COMPARISON TABLE

This comparison table is concerned with the various techniques used for image enhancement described by different researchers.

<u>YEAR</u>	<u>RESEARCHER</u>	<u>TECHNIQUES</u>
April 2012	Snehal O. Mundhada Prof V.K Shandilya	a)Spatial Domain techniques b)Frequency domain technique
April 2012	Aroop Mukherjee Soumen Kanrar	Binarization Techniques
June 2013	Tarun Mahashwari Amit Asthana	Fuzzy enhancement method
November 2014	Jishan Tang Jeonghoon Kim Eli Peli	JPEG Domain DCT Domain
November 2012	Nirmala S.O T.D Dongale R.K Kamat	a) spatial domain method b) Frequency domain method
September 2015	P.Janani J.Premaladha K.S Ravichandran	Spatial Domain Filtering Technique
July 2011	Dr. Muna F Al samaraie	Histogram Equalization
April 2013	Er. Mandeep kaur Er. Kiran Jain Er. Virender Rathor	Histogram Equalization

## APPLICATIONS

Image enhancement is mainly used for improving the quality of an image. The applications of image enhancement are Vision Graphics, Aerial imaging, Remote Sensing, Satellite imaging, Medical imaging etc.

## CONCLUSION

This paper presented a method to enhance the image using histogram and fuzzy technique. Histogram equalization technique works on enhancing the image by redistributing the gray levels uniformly whereas in case of fuzzy Background suppressed fuzzy contrast enhancement (BSFCE) is used which increases the contrast of input CT images by following a proper procedure. Comparison table has also been presented to show the various techniques used by different researchers. More research work can be done on these two techniques.

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