Detecting Defects in CT Images using CLAHE and Morphological Segmentation

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ABSTRACT: Various enhancement schemes are used for image such as scale manipulation, filtering and Histogram Equalization, Where Histogram equalization is one of the well known image enhancement technique. It became a popular technique for contrast enhancement because it is simple and effective. The basic idea of Histogram Equalization method is to remap the gray levels of an image. Histogram equalization is performed using CLAHE algorithm. Using morphological segmentation we can get the segmented image. Morphological reconstruction is used to segment the image. Defects in MRI images can be easily find out using morphological reconstruction

KEYWORDS: Image enhancement;Histogram Equilization; CLAHE algoritm; Morohological segmentation; Morphological reconstruction

I. INTRODUCTION

Image processing can be defined as a process that transforms a degraded image to another image of better quality in order to facilitate its posterior interpretation. Image processing techniques can be then applied in order to facilitate the interpretation of images by further using computer vision algorithms. Therefore, in this context, image processing can be considered to be a preprocessing stage for computer vision [1]. The process involved in making an image more interpretable for particular application is image enhancement.

The appearance of defects finds the degree of disease from CT images. From visual inspection, CT appear to be a defected during morphological segmentation. In this paper, concentration is on morphological segmentation as a marker for the presence of defects in CT image.

Image enhancement is basically improving the interpretability or perception of information in images for human viewers and providing `better' input for other automated image processing techniques. 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 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:

1. Spatial Domain Methods
2. Frequency Domain Methods

In spatial domain techniques [2], we directly deal with the image pixels. The pixel values are manipulated to achieve desired enhancement. In frequency domain methods, the image is first transferred in to frequency domain. It means that, the Fourier Transform of the image is computed first. All the enhancement operations are performed on the Fourier transform of the image and then the Inverse Fourier transform is performed to get the resultant image. These enhancement operations are performed in order to modify the image brightness, contrast or the distribution of the grey levels. As a consequence the pixel value (intensities) of the output image will be modified according to the transformation function applied on the input values. Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images. Morphological operations can also be applied to gray scale images such that their light transfer functions are unknown and therefore their absolute pixel values are of no or minor interest. This paper includes Literature survey of image enhancement and image segmentation, proposed method, experimental results, statistical analysis of results; finally end with conclusion.

II. RELATED WORK

In [3] authors has done Fine Exudate Detection using Morphological Reconstruction Enhancement. X. Zhang and O. Chutatape [9] use lo-cal contrast enhancement and Fuzzy C-Mean (FCM)to segment candidate bright lesion areas. SVMs are also used to classify exudates and cotton wool spots. Kavita and Shenbaga [4] propose median filtering and morphological operations for blood vessel detection. They use multilevel thresholding to extrat bright regions assumed to be the optic disc or exudates. They detect the optic disc as the converging point of the blood vessels, and then classify the other bright regions as exudates. A. Osarah et al. [5], use fuzzy c-means (FCM) clustering to segment colour retinal images, then a neural network and support vector machines (SVMs) are used to separate exudate and non-exudate areas. Most of the techniques mentioned earlier are applied to images taken where the pupils of the patient are dilated, in which the exudates and other retinal features are clearly visible. All of these techniques are highly sensitive to image contrast.

III. PROPOSED ALGORITHM

A. *CLAHE algorithm:*

CLAHE algorithm is applied on input image to perform histogram equalization. Contrast Limited Adaptive Histogram Equalization differs from ordinary adaptive histogram equalization in its contrast limiting. This feature can also be applied to global histogram equalization, giving rise to contrast limited histogram equalization, which is rarely used in practice. In the case of contrast limited histogram equalization, the contrast limiting procedure has to be applied for each neighborhood from which a transformation function is derived. Contrast limited histogram equalization was developed to prevent the over amplification of noise, which is a problem in adaptive histogram equalization.

B. *Image Segmentation*

Segmentation [7] subdivides an image into its constituent regions or objects. The level to which the subdivision is carried depends. That is, segmentation should stop when the objects of interest in an application have been isolated .Segmentation of nontrivial images is one of the most difficult tasks in image processing. Segmentation accuracy determines the eventual success or failure of computerized analysis procedures. For this reason, considerable care should be taken to improve the probability of rugged segmentation. In some situations, such as industrial inspections applications, at least some measure of control over the environment is possible in times. The experienced image processing system designer invariably pays considerable attention to such opportunities. In other applications, such as autonomous target acquisition, the system designers have no control of the environment. Then the usual approach is to focus on selecting the types of sensors most likely to enhance the objects of interest while diminishing the contribution of irrelevant image details. A good example is the use of infrared imaging by military to detect objects with strong heat signatures, such as equipment and troops in motion.

Image segmentation algorithms generally are based on one of two basic properties of intensity values: discontinuity and similarity. In the first category, the approach is to partition an image based an abrupt change in intensity, such as edges in an image. The principal approaches in the second category are based on partitioning an image into regions that are similar according to set of predefined criteria

C. *Morphological Reconstruction*

Reconstruction [8] is a morphological transformation involving two images and a structuring element (instead of a single image and structuring element). One image, the marker, is the starting point for the transformation. The other image, the mask, constrains the transformation. The structuring element used defines connectivity. In this section we use 8-connectivity (the default), which implies that B in the following discussion is a 3x3 matrix of 1s, with the center defined at coordinates (2, 2). In this section we deal with binary images; If G is the mask and F is the marker, the reconstruction of G from F, denoted $R_G(F)$ is defned by the following iterative procedure:

1. Initialize h1 to be the marker image, F.
2. Create the structuring element: B = ones (3).
3. Repeat: $h_{k+1} = (h_K \text{XOR B}) \cap G$ until $h_{k+1} = h_K$
4. R_G (F) = h_{k+1}
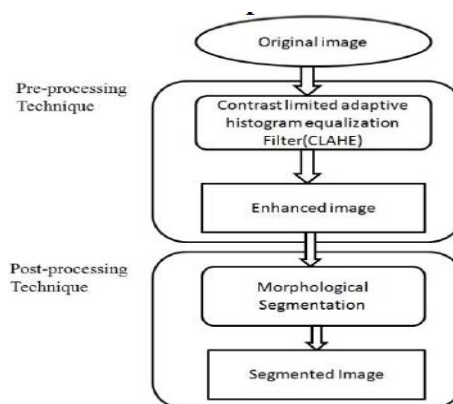Marker F must be a subset of G

Fig 1: Block diagram of proposed method

IV. RESULTS

The method is applied on more than 100 CT images and output were found out. Output shows that the proposed method out perform all existing methods. CLAHE is applied on input image and histogram equalized image shows better clarity .Then morphological segmentation and reconstruction is applied and the resulting image is superimposed on the original image to get the output. The following figures shows the generated output during each step of the process.
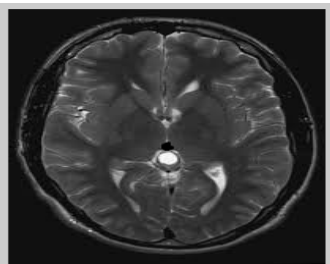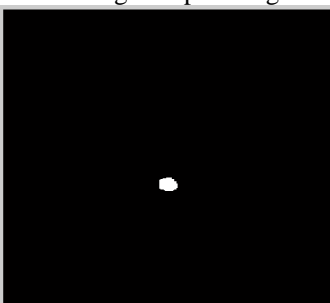

Fig 2: Input Image

Fig 3: CLAHE enhanced image
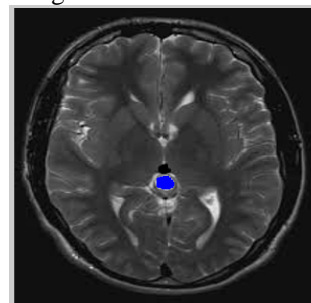

Fig 4: segmented image

Fig 5: Defect detected CT image

V. CONCLUSION

In this paper an image enhancement method and image segmentation using Morphological techniques was proposed. By observing all of the above quality assessment metrics for "CT of Lungs" image, it is concluded that CLAHE enhancement method is having less noise and having more contrast. The enhanced image is segmented by using Morphological techniques. By the segmentation the segmented image can be obtained and it is superimposed on the original image, to get the perfect outlined structure of the talc deposition in the image. The result shows proposed method outperforms all the existing methods.

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BIOGRAPHY

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