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Review Report on Lung Cancer Detection using different Segmentation Technique

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Abstract: ***This work is a review report on image processing technique by using MATLAB. As we know image processing techniques are extensively use in bio-medical sector for advance medication. The entire process consists of noise removal operation, thresholding, gray scale imaging, histogram equalization, segmentation, morphological operation and comparison operation for identifying that which operation is better. Here we are using five different types of segmentation method and made a comparison between them. We adapted the same sample on each segmentation techniques. Detection of tumor from computed tomography (CT) images is done by using MATLAB software. These all are just a comparison for identifying the tumor very accurately. We have done this comparison just to identify the technique which is best to detect tumor.***
Keywords: **Image Acquisition, Image enhancement, Image Segmentation, Morphological operation.**

I. INTRODUCTION

In this work we are detecting the tumor from the images (tumor) by using image processing technique in MATLAB. First of all we must know that what tumor is, so tumor is a disease in which abnormal cells multiplying and growing and forms a tumor in lungs. This work is starts with collecting a number of scanned images from the available data base. This images will be further being processed, enhanced, and segmented than load the images into mat lab for cancer detection and then after comparison classify into normal and abnormal tumor. This techniques helps to detects cancer and help us for diagnosis solution. The scanned images are used as an input image, after getting the input image we removed the noise from the input image by using different filtration technique. In next stage the gray scale imaging and thresholding operation has been done to the image and after that image is subjected to histogram equalization, these all above mentioned operations are falls under the image acquisition and image enhancement. In next stage image segmentation will be done the segmentation is done, there are different types of image segmentation (thresholding segmentation, texture segmentation, watershed segmentation, k-mean clustering, Otsu segmentation) are used for the comparison. Our focus is to get more precise result by using image enhancement technique and different image segmentation operation. We can also use MRI images, X-ray images of tumor for the cancer detection as an input image instead of using computed tomography (CT) image, the whole procedure will be the same.

II. METHODOLOGY

This work consists of four major stages, the first stage is Image Acquisition, the second stage is Image Processing techniques, third stage is consist of image segmentation operation and the fourth or last stage is image extraction, and comparison. All the four stages are having some basic procedures which are necessary to full fill the needs and to complete the stage step by step.

The different steps are as following

1) Image Acquisition
2) Image Enhancement
3) Removal of noise
4) Convert the input image to gray scale image
5) Compute threshold technique
6) Apply histogram equalization technique
7) Compute image segmentation
8) Morphological operation and comparison.

A. Image Acquisition

The first stage of any image processing system comprises of image acquisition, after the image has been attained next operations are enforced. The objective of image acquisition is to gain the image of needed area or exposed region so that the detection can be done. It starts with gathering images of tumor of different person from the record or available directory. These images are further used as input to the system. After image acquisition we can continue to image processing stage for next operations.

B. Image Enhancement

The second stage is an image enhancement. Image enhancement is a technique which is used to improve the quality of the image and to get the better image than the provided one, it provides a clear better and the accurate parameter of the desired region. For this purpose noise removal from the images, image filtering and techniques are use which will helpful to detect cancer parameter during processing.

1) *De-Noisin:* Digital images can have various types of noise. This noise can be the result of error in the image processing and segmentation and some other further operations that result in the pixel values that do not true intensity of real image. This noise may leads to disrupted or wrong values which can give the wrong data about the tumor and the person can be confused so the elimination of noise is compulsory. We are adopting median filter for the elimination of noise, but we can adopt either of the method from all above. The median filter is a nonlinear digital filtering approach, usually used to eliminate noise. Such noise reduction is a typical pre-processing step to enhance the results of later processing for example, edge detection on an image. In median filtering the value of an output pixel is determined by the median of neighbourhood pixels, rather than the mean values of the pixels.
2) *Grayscal Imaging*: The computed tomography (CT) images are combination of two shade i.e., black and white images. When we proceed with these images as input on system, system recognizes these images as a black and white image. So we lay on gray scale imaging to the image. Gray scaled images are not like simple black and white images it provides a combination of black and white or we can say a gray shade instead of providing only two black and white shades. On images gray scale is one in which the magnitude of each pixel is separate specimen represents the magnitude of light it consists or we can say that, it carries only the intensity information.
3) *Thresholding*: Image thresholding is a easiest way of dividing an image into a leading edge and background. Generally an image thresholding algorithm is a combination of histogram and multilevel thresholding. Now we know the main objective of thresholding, so the function of thresholding is –the easiest characteristic that pixels in a region can share is intensity. So, thresholding operation segments such regions and separate light and dark regions. It generates binary images from grey-level ones by converting some pixels values into below the threshold value and converts some pixels above the threshold value and apart the dark and lighter area from each other.
4) *Image Segmentation:* Image segmentation is a necessary process for maximum image analysis in successive functions. In peculiar, most of the current techniques for image information and recognition based highly on the segmentation results. Segmentation separates image into its composing regions or objects as well as it can detect the edge of the images.
5) *Histogram Equalization:* Histogram equalization is technique used for the segmentation of the image; it is one of the most effective techniques for segmentation. Histogram equalization of an image represents the pixels intensity values. For example generally it forms a graph in which x-axis represents the gray level concentration and the y-axis represents the frequency of these concentrations. Usually, a histogram is the assessment of the probability distribution of pixel values. An image histogram is a kind of distribution which gives a graphical representation of the tonal distribution of the grey values in a digital image.
6) *Threshold Segmentation:* Thresholding is the easiest procedure of image segmentation. The input to threshold segmentation is usually a gray scale or colour image. In this segmentation method the same fixed criteria is applied simultaneously to all the pixels of the image. The pixels are partitioned depending on their intensity value. In this simplest segmentation, the output is a binary image. In which the dark pixels shows the background and the white pixels represent the leading edge. The histogram equalization technique has an important role for choosing the thresholds. The bars value peaks and valleys of the histogram image or graph help us for choosing the threshold value. In our work we are using histogram based threshold selection method.

a) *Global Thresholding:* The global thresholding is the oldest technique; it has been popular technique from many years. In this technique a single threshold value is used for the entire image. It is used for the image where the intensity distribution of objects and background pixels are sufficiently distinct or when the pixels vale of the affected area and the background are fairly consistent in their respective values over the whole image.

b) *Local Thresholding:* In local thresholding method the threshold values are depend on gray levels and some local image properties of neighbouring pixel mean or variance. This technique is used when the gradient effect is small with respect to the chosen image size and also when the single threshold value will not work because of the uneven illumination due to the shadows or direction of illumination.

c) *Adaptive Thresholding:* As we know whenever the background illumination is uneven the global thresholding is not suitable at this condition we can use adaptive thresholding method. The adaptive thresholding method the input is generally taken from the gray scale or colour image and after the segmentation the output is a binary image shows the segment. In this method the threshold value is calculated for each pixels value. If the pixels values are less than threshold value then they are set as background otherwise set as a foreground.

d) *Watershed Segmentation:* Image segmentation algorithm occurs when the objects of same predefined class are in close proximity to each other, for this pixel clustering is necessary to group the classified image into objects. It begins with finding and then deciding that which pixels belong to each object. If we assume bright areas are "top" and dark areas are "bottom", then it might look like surface, so that it is natural to think that in terms of catchment basins and watershed line which separate the objects from the background or from each other. Watershed segmentation method comes under the edge base segmentation method. The aim of watershed segmentation algorithm is to find the "watershed lines" in an image separate the different regions. In watershed segmentation the image is visualized in three dimensions – two spatial coordinates and one is intensity. The steps are involve in watershed segmentation are:- Compute a watershed segmentation function, it reads the colour image and convert it to gray scale, uses the gradient method as the segmentation function, then it marks the foreground and back ground objects, then computes the watershed transform of the segmentation function.

7) *K-Means Clustering:* K-means clustering is an easy self-learning algorithm that is used to solve clustering problems. It pursues a simple method of classifying a given data set into a number of clusters, described by the letter "K" which is fixed earlier. The clusters are then arranged as points are associated with the closest clusters, computed, altered and then the process begins with modification until a desired result is achieved. K-means clustering is a process of vector quantization, basically from signal processing, i.e., favourable for cluster analysis in data mining. Objective of K-means clustering is separation and observations into k clusters in which every observation belongs to the group with the closest mean, serving as a model of the cluster. The outcome is a differentiation of the information area into Voronoi cell.

8) *Otsu Segmentation:* Threshold is a simple but effective method for image segmentation techniques. Threshold is used to extract an object from its background by using an intensity value (threshold) for each pixel such that each pixel is classified either as an object point or a background point. The aim of this procedure is that objects and background are separated into non overlapping sets. The Otsu method is a method that expands the between class variance and a frequently used non parametric method for its simplicity and effectiveness. Experimental method shows that, it leads to an accurate threshold value and get an ultimate outcome in segmentation. The algorithm presume that the image contains two categories of pixels following bi-model histogram, then it evaluates the favourable threshold separating the two categories so that their united expansion is nominal or equivalently, so that their inter class variance is high. Therefore, Otsu's method is approximately a one dimensional, discontinuous analogy of Fisher's Discriminate Analysis.

9) *Texture Segmentation:* The texture is most essential aspect in most image analysis or computer vision implementation. It is a group of metrics evaluated in image processing to quantify the texture of an image. Texture of image provides us information of the spatial arrangement of colour or selected area of an image. The issue associated with texture segmentation can be divided into four categories: structural approach, statistical approach, model based approach and filter based approach. Out of various definitions described, priority is given to filter based methods, like Fourier transform, Gabor, Thresholding, Histogram and wavelet transforms. An image texture can be used in segmentation or classification of an image, or to extract boundaries between major texture regions. For more accurate result in segmentation the most useful features are spatial frequency and an average gray level. Texture is a difficult concept to represent. The specification of certain textures in an image is attained initially by modelling texture as a two-dimensional gray level variation. The comparative brightness of pairs of pixels is evaluated such that grade of contrast, uniformity, coarseness and directionality. There are two main kind of texture segmentation i.e., region based and boundary based texture segmentation.

C. Morphological Operation

This is the final step for the identification of tumor. This stage is an important stage that uses algorithms and techniques to detect and isolate various desired portions or shapes of a given image. It is usedto forecast the expectation of tumor existence when the input data to an algorithm is too large to be managed and it is suspected to be notoriously repetitious, then the input data will be converted into a decreased representation set of features. From all of the previous stage like image processing, image segmentation, we achieve the clean image of the tumor region in lung, so differentiate the tumor are called morphological operation. The basic characters for the morphological operation are area for which the numbers of iterations are performed. These are the values which we evaluate the area of the tumor which we achieve from upgraded and segmented images and also from morphological operation. These attributes are computed in scalar.

III. RESULT

This work is based on the processing of images. We also conclude that the tumor can be detected in an early stage by using any one of this method and by following all the four steps mentioned above. The median filter is chosen. After Filtration we are going for the segmentation process. In segmentation process histogram equalization is used with any of the five analysed segmentation process. In our evaluation we come to know that different segmentation has its own working area. But for the CT scanned image or for the lung cancer detection, the watershed segmentation and K-means clustering having the higher accuracy remaining the other techniques. So by this result we can conclude that watershed and K-mean is better than remaining three.

IV. CONCLUSIONS

According to the analysis of different segmentation technique and after reviewing their features we can say that the watershed and k-mean clustering segmentation are having the more accuracy and sensitivity towards the CT scan image then the remaining techniques, i.e., texture, threshold and otsu segmentation. So we can conclude that for the accurate detection we should go for the either water shed or k-mean segmentation technique.

V. FUTURE SCOPE

We are aiming to get the more precise results by using different enhancement and segmentation technique, different segmentation strategies and calculations are the basic idea of digital image processing the more precise result will be more useful to quick fix the diagnosis and the person can have more possibility of survival from this threatening disease and we can do one more thing apart from using different strategies we can use a fusion method of all this techniques or the hybrid methods to get the more accurate result. We can also evolve the system as a real time system in future. It means the system will do its job at the time of diagnosis as well as with the time CT scan, the benefit of the real time system will be that it helps the person to cure the disease as soon as possible and provides a help for early treatment so the survival chance can be increase. In future by parameter and area calculation of the tumor at the time of detection we can also find that tumor has been in which stage.

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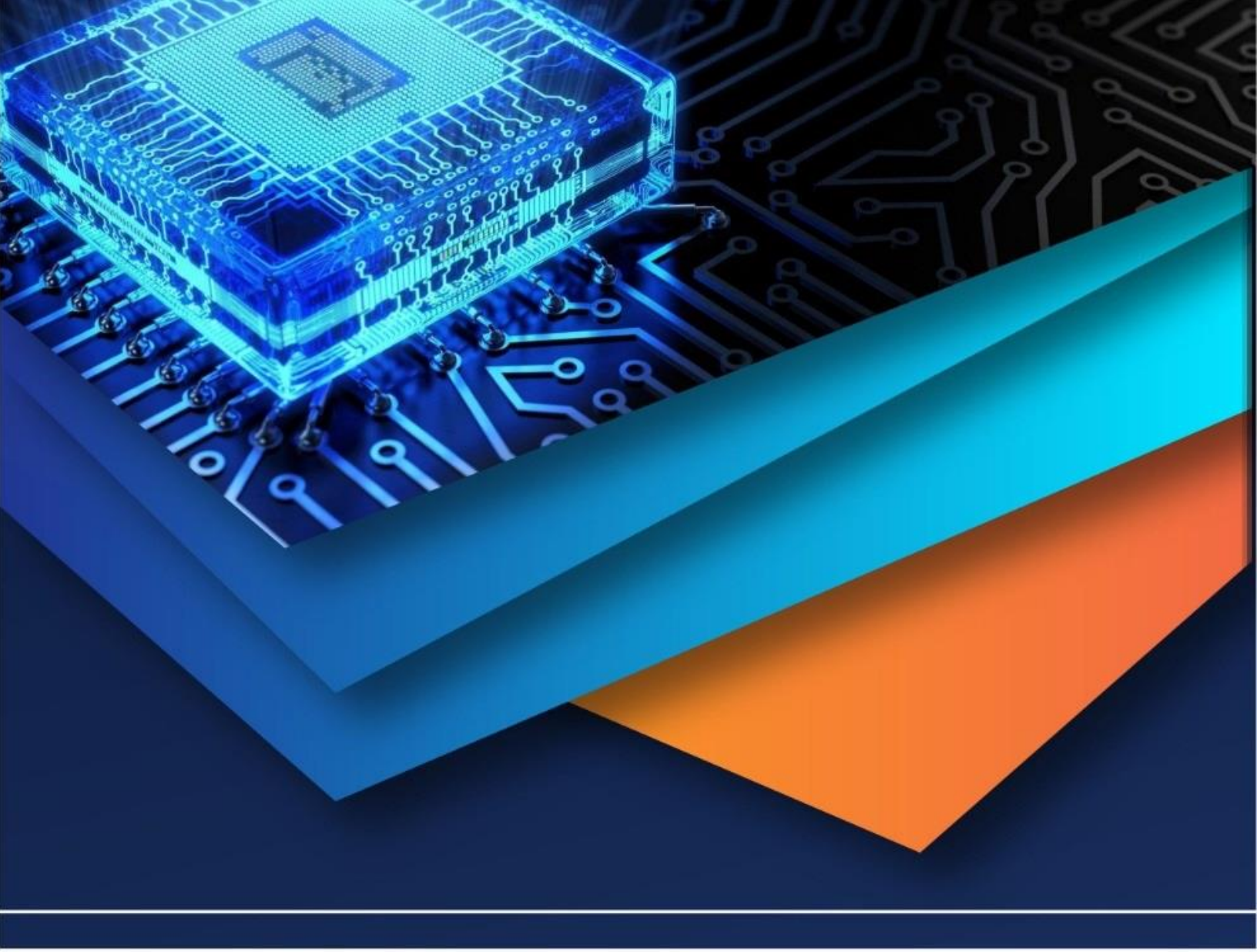

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