

Detection of the Abdominal Diseases using Improved Image Processing Techniques

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Abstract— Image processing mechanisms are used widely for the early detection of the various tumors and internal bleeding issues. Image processing along with the other advanced techniques will enable proper detection of the abnormal parts. It becomes essential to improve the clarity of image by image enhancement methods. Methods like thresholding and watershed image segmentation are better approaches to detect the cancerous cells. Feature extraction will enable to extract properties other than color differences.
Key words: Enhancement, Segmentation, Feature Extraction

I. INTRODUCTION

One of the serious health problems that is less predictable is cancer. Lung cancer is the one with the highest mortality rate and the rate of survival is low. An estimated 85% of lung Cancer cases in males and 75% in females are caused by cigarette smoking [1]. Last year about 1,660,290 cases had been reported of cancer. Cancer remains the second most common cause of death in the US, accounting for nearly 1 of every 4 deaths. It is observed that the chance of survival from cancer is 63%.Surgery, radiation therapy, and chemotherapy have been used in the treatment of lung cancer; the five year survival rate for all stages combined is only 14% [2].The major portion that is being affected by cancer is the middle of the chest. Tumor initiated in the lung is considered crucial lung cancer. Lung cancer can be further classified into small cell lung cancer and non-small cell lung cancer. Subtypes of non-small cell lung cancer are Carcinoma, Aden carcinoma and Squamous cell carcinomas [3].

A. Image Acquisition:

Initially the process starts with the collection of the scanned images that is being stored in the database. In a MATLAB images are displayed as a gray scale image. Better clarity and low noise along with lesser distortions are provided using computer tomography.

B. Image Pre-Processing:

All the images have been undergoing several preprocessing process such as noise removal and enhancement. For the process to begin it is initially a normal scanned image that undergoes RGB conversion. The converted image further undergoes grey-scale conversion. The reason why this conversion occurs is that RGB format is not being supported in MATLAB. The disturbances in the image should be removed. It is here the filtering process is done. Further morphological dilation is done to dilate the image. There are several categories of noises among which white noise is the one that occurs very commonly and which is considered to be removed. Filtering techniques are applied to remove such disturbances [12].

Algorithm to determine the distances between the pixels

INPUT : PREPROCESSED IMAGE

OUTPUT: Bleeding regions

For each pixel perform the Gaussian filter for noise removal,

Compare each pixel to compute the distance,
 $Scolor = ((li -lj)^2 + (ai -aj)^2 + (b-bj)^2)^{1/2}$

Where l, a, b are the pixels nearby.

Label the pixel based on the closest similarity to it,
 Relabel the disjoint cluster and generate new super pixel.

Separate the bleeding and non-bleeding regions

C. Image Enhancement:

It is an important procedure to improve the quality of an image. To obtain an improved image, image enhancement is done .The darker or lighter shades of the image can be improved that is useful for the clarity improvement. To lighten or darken an image is actually not a difficult procedure but what makes it confusing is that it is not easy to determine the exact specification which varies from person to person [4]. In real world applications there are a lot of instances where improper image clarity is obtained. For example consider the satellite images or any medical images, all these suffer from quality issues. In order to improve the contrast and reduce the noise disturbances in the images we have follow some image enhancement techniques. According to the role of application the enhancement techniques varies from one and another.

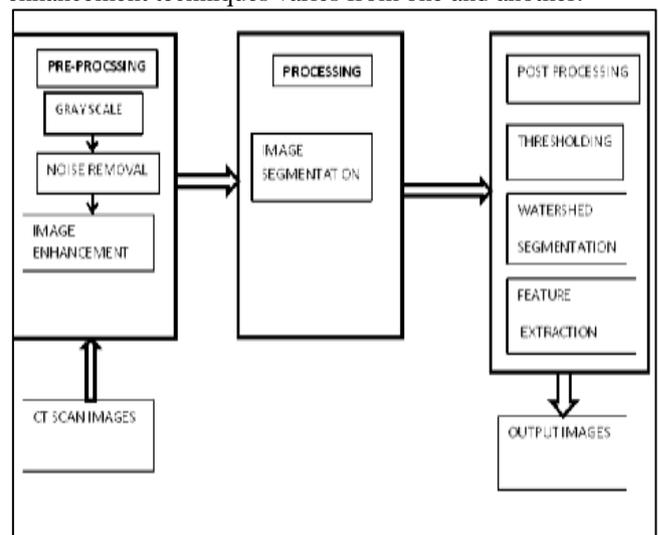


Fig. 1: Overall design of image enhancement

II. PROCESSING

Image Segmentation is one of the major steps for the processing of image enhancement.

A. Image Segmentation:

It is essential to determine the minute details of an overall image. It might be the specification of minute pixels we bring about the differences. To focus on the minute details it is convenient to segment the various parts of the image to get a clearer view. So image segmentation is a better option that can be followed for the enhancement of all the regions. The partitioning refers to the segmentation of the digital image into multiple segments. Grouping of pixels are called super pixels. When segmentation is done it will provide an easier option to determine the lines and edges of an image. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, texture. All image processing operations generally aim at a better recognition of objects of interest, i.e., at finding suitable local features that can be distinguished from other objects and from the background. The next step is to check each individual pixel to see whether it belongs to an object of interest or not. This operation is called segmentation and produces a binary image. A pixel has the value one if it belongs to the object otherwise it is zero. After segmentation, it is known that which pixel belongs to which object [7].

III. POST-PROCESSING:

Post processing segmentation is done using following methods.

A. Thresholding Approach:

Segmentation involves separating an image into regions (or their contours) corresponding to objects. We usually try to segment regions by identifying common properties. Or similarly we can identify contours by identifying differences between regions (edges). The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one.

The major problem with thresholding is that we consider only the intensity, not any relationships between the pixels. There is no guarantee that the pixels identified by the thresholding process are contiguous. We can easily include extraneous pixels that aren't part of the desired region, and we can just as easily miss isolated pixels within the region (especially near the boundaries of the region). These effects get worse as the noise gets worse, simply because it's more likely that pixels intensity doesn't represent the normal intensity in the region [8]. Otsu's method using (gray thresh) function Computes global image threshold. Otsu's method is based on threshold selection by statistical criteria. Otsu suggested minimizing the weighted sum of within-class variances of the object and background pixels to establish an optimum threshold. Otsu's method is based on threshold selection by statistical criteria. Otsu suggested minimizing the weighted sum of within-class

variances of the object and background pixels to establish an optimum threshold. Recall that minimization of within-class variances is equivalent to maximization of between-class variance. This method gives satisfactory results for Bimodal histogram images [9].

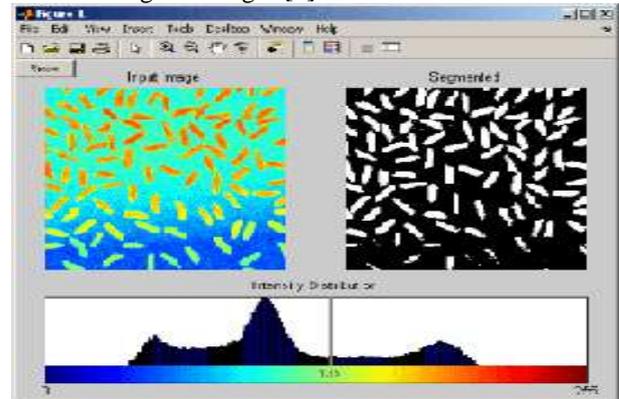


Fig. 2: The cells after thresholding

B. Marker-Controlled Watershed Segmentation:

Segmentation using the watershed transforms works well if you can identify, or "mark," foreground objects and background locations. Marker-controlled watershed segmentation follows this basic procedure 1. Compute a segmentation function. This is an image whose dark regions are the objects you are trying to segment. 2. Compute foreground markers. These are connected blobs of pixels within each of the objects. 3. Compute background markers. These are pixels that are not part of any object. 4. Modify the segmentation function so that it only has minima at the foreground and background marker locations. 5. Compute the watershed transform of the modified segmentation function.

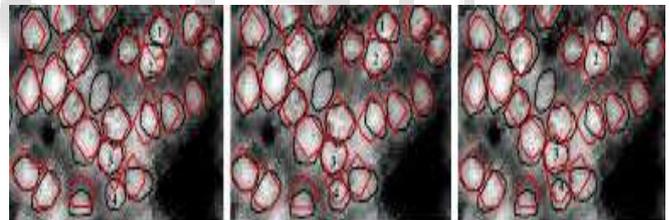


Fig. 3: Images after water shedding

In Marker-based watershed segmentation markers are used. A marker is a connected component belonging to an image. The markers include the internal markers, associated with objects of interest, and the external markers, associated with the background. Separating touching objects in an image is one of the more difficult image processing operations. The water shed transform is often applied to this problem. The marker based watershed segmentation can segment unique boundaries from an image. The strength of watershed segmentation is that it produces a unique solution for a particular image. The over-segmentation problem is also removed by marker watershed segmentation [10]. Generally, the watershed transform is computed on the gradient of the original image. It possesses the number of advantages: it is a simple, intuitive method, it is fast and can be parallelized and it produces a complete division of the image in separated regions even if the contrast is poor. An important task was to identify what features must be taken into consideration of an image for successfully detecting the lung cancer [11].

C. Features Extraction:

The Image features Extraction stage is very important in our working in image processing techniques which using algorithms and techniques to detect and isolate various desired portions or shapes (features) of an image. After the segmentation is performed on lung region, the features can be obtained from it and the diagnosis rule can be designed to exactly detect the cancer nodules in the lungs. This diagnosis rules can eliminate the false detection of cancer nodules resulted in segmentation and provides better diagnosis. In the literature we found among the features used in the diagnostic indicators [12]. Two approaches to predict the probability of lung cancer presence first approach is binarization and the second is masking.

D. Binarization Approach:

Binarization approach depends on the fact that the number of black pixels is much greater than white pixels in normal lung images, so that the counting starts the black pixels for normal and abnormal images to get an average that can be used later as a threshold, if the number of the black pixels of a new image is greater that the threshold, then it indicates that the image is normal, otherwise, if the number of the black pixels is less than the threshold, it indicates that the image in abnormal [13].

E. Masking Approach:

Masking approach depends on the fact that the masses are appeared as white linked areas inside ROI (lungs), as they increase the percent of cancer presence increase. The appearance of solid blue color indicates normal case while appearance of RGB masses indicates the presence of cancer.

IV. Experiment and result

The preprocessing, processing and the post processing methods are used to show a complete image with enhancement. Threshold segmentation is applied on the image .Areas with higher intensity values mostly comprise of cancer cell. So through threshold segmentation we can specify the location of cancer cell.

The comparison between watershed and thresholding methods is classified. Water shed method further improves the quality of the image. Finally an enhanced image is obtained. Cancer cells are determined by applying the enhancements techniques.

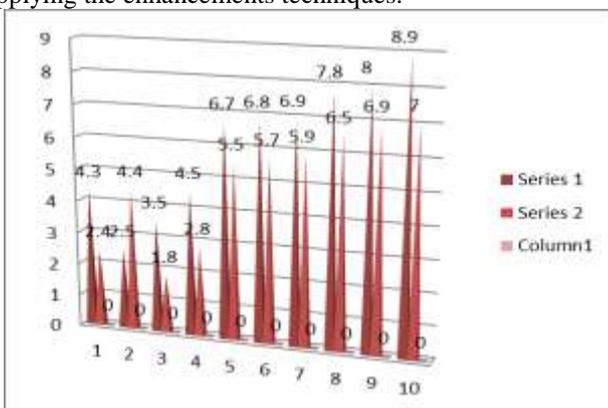


Fig. 4: Performance analysis between watershed method and thresholding.

The Gabor filter was originally introduced by Dennis Gabor, we used it for 2D images (CT images). The Gabor function

has been recognized as a very useful tool in computer vision and image processing, especially for texture analysis, due to its optimal localization properties in both spatial and frequency domain. The marker watershed method is applied to lung image. The result obtained by proposed method shows the clarity and detection of objects marked by image markers. Two types of markers are used. External associated with the background and Internal associated with the objects of interest.

V. CONCLUSION

Cancer is considered the most dangerous and widespread in the world according to the stage of discovery of the cancer cells. It makes it necessary that detection of the abnormal parts will help us identify the areas that have to be dealt. To obtain more accurate results three stages as image enhancement stage, image segmentation stage and features extraction stage are implemented. Marker Controlled Watershed Segmentation approach is said to provide a more accurate and quality than Thresholding approach.

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