



Image Processing Techniques for Lung Cancer Detection

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ABSTRACT: Recently, image process techniques square measure wide employed in many medical areas for image improvement in earlier detection and treatment stages, where the time issue is incredibly necessary to find the abnormality problems in target images, particularly in numerous cancer tumors like carcinoma, breast cancer, etc. Image quality and accuracy is that the core factors of this analysis, image quality assessment further as improvement square measure reckoning on the enhancement stage wherever low pre-processing techniques is employed supported Gabor filter at intervals mathematician rules. Following the segmentation principles, an enhanced region of the article of interest that's used as a basic foundation of feature extraction is obtained. Counting on general options, a normality comparison is created. During this analysis, the most detected options for correct images comparison square measure pixels proportion and mask labelling.

KEYWORDS: Cancer Detection; Image processing; Feature extraction; Enhancement Watershed; Masking.

I. INTRODUCTION

Lung cancer could be a illness of abnormal cells multiplying and growing into a neoplasm. Cancer cells will be over excited from the lungs in blood, or body fluid fluid that surrounds respiratory organ tissue. body fluid flows through humour vessels, that drain into body fluid nodes placed within the lungs and within the centre of the chest. carcinoma usually spreads toward the centre of the chest because the natural flow of body fluid out of the lungs is toward the centre of the chest. Metastasis happens once a neoplastic cell leaves the positioning wherever it began and moves into a body fluid node or to a different a part of the body through the blood stream [1]. Cancer that starts within the respiratory organ is called primary carcinoma. There ar many differing kinds of carcinoma, and these ar divided into 2 main groups: little cell carcinoma and non-small cell carcinoma that has 3 subtypes: cancer, carcinoma and epithelial cell carcinomas.

The ordering of cancers for each males and females among Jordanians in 2008 indicated that there have been 356 cases of carcinoma accounting for (7.7 %) of all new diagnosed cancer cases in 2008. carcinoma affected 297 (13.1 %) males and fifty nine (2.5%) females with a male to feminine magnitude relation of 5:1 that carcinoma stratified second among males and tenth among females [2]. Figure one shows a general description of carcinoma detection system that contains four basic stages. the primary stage starts with taking a group of CT images (normal and abnormal) from the accessible info from IMBA Home (VIA-ELCAP Public Access) [3]. The second stage applies many techniques of image sweetening, to get best level of quality and clearness. The third stage applies image segmentation algorithms which play an efficient rule image process stages, and also the fourth stage obtains the general options from increased metamer image which provides indicators of normality or abnormality of pictures.

Lung cancer is that the most dangerous and widespread cancer within the world in line with stage of discovery of the cancer cells within the lungs, that the method early detection of the sickness plays a really necessary and essential role to avoid serious advanced stages to scale back its percentage of distribution. The aim of this analysis was to sight options for correct pictures comparison as pixels proportion and mask-labeling.

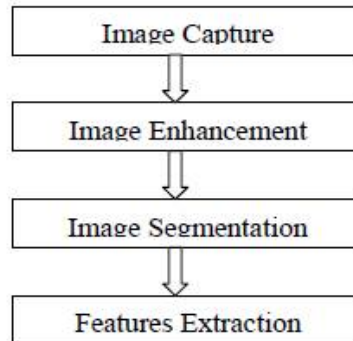


Figure 1. Lung cancer image processing stages

II. MATERIAL AND METHOD

In this analysis, to get a lot of correct results we have a tendency to divide our work into the following 3 stages:

1. Image sweetening stage: to form the image higher and enhance it from noising, corruption or interference. the subsequent 3 strategies are used for this purpose: Dennis Gabor filter (has the most effective results), machine sweetening algorithmic rule, and FFT quick Fourier Transform (shows the worst results for image segmentation).
2. Image Segmentation stage: to divide and phase the improved pictures, the used algorithms on the ROI of the image (just 2 lungs, the strategies used are: Thresholding approach and Marker-Controlled Watershed Segmentation approach (this approach has better results than thresholding)).
3. Options Extraction stage: to get the final options of the improved segmental image victimization Binarization and Masking Approach.

III. RESULT AND DISCUSSION

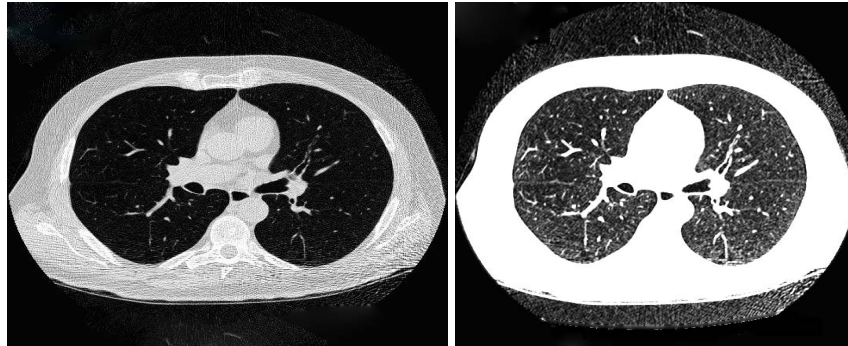
A. Image Enhancement

The image Pre-processing stage starts with image enhancement; the aim of image enhancement is to enhance the interpretability or perception of knowledge enclosed within the image for human viewers, or to supply higher input for different machine-driven image process techniques. Image sweetening techniques will be divided into 2 broad categories: spatial domain ways and frequency domain ways. Sadly, there's no general theory for determining what "good" image sweetening is once it involves human perception. If it looks good, it is good. However, once image sweetening techniques square measure used as pre-processing tools for alternative image process techniques, the quantitative measures will determine that techniques square measure most applicable [4]. Within the image sweetening stage we tend to used the subsequent 3 techniques: Gabor filter, Auto-enhancement and quick Fourier transform techniques.

i) Gabor Filter

Image presentation supported physicist operate constitutes a superb native and multiscale decomposition in terms of logons that square measure at the same time (and optimally) localization in space and frequency domains [5].

A physicist filter could be a linear filter whose impulse response is outlined by a harmonic function increased by a Gaussian operate as a result of the multiplication-convolution property (Convolution theorem), the Fourier rework of a physicist filter's impulse response is the convolution of the Fourier rework of the harmonic operate and also the Fourier rework of the Gaussian operate [6]. Figure a pair of describes (a) the first image and (b) the improved image victimization physicist Filter.



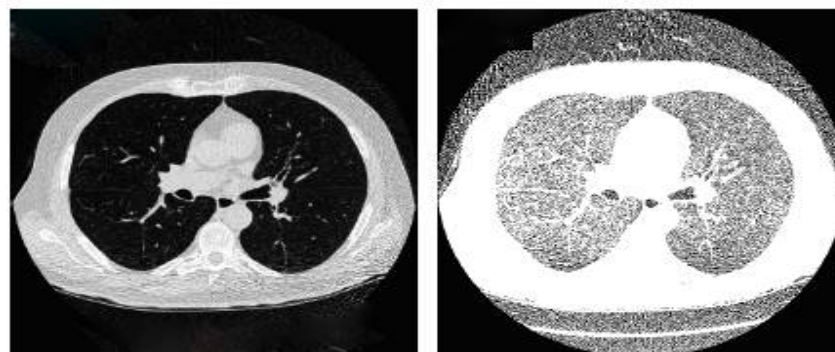
(a) Original Image (b) Enhanced by Gabor

Fig. 2: The result of applying Gabor enhancement technique

Auto enhancement method is strongly depends on subjective observation and statistical operations such as mean and variance calculation. The enhancement percentage in this research was equal to 38.025%.

ii) Fast Fourier Transform

Fast Fourier remodel technique operates on Fourier remodel of a given image. The frequency domain may be a area within which every image price at image position F represents the amount that the intensity values in image “I” vary over a particular distance associated with F. Fast Fourier remodel is employed here in image filtering (enhancement). Figure three describes the result of applying FFT on original pictures, wherever FFT technique has associate degree improvement proportion of 27.51%.



(a) Original Image (b) Enhanced by FFT

Figure 3. Auto enhancement technique using FFT

B. Image Segmentation

Image segmentation is a necessary method for many image analysis sequent tasks. In specific, several of the present techniques for image description and recognition rely highly on the segmentation results [7]. Segmentation divides the image into its constituent regions or objects. Segmentation of medical pictures in 2nd, slice by slice has several helpful

Applications for the medical skilled such as: visual image and volume estimation of objects of interest, detection of abnormalities (e.g. tumors, polyps, etc.), tissue quantification and classification, and a lot of [8]. The goal of segmentation is to change and/or modification the representation of the image into one thing that's a lot of meaty and easier to analyze. Image segmentation is often accustomed find objects and limits (lines, curves, etc.) in images. a lot of exactly, image segmentation is that the method of distribution a label to each picture element in a picture such pixels with an equivalent label share sure visual characteristics [9]. The result of image segmentation may be a set of segments that conjointly cowl the complete image, or a set of contours extracted from the image (edge detection). All pixels in an exceedingly given region square measure similar with reference to some characteristic or computed property, like color, intensity, or texture. Adjacent regions square measure considerably completely different with reference to an equivalent characteristic(s).

i) Thresholding Approach

Thresholding is one among the foremost powerful tools for image segmentation. The segmented image obtained from thresholding has the benefits of smaller cupboard space, fast processing speed and ease in manipulation, compared with grey level image that sometimes contains 256 levels. Therefore, thresholding techniques have drawn lots of attention throughout the past twenty years [10]. Thresholding may be a non-linear operation that converts a gray-scale image into a binary image wherever the 2 levels are allotted to pixels that are below or higher than the specified threshold price. during this analysis, Otsu’s methodology that uses (gray thresh) perform to compute international image threshold is employed. Otsu’s methodology is predicated on threshold choice by statistical criteria. Otsu advised minimizing the weighted add of within-class variances of the thing and background pixels to ascertain an optimum threshold. Recalling that minimization of within-class variances is admiring maximization of between-class variance. This methodology provides satisfactory results for bimodal bar graph pictures. Threshold values supported this methodology are between zero and one, once achieving the brink value; image are segmental supported it. Figure four shows the results of applying thresholding technique.

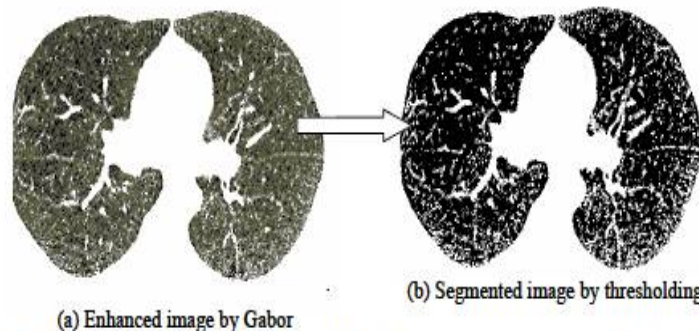


Figure 4. Normal enhanced image by Gabor filter and its segmentation using thresholding approach

ii) Marker Controlled Watershed Segmentation Approach

Marker-driven watershed segmentation technique extracts seeds that indicate the presence of objects or background at specific image locations. Marker locations are unit then set to be regional minima among the topological surface (typically, the gradient of the first input image), and therefore the watershed rule is applied [11]. Separating touching objects in a pictures one in all the foremost tough image process operations, wherever the watershed rework is often applied to such drawback. Marker-controlled watershed approach has 2 types: External associated with the background and Internal related to the objects of interest.

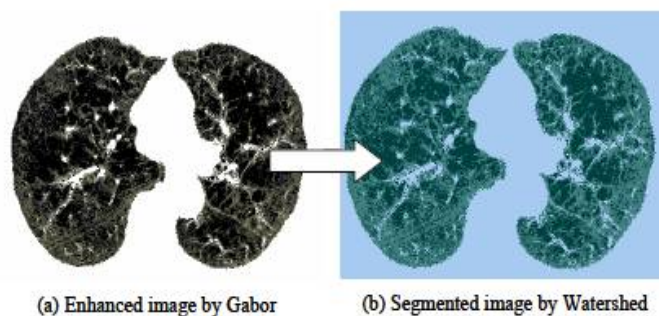


Figure 5. Normal Enhanced image by Gabor filter and its Segmentation using Marker-Controlled Watershed approach

Image Segmentation victimization the watershed transforms works well if we will establish or “mark” foreground objects and background locations, to search out “catchment basins” and “watershed ridge lines” in a picture by treating it as a surface wherever light-weight pixels area unit high and dark pixels area unit low. Figure five shows a metamer image by watershed.

C. Features Extraction

Image options Extraction stage is a crucial stage that uses algorithms and techniques to sight and isolate numerous desired parts or shapes (features) of a given image. To predict the likelihood of carcinoma presence, the subsequent 2

strategies square measure used: binarization and masking, each strategies square measure supported facts that powerfully associated with respiratory organ anatomy and knowledge of respiratory organ CT imaging.

i) Binarization Approach

Binarization approach depends on the very fact that the quantity of black pixels is way greater than white pixels in traditional respiratory organ pictures, thus we tend to began to count the black pixels for normal and abnormal pictures to induce a mean that may be used later as a threshold, if the quantity of the black pixels of a replacement image is larger than the brink, then it indicates that the image is traditional, otherwise, if the quantity of the black pixels is a smaller amount than the brink, it indicates that the image in abnormal. the brink worth that's employed in this analysis is 17178.48 and also the True acceptance rate (TAR) is (92.86%) and False acceptance rate (FAR) is (7.14%). Figure half dozen shows the binarization methodology procedure and figure seven shows binarization check methodology flow chart.

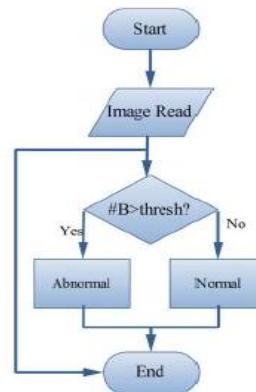
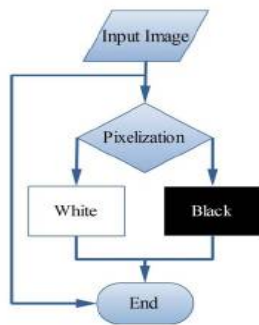


Figure 6. Binarization method procedure Figure 7. Binarization check method flowchart

ii) Masking Approach

Masking approach depends on the actual fact that the lots area unit appeared as white connected areas within ROI (lungs), as they increase the % of cancer presence increase. The look of solid blue color indicates traditional case whereas appearance of RGB lots indicates the presence of cancer, the TAR of this technique is (85.7%) and much has (14.3%). Figure eight shows traditional and abnormal pictures resulted by implementing Masking approach using MATLAB.

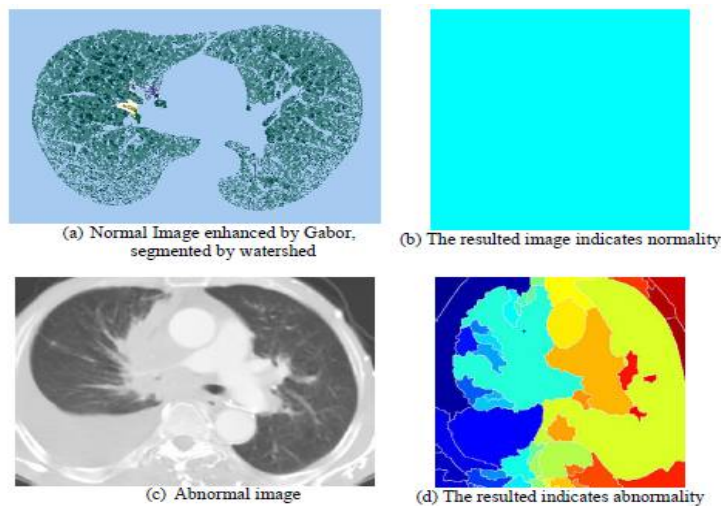


Figure 8. Normal and abnormal images using Masking approach



Combining Binarization and Masking approaches along can lead United States to require a decision whether or not the case is traditional or abnormal in step with the mentioned assumptions in the previous 2 approaches, we are able to conclude that image that has variety of black pixels greater than white ones, indicates normality, and otherwise it indicates abnormality.

IV. CONCLUSION

An image improvement technique is developing for earlier malady detection and treatment stages; the time issue was taken in account to find the abnormality problems in target pictures. Image quality and accuracy is that the core factors of this analysis, image quality assessment further as improvement stage wherever were adopted on low pre-processing techniques supported Gabor filter among mathematician rules. The planned technique is economical for segmentation principles to be a vicinity of interest foundation for feature extraction obtaining. ar pixels proportion and mask-labeling with high accuracy and strong operation.

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