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Digital Image Processing Methods for Detecting Cancer Cells: A Review

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Abstract--- *In recent years, image processing mechanisms have been widely used in several medical areas to improve early detection and treatment phases, in which the time factor is very important for the patient to discover the disease as quickly as possible, especially in various cancer tumours such as lung cancer. Lung cancer has attracted the attention of the scientific and sciatic communities in recent years due to its high prevalence combined with difficult diagnosis. Statistics show that lung cancer is the one that attacks the largest number of people in the world. Early detection of lung cancer is very critical to successful treatment. There are few methods available to identify cancer cells. Here two segmentation approaches, such as thresholding and watershed, are used to identify cancer cells and to find a better response to them. Cancer diagnosis also requires the application of radiological imaging. Digital image processing is also used to monitor the spread of cancer and the progress of treatment and to monitor cancer. Oncological imagery is becoming increasingly diverse and precise. The aim of digital image processing is to find the most appropriate treatment option for each patient. Imaging methods are often used in conjunction to provide sufficient information.*

Keywords--- *Cancer Identification, CT scan, Digital image processing, Enhancement, Lung cancer*

I INTRODUCTION

Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body, and CANCER is one of the most serious health problems in the world. Those contrast with benign tumors that do not spread. Possible signs and symptoms include lumping, irregular bleeding, excessive coughing, unexplained weight loss, and changes in bowel movements. While these symptoms may suggest cancer, they may have other causes as well. More than 100 forms of cancers affect humans. Tobacco use is responsible for about 22 percent of cancer deaths. About 10% is due to obesity, poor diet, and lack of physical activity or excessive drinking. Other factors include certain infections, ionizing radiation exposure and environmental pollutants. In the developing world, 15% of cancers are caused by infections such as Helicobacter pylori, hepatitis B, hepatitis C, human papillomavirus infection, Epstein-Barr virus and human immunodeficiency virus (HIV). Such factors function, at least in part, by modifying the genes of a cell. Usually, many genetic changes are needed before cancer grows. Approximately 5–10 percent of cancers are caused by inherited genetic defects of the parents of a child. Some signs and symptoms or screening tests that detect cancer. It is then normally further tested by medical imaging [1] and confirmed by biopsy. Most cancers can be avoided by not smoking, maintaining a healthy weight, not drinking too much alcohol, eating too many vegetables, fruits and whole grains, vaccination against certain infectious diseases, not eating too much processed and red meat and preventing too much exposure to sunlight. Early detection by screening is useful for cervical and colorectal cancer. Benefits of the screening process. Pain and pain control are an important part of the treatment [2]. Palliative care is particularly important in people with advanced diseases. The chance of survival depends on the type of cancer and the severity of the disease at the start of treatment. In children under 15 years of age, the 5-year survival rate in the developed world is on average 80 per cent. The estimated5-year survival rate for cancer in the United States is 66%. About 90.5 million people had cancer in 2015. Approximately 14.1 million new cases occur every year (not including skin cancer other than melanoma). Approximately 8.8 million deaths (15.7% of deaths) were recorded. Lung cancer,

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prostate cancer, colorectal cancer and stomach cancer are the most common types of cancer in males. The most common types of women are breast cancer [3], colorectal cancer, lung cancer and cervical cancer. When skin cancer other than melanoma were included in a number of new cases of cancer each year, this would account for about 40 percent of cases. Acute lymphoblastic leukaemia and brain tumours are most common in children, except in Africa where non-Hodgkin lymphoma occurs more frequently. Around 165,000 children under 15 years of age were diagnosed with cancer in 2012. The risk of cancer increases significantly with age, and many cancers are more common in developed countries. The rates are rising as more people live to old age and lifestyle changes are taking place in the developing world. The incidence of cancer has been measured at $1.16 trillion per year. The mortality rate for lung cancer is the highest among all other types of cancer. Lung cancer is one of the most dangerous cancers in the world, with the lowest survival rate following diagnosis, with a steady increase in the number of deaths every year. Survival from lung cancer is directly related to its development at the time of diagnosis. The earlier the diagnosis is performed, the better the probability of successful treatment. An approximate 85 percent of cases of lung cancer in males and 75 percent in females are caused by cigarette smoking. Cancer remains the world's second most common cause of death. The overall survival rate for all types of cancer is 63%. While surgery, radiation therapy, and chemotherapy have been used to treat lung cancer, the five-year survival rate for all stages combined is only 14 per cent. This has not improved in the last three decades. Lung cancer also spreads in the direction of the middle of the chest, because the usual course of the lymph out of the lungs is on the way to the centre of the body. Metastasis occurs when a malignancy cell is placed where it starts and moves to a lymph node or to another part of the body in the process of blood flow. The tumour that starts in the lung is called critical lung cancer. There are a number of different types of lung cancer, which are divided into two major groups: small cell lung cancer and non-small cell lung cancer. Non-small cell lung cancer [4] has three subtypes: carcinoma, Aden carcinoma and squamous cell carcinoma. The goal of this paper is to identify the cancer cells present in the CT images of the lung and to provide a more accurate result by using various enhancement and segmentation techniques, such as thresholding and transformation of the watershed [5].

II METHODOLOGY OF PROPOSED SYSTEM

II.I Image Acquisition:

The first stage begins with a set of CT scan images from the Database (ACSC). Images are processed in MATLAB and shown as a grayscale image. Lung CT images with low noise compared to the scan image and the MRI image. So the CT scans can be used to locate the lungs. Key benefit of a computer tomography image having better quality, low noise and distortion for the experimental reason 10 male images are analysed, their CT scans have been placed in the database of images in the JPEG / PNG image standards [6].

II.II Image Pre-Processing:

Both images have undergone a variety of pre-processing procedures, such as noise reduction and enhancement.

II.III Noise Removal:

Image de-noising algorithms may be most widely used for image processing. The input image is a regular image of the RGB. The RGB image is transformed to a grayscale image because the RGB format is not allowed in the Mat lab. Then the grey scale image contains noises such as white noise, salt and pepper noise, etc. White noise is one of the most common problems with image processing [7]. This can be added using an extracted lung image filter.

II.IV Image Enhancement:

Image enhancement, described as a way to improve the quality of the image, so that the resulting image is better than the original image, is a method to improve the quality of the digitally recorded image by manipulating the image with MATLABTM software. It's quite easy, for example, to make the image lighter or darker, or to increase or decrease the contrast. Sadly, there is no general theory to decide what "right" image enhancement is when it comes to human perception. The goal of the Image Enhancement is to enhance the visual appearance of the image or to provide better representation for future automated image processing. Most pictures, such as medical photos, satellite images, aerial images, and even real-life photographs, suffer from poor contrast and noise. It is important to enhance contrast and remove noise in order to improve image quality. Figure 1 shows stages of lung cancer detection.

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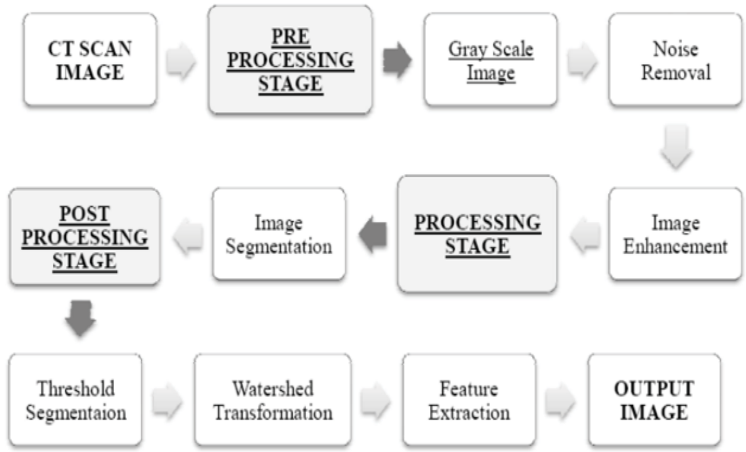

Fig.1: Stages of Lung Cancer Detection

Enhancement methodology varies from field to field depending on its purpose. Gabor filter enhancement technique has been used in the image enhancement stage. This stage mainly involves segmentation, which is described as follows:

II.V Image Segmentation:

In computer vision, segmentation refers to the process of partitioning a digital image [8] into multiple segments (pixel sets, also known as super pixels). Image segmentation is typically used to locate objects and bounds (lines, curves, etc.) in images. More specifically, image segmentation is the method of assigning a label to each pixel in an image in such a way that pixels with the same label share similar visual characteristics. The product of the segmentation of the image is a set of segments that collectively cover the entire image, or a collection of contours derived from the image. Pixel in a region is identical with respect to some characteristic or computational property, such as colour, intensity, texture both image processing operations are usually aimed at better recognition of objects of interest, i.e. at finding appropriate local features that can be distinguished from other objects and from the context. The next move is to search every pixel to see whether or not it belongs to an object of interest. This operation is called segmentation and generates a binary image. A pixel has a value of one if it belongs to an object, otherwise it is zero. After segmentation, it is known which pixel belongs to which entity [9].

II.VI Post-Processing:

Post segmentation is conducted using the following methods. Thresholding is useful in distinguishing from the background to the foreground. The grey Level Image can be transformed to a binary image by choosing the correct threshold value T. The binary picture will contain all the essential information about the location and shape of the objects of interest (foreground). The benefit of first obtaining a binary image is that it reduces the complexity of the data and simplifies the process of identification and classification. The most common way to convert a grey-level image to a binary image is to select a single threshold value (T). Then all values of the grey level below this T will be classified as black (0) and the values above T will be white (1). Otsu method using the (grey thresh) function Calculates the global image threshold. The Otsu approach is based on the determination of the threshold by statistical criteria [10]. Otsu suggested minimizing the weighted sum of the object variances within the class and the background pixels in order to set the optimum threshold. Recall that reducing intra-class variances is equal to maximizing the variance between groups. This method provides satisfactory results for bimodal histogram images.

II.VII Marker-Controlled Watershed Segmentation:

Marker-based watershed segmentation markers are used. The marker is a linked component that belongs to the image. The markers shall include the internal markers associated with the objects of interest and the external markers associated with the context. Separating touch objects in an image is one of the most difficult image processing operations. The transformation of the water shed is often applied to this issue. The watershed-based segmentation marker can be used to segment specific boundaries from a picture. The strength of the watershed segmentation is that it produces a unique solution for a specific image. The over-segmentation problem is also removed by the watershed segmentation marker. Generally, the transformation of the watershed is calculated on the gradient of the original image. It has many advantages: it is a simple, intuitive method, it is fast and can be parallelized and produces a complete

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division of the image in separate regions even if the contrast is poor. An important task was to determine what features the Dicom picture would take into account in order to successfully detect lung cancer [11].

II.VIII Features Extraction:

Image features the extraction stage is very important for working in image processing techniques that use algorithms and techniques to detect and isolate the desired portions or shapes (features) of the image. After segmentation in the lung area, the characteristics can be derived from it and the diagnostic rule can be designed to precisely detect the cancer nodules in the lungs. Such diagnostic rules will remove the false detection of cancer nodules resulting in segmentation and provide a better diagnosis. Some of the features used in diagnostic tests have been described in the literature. Two approaches to predict the probability of lung cancer presence first approach is Binarization and the second is masking.

II.IX 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.

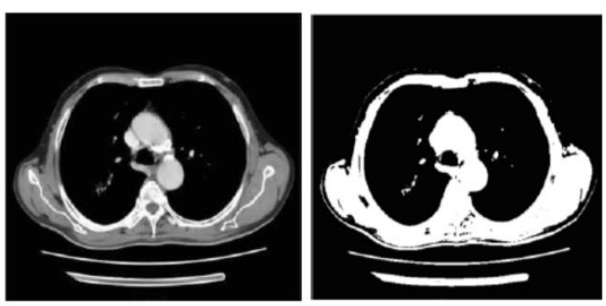
II.X Masking Approach:

The masking strategy relies on the fact that the masses appear as white-linked areas within the ROI (lungs) as they increase the percentage of cancer intake. The appearance of a solid blue c olor suggests a regular event, while the appearance of RGB mass indicates the presence of cancer.

III EXPERIMENT AND RESULT

III.I. Thresholding Approach:

Figure 2(a) shows the lung input picture. Threshold segmentation is applied to the image shown in Figure 2(b). This is a region with an intensity value higher than the given threshold. High-intensity areas are mostly cancer cells. Thus, the location of the cancer cell can be specified through threshold segmentation.



(a) (b)

Fig.2: (a) Original Image (b) Image by Threshold Segmentation

III.II Evaluation of Gabor filter:

The Gabor filter was originally introduced by Dennis Gabor and was used for 2D images (CT images). Gabor has been recognized as a very useful tool for computer vision and image processing, particularly for texture analysis, due to its optimal localization properties in both the spatial and frequency domains. Figure 3 shows the result of this.

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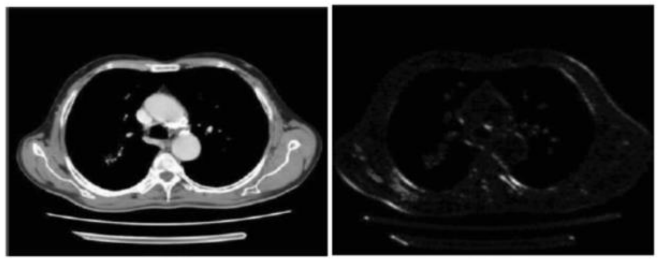

(a) (b)

Fig.3: The result of applying Gabor enhancement technique (a) Original image (b) Enhanced by Gabor

III.III Approach of Marker Controlled Watershed segmentation:

The watershed marker technique is applied to the picture of the lung. The result obtained by the proposed method shows the clarity and detection of objects marked with an image marker. Table 1 shows image segmentation results. There are two types of markers used. External relates to the context and internal related to the objects of interest. Figure 4 indicates the performance of the tests.

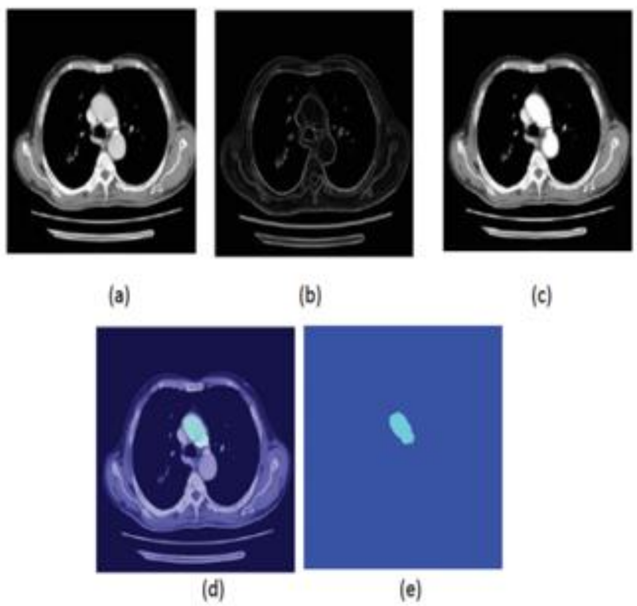

Fig.4: (a) Original image (b) Gradient image (c) Watershed applied to original image (d) Superposition of original image with watershed € Segmented image by Marker Watershed.

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Image	Thresholding Approach	Marker Watershed Method
Image 1	81.2466	83.7769
Image 2	80.7752	85.2737
Image 3	80.0130	86.3968
Image 4	79.6489	84.7092
Image 5	79.4329	84.5383
Image 6	78.7794	84.7046
Image 7	77.1633	83.9142
Image 8	76.0059	82.7316
Image 9	75.9029	80.9555
Image 10	75.4174	81.5094

Table.1: Image Segmentation experimental results

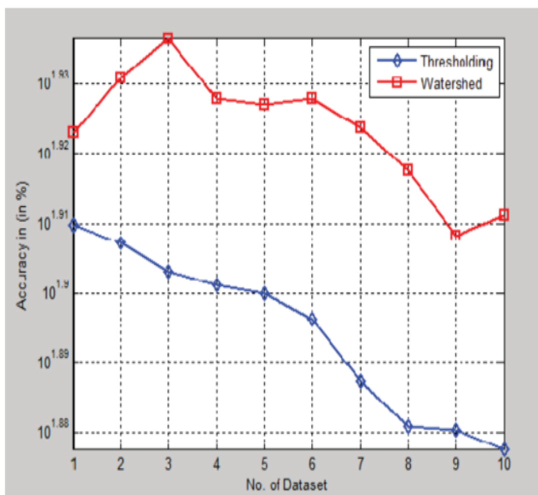

Fig.5: Plot of Accuracy of Threshold vs. Marker Watershed Segmentation

IV CONCLUSIONS

This paper summarized the literature on the treatment of lung cancer. However, current protocols for the detection of cancer cells report many false positives, requiring substantial improvements in the technology and its applications in the practice of lung cancer screening. Lung cancer is the most harmful and common in the world according to the stage of the detection of the cancer cells in the lungs, which gives us an idea that the mechanism of detecting this disease plays a very important and essential role in preventing severe stages and the percentage of cancer in the world. In order to obtain more accurate results, three steps are used: Image Enhancement stage, Image Segmentation stage and Features Extraction stage.

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