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REVIEW ARTICLE

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ROBUST AND AUTOMATED LUNG CANCER NODULE DETECTION USING IMAGE PROCESSING TECHNIQUES

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***Abstract*:** In the medical field among all the types of cancers, lung cancer is more serious disease. Detection of lung cancer in the beginning will recover the lifetime of the patient. Using image processing techniques, Computed tomography scan images are very useful to find lung cancer nodule. The image pre-processing methods are feature extraction, image enhancement and image segmentation. Watershed transformation and based on Gabor filter to find lung cancer nodule. This research paper aim is to find more precise results using different segmentation and enhancement techniques.

Keywords: Image processing, Watershed transformation, Gabor filter, Lung cancer.

I. INTRODUCTION

The main purpose of medical image analysis is to detect lung cancer using meaningful information to support disease diagnosis and therapy. Accuracy and quality are two factors of the image, image enhancement and segmentation principles used in pre-processing to get feature extraction in the following steps: **1.** Cigarette smoking cases of the male are 85% and the female are 75% [1]-[2]. **2**. Gabor filter and watershed transform are more useful to remove the noise. **3.** As shown in figure 1 explains the theory of the various steps in the pre- processing stage. **4**. The patient life span can be increased at the early stage of the cancer. *Al Taraweeh et al [3]* explained the image enhancement methods strongly depends on statistical operations and subjective observation such as variance and mean calculation. *Sami et al [4]* has presented that lung disease scan images are used to find the lung cancer. *Ajil et al[5]* described CT images are more sensitive in finding the tumor size and the lymph nodes of the lung.

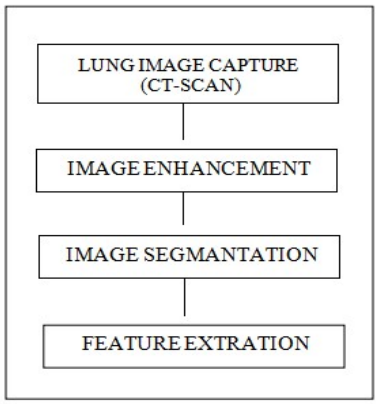

Figure. 1:- Lung cancer detection system architecture diagram

I.I Image Enhancement

Chaudary et al.[7]-[8] explained with image enhancement by the focus to improve the sensitivity, quality, and interpretability in an image pre-processing stage.

The image enhancement methods are given below.

- Noise removal using a wiener filter
- Median filtering
- Filtering with morphological operators
- Histogram equalization

The quality of computed tomography images can be improved by the transform coefficient functions. The image enhancements benefits are as follows:

- Frequency domain
- Computations of Complexity
- Frequency coefficient of an image manipulation
- Domain purpose improvement.

Xiuhua et al.[6] explained early diagnosis and better treatment can save a life, lung cancer is more critical and life taking disease in the world.

I.II Equalization of histogram

Histogram **e**qualization is a process of contrast enhancement, as explained a framework technique is used in histogram modification. The distributed histogram is obtained by cumulative distribution function, in the input image.

I.III Segmentation of image

Partition of a prototype into equivalent measure of component part in which to each one picture element holding with as is attributes. These partitioned images are meaningful and useful information. The first step of the

image from low-level image processing into more other images such as objects and features, an accurate partitioning of an image in the image segmentation is a challenging problem [10]-[11].

Application areas of image segmentation are mentioned below.

- Pattern Recognition
- Image Encryption
- Image Processing
- Medical and Biomedical imaging
- Computer Graphics
- Computer Vision

I.IV Thresholding.

It is a process of segmenting the image into equal parts, by separating of light and dark pixels. If A(i, j) is a threshold version of B (i, j) at some global threshold T. A=1 if when $B(i,j) \geq T$.

Huang et al. [13] explained about thresholding technique is based on the similarity in textural features.

I. V Feature Extraction

In image processing techniques feature extraction is a part of thresholding, resizing linearization, and normalization. Feature extraction techniques used in image recognition and classification as character recognition.

II. PROPOSED METHODOLOGY

Rendon and gonzalez et al. [12] and [14] lung cancer detection is having four steps:

- Enhancement.
- Feature extraction.
- Segmentation and
- Nodule detection.

The proposed methodology includes pre-processing of the images to extract the features of lung cancer in an automated process and subjected to the following steps.

- The pre-processing stage that improves the nature of the picture by evacuating the undesirable noise to feature the malignant information.
- The feature extraction acquires the discrete components of the image under processing.
- The classification stage identifies the objects of an image according to certain classes and helps in recognition of efficient data.

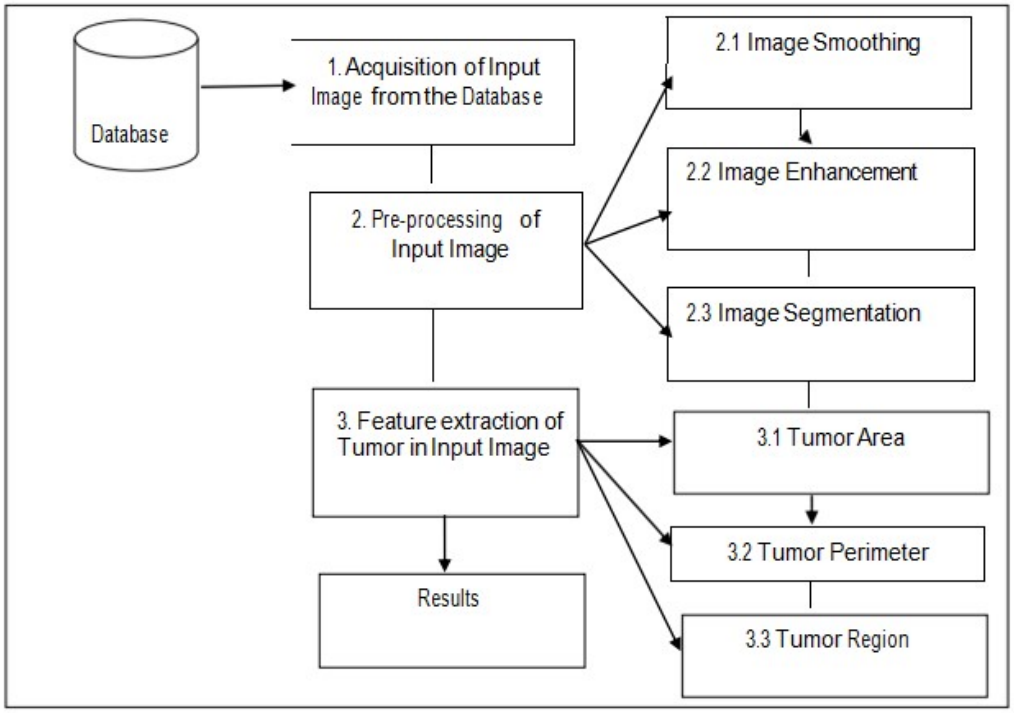

Figure. 2:-Different types of techniques for identifying lung cancer.

II .I Pre-processing

Smoothing is a process of image processing technique to remove noise and fluctuations in the image. To remove the image noise, reduce salt and pepper noise by using median filter. *Ruchika et al.*[9] explained about an image smoothing in the image pre-processing stage. The smoothing process is also used for detection of lung cancer nodule and in reduction of noise from the computed tomography images.

II.II Feature extraction

As shown in figure.2, a flowchart which explains various steps while detecting the malicious node, from various CT scan images.

A) Area of the nodule:

Area=(Axy, IROI [AREA] = x, J ROI [Area] =y) Where x& y are the pixels.

B) The array of edge that contains at least one value, among 0 to 255 values

created by transformation function. Perimeter of the nodule:

P= (Pxy , I edge[P]=x, J edge [P]=y)

Where I and J are vectors, x & y are the pixels.

C) Eccentricity: Eccentricity is used to measure the region of tumor (I). If it is

circular I value is 1, otherwise < 1. (I) = major axis / minor axis

III. RESULTS AND DISCUSSION

Detection of cancer using image processing techniques, lung cancer stages are involved in the practical situation of cancer which transforms from the human body to various parts [15]-[16]. The smallest lung cancer nodule sizes are all between 5 mm and 25 mm [17]-[18].

Wang J et al.[22] computed tomography(CT) and Computer-aided diagnosis(CAD) schemes for thoracic are widely used to detect lung abnormalities. Threshold value is verified after the edge of the lung boundary is matched [19]-[21] and [25].

For more details of lung cancer detection by using based on Gabor filter and watershed segmentation, see [23], [24], [26], [27] and [28]. And also knows that the presence or absence of cancer in lymph nodes.

As shown in Fig. 3, the lung cancer nodule image is shown in the above diagrams. For more details of image enhancement and feature extraction, see [29], [30], [31], [32], [33] and [34].

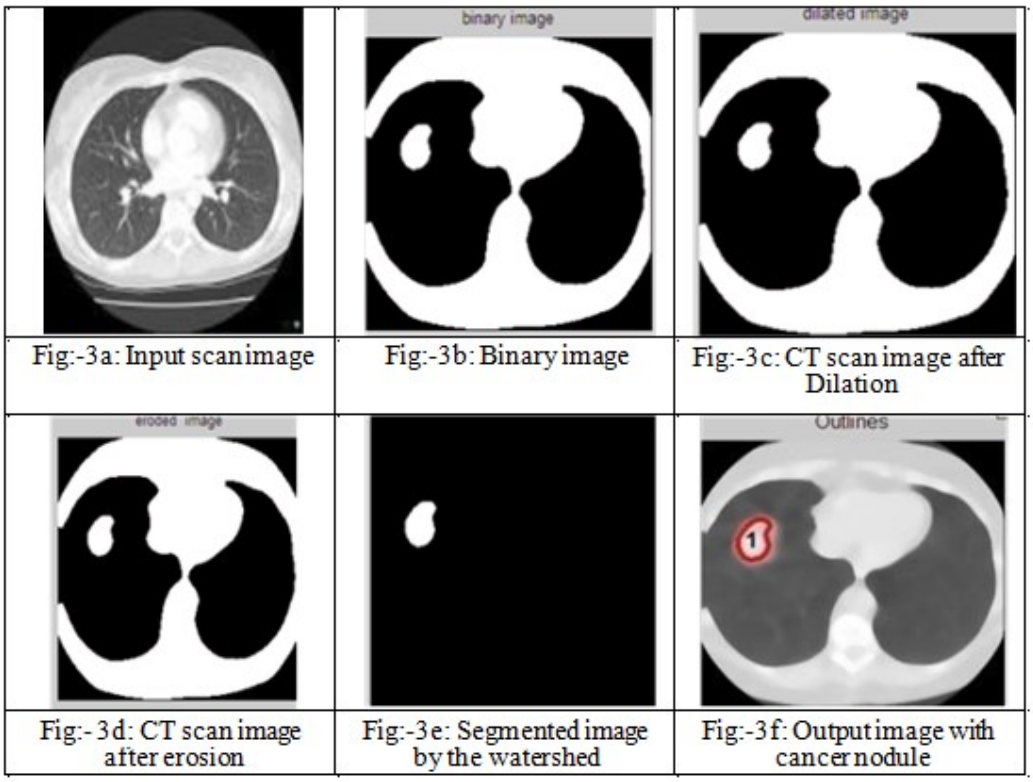

Figure 3

IV. CONCLUSION

The lung cancer detection system has been developed successfully. Lung cancer is the most critical disease which grows cancer cells in the abnormal way. The various image processing techniques are mostly useful in the medical areas. Computed tomography scan images are very useful for finding the lung tumor, based on the Gabor filter and various types of image segmentation techniques are used to detect the lung cancer. So this proposed method is highly suitable for identification of perimeter, eccentricity and area of the lung cancer tumor, according to this information diagnosis will be given by the physicians.

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