

LUNG CANCER DETECTION USING IMAGE PROCESSING

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Technology degree in
Biomedical Engineering

by

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DEPARTMENT OF BIOMEDICAL ENGINEERING
SCHOOL OF BIO AND CHEMICAL ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH 2021



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DEPARTMENT OF BIOMEDICAL ENGINEERING

This is to certify that this Project Report is the bonafide work of **K NAGA DIVYA (37240042)** , **PRIYAMVADHA. P(37240058)** who have done the project work as a team who carried out the project entitled "**Lung Cancer Detection Using Image Processing**" under my supervision from **October 2020** to **March 2021**

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Internal Guide

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Submitted for Viva voce Examination held on 10. 04. 2021

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DECLARATION

We **K NAGA DIVYA (37240042)** , **PRIYAMVADHA. P(37240058)** hereby declare that the Project Report “**Lung Cancer Detection Using Image Processing**” done by us under the guidance of **Dr. J. Bethanney Janney, ME., Ph.D.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Technology degree in Biomedical Engineering.

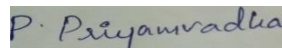
DATE: 05. 04. 2021

PLACE: CHENNAI

1.



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SIGNATURE OF THE CANDIDATES

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ABSTRACT

As per the latest trend taken into consideration, based on that we have decided to make research over biomedical term that is lung cancer detection. Image processing techniques that are widely used in several medical areas for the purpose of image improvement in the earlier detection and treatment stages. Various types of cancers such as lung cancer, blood cancer, brain cancer, breast cancer, throat cancer, mouth cancer, tongue cancer etc. Lung cancer is defined as a disease of abnormal cells that are multiplying and are growing into a tumor. Cancer cells that can be carried away from the lungs in blood, or the lymph fluid that surrounds the lung tissue. Cancer images that are collected from different hospitals, where as we access cancer image into MATLAB. Core factors of this research is Image quality and accuracy, image quality assessment as well as improvement are depending on the enhancement stage where the low pre-processing techniques is used based on Gabor filter within Gaussian rules. Segmentation and enhancement procedure that are used in order to obtain the feature extraction of the normal and abnormal image. The main detected features for accurate images comparison are pixels percentage and mask- labelling in this research.

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LIST OF ABBREVIATIONS

IARC	INTERNATIONAL AGENCIES FOR RESEARCH
WHO	WORLD HEALTH ORGANISATION
KNN	K- NEAREST NEIGHBORS
PCA	PROMPT CORRECTIVE ACTION
VGA	VIDEO GRAPHICS ARRAY
LINPACK	LINEAR SYSTEM PACKAGE
EISPACK	EIGEN SYSTEM PACKAGE

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CHAPTER 1

INTRODUCTION

1.1 LUNG CANCER

Lung cancer is the most common invasive cancer in women. Second main cause of cancer death in women, after lung cancer. The numbers of deaths caused by cancer around 8.2 million in the year of 2012, according to the International Agency for Research on Cancer (IARC), which is the part of the World Health Organization (WHO). By 2030 the number of new cases is expected to increase to more than 27 million. Using medical images testing breast cancer can be diagnosed like histology and radiology images. The radiology images analysis can help in order to identify the areas where the abnormality is located. However, they can't be wont to determine whether the world is cancerous. The biopsy, that is where an tissue is taken and it is studied under a microscope to see whether cancer is present, this is the only sure way to identify if an area is cancerous. After completing the biopsy, the diagnosis will be based on the qualification of the histopathologists, the one who will examine the tissue under a microscope, looking for cancerous or abnormal cells. According to a specific pattern the histology images allow us to distinguish their architecture and cell nuclei types. Practically, histopathologists visually examine the regularities of tissue distributions and cell shapes and determine malignancy degree and cancerous images. The histopathologists should be well-trained or otherwise this may lead to an incorrect diagnosis. Also, there's a scarcity of specialists, which keeps the tissue sample on hold for up to 2 months, for instance, this happens often in Norway. There is also the problem of reproducibility, as histopathology is a subjective.

CHAPTER 2

2.1 LITERATURE SURVEY

Marzorati, D. *et al.* (2018) One of the most causes of the high deathrate in carcinoma is that the late-stage tumor detection. Early diagnosis is therefore essential to extend the probabilities of obtaining an efficient treatment quickly thus increasing the survival rate. Current screening techniques are supported imaging, with low-dose computerized tomography (LDCT) because the pivotal approach. Even if LDCT has high accuracy, its invasiveness and high false positive rate limit its application to high-risk population screening. A non-invasive, cost-efficient, and easy-to-use test should instead be designed as an alternate . Exhaled breath contains thousands of volatile organic compounds (VOCs). Since past , it's been understood that changes within the VOCs' mixture could also be directly associated with the presence of a disease, and up to date studies have quantified the change in the compounds' concentration. Analyzing exhaled breath to realize carcinoma early diagnosis represents a non-invasive, low-cost, and user-friendly approach, thus being a promising candidate for high-risk carcinoma population screening. This review discusses technological solutions that are proposed within the literature as tools to research exhaled breath for carcinoma diagnosis, along side factors that potentially affect the outcome of the analysis. Even if research on this subject started a few years ago, and lots of different technological approaches have since been adopted, there's still no validated clinical application of this system . Standard guidelines and protocols should be defined by the medical profession so as to translate exhaled breath analysis to clinical practice.

Chunyan Wang et al. (2020) Accurate classification of adenocarcinoma (AC) and epithelial cell carcinoma (SCC) in carcinoma is critical to physicians' clinical decision-making. Exhaled breath analysis provides an incredible potential approach in non-invasive diagnosis of carcinoma but was rarely reported for carcinoma subtypes classification. In this paper, we firstly proposed a combined method, integrating K-nearest neighbor classifier (KNN), borderline2-synthetic minority over-sampling technique (borderlin2-SMOTE), and have reduction methods, to research the power of exhaled breath to distinguish AC from SCC patients. The classification performance of the proposed method was compared with the results of 4

classification algorithms under different combinations of borderline2-SMOTE and have reduction methods. The result indicated that the KNN classifier combining borderline2-SMOTE and have reduction methods was the foremost promising method to discriminate AC from SCC patients and obtained the very best mean area under the receiver operating characteristic function (0.63) and mean mean (58.50) in comparison to others classifiers. The result revealed that the combined algorithm could improve the classification performance of carcinoma subtypes in breathomics and suggested that combining non-invasive exhaled breath analysis with statistical method is a promising screening method for informing treatment options and facilitating individualized treatment of carcinoma subtypes patients.

P. Bhuvaneswari et al. (2019) As a molecular and non-invasive detection technology, Raman spectroscopy is promising to be used within the first diagnosis of tumours. The SNR of spectra obtained from portable Raman spectrometers is low, which makes classification harder. In this paper, an algorithm of entropy weighted local-hyperplane k-nearest-neighbour (EWHK) is proposed for the identification of the spectra. When calculating the weighted distance between the prediction and thus the sample hyperplane, EWHK introduces the knowledge entropy weighting to reinforce the algorithm of adaptive weighted k-local hyperplane (AWKH). It can reflect all of the sample information within the classification objectively and improve the classification accuracy. The carcinoma detection experimental results of EWHK showed an enormous improvement compared with those of AWKH and k-nearest neighbour (KNN). The EWHK classifier yielded a mean diagnostic accuracy of 92.33%, a sensitivity of 93.81%, a specificity of 87.77%, a positive prediction rate of 95.99% and a negative prediction rate of 83.69% during randomized grouping validation. The algorithm is effective for cancer diagnosis.

N. Panpaliya et al. (2019) Lung cancer, also referred to as lung carcinoma, may be a malignant neoplasm characterized by uncontrolled growth of the cell in tissues of the lung. It is mandatory to treat this to avoid spreading its growth by metastasis to other parts of the body. Most cancers that start within the lung are carcinomas. The two main types are small-cell lung carcinoma and non-small-cell lung carcinoma [1]. Long-period tobacco smoking is that the primary factor for 85% of lung cancers [2]. About 10–15% of cases occur in people that haven't smoked but thanks to pollution,

second hand smoking, asbestos, and radon gas. Computer tomography (CT) and radiographs are the traditional methods to detect the presence of carcinoma. The diagnosis is confirmed by biopsy which is typically performed by bronchoscopy or CT scan. The explanation for cancer-related death among men is especially thanks to carcinoma. Hence, it's essential to work out a replacement robust method to diagnose the carcinoma at an earlier stage [3]. For this study, 20 lung image samples and 4 algorithms are taken for analysis. It was proved that the mixture of adaptive median filter, adaptive histogram equalization, and guaranteed convergence particle swarm optimization- (GCP SO-) based algorithm has more accurate results among others.

Muhammad Usman et al. (2017) As per the technical evolution and latest trend taken into consideration, we've decided to form research over biomedical term i.e. Lungs cancer detection. Recently, image processing techniques are widely utilized in several medical areas for image improvement in earlier detection and treatment stages. There are various types of cancers i.e. lungs cancer, carcinoma, blood cancer, throat cancer, brain cancer, tongue cancer, mouth cancer etc. Lung cancer may be a disease of abnormal cells multiplying and growing into a tumour. Cancer cells are often over excited from the lungs in blood, or lymph fluid that surrounds lung tissue. In this project we access cancer image into MATLAB collected from different hospitals where present work goes on and this available image was color image we've access that image into MATLAB and followed conversion. Image quality and accuracy is that the core factors of this research, image quality assessment also as improvement are counting on the enhancement stage where low pre-processing techniques is used supported Gabor filter within Gaussian rules. The segmentation and enhancement procedure is employed to get the feature extraction of normal and abnormal image. Relying on general features, a normality comparison is formed. In this research, the most detected features for accurate images comparison are pixels percentage and mask-labelling

CHAPTER 3

AIM AND SCOPE

3.1 AIM

Image enhancement using Gaussian filter

Image segmentation using KNN Segmentation Approach

Obtain the general features of the enhanced segmented image using PCA.

3.2 SCOPE

We are aiming to get the more accurate results by using various enhancement and segmentation technique, different segmentation strategies and calculations are the root idea of digital image processing and the more accurate result will be more helpful and good for the diagnosis solution and the person can have more chances of survival from this dangerous disease and we can do more thing apart from different strategies we can develop system as a real time system in future. It means system will work at the time of diagnosis as well as with the time when we take the computer tomography images.

3.2 EXISTING SYSTEM

Image pre-processing is done to enhance some image features which is important for further processing and it removes noise factor if present in an image. To find the boundaries of objects within image, an imaging processing technique is used which is an edge detection. Edge detection works by detecting discontinuities in the brightness of image. Edge detection is used for image segmentation in various fields such as image processing, machine vision and computer vision. Some of the common edge detection algorithms include Sobel, Roberts, Prewitt, canny and fuzzy logic methods 3.3 Feature extraction techniques used in image processing for extraction of desired features from image like shapes of an image, portions.

In this stage normality and abnormality of an image can be determined. Provides a basis for process of classification by the detected features. Various features of an image can be area, eccentricity, perimeter, intensity, etc. Histogram of oriented

gradients, local binary patterns, Gray-Level Co-Occurrence Matrix these all are the various feature extraction techniques used.

DISADVANTAGES

Various filtering techniques are median filtering, averaging filtering and Morphological filtering. That are very Complexity. Accuracy Can't be Achieved Correctly. It works by detecting discontinuities in brightness.

3.3 PROPOSED SYSTEM

Enhancement process Image enhancement is to enhance the perception or interpretability of data included within the image for human viewers, or it provide better input for other automated image processing techniques. Collect the carcinoma images from the respective cancer hospital. Access one among the actual image into MATLAB with the assistance of command. Gaussian filter is using for image enhancement process .

Segmentation process Segmentation divides the image into its constituents objects or regions. For the medical professional, segmentation has useful applications like volume estimation of object of interest, and visualization, qualification of the tissue and classification, detection of abnormalities and more. For segmentation we are using KNN Segmentation Approach .We are using PCA for feature extraction to know normality or abnormality of the images.

On Fourier transform of a given image, Fast Fourier Transform technique operates. The frequency domain may be a space, where each image value at image position F represents the quantity that the intensity values in image

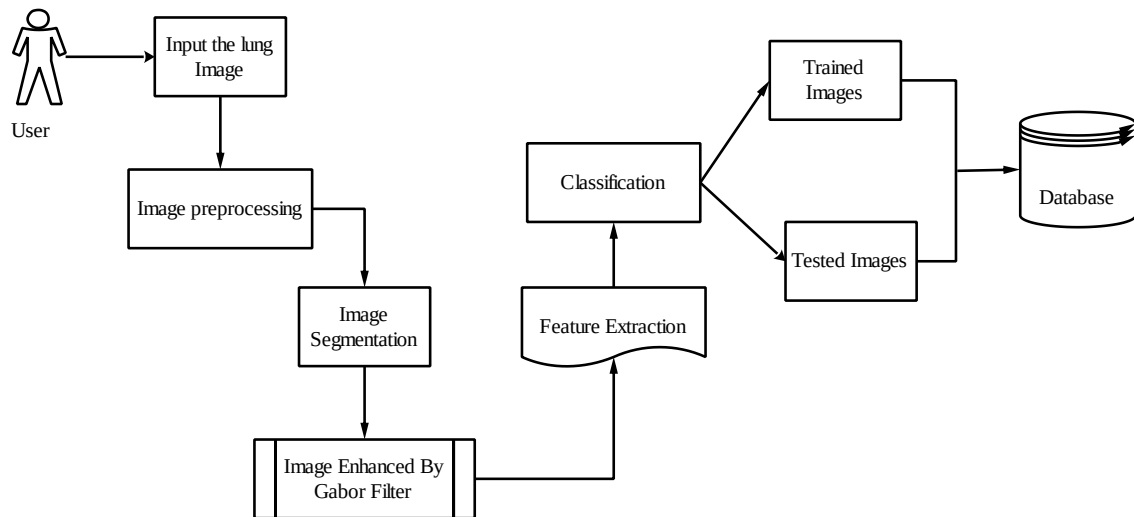
ADVANTAGES

Early detection of cancer greatly helpful in increasing the chances or probabilities for successful treatment. This treatment is often simpler and more likely to be effective. The proposed systems give the higher result and are more efficient. Provides better accuracy and image quality.

CHAPTER 4

METHOD AND MATERIALS

4.1 SYSTEM ARCHITECTURE



MODULES:

Input raw image
Noise reduction
Contrast enhancement using histogram equalization
Pre-processing
Filtering of cells
Image segmentation
Database
Image Recognition

MODULES DESCRIPTION:

Input raw image

Input the image that is taken from the data base.

Noise reduction

We used median filtering method to reduce the salt noise and paper. We have used 3x 3 masks to get their consistent grey value and to get eight neighbors of a pixel.

Contrast enhancement using histogram equalization:

The difference of each image is being enhanced using histogram equalization method. The function wont to improvement that's $J = \text{histeq}(k)$; histeq enhances the contrast of the pictures by converting the values in an intensity image. When image pixel intensity of 8-neighbourhood connectivity, we supply a preferred histogram, histeq chooses the grayscale conversion T to minimize(attenuate).

$$| c_1(T(k)) - c_0(k) |$$

In below we state that the change of histogram from original image and after smearing the contrast enhancement using histogram equalization.

Cell Segmentation

It measures a group of properties for every labelled region within the label matrix. It delivers a function called region props(). Bounding box is used to measure the properties of the image region. The region will be removing from the input image after labeling the connecting components.

Pre processing

This phase consists of conventional techniques for example, improving the visibility of the image and some enhancement in image, image filtering. Some of the basic filters are applied on the area of number plate that is Histogram Equalization, Morphological filters and Median filters.

For any image processing histogram equalization is one of the most important part of the software. It improves the goal of histogram equalization and contrast is to obtain a uniform histogram. This technique is used on a whole image.

Normally median filter is used to reduce noise in an image; it often does a much better job than the mean filter of preserving useful detail within the image. Median filtering is very effective noise removal filtering process and is simple. Its performance is especially good for removing shot noise. Shot noise comprises of strong spike like isolated values. This class of filter belongs to the category of edge preserving smoothing filters which are non-linear filters. While keeping the tiny and sharp details this filter smooths the information..

Filtering of Cells

Now the black and white image of the wbc are often obtained. It has been cropped to an oblong shape during which it enhances the algorithm to be more uniformed within the further stages. The non-digits substance which appears within the image is caused by the noise (quantization which will transform to „Black“), object or substance which isn't digits/characters like screws, sand, water droplet, frame lines, effects on JPEG compression.

By Filtering, noise or unwanted substances can be removed or filtered out that is not a character or digits. Finally, the image is only left with cells and digits in which we are interested.

The 2 stages of the algorithm is cts.

1)Remove out the connected components or small objects

Identify the frame line that's connected to the digits and separate it. Identify and remove away the small connected objects.

Image segmentation

Image segmentation is used in order to extract and analyzed the object characteristic, the process which need to partition the image into different parts that will have a strong correlation with the objects.

Segmentation process that can be categorized into several parts. Firstly is the global knowledge of an image. Histogram represents the features of the image.. Secondly, in the boundary-based segmentation edge detection is used to obtain the objects and region contours will construct from the obtain contours. Another one is edge-based segmentation. For this paper, first category segmentation method is getting used which is by using threshold.

Database

It is a collection of information or data which it is being orderly organize, where it can be accessed easily and updated. Database can be in the form of text, images and contents and is needed in order to make sure that the image space can contained enough characters which have been extracted and the vehicle number plate number stored in the excel sheet for the purpose of comparison. In order to improve the better chances of obtaining the correct result and accuracy ,data base would be large enough.If the computed ratio is correct that will be checked by the class recognition . If the image thresholding is too low it will ignore the class. If the class is matched correctly, it will be compared with data set in the predefined database and provides an output if the image is recognized correctly.

Cell Recognition

In this step, the extracted characters that are resized to suit the characters into an window. Each character is normalized to the size of (50x30) binary image for the paper and then follow by reshape to standard dimension before sending the data set to neural network for training. Its performance is especially good for removing shot noise. Shot noise comprises of strong spike like isolated values. This class of filter belongs to the category of edge preserving smoothing filters which are non-linear filters. This filter smooths the information while keeping the tiny and sharp details. Input the image that is taken from the data base.

4.2 SYSTEM REQUIREMENTS:

Hardware requirements:

- Processor : Any Processor above 500 MHz.
- Ram : 4GB.
- Hard Disk : 160 GB.
- Input device : Standard Keyboard and Mouse.
- Output device : VGA and High Resolution Monitor

Software requirements:

- Operating System : Windows Family.
- Language : MATLAB R2018a or above3.3 MATLAB

4.3 INTRODUCTION TO MATLAB

MATLAB is that the application-oriented language and interactive environment employed by many engineers and scientists worldwide. It allows you to explore and visualize ideas and collaborate across disciplines including signal and image processing, communications, control systems, and computational finance. The name MATLAB stands for Matrix Laboratory. MATLAB was written originally to supply quick access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects.

MATLAB [1] could even be a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is modern programming language environment: it's sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an outstanding tool for teaching and research MATLAB has many advantages compared to plain computer languages (e.g., FORTRAN) for solving technical problems. MATLAB is an interactive system

whose basic data element is an array that doesn't require dimensioning. The software package has been commercially available since 1984 and is now considered as a typical tool at the foremost universities and industries worldwide. MATLAB provides several tools which may be used to control the flow of a program (script or function).

MATLAB is additionally a programming language. Like other programming languages, MATLAB has some deciding structures for control of command execution.

4.4 FUNDAMENTALS OF IMAGE PROCESSING

Image processing convert an image signal in to a physical image. Image processing is an physical process. The image signal can be either digital or analog. The actual output itself can be an actual physical image or the characteristics of an image. The digital imaging field that created new applications and tools that are previously impossible. Face recognition software, medical image processing and remote sensing are all possible due to the development of digital processing. Specialised computer programs are used to enhance and correct images. These programs apply algorithms to the actual data and to reduce signal distortion, clarify fuzzy images and add light to an underexposed image.

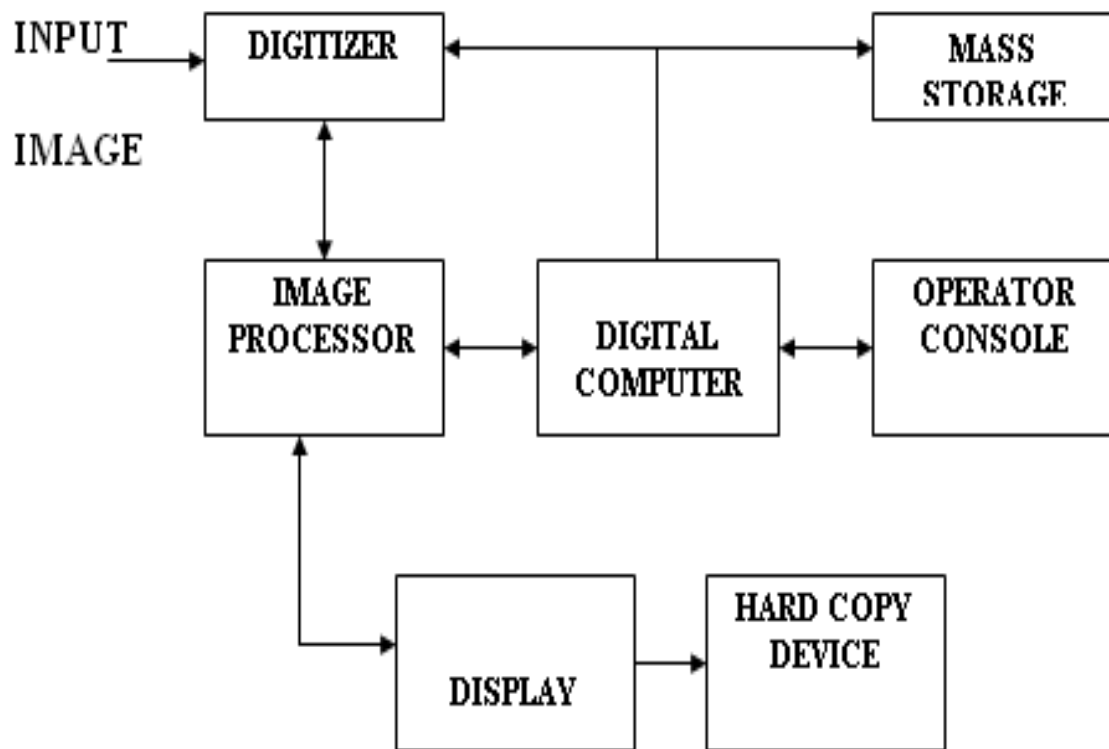


Fig 4.4 : block diagram for image processing system

Digitizer

An image is converted by an digitizer into a numerical representation suitable for input into a digital computer. Some common digitizers are

1. Microdensitometer
2. Flying spot scanner
3. Image dissector
4. Videocon camera
5. Photosensitive solid- state arrays.

4.5 IMAGE PROCESSOR

An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and eventually displays or records the resulting image. The fundamental sequence involved in an image processing system is given by the following block diagram.

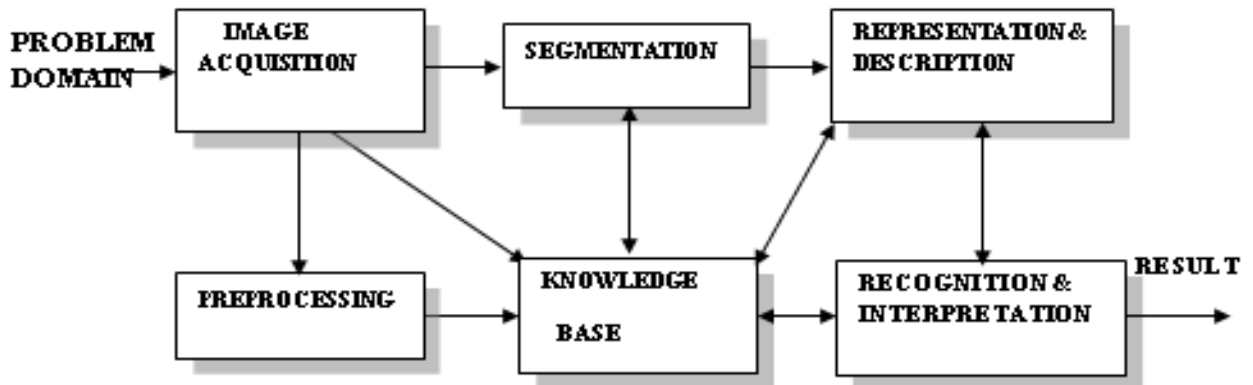


FIG 4.5 : BLOCK DIAGRAM OF FUNDAMENTAL SEQUENCE INVOLVED IN AN IMAGE PROCESSING SYSTEM

The first step in the process is image acquisition by an imaging sensor in the conjunction with a digitizer in order to digitize the image. The next step is the pre-processing step where the image is that's improved and is being fed as an input there to of the opposite processes. Pre -processing typically it deals with removing noise, enhancing, isolating regions, etc. Segmentation divides an image into its constituent objects or that of the parts.

The segmentation output is usually raw pixel data, it consists of either the pixels in the region or the boundary of the region themselves. Representation is nothing but the process of transforming the raw pixel data into a form which is useful for subsequent processing by the computer. Description that it deals with the extracting features that are basic in differentiating the one class of objects from another. Based on the information provided by its descriptors/recognition assigned a label to an object. Interpretation it involves assigning meaning to an ensemble of recognized

objects. About a problem domain that is incorporated into the knowledge base. Operation of each processing module is guided by the knowledge base and also it controls the interaction between the modules.

Digital Computer

Mathematical processing such as convolution, averaging, addition, subtraction, etc. Of the digital image are done by the computer.

Mass Storage

The secondary storage devices normally used are CD ROMs, floppy disks.

Hard Copy Device

The hard copy device is responsible for the storage of the software involved and is used to produce a permanent copy of the image.

Operator Console

The operator console consists of arrangements and equipments for alterations in the software as and when require and also for the verification of intermediate results. It is also capable of checking for the entry of requisite data and for any resulting errors.

4.6 IMAGE PROCESSING TECHNIQUES

This section gives various image processing techniques.

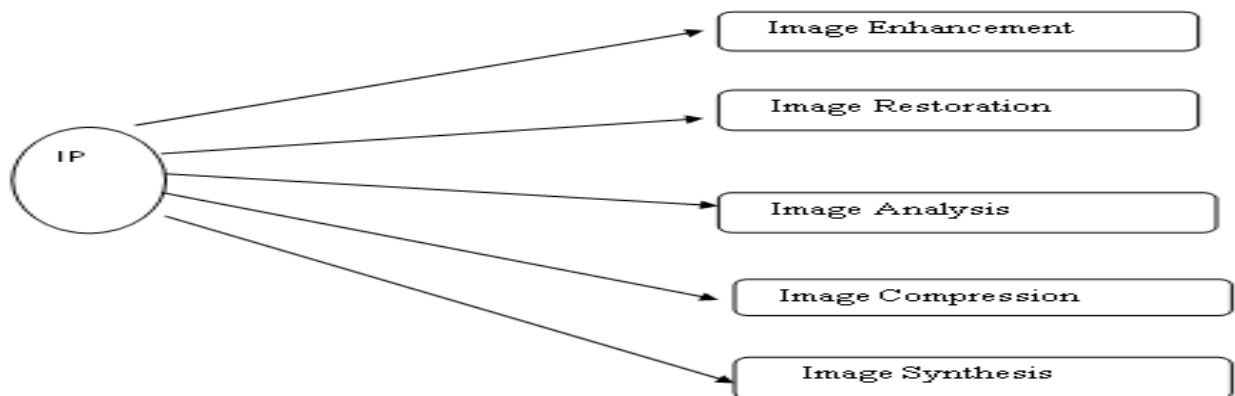


FIG 4.6 : IMAGE PROCESSING TECHNIQUES

Image Enhancement

Operations improve the qualities of an image like improving the brightness characteristics of the image and also improving image's contrast. reducing it sharpen the details or reducing its noise content. Therefore this enhances the image and it reveals the same information in more understandable image. Where it does not add any information to it.

Image Restoration

Same like enhancement, image restoration improves the qualities of image but all the operations that are mainly based on known, degradations or measured of the original image. Image restorations that restores the images. Problems such as geometric distortion, repetitive noise, camera motion and improper focus. Image restoration helps to correct images for known degradations.

Image Analysis

Numerical or graphical information is produced by the image analysis based on characteristics of the original image. They break into objects and then classify them. As they depend on the image statistics. Extraction and description of scene and image features, object classification and automated measurements are the common operations. In machine vision applications mainly image analyze is used.

Image Compression

Image compression and decompression that reduce the data content which is necessary to describe the image. Many of the images contain lot of redundant information, so the compression it removes all the redundancies, the size is reduced because of the compression,so stored or transported efficiently. The compressed image that is decompressed when displayed. Exact data in the original image is preserved by the lossless compression, Lossy compression provide excellent compression but it does not represent the original image.

Image Synthesis

Image synthesis operations create images from non-image data or from other images. Image synthesis operations generally create images that are either impractical to accumulate or physically impossible.

4.7 IMAGE TYPES

There are many ways of encoding the information in an image.

1. Binary image
2. Grayscale image
3. Indexed image
4. True color or RGB image

Binary image

Each pixel is just black or white. Since there are only two possible values for every pixel (0, 1), we only need one bit per pixel.

Gray scale image

Each pixel may be a shade of gray, normally from 0 (black) to 255 (white). This range means that each pixel can be represented by exactly one byte or eight bits. Other grayscale ranges that are used, but generally they are a power of Grayscale Image.

Indexed image

An indexed image consists of an colour map matrix and array. In the array the pixel values are direct indices into a colour map. By convention, this documentation uses the variable name map to refer to the colour map and X to refer to the array.

True color or RGB image

Each pixel features a particular color; that color is described by the quantity of red, green and blue in it. If each of those components features a range 0–255, this provides a complete of 2563 different possible colors. Such a picture may be a “stack” of three matrices; representing the red values, green values and blue values for every pixel. This means that for each pixel there correspond 3 values.

4.8 APPLICATIONS OF IMAGE PROCESSING

Image processing has a broad spectrum of applications; almost each and every area of technology and science can make use of image processing methods. Here may be a list just to offer some indication of the range of image processing applications.

Document Processing

Documents to a digital image form, also used in scanning, compressing the image, and then storing it on magnetic tape. It is also used in document reading for automatically recognizing and detecting printed characteristics.

Medicine

Interpretation and inspection of images that are obtained from X-rays, MRI or CAT scans, of chromosome karyotype, analysis of cell images. In medical applications, one is concerned with processing of cine angiograms, projection images of transaxial tomography processing of chest X-rays and other medical images that occur in nuclear magnetic resonance (NMR), ultrasonic scanning and radiology. These images may be used for patient monitoring or for detection of tumors or for patient screening or other disease in patients.

Industry

Automatic inspection of things on a inspection of paper samples, assemble line.

Defence /Intelligence

It is used in reconnaissance photo-interpretation for automatic interpretation of earth satellite imagery to look for sensitive targets or military threats and target acquisition and guidance for tracking targets in real-time smart-bomb and missile-guidance systems and recognizing.

Radar Imaging System

Sonar and radar images that are used for recognition and detection of varied sorts of targets or in guidance and maneuvering of aircraft or missile systems.

Agriculture

Aerial/satellite views of land, for instance so as to workout what proportion of land is getting used for various purposes, or to research the suitability of various regions for various crops, inspection of vegetables and fruits distinguishing good and fresh produce from old.

CHAPTER 5

RESULT AND DISCUSSION

5.1 RESULT

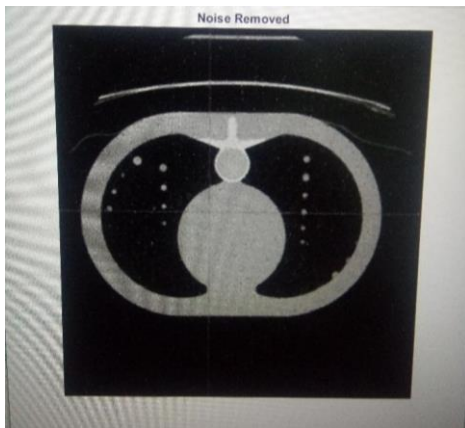


Fig: 5.1.1 noise removed picture

- Noise removal algorithm is the process of removing the noise of the image.
- The noise removal algorithm remove the visibility of noise by smoothing the entire image leaving areas near contrast boundaries.

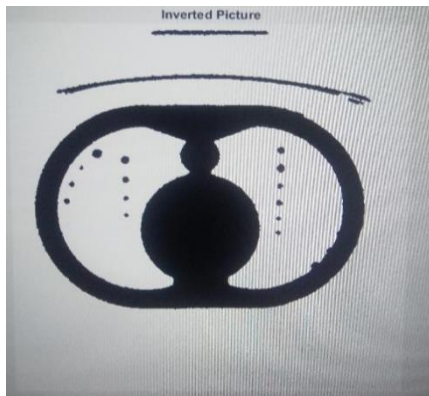


Fig: 5.1.2 inverted grey scale picture

- The reason behind choosing grey scale image is even minimum pixel intensity is also helpful in detecting changes in the cells

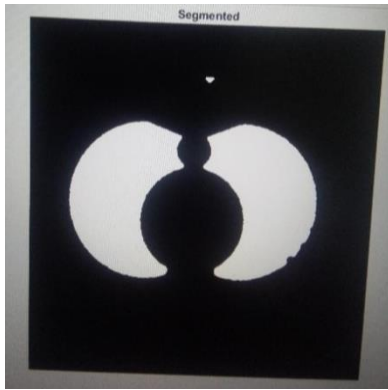


Fig: 5.1.3 segmented image

- Segmentation divides the image into its constituent regions.

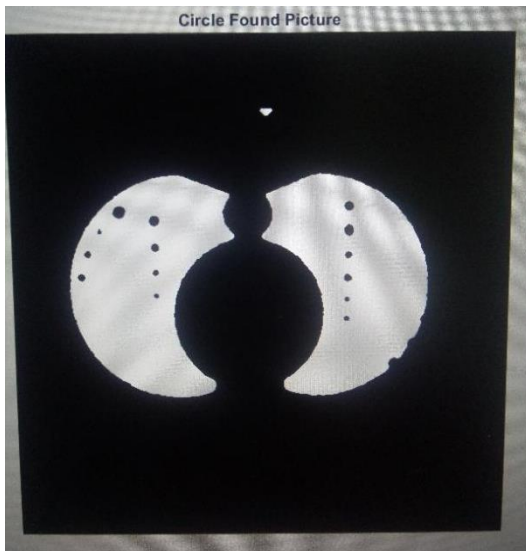


Fig: 5.1.4 circle(tumour) found picture

- It differentiate the tumor areas from the picture

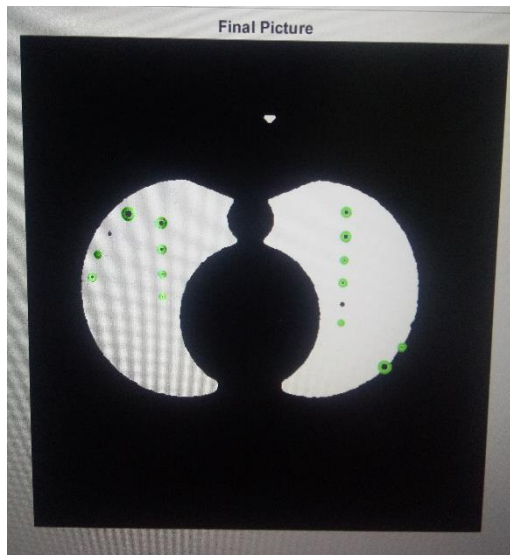


Fig: 5.1.5 Final Picture (An abnormal image)

- The output of the image contain pixels of infected lung tissues which are not labelled
- This figure clearly represent the infected areas of lung

5.2 DISCUSSION

As we know lung cancer is one of the most dangerous diseases in the world. An image improvement technique is development for earlier diseases detection and treatment stages. Correct diagnosis and early detection of lung cancer can increases the survival rate. Image quality and accuracy is the core factors of this research, image quality assessment as well as enhancement stage. This project is based on the processing of computed tomography images. We also conclude that the lung cancer can be detect earlier by using this method.

For experimentation of the proposed technique, the CT images are obtained from a Lung Image Database Consortium data set that provides the chance to do the suggested research. Collected lung images are passed to the proposed this system. The diagnosis rules are generated from those pictures and these rules are passed through the classifier for the learning process. After learning, a lung image is passed to the prosed system. Then the proposed system will process through its processing steps and finally it will detect whether the supplied lung image is with cancer or not.

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 SUMMARY

In this project we have detected a presence of lung cancer in a computed tomography (CT) images and classified into normal and abnormal images. Removed noise and segmented using KNN algorithm. Classified using PCA classifier.

6.2 CONCLUSION

An image processing technique is built to detect diseases at early stage of cancer so the patient can take the treatment at early stages. The time factor is major major factor to discover the abnormal tissue in target x-ray images. The accuracy and therefore the quality of image is one the main core factor of this research. Image quality also as image enhancement stage were adopted as low pre-processing techniques based on gaussian filter. This technique is efficient for segmentation stage so the region of interest for feature extraction obtaining. on the basis of general features a normality and abnormality comparison is formed.the main feature for detection of accurate image comparison are pixel percentage and mask labelling which provides us the indication that the method of detection this disease plays a really important and essential role to avoid serious stages and to reduce its percentage distribution within the world.In order to get more accurate results we go for three stages: Image Enhancement stage, Image Segmentation stage and Features Extraction stage.

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APENDEX

SOURCE CODE

```
function lungAnalysis(image_jpg)

[filename,filepath]=uigetfile({'*.jpg'},'Select input image');

input_img = imread(strcat(filepath, filename));

figure,imshow(input_img);

% Resize image

input_imgr = imresize(input_img, [584 565]);

figure,imshow(input_imgr);


%Reads Image Files

%Selected_Image = imread(image_jpg); %read picture

%subplot(3,3,1); %divides figure into rectangular panes

%imshow(Selected_Image); %show image

title('Selected Image'); %image name


%Noise Removal Section

greyscale_Method = rgb2gray(input_imgr); %convert into grayscale
```

```
median_filtering_Image = customfilter(greyscale_Method); %Uses Noise  
Removal
```

```
%subplot(3,3,2); %divides figure into rectangular panes
```

```
figure,imshow(median_filtering_Image); %show image
```

```
title('Noise Removed'); %image name
```

```
%Binary Image Conversion
```

```
binary_picture = im2bw(median_filtering_Image, 0.2); %Convert into Black  
and White
```

```
%subplot(3,3,3); %divides figure into rectangular panes
```

```
figure,imshow(binary_picture); %show image
```

```
title('Binary Image'); %image name
```

```
44%Create morphological structuring element
```

```
se1 = strel('disk', 2); %creates a flat, disk-shaped structure,
```

```
postOpenImage_1 = imopen(binary_picture, se1);
```

```
%subplot(3, 3, 4); %divides figure into rectangular panes
```

```
figure,imshow(postOpenImage_1); %show image
```

```
title('Opening Image'); %image name
```

```
%Create morphological structuring element

se2 = strel('disk', 8); %creates a flat, disk-shaped structure,

postOpenImage_2 = imopen(binary_picture, se2);

inverted = ones(size(binary_picture));
```

```
%Creates Inverted Picture

invertedImage_1 = inverted - postOpenImage_1;

invertedImage_2 = inverted - postOpenImage_2;

%subplot(3,3,5); %divides figure into rectangular panes

figure,imshow(invertedImage_1); %show image

title('Inverted Picture'); %image name

%Specify initial contour

mask = zeros(size(invertedImage_1));

mask(50:end-50,50:end-50) = 1;
```

```
%Segments image into foreground and background

bw_1 = activecon
```

```

tour(invertedImage_1, mask, 800); %800 iterations

bw_2 = activecontour(invertedImage_2, mask, 400); %400 iterations

%Create Combination Pictures with Inverted image and Contour

mix_Image_1 = invertedImage_1 + bw_1;

filter_mix_Image_1 = medfilt2(mat2gray(mix_Image_1),[5 5]); %Filtering

mix_Image_2 = invertedImage_2 + bw_2;

filter_mix_Image_2 = medfilt2(mat2gray(mix_Image_2),[7 7]); %Filtering


%Black White Combination to Create Final Images

final_2 = im2bw(filter_mix_Image_2, 0.6);

final_1 = im2bw(filter_mix_Image_1, 0.6);

pre_final = final_1; %transfer

%subplot(3,3,6); %divides figure into rectangular panes

BW5 = imfill(pre_final,'holes');

figure,imshow(BW5); %show image

title('Segmented'); %image name


%Display Final Image

%subplot(3,3,7); %divides figure into rectangular panes

```

```

figure,imshow(final_1); %show image

title('Final Picture'); %image name


%Find Circles within Image using Polarity and Sensitivity

warning('off', 'all')

circle_image = final_1;


[centers,radii] = imfindcircles(circle_image,[1
9],'ObjectPolarity','dark','Sensitivity',0.88);

viscircles(centers,radii,'EdgeColor','g'); % Circles Display Green

display(size(centers, 1), ' Numbers of Circles');

%subplot(3,3,8); %divides figure into rectangular panes

figure,imshow(circle_image); %show image

title('Circle Found Picture'); %image name


segment_pic = final_2 - final_1; % Creates Segmented Image


%Creates before Colour Image

pre_colour_pic = im2bw(medfilt2(mat2gray(segment_pic),[3 3]), 0.6);

%subplot(3,3,9); %divides figure into rectangular panes

figure,imshow(pre_colour_pic); %show image

```

```

title('Circles Segmented'); %image name

%Circles Segmented Circles

[B] = bwboundaries(pre_colour_pic,'holes');

hold on

for k = 1:length(B)

    boundary = B{k};

    plot(boundary(:,2), boundary(:,1), 'g', 'LineWidth', 2)

end

end

clc

clear all

close all

%%

img1 = imresize(imread(fname),[256 256]);

figure,image(img1);

colormap(gray(256));

title 'Input Image'

```

```

I=img1;

%% Convert to grayscale

if ndims(I)==3

    gray = rgb2gray(I);

    Else

        gray=I;

end

figure,imshow(gray);

title 'Input Image in GrayScale form'

%% Otsu Binarization for segmentation

level = graythresh(I);

img = im2bw(I,level);

figure, imshow(img);

title('Otsu Thresholded Image');

Drawnow.,

%% Detect the SIFT features:

fprintf(1,'Computing the SIFT features for ima1.jpg...\n')

[features1,pyr1,imp1,keys1] = detect_features(img1);

%%

```

```

figure,showfeatures(features1,img1);

title('SIFT features of Input Image');

drawnow;

%%

figure,plotpoints(features1,img1,0);

title('Points of Input Image');

drawnow;

%%

[M N v]=size(I);

I=gray;

data=double(reshape(I,[size(I,1)*size(I,2) 1]));

n=3;


[center, U, obj_fcn] =fcm(data, n);

maxU = max(U);


data = data';


wholeD = zeros(size(data));

```

```

for k = 1:n

    indexk = (U(k,:) == maxU);

    Ik = indexk.*data;

    Ik = reshape(Ik,M,N);

    result{k} = Ik;

    wholeG(indexk) = k-1;

end

mean_cluster_val = zeros(3,1);

for k = 1:n

    mean_cluster_val(k) = mean(center(k));

End

[mean_cluster_val,idx] = sort(mean_cluster_val);

imgr=result{idx(end)};

imgr=medfilt2(imgr,[1 1]);

figure,imshow(imgr);

hh=imgr;

title(['Segmented image with ',num2str(n),' bins']);

```

```

imwrite(hh, strcat('seg_img.bmp'))

seg_img=hh;

% Extract features using DWT

x = double(seg_img);

m = size(seg_img,1);

n = size(seg_img,2);


signal1 = seg_img(:,:);

[cA1,cH1,cV1,cD1] = dwt2(signal1,'db4');

[cA2,cH2,cV2,cD2] = dwt2(cA1,'db4');

[cA3,cH3,cV3,cD3] = dwt2(cA2,'db4');


DWT_feat = [cA3,cH3,cV3,cD3];

G = pca(DWT_feat);

whos DWT_feat

whos G

g = graycomatrix(G);


stats = graycoprops(g,'Contrast Correlation Energy Homogeneity');

Contrast = stats.Contrast;

```

```
Correlation = stats.Correlation;
```

```
Energy = stats.Energy;
```

```
Homogeneity = stats.Homogeneity;
```

```
Mean = mean2(G);
```

```
Standard_Deviation = std2(G);
```

```
Entropy = entropy(G);
```

```
RMS = mean2(rms(G));
```

```
%Skewness = skewness(img)
```

```
Variance = mean2(var(double(G)));
```

```
a = sum(double(G(:)));
```

```
Smoothness = 1-(1/(1+a));
```

```
Kurtosis = kurtosis(double(G(:)));
```

```
Skewness = skewness(double(G(:)));
```

```
% Inverse Difference Movement
```

```
m = size(G,1);
```

```
n = size(G,2);
```

```
in_diff = 0;
```

```

for i = 1:m

    for j = 1:n

        temp = G(i,j)./(1+(i-j).^2);

        in_diff = in_diff+temp;

    end

end

IDM = double(in_diff);


feat = [Contrast,Correlation,Energy,Homogeneity, Mean, Standard_Deviation,
Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM];


load Features

xdata = meas;

group = label;

species= label;


g1='ORIGINAL';

g2='FORGERY';

X=meas;Y=label;

```

```
mdl = fitcknn(X,Y)
```

```
c = knnclassify(feats,meas,label);
```

```
hyu=cell2mat(c);
```

```
det=[];
```

```
disp('After Classification, the selected is original it shows "det=1" otherwise it  
shows "det=0"')
```

```
helpdlg('After Classification, the selected is original it shows "det=1" otherwise  
it shows "det=0"')
```

```
pause(2)
```

```
rloss = resubLoss(mdl)
```

```
cvmdl = crossval(mdl);
```

```
kloss = kfoldLoss(cvmdl)
```