UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF COMPUTED TOMOGRAPHY LUNG CANCER ANALYSIS SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology with Honours.

by

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I hereby, declared this report entitled DEVELOPMENT OF COMPUTED TOMOGRAPHY LUNG CANCER ANALYSIS SYSTEM is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kanser paru-paru ialah salah satu bentuk kanser yang paling popular. Diagnosis awal kanser paru-paru dengan pendekatan penjagaan yang betul adalah penting untuk kehidupan individu. Dalam projek ini, kaedah ambang untuk segmentasi dan pengekstrakan lesi paru paru telah dicadangkan dalam Sistem Analisasi Kanser Paru-Paru Tomografi Dikira. Laporan ini memberikan kaedah pengesanan kanser yang diperoleh daripada imbasan CT DICOM Lung untuk mengenal pasti lesi kanser. Imej pra-proses (ambang) dikumpulkan selepas mengimbas imej CT Paru.Seterusnya, fokus pada ciri-ciri tekstur pada imej paru-paru dalam perisian MATLAB dan aplikasi ALIZA. Tujuan projek ini adalah untuk menunjukkan keadaan perbandingan ukuran dan prestasi lesi menggunakan pemprosesan gambar barah paru-paru dan menilai ketepatan ambang iaitu Teknik Ambang dan Kaedah Fuzzy. Sistem ini menggunakan konvensyen visual untuk mewakili perkembangan system analisis barah paru-paru Tomografi Dikira. Gambar asal dan gambar segmen dari proses segmentasi adalah antara gambar di dalam Sistem GUI. Nommbor dan ukuran lesi pesakit ditunjukkan juga di dalam Sistem GUI. Gambaran kaedah ambang menjadi jelas bahawa ukuran dan keluaran harus saling menghampiri, dibandingkan dengan dua kaedah iaitu Teknik Ambang dan Kaedah Fuzzy. Akhirnya, pretasi tekah dikira dari pengukuran lesi di MATLAB dan dibandingkan dengan ukuran lesi dari aplikasi ALIZA.

ABSTRACT

Lung cancer is one of the most popular forms of cancer. Early diagnosis of lung cancer with proper care is important for the life of the individual. In this project, threshold methods for segmentation and extraction of lung lesions have been proposed in the Computed Tomography Lung Cancer Analysis System. This report provides a cancer detection method texture features derived from the DICOM Lung CT scan for the recognition of cancerous lesions. The pre-process images by thresholding collected after scanning Lung CT images. Next, focus on features of lesion in the lung image that have cancer in MATLAB Software and ALIZA Application. The purpose of the project is to present the state of comparison of seize and performance lesion using image lung cancer processing and evaluating the accuracy of segmentation by thresholding that is Otsu Thresholding and Fuzzy C Means. This system use visual conventions to represent the development of Computed Tomography lung cancer analysis system on Graphical User Interface. The original image and segment image from segmentation process are among the images in the GUI system. Patient number and size of lesion displayed also in GUI System. The image of the thresholding method became clear that the size and output should be approaching, comparing from the two methods, OTSU Thresholding and Fuzzy C Means. Finally, the performance had calculated from the lesion size measurements in MATLAB and compared to the size of lesion from ALIZA Application.

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LIST OF ABBREVIATION

2D	-	2 Dimension
3D	-	3 Dimension
4D	-	4 Dimensions
AC	-	Alternating Current
CM	-	Centi Meter
MM	-	Milli Meter
HU	-	Hounsfield Unit
CAD	-	Computed Aided Detection
CT	-	Computed Tomography
LIDC	-	Lung Image Database Consortium
FCM	-	Fuzzy C Means
FMM	-	Finite Mixture Model
SOM	-	Self-Organizing Maps
MLP	-	Multi-Layer Perceptron
SVM	-	Support Vector Machine
MRF	-	Markov Random Fields
DICOM	-	Digital Imaging and Communications On Medicine
SSMs	-	Statistical Shape Models
FPNs	-	False Positive Nodules
TPNs	-	True Positive Nodules
MRI	-	Magnetic Resonance Imaging

PET	-	Positron Emission Tomography
ROI	-	Release of Information
GUI	-	Graphical User Interface
RGB	-	Red Green Blue
SNR	-	Signal to Noise Ratio
FOV	-	Field of View

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CHAPTER 1

INTRODUCTION

1.1 Background

Lung Cancer is the primary cause of the disease related death globally, with 30%-40% happening in developing countries. More than 1.8 million cases of lung cancer globally have resulted in 1.6 million deaths in 2012. Prevalence of lung cancer and consequent death from lung cancer is expected to increase over the next decade due to an increase in smoking rate. (Siang and John, 2016)

Proof that early detection of lung cancer has resulted more effective. Within this research, a Computer-Aided Detection (CAD) method is introduced is an effort to identify lung cancer areas utilizing Computed Tomography (CT) images. (El-Baz *et al.*, 2013)

CT scan is one of the imaging techniques used to examine disease or lesion. CT stands for computed tomographic modality, which depicts the scanned organ in a black and white setting. This modality often includes graphical readings at its edges in order to pinpoint the diseased region precisely. Big shifts, such as when the illness is at malignant level, display a noticeable improvement in the CT scan. In fact, the cancer checks are carried out and a CT scan of the lung is obtained for examination.

1.2 Problem Statement

Medical neglect is a major public health issue and a leading cause of death. According to specific physical conditions such as human visual system impairment,

exhaustion and agitation, physicians do not allow optimum use of CT images data. It is difficult to find a consistent and feasible solution that minimises the chances of a repeat case. Differentiating the infected of the cancer in the lungs and providing the proper solution to the problem are also the toughest in the medical job. Classification problems and the related solutions to get a better image of nodule. Image analysis may be solvent for this form of challenge, in particular to distinguish cancer affected areas in the lungs.

This research is suggested in order to increase the quality and precision of manual disease diagnosis. With this implementation manual work can be minimized and categorizing the distinction computer applications in any CT datasets can be performed automatically. It may serve to prevent a medical mistake and a misdiagnosis. It can be done by compiling a sample of correct CT scan readings and adding a sample classification algorithm. This research also carried out a review of the evidence on lung cancer and recommends the best method use to read the image of the nodule in lung.

1.3 Objective

The proposed CAD method has three key phases: segmentation the CT images, classification of identified areas that is lesions and compare the performance between methods used. The research is qualified, tested and verified using images of lung cancer.

Results obtain in the assessment of the lesion using MATLAB Software. In addition, the propose research can identify which methods is more accurate or closer to the original measurement.

The key objectives of the project are:

- To develop a Computed Tomography Lung Cancer Analysis System

- To proposed Thresholding method for the lung cancer segmentation and extraction.
- To present the state of comparison of lesion size and performance between Thresholding Methods.

1.4 Project Scope

The purpose out of this effort is the new approach that can be used to classify lung nodules. And it has been known to be reasonable accuracy. The algorithm is a series of simple procedure for image processing. In order to build a strong lung cancer screening method, the method utilizes at MATLAB, a high performance programming tool. Toolboxes allow the learning and implementation of specialized technology.

The suggested CAD method begins with the pre-processing of 3D CT scans utilizing segmentation, normalization, down sampling and zero-centering. The final classification stage deals with patterns that are depicted as point in a feature space. Seeking judgement boundaries in such vector spaces is a core concern in the theory of pattern recognition. The dataset for lung cancer images is from The Cancer Imaging Achieved (TCIA).

The purpose of the project is to present the state of comparison using image lung cancer processing and evaluating the accuracy of segmentation by thresholding methods that is Otsu Thresholding and Fuzzy C Means. Thresholding segmentation approaches have been shown to be successful in the measurement of lung lesion and this implementation by Computed Tomography (CT scan). However, the image data collection from the CT scan as a device image had very unique style as DICOM format.

It is because it does not only place the pixel of the image data but also data sets which are made up of attributes. This is because it not only stores image pixel info, but also data sets that are made up of attributes. To process the image requires a few images with only a cancer appearance in the lung, not a process for all pieces of slice image.