Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF CAD SYSTEM FOR CT LUNG CANCER ANALYSIS AND DIAGNOSIS USING GRAPHICAL USER INTERFACE

NAZA SYAHMIE BIN NAHA AZNI

Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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DEVELOPMENT OF CAD SYSTEM FOR CT LUNG CANCER ANALYSIS AND DIAGNOSIS USING GRAPHICAL USER INTERFACE

NAZA SYAHMIE BIN NAHA AZNI

A project report submitted
in partial fulfillment of the requirements for the degree of
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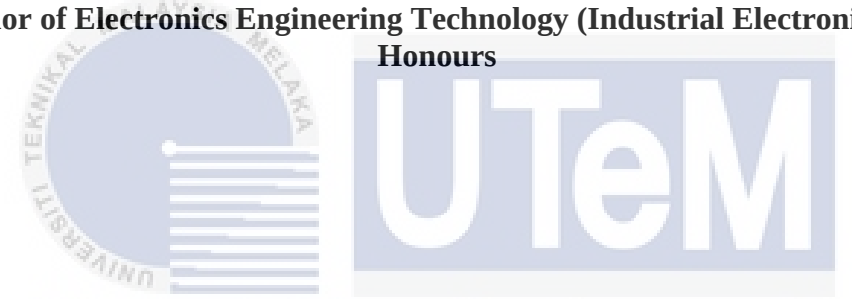

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DEDICATION

Dedicated especially to my adored parents and family

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ABSTRACT

Development of a Computer Aided Design for Computed Tomography (CT) Lung Cancer Analysis and Diagnosis by displaying the picture in MATLAB utilising DICOM data from the LIDC dataset. CT is a non-invasive technique that produces CT pictures of any part of the human body without superimposition of neighbouring structures. The majority of lung tumour cells grow bigger and spread throughout the organs. The CT picture offers further information on the problem of lung cancer diagnosis by chest X-ray, however tiny tumours cannot be seen. To get the best possible result from the CT picture, two stages are required: pre-processing and segmentation. Pre-processing is used to isolate noise in CT images, while segmentation is used to divide the treated CT picture into several areas. The final result will be more accurate by pre-processing images, and the photos will be of more excellent quality. Thus, this work demonstrates how to construct a Graphical User Interface to display DICOM pictures using AppDesigner in MATLAB. To improve the quality of lung cancer segmentation, implying Otsu Threshold, it is possible to distinguish cancer that arises between other organs in the lung. The Otsu Threshold technique is a method for image thresholding based on clustering. It is effective if the histogram is bimodal. Essentially, the method seeks to decrease within-class variation while increasing between-class variance. The picture obtained by thresholding may be used to determine the cancer size's accuracy and compare it to the TCIA dataset with exact values.The ultimate goal of a wide variety of image processing applications is to extract significant characteristics from visual data for the computer to offer a description, interpretation, or understanding of the scene. The term "image processing" refers to the process of modifying or editing an existing image. Image processing aims to visually improve or statistically analyse some feature of the idea that is not immediately visible in its original state.

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ABSTRAK

Pembangunan Reka Bentuk Berbantukan Komputer untuk Analisis dan Diagnosis Kanser Paru Tomografi Berkomputer (CT) dengan memaparkan gambar dalam MATLAB menggunakan data DICOM daripada dataset LIDC. CT ialah teknik bukan invasif yang menghasilkan gambar CT mana-mana bahagian badan manusia tanpa superimposisi struktur jiran. Majoriti sel tumor paru-paru tumbuh lebih besar dan merebak ke seluruh organ. Gambar CT menawarkan maklumat lanjut tentang masalah diagnosis kanser paru-paru melalui X-ray dada, namun tumor kecil tidak dapat dilihat. Untuk mendapatkan hasil terbaik daripada gambar CT, dua peringkat diperlukan: pra-pemprosesan dan pembahagian. Pra-pemprosesan digunakan untuk mengasingkan hingar dalam imej CT, manakala segmentasi digunakan untuk membahagikan gambar CT yang dirawat kepada beberapa kawasan. Hasil akhir akan menjadi lebih tepat dengan pra-memproses imej, dan foto akan menjadi lebih berkualiti. Oleh itu, kerja ini menunjukkan cara membina Antara Muka Pengguna Grafik untuk memaparkan gambar DICOM menggunakan AppDesigner dalam MATLAB. Untuk meningkatkan kualiti pembahagian kanser paru-paru, membayangkan Ambang Otsu, adalah mungkin untuk membezakan kanser yang timbul antara organ lain dalam paru-paru. Teknik Otsu Threshold ialah kaedah untuk threshold imej berdasarkan pengelompokan. Ia berkesan jika histogram adalah bimodal. Pada asasnya, kaedah ini bertujuan untuk mengurangkan variasi dalam kelas sambil meningkatkan varians antara kelas. Gambar yang diperoleh melalui ambang boleh digunakan untuk menentukan ketepatan saiz kanser dan membandingkannya dengan set data TCIA dengan nilai yang tepat. Matlamat utama pelbagai aplikasi pemprosesan imej adalah untuk mengekstrak ciri penting daripada data visual untuk komputer menawarkan penerangan, tafsiran atau pemahaman tentang pemandangan. Istilah "pemprosesan imej" merujuk kepada proses mengubah suai atau menyunting imej sedia ada. Pemprosesan imej bertujuan untuk menambah baik secara visual atau menganalisis secara statistik beberapa ciri idea yang tidak kelihatan serta-merta dalam keadaan asalnya.

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LIST OF SYMBOLS

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LIST OF ABBREVIATIONS

GUI	-	Graphical User Interface
dcm	-	DICOM
DICOM	-	Digital Imaging and Communication in Medicine
TCIA	-	The Cancer Imaging Archieve
CT	-	Computed Tomography
LIDC	-	Lung Imaging Database Consortium
CAD	-	Computer Aided Design
MRI	-	Magnetic Resonance Imaging
HU	-	Hounsfield Unit
API	-	Application Program Interface

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CHAPTER 1

INTRODUCTION

In recent years, image processing mechanisms have been widely used in many medical fields to improve the early detection and treatment stages, where the time factor is very important to discover the patient's disease as quickly as possible, especially in cases such as lung cancer. In recent years, due to the relationship between the high incidence of cancer and the difficulty of treatment have attracted the attention of medical and static communities. Early detection of such cancer is very important for successful treatment. There are very few methods to detect this cancer. One of this popular method is to use image pre-processing and image segmentation. The image processing can easily detect the lung nodules. So we prefer the image processing for accuracy and easily detect the lung nodules, which results faster. Digital image processing has some pixels on the image in a physical point. Each pixel has a variable size that is different.

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1.1 Project Background

Worldwide in 2012, lung cancer occurred in 1.8 million people and resulted in 1.6 million deaths. This makes it the most common cause of cancer-related death in men and second most common in women after breast cancer. Smoking causes the most majority of lung cancers both in smokers and in people exposed to secondhanded smoke. But lung cancer also occurs in people who never smoked and in those who never had prolonged

exposure to second-hand smoke. This project intended to detect the lung cancer before it gets more serious and will turn to death. By applying this project, we can find out the stage of the lung cancer and can avoid it from spread to any lymph node. We use medical imaging in our project because it gives a good result when the image process is done on it. We focus on the identification of lung nodules using medical imaging. This image can be patterned in the form of a multi - dimensional system. Lung cancer is a major disorder that affects both children and adults.[1]

1.2 Problem Statement

In 2018, lung cancer is the highest cancer in the worldwide. These facts have led researchers to continue studying how to treat and detect lung cancer. By using CT scan, it can access the heart's structure and pumping function and the structures of the large vessels such as aorta and pulmonary artery to create cross-sectional images of the body. These images provide more detailed information than normal X-ray images.

As we do the analysis, the process of extracting medical images from LIDC dataset is one of the most challenging fields nowadays. The LIDC dataset is too many to be used as test material while the image is almost identical. It provides a volumetric size estimate for all the pulmonary nodules with boundary markings. The reason of this list is to provide a common size index for the selection of subsets of nodules with a given size range.

In advanced technology now make it easier to make the picture look very clear and get a better quality from noise in the picture. By applying technique, which is image pre-processing and image segmentation, we can get better result of the image that have some noise.

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The purpose of this study is to improve the quality and accuracy of manual illness diagnosis. Physical work may be reduced and classifying the distinctions between computer programmes in any CT datasets may be done automatically with this approach. It may help to avoid medical errors and misdiagnosis. This may be accomplished by assembling a sample of accurate CT scan data and including a sample classification algorithm. Additionally, this study conducted a review of the available data about lung cancer and suggests the best technique for reading the picture of a lung nodule.

1.3 Project Objective

The proposed method consists of three phases which is segmentation, classification, and comparison of the computed tomography images of lung cancer. To analyze the data using MATLAB software to see which method is accurate.

The objective of the project is:

a) To develop a CT lung cancer analysis and diagnosis with Graphical User Interface (GUI) by using MATLAB.

b) To propose a thresholding method for segmenting lung cancer.

c) To analyze the accuracy of the cancer size in MATLAB compare to TCIA dataset.

1.4 Project Scope

The project aim is to do analysis and display the result on MATLAB. By using DICOM image from LIDC dataset, we can see the different of size of lung nodule for each image. CT scan image is considered as one of the best methods to diagnose the pulmonary nodules. It uses x-rays to obtain structural and functional information about

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the human body. However, the CT image quality is influenced a lot by the radiation dose. The quality of image increases with the significant amount of radiation dose. By apply the technique that we already talk at above we can reduce the noises in these images.

This project aims to evaluate the accuracy of segmentation by Otsu Threshold method in image lung cancer processing. Otsu Threshold method is a approach includes iterating overall potential threshold values and computing the spread between the pixel levels on each side of the threshold and the pixels that are either foreground or background. It also holds the image's data sets and attributes. This is because it does not only store the image's pixel info, but also the attributes that are made up of it.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain the research of literature related to this project. It contains of some work that already done by other student or institutes. They have also described several concepts of this project in this chapter. This is because the understanding between theory and work will help much in preparing this project.

2.2 Cancer

2.2.1 Historical Cancer

Cancer is an uneven growth of cells (typically from a single defective cell) (usually from a single abnormal cell). Cells have established natural control structures and can now duplicate constantly, invade surrounding tissues, disseminate to remote areas of the body and encourage the development of new blood arteries through which the cells receive nutrition. Cancer (malignant) cells may occur from any tissue inside the body.

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When the cancer cells develop and spread, they produce a mass of malignant tissue called a tumour that invades and kills their neighbouring tissues. The word tumour alludes to the uneven development of body mass. Tumours can be malignant or noncancerous. Cancer cells from the main (initial) place will travel across the body (metastasize).[2]

2.3 Type of Common Cancer

2.3.1 Lung Cancer

Lung cancer is the most common type of cancer in both women and men, and it affects both men and women. According to statistics, smoking is the single most significant risk factor for more than 90 percent of patients who have the condition. On the other hand, lung cancer can develop in those who are exposed to contaminated air.[3]

2.3.2 Breast Cancer

Breast cancer is a cancer kind that is found in a breast. Cancer begins as cells continue to develop out of equilibrium. Breast cancer cells frequently form a tumour that can be detected through x-rays or perceived like a glob. Breast cancer happens nearly exclusively in women, although men may also develop breast cancer.[4]

2.3.3 Brain Cancer

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Brain tumours result from an accumulation of abnormal and unhealthy cells developing in the brain. Brain tumours are classified according to their location, growth rate, and benign or malignant. In addition, the tumour is frequently classified according to its degree of malignancy and its propensity for development and spread.

Tumours of the brain can be benign or malignant. Malignant brain cancers are frequently referred to as brain cancer disease. Brain malignant tumours vary significantly in their development and response to treatment. Others are tightly enclosed (encapsulated) within the capsule and are relatively easy to extract. Some have thick, thin filaments that run through the brain, like a plant's roots.[5]