ANALYSIS OF MEDICAL IMAGING USING DIGITAL IMAGE PROCESSING

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This report is submitted in partial fulfillment of the requirements for the award of the Bachelor of Electronic Engineering (Computer Engineering) with Honours

Faculty of Electronic and Computer Engineering
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Specially dedicated to
My beloved parents, Hj Mohd Hassan Bin Zakaria and Noriah Binti A.Rahman
brother, sisters, respectful supervisor, friends and who those have helped me,
directly and indirectly in my project

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ABSTRACT

This project is about analysis of medical imaging using Digital Image Processing. This project will design and implement image analysis technique such as spectrum analysis to analyze medical image in biomedical imaging. The purpose is to do prediction of normal and 'Silent Sinus Syndrome' disease. Lately, almost all processing of biological and medical information was performed directly by human experts such as doctor need lot of heuristic experience to diagnostic what type of problem that patient get. This project will explain about of 'Silent Sinus Syndrome' disease and how doctor diagnostic this disease. This project will explained step to analysis medical image processing using MATLAB such as MRI image. Parameter extraction based on result on algorithms using MATLAB. At the end of this project, the expected result is getting some information from the 2D-DFT and reconstructs data to contour plot of the image that can categorize the normal health person and the 'Silent Sinus Syndrome' disease to spectrum signal.

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ABSTRAK

Projek ini secara asasnya adalah analisis mengenai imej perubatan dengan menggunakan pemprosesan imej digital. Projek ini mereka dan menjalankan analisis mengenai teknik imej perubatan ditukar kepada isyarat spectrum berdasarkan hasil perbezaan imej perubatan bagi seseorang yang normal dan pesakit 'Silent Sinus Syndrome'. Kebelakangan ini, kebanyakkan pemprosesan biologi dan maklumat perubatan dilakukan secara normal seperti doctor perlu banyak pengalaman dalam menganalisis imej perubatan untuk mengenalpasti masalah yang dihadapi oleh pesakit. Projek ini menerangkan mengenai penyakit 'Silent Sinus Syndrome' dan bagaimana doktor mengenalpasti penyakit ini. Projek ini mengenalpasti imej perubatan seperti imej *MRI* dengan mengunakan perisian MATLAB. Parameter yang digunakan adalah 2D-DFT untuk membuat simulasi imej perubatan ini. Pada akhir projek ini, keputusan yang dijangka ialah dapat menukar imej perubatan kepada isyarat spectrum menggunakan kaedah 2D-DFT dan plot imej dalam bentuk contor plot.

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LIST OF ABBREVIATION

1D-DFT	- one dimensional –Discrete Fourier Transform
2D-DFT	- two dimensional –Discrete Fourier Transform
E	- Ethmoid sinuses
ET	- Eustachian tube orifice
F	- Frontal sinuses
IT	- Inferior turbinate
M	- Maxillary sinuses
MM	- Middle meatus
MRI	- Magnetic Resonance Imaging
O	- Maxillary sinus ostium
S	- Septum
SM	- Superior meatus
SR	- Sphenoethmoidal recess
SS	- Sphenoid sinus
ST	- Superior turbinate
T	- Middle turbinate

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Nowadays, doctors do manual diagnostic of the medical image to diagnostic the type of problem that patient get. In the diagnostic, doctors need lot of experience to analyze the disease. Nevertheless, technologies also got advantages and disadvantages in people life depend how is being applied using technologies such as analysis of medical images using Digital Image processing.

This project will design and implement image analysis technique such as spectrum analysis to analyze medical image in biomedical imaging. The purpose is to do prediction of normal and 'Silent Sinus Syndrome' disease based on medical data.

The accuracy and reliability of such 'manual' diagnostic processes are limited by a number of factors including limitations of humans in extracting and detecting certain features from signal.

This image processing encompasses the techniques that apply mathematical tools to extract important diagnostic information from medical image and biological data. The combination of all these mathematical technique provides the computational skill needed to analyze biomedical signal and image.

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Analysis medical image processing using MATLAB such as MRI image. Parameter extraction based on result on algorithms using MATLAB. The expected result is getting some information from the 2D-DFT and reconstructs data to contour plot.

1.2 Problem Statement

Nowadays, almost all processing of biological and medical information was performed directly by human experts, for example doctor need to do visual inspection. Beside that doctor need lot of heuristic experience to diagnostic what type of problem that patient get.

1.3 Project Objectives

a. To analyze of normal health and 'Silent Sinus Syndrome' disease base on medical data using MRI image.
b. To analyze MRI images of normal health and 'Silent Sinus Syndrome' disease using 2D –DFT and reconstruct data to contour plot.
c. To get features from the extraction of medical image using these algorithm.
d. A computerize analysis can help a clinician get some information or detection of the disease.

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1.4 Project Scope

There are 4 scopes in this project:

a. Firstly, analysis of normal person and 'Silent Sinus Syndrome' disease based on the symptom.
b. This project also analyzes the types of medical image using MRI image.
c. Type image processing algorithm by using 2D-DFT and reconstruct data to contour plot.
d. Find parameter extraction from the 2D-DFT and reconstruct data to contour plot.
e. This project only analyzes technique and finds the extraction, not doing intelligence classification from the extraction.

1.5 Expected Result

At the end of this project, the expected result is getting some information from the 2D-DFT and spectrogram of the image that can categorize the normal health person and the 'Silent Sinus Syndrome' disease.

In the future, low cost software can be developing to help doctor and patient, such as upgrade this analysis to e-health, internet database or website for better health.

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1.6 Thesis outline

This thesis represents five chapters. The following outline below is content of this project:

Chapter 1

The first chapter of this thesis describes about background study, problem statement, and project objective, scope regarding of project and expected result of the project.

Chapter 2

This chapter describe about literature review which is focus on the research and information about the project. Every fact and information which is found through journal or other references will be compared and the better methods have been chosen in this project.

Chapter 3

This chapter explains about the project methodology approach taken and a closer look on how the project implemented. Each achievement and selection taken when the project is implemented will be explained in detail for each stage until the project is success. This chapter also briefly describe about the clock diagram and step of the project and the method that used in this project and how to operate it.

Chapter 4

This chapter will describe about the project finding such as result and the analysis conducted by 2D-DFT and reconstruct image to contour plot techniques. These methods are performed on the medical image data of normal and Silent Sinus disease. Analysis results were obtained in MATLAB for represent the characteristic.

Chapter 5

Discussion and conclusion achieved in this project and also future suggestion in order to improve this project.

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CHAPTER 2

LITERATURE REVIEW

This chapter will explained in detail about Silent Sinus Syndrome disease, medical images of Silent Sinus Syndrome, Magnetic Resonances Image and the Digital Image Processing.

2.1 Medical Image

Medical imaging refers to the techniques and processes used to create images of the human body (or parts thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology).

Medical imaging is often perceived to designate of the set of techniques that noninvasively produce images of the internal aspect of the body. In this restricted sense, medical imaging can be seen as the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect (the observed signal). In the case of ultrasonography the probe consists of ultrasonic pressure waves and echoes inside the tissue show the internal structure.

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2.2 Silent Sinus Syndrome

Silent sinus syndrome is a spontaneous, asymptomatic collapse of the maxillary sinus and orbital floor associated with negative sinus pressures. It can cause painless facial asymmetry , diplopia and enophthalmos [8].

The silent sinus syndrome is characterized by painless enophthalmos associated with involution of the maxillary sinus after infundibular occlusion. It is a well-recognized entity in the field of otolaryngology, but the syndrome remains relatively unknown among radiologists despite its characteristic radiologic features.

2.2.1 Symptom of Silent Sinus Syndrome

The symptom of Silent Sinus Syndrome is nose may feel blocked. The symptoms usually start after exposure to dust or with changes in temperature. These are only general guidelines to sensitive noses. It usually happens when the mucosal lining of the nose is over sensitive to external factors like dust. In medical terms, the Silent Sinus Syndrome is known as allergic rhinitis. It is often mistakenly referred to as “sinus”. Actually sinusitis is a bacterial infection of the air cavities in the facial bones (sinuses) and shows up as thick yellowish discharge.

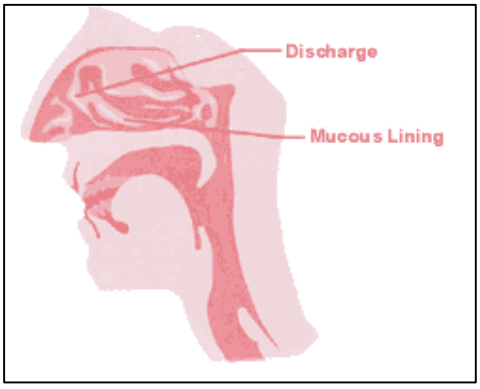

Figure 2.1 Yellowish discharge blocked the nose

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2.2.2 Diagnostic of Silent Sinus Syndrome

There are four sets of sinuses: maxillary, ethmoid, frontal and sphenoid sinuses.

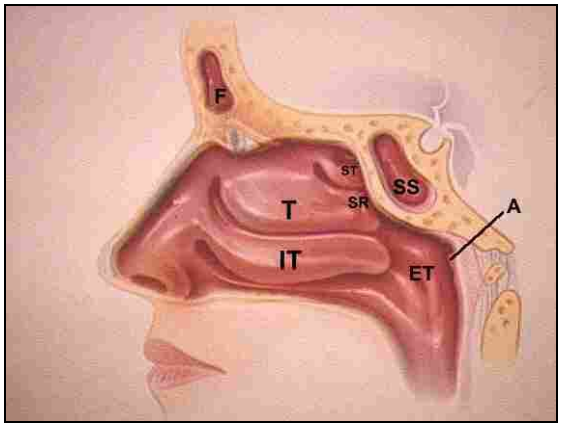

Figure 2.2 Set of Sinuses from side of face

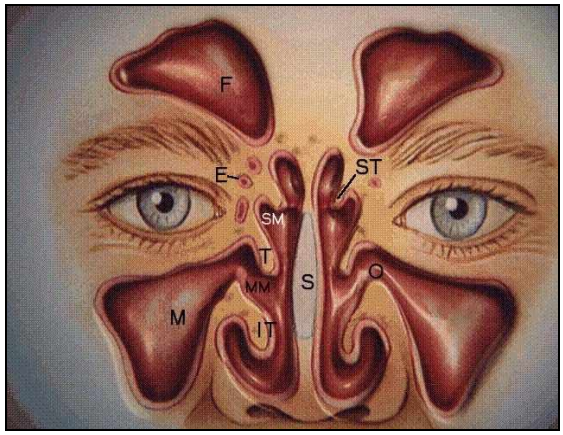

Figure 2.3 Set of Sinuses from in front of the face

LEGEND:

F *- Frontal sinuses*	***E*** *- Ethmoid sinuses*
M *- Maxillary sinuses*	***O*** *- Maxillary sinus ostium*
SS *- Sphenoid sinus*	***ST****- Superior turbinate*
T *- Middle turbinate*	***IT****- Inferior turbinate*
SM*- Superior meatus*	***MM****- Middle meatus*
SR *- Sphenoethmoidal recess*	***S****- Septum*
ET *- Eustachian tube orifice*	***A*** *– Adenoids*

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In the Figure 2.2 representation, the three overlapping flaps of tissue, called turbinates (inferior - IT, middle - T, and superior - ST) protect the openings of the sinuses, and allow humidification, filtration and warming of air. The frontal (F) sinus is seen in this view, but is not usually involved to any great extent in sinusitis. The sphenoid sinus (SS) is also seen in this view, and is sometimes involved in sinusitis. The sphenoid sinus drains into the sphenoethmoidal recess (SR) .

In the Figure 2.3 representation, the maxillary sinuses (M) drain through the maxillary sinus ostia (O) into the middle meatus (MM). It should be noted that in this graphic diagram, the opening at O appears to be extremely large. The ethmoid sinuses (E) drain into both the middle meatus as well as into the superior meatus (SM).

The middle meatus (MM) is bounded by the middle turbinate (T) and the inferior turbinate (IT). (There is also a superior turbinate (ST), but that is relatively unimportant.) Another important structure is the "**ostiomeatal unit**" which is the outflow tract from the sinuses and includes the ostium of each sinus as well as the meati. When blocked, the ostiomeatal unit can cause obstruction of the sinuses, analogous to putting a plug in a bathtub.

The frontal sinuses (F) are occasionally important, but will not be dealt with to any great extent in this discussion. The septum (S) creates a barrier between the two sides of the nose. If it is deviated to a great enough extent, an obstruction can occur. Occasionally, there may be a perforation (hole) in the septum, which can cause problems with the architectural support of the nose.

Usually the diagnosis is suspected clinically, and it can be confirmed radiologically by characteristic imaging features that include maxillary sinus outlet obstruction, sinus opacification, and sinus volume loss caused by inward retraction of the sinus walls.Treatment is surgical involving making an outlet for mucous drainage from the obstructed sinus. A ‘cure’ may be difficult because the underlying cause is the oversensitivity of the person, an inherent cause. Only when medical treatment fails, or when symptoms a sufferer’s work or social life, is surgery considered[7].

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