Faculty of Information and Communication Technology

STEGANOGRAPHY FOR SECURING IMAGE DATA USING HYBRID SLT AND DCT

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اونيۏرسيتي تيکنيکل مليسيا ملاک

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STEGANOGRAPHY FOR SECURING IMAGE DATA USING HYBRID SLT AND DCT

EKO HARI RACHMAWANTO

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in fulfillment of the requirements for the degree of
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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2012

DECLARATION PAGE

I declare that this master project entitled "Steganography For Securing Image Data Using Hybrid SLT and DCT" is the result of my own research except as cited in the references. This masters project has not been accepted for any degree and is not currently submitted in candidature of any other degree.

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Date : 22 June 2012

APPROVAL

I hereby declare that I have read through this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the degree of Master of Computer Science (Software Engineering and Intelligence).

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Date : 22 June 2012

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DEDICATION

To my love: father, mother, sister and brother.

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ABSTRACT

This study proposes a hybrid technique in securing image data that will be applied in telemedicine in future. Based on the web-based ENT diagnosis system using Virtual Hospital Server (VHS), patients are able to submit their physiological signals and multimedia data through the internet. In telemedicine system, image data need more secure to protect data patients in web. Cryptography and steganography are techniques that can be used to secure image data implementation. In this study, steganography method has been applied using hybrid between Discrete Cosine Transform (DCT) and Slantlet Transform (SLT) technique. DCT is calculated on blocks of independent pixels, a coding error causes discontinuity between blocks resulting in annoying blocking artifact. While SLT applies on entire image and offers better energy compaction compare to DCT without any blocking artifact. Furthermore, SLT splits component into numerous frequency bands called sub bands or octave bands. It is known that SLT is a better than DWT based scheme and better time localization. Weakness of DCT is eliminated by SLT that employ an improved version of the usual Discrete Wavelet Transform (DWT). Some comparison of technique is included in this study to show the capability of the hybrid SLT and DCT. Experimental results show that optimum imperceptibility is achieved.

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ABSTRAK

Penyelidikan ini adalah sejajar untuk menghasilkan teknik gabungan dalam mengukuhkan data dalam pengimejan untuk diaplikasikan ke rangakaian teleperubatan di masa akan datang. Menggunakan sistem diagnosis ENT yang berdasarkan web dengan kebergantungan terhadap *Virtual Hospital Server (VHS)*, para pesakit boleh melakukan pemeriksaan sendiri seterusnya menghantar maklumat simptom fizikal dan data multimedia terus ke internet melalui pelayan maya. Dalam sistem teleperubatan,data dalam pengimejan adalah sulit dan memerlukan rangkaian keselamatan untuk memelihara data-data yang dihantar oleh pesakit. Justeru, kriptografi dan steganografi adalah teknik-teknik yang sesuai untuk diaplikasikan untuk menjaga keselamatan data pesakit. Dalam penyelidikan ini, teknik steganografi telah diaplikasikan dengan menggunakan gabungan *Discrete Cosine Transform (DCT)* dan teknik *Slantlet Transform (SLT)*. *DCT* diperolehi hasil dari kiraan blok piksel tersendiri *(blocks of independent pixels)* dan ralat dalam kod program akan menyebabkan ketidaksinambungan antara blok-blok tersebut justeru menyebabkan terjadinya ralat dalam penghasilan blok artifak. Manakala *SLT* pula akan diaplikasikan ke atas imej dan menganjurkan pemadatan tenaga yang lebih baik berbanding *DCT* tanpa halangan ke atas blok artifak. Selanjutnya, *SLT* membahagikan komponen kepada pelbagai jalur frekuensi yang dipanggil jalur sub atau jalur oktaf. Adalah diketahui bahawa *SLT* merupakan teknik yang lebih baik berbanding DWT dari segi penglokalan masa (*time localization*). Namun demikian, terdapat kelemahan dalam *DCT* di mana telah dihapuskan oleh *SLT* yang menggunakan teknik Discrete Wavelet Transform (*DWT*) yang telah diubahsuai menjadi lebih baik. Antara perbandingan teknik yang terdapat dalam penyelidikan ini telah menghuraikan kebolehan teknik gabungan *SLT* dan *DCT* ini. Hasil eksperimen telah menunjukkan ketidakbolehcapaian optimum telah dilaksanakan.

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LIST OF ABBREVIATIONS

SLT	-	Slantlet Transform
ISLT	-	Inverse Slantlet Transform
DCT	-	Discrete Cosine Transform
DWT	-	Discrete Wavelet Transform
HVS	-	Human Visual System
LSB	-	Least Significant Bit
MSE	-	Mean Squared Error
PSNR	-	Peak Signal to Noise Ratio
NC	-	Normalized Correlation

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowdays, internet provides as a tool to send data in where due to the ease of data transmission. In the course of sending data, often there some modification data.

Telemedicine is one of the application which use Internet to communicate and share data. The telemedicine was developed based on multidisciplinary integration of information technology, network technology, medical instrumentations and clinics medicines. The focus of this study is related to there is few application published. According to (C.-hsien Kuo & J.-J. Liu 2010) described Ear-Nose-Throat (henceforth, ENT) medical image in diagnosis system to find the sender of data. Through this system, patient can be sent using virtual hospital server that take an advatage of the internet.

For the example, the patients may ask for a diagnosis at a distance location instead of going to hospital directly. Using Virtual Hospital Server (VHS), physician may process the online diagnosis in the Internet. More attackers could be eliminated by securing methods. Methods and techniques will be secured the data. Both cryptography and steganography are able to secure the data directly or indirectly.

Cryptography uses for encrypt and decrypt data so that data cannot be opened. Steganography is the art of hiding the existence data in another medium transmission to

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achieve secret communication. We focus in steganography to secure the data to hide into another data.

In steganography, secret message is the data that sender wishes to remain confidential and can be text, images, audio, video or any other data that can be represented by a stream of bits. The cover or host which the message is embedded and serves to hide the message called "Stego-Image" (Shejul & Kulkarni 2010).

There are three characteristic to design Steganography: (a) Invisibility (Shejul & Kulkarni 2010), where human eyes cannot distinguish between original and stego-image. Invisibility is also known as imperceptibility. (b) Capacity (Shejul & Kulkarni 2010), where it manage to embed more data, providing that the manage remains its quality. (c) Time Localization, where the use of Slantlet (henceforth, SLT) perform of the stego-image more effectively. In addition, a good time localization properties make a good representation of image (Selesnick 1999).

Additionally, embedded secret data is performed using frequency domain approach – SLT and DCT. Secret data is hidden in one of the high frequency sub-band of SLT by tracing skin pixels in that sub-band or octave-band.

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1.2 Background Study

According to (C.-H. Kuo et al. 2005) present about asynchronous Internet-Based Ear-Nose-Throat (ENT) diagnosis system to promote the location independent diagnosis. As a result were marginally accepted by the physicians. The ENT physician can diagnose the electric patient record (henceforth, EPR) in Internet.

Another paper (C.-hsien Kuo & J.-J. Liu 2010) develop web-based telemedicine system for remote ENT diagnoses to carry out location independent diagnoses. In this case, a patient with chronic middle ear disease and perforated ear drum is tested. A nurse used

an EHD and a SDRS program to submit the EPR to the VHS. A physician review the EPR using web browser and then the symptom can be successfully found, as shown in Figure 1.1.

Figure 1.1 Web Diagnosis for chronic middle ear with perforate ear drum (C.-hsien Kuo & J.-J. Liu 2010)

Meanwhile, the patients site modules of EDH and SDRS will be combined together and then implemented using an Advance RISC Machine (ARM) based embedded system to reduce the wiring complexity and improving the reliability.

In (Shejul & Kulkarni 2010) used steganography method to embed secret data using frequency domain approach are DWT and DCT. Secret data is hidden in one of the high frequency sub-band of DWT by tracing skin pixels in that sub-band. (Negrat et al. 2010) used multiple frequency domain steganography- DWT and DCT technique. In this paper, describe about embedding the secret message in high frequency coefficients to provide a high imperceptibility. Whereas, Sushil Kumar and S.K. Muttoo proposed distortion less data hiding based on T-Codes to be more robust and Slantlet Transform can provide better time localization than compared to DWT base scheme (Kumar & Mutto, 2009).

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This research explain about telemedicine in ENT diagnosis and secure the image data which send back to the patient using steganography algorithm with hybrid SLT and DCT algorithm.

1.3 Problem Statement

In recent years, researchers create new scheme through unitary transform to send the telemedicine images such as Ears, Nose and Throat. The important thinks to make sure secret message without peoples know about the contents. Inserting contents in image of ENT Telemedicine is used to hide information of patient data. Towards securing ENT medical images, this study selecting Steganoghraphy as method to solve this problem which SLT and DCT are selected algorithm.

Whereas, previous research in (Shrestha & Wahid 2010) using DWT-DCT has been achieved good performance in imperceptibility. Seeking the benefit and the drawback of each algorithm was sumarized the capability though the merit technique between DWT-DCT. The last decade find out the improve of DWT that called SLT. It is the opportunity to combine SLT and DCT as improved from DWT-DCT. This

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1.4 Research Question

This study has a main research question is develop steganography algorithm based on Slantlet Transform (SLT) and Discrete Cosine Transform (DCT) in order to hide data patient without people know the contents.

1.5 Research Objective

According to research question above, this study have three objectives are:

1) To proposed hybrid Slantlet Transform (SLT) and Discrete Cosine Transform (DCT) algorithm in order to hide patient data.
2) To analysis the proposed hybrid Slantlet Transform (SLT) and Discrete Cosine Transform (DCT) algorithm.
3) To test and validate the proposed hybrid Slantlet Transform (SLT) and Discrete Cosine Transform (DCT) algorithm.

1.6 Research Scope and Limitation

Every research have scope and limitation. Here, this study has three constraint in the implementation that gives are follows:

1) Steganography has been applied in image, video or audio. Whereas, this study using steganography scheme to implement in telemedicine ears, nose and throat digital image.
2) This study using four image as cover that is in ENT medical image which is in 512x512 pixel, meanwhile the message image size is in 32x32 pixel. Here, all selected images are grayscale.
3) All of an experiment conducted using Matlab by Math Work.

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1.7 Significant and Research Contribution

Steganography usually used as the technique for hiding data, such as to covert communications through internet. In telemedicine medical image, patients send the data using internet, which is has a drawback for securing data. To avoid the data manipulations, Steganography used as the one of method to hide the data. Whereas, this study chose

Steganography to secure medical image data using hybrid of SLT and DCT. The contribution of this study is to provide a hybrid digital image Steganography algorithm that can hide data patient without people know the contents.

1.8 Organization of the Thesis

In this study, all of six chapter has a fouccused of discussion that will be explain below:

Chapter 1 describes an overview of background study while gives a brief of information in Steganography technique that focused to made some constraint for this research that reflecting the research questions and research objectives. In addition, this chapter also explained about the scope and limitation and summary of research contributions.

Chapter 2 Literature Reviews: covers the background of this research. More specially, the introductions to image steganography especially in various transforms domain method are discussed in this chapter.

Chapter 3 covers research methodology of hybrid SLT and DCT in image steganography. It discusses the processes that are used to complete the research.

Chapter 4 Experimental Result presents the finding and results of this research. The analysis and comparison image steganography method between DCT, DWT, DWT-DCT, SLT and SLT-DCT will be done and explained in this chapter.

Chapter 5 Result and Discussion describes overall of experimental result that has been achieved as explained previous chapter.

Chapter 6 Conclusion and Future Work discuss and conclude on overall research. This chapter will present the conclusion and recommendations that are related to each research objectives of this research.

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1.9 Summary

This study is to propose Steganography technique based on Slantlet Transform (SLT) and Discrete Cosine Transform (DCT) transform domain in order to hide data patient without people know the contents.

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CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

Inside of literature review basics and foundation of steganography has been summarized. The researcher investigates that reader may not know about the steganography before. The reader can know and summarized from the study and analysis the current issues involving topic for the project. This chapter focuses in digital image steganography using hybrid Discrete Cosine Transform (henceforth, DCT) and Slantlet Transform (henceforth, SLT).

In section 2.1 describe introduction of literature reviews, meanwhile section 2.2 explain an overview of steganography, here in after section 2.3 gives a brief about cryptography, watermarking and steganography, whereas in section 2.4 the performance evaluation of Steganography has been shown, moreover an existing steganography technologies has been represented in section 2.5, and then in section 2.6 pointed steganalysis in Stegano system, which continued for the performance evaluation of Steganography in section 2.7, and finally section 2.8 denote the propose method.

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2.2 Overview of Steganography

Steganography are formed from two words, while Steganos that means secret or cover, meanwhile graphia that means drawing or writing. Steganography is a technique to