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Fingerprint identification / Siti Norhazlina Shafie.

FINGERPRINT IDENTIFICATION

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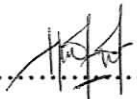
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Special dedicated to my beloved parents, family, fiancé and fellow friends, who had strongly encouraged and supported me in my entire journey of learning...

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ABSTRACT

The use of fingerprint for identification has been employed in law enforcement for about a century. A much broader application of fingerprint is for personal authentication, for instance to access a computer, a network, a bank-machine, a car, or a home. Fingerprint verification system based on neural network analysis is a process of verifying the fingerprint. This project highlights the development of fingerprint identification system using MATLAB. Verification is done by comparing the data of fingerprint with true owner fingerprint. The fingerprint images then will go through the processing data and comparison process to differentiate the data fingerprint. In this project, a backpropagation neural network algorithm in toolbox MATLAB was trained to learn and identify whether the fingerprint is genuine or forgery.

ABSTRAK

Penggunaan cap jari sebagai pengenalan identiti telah digunakan dalam penguatkuasaan undang-undang untuk bertahun-tahun lamanya. Aplikasi penggunaan cap jari sebagai pengenalan peribadi digunakan untuk mengakses komputer, rangkaian, mesin ATM, kereta atau rumah, dan sistem kehadiran untuk sesebuah organisasi. Sistem pengesahan cap jari berasaskan pada analisis rangkaian neural adalah proses untuk mengesahkan identiti sesuatu cap jari. Projek pengesahan cap jari ini dibangunkan menggunakan perisian MATLAB. Pengesahan dilakukan dengan membuat perbandingan imej cap jari yang diambil untuk membuktikan pemilik sebenar cap jari. Imej cap jari tersebut akan melalui proses pemprosesan data, proses penapisan kebisingan dan proses perbandingan untuk mengenal pasti perbezaan setiap data cap jari. Dalam projek ini, algoritma 'Backpropagation Neural Network' di dalam 'toolbox' MATLAB digunakan untuk mengesahkan ketulenan cap jari tersebut.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	DECLARATION FORM OF REPORT STATUS	ii
	DECLARATION	iii
	SUPERVISOR'S DECLARATION	iv
	DEDICATION	v
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	CONTENTS	ix
	LIST OF TABLE	xiii
	LIST OF FIGURE	xiv
	LIST OF APPENDIX	xvii
I	INTRODUCTION	
	1.1 PROJECT OVERVIEW	1
	1.2 PROJECT OBJECTIVES	3
	1.3 PROBLEM STATEMENT	4
	1.4 PROJECT SCOPE	5
	1.5 THESIS OUTLINES	5
II	LITERATURE REVIEW	
	2.1 INTRODUCTION	7
	2.2 FINGERPRINT CLASSIFICATION	10

2.2.1	Model Based	10
2.2.2	Structure Based	11
2.3	FINGERPRINT IDENTIFICATION	12
2.4	SOFTWARE DEVELOPMENT	18
2.4.1	MATLAB Software	18
2.4.2	Neural Network	18
2.4.3	Learning in Artificial Neural Network	19
2.4.3.1	Supervised Learning	20
2.4.3.2	Unsupervised Learning	20
2.4.4	Artificial Neural Networks Paradigms	21
2.5	BACKPROPAGATION METHOD	22
2.5.1	Backpropagation Network Definition	22
2.5.2	Self-Organizing Maps	23
2.5.3	Learning Vector Quantization Networks (LVQ)	24
2.6	SUMMARY OF THE PREVIOUS CASE STUDY	24
2.7	CLOSING REMARK	25

III METHODOLOGY

3.1	INTRODUCTION	26
3.2	OVERVIEW OF THE PROCUDURES	26
3.3	LOAD IMAGE	29
3.4	MINUTIA EXTRACTOR	29
3.4.1	Fingerprint Image Processing	29
3.4.1.1	Fingerprint Image Enhancement	29
3.4.1.2	Fingerprint Image Binarization	31
3.4.1.3	Fingerprint Image Segmentation	32
3.4.2	Minutia Extraction	35
3.4.2.1	Fingerprint Ridge Thinning	35
3.4.2.2	Minutia Marking	36
3.4.3	Minutia Postprocessing	38
3.4.3.1	False Minutia Removal	38
3.5	MINUTIA MATCHER	40

3.5.1	Alignment Stage	40
3.5.2	Minutia Match	41
3.6	MATLAB PROGRAMMING	41
3.7	CLOSING REMARK	45

IV RESULTS, ANALYSIS AND DISCUSSIONS

4.1	INTRODUCTION	46
4.2	SELECTED SOURCE CODES	47
4.2.1	Load Image	47
4.2.2	Enhancement	50
4.2.3	Binarization	55
4.3	RESULTS AND DISCUSSIONS OF THE PROGRAMMING	56
4.3.1	Load Image	56
4.3.2	Histogram Equalization	58
4.3.3	Fast Fourier Transform	59
4.3.4	Binarization	60
4.3.5	Fingerprint Image Segmentation	61
4.3.6	Fingerprint Ridge Thinning	63
4.3.7	Minutia Marking	66
4.3.8	False Minutia Removal	66
4.3.9	Minutia Matching	68
4.4	SUMMARY OF THE RESULTS	68
4.5	ANALYSIS	71
4.5.1	Histogram Analysis	71
4.6	CLOSING REMARK	73

V CONCLUSIONS AND RECOMMENDATIONS

5.1	CONCLUSIONS	74
5.2	RECOMMENDATIONS	75

5.2.1	Detection and Recognition from Various Position	75
5.2.2	Real Time Detection and Recognition	75
5.2.3	Image Format	75
REFERENCES		77
APPENDIX		80

LIST OF TABLES

NO	TITLE	PAGE
2.1	Artificial Neural Network Paradigms	22
3.1	Commands In MATLAB Programming	42
4.1	Comparison Of The Original Image With The Database	69
4.2	Comparison Of The Original Image With The Distorted Image	70

LIST OF FIGURES

NO	TITLE	PAGE
1.1	A Fingerprint Image Acquired By An Optical Sensor	2
1.2	Minutia (Valley Is Also Referred As Furrow, Termination Is Also Called Ending And Bifurcation Is Also Called Branch)	3
2.1(a)	Global And Local Features Of A Fingerprint	7
2.1 (b)	Examples Of Minutiae : A Minutiae Can Be Characterized By Its Position And Its Orientation	8
2.2	Each Fingerprint In The Figure Belongs To A Different Subclass Of The FBI's Classification Scheme; From Left To Right And From Top To Bottom: Whorl, Plain Arch, Right Loop, Left Loop, Central Pocket, Tented Arch, Twin Loop and Accidental Whorl.	9
2.3	Three Approaches Of Fingerprint Classification	10
2.4	The Five Models Corresponding To Each Type Of A Fingerprint	11
2.5	Directional Image Of Left Loop Of A Fingerprint	11
2.6	A Ridge Ending And Bifurcation Of Fingerprint Minutiae	13
2.7	Fingerprint Patterns : Arch, Loop And Whorl	14
2.8(a)	Feed-forward Configuration	18
2.8(b)	Feedback Configuration	19
2.9	Configuration Of A Supervised Learning	20
2.10	A Typical Diagram Of Unsupervised Learning	21
3.1	System Design	27
3.2	Minutia Extractor	28
3.3	Minutia Matcher	28
3.4	The FFT Image	31
3.5	The Binarized Image	32

3.6	Direction Map	34
3.7	Original Image Area	34
3.8	After CLOSE Operation	34
3.9	After OPEN Operation	35
3.10	ROI + Bound	35
3.11	The Thinned Ridge Map	36
3.12	Bifurcation	37
3.13	Termination	37
3.14	Triple Counting Branch	37
3.15	False Minutia Structures	38
3.16	MATLAB 6.5 Icon	42
3.17	Current Directory, Workspace And Command Window	43
3.18	Open File window	43
3.19	Open 'Work' and 'finger' Folder	44
3.20	Start_gui_single_mode Part	44
4.1	Source Code Of Loading Image	48
4.2	Output Of The Loading Image	49
4.3	Classification Of '0' and '255'	49
4.4	Source Code Of The Histogram Equalization	50
4.5	Output Of The Histogram Equalization	51
4.6	Output After The Histogram Equalization	51
4.7	Histogram Equalization For Distorted Image	52
4.8	Source Code Of FFT	54
4.9	Output Of The FFT	54
4.10	Source Code Of Binarization	56
4.11	The Interface Part Of The Programming	57
4.12	The Pop Up Of Message Box	57
4.13	Selected Image	58
4.14	Histogram Enhancement	59
4.15	Fingerprint Enhancement By FFT	60
4.16	The Fingerprint Image After Adaptive Binarization	61
4.17	Direction Map	62
4.18	Region of Interest (ROI)	63
4.19	The Thinned-ridge Map	64

4.20	Removal Of H Breaks	65
4.21	Removal Of Spikes	65
4.22	Minutia Marking	66
4.23	Removal Of Spurious Minutia	67
4.24	Saved Image	67
4.25	Matching Percentage	68
4.26	Original Image Of Fingerprint	71
4.27	Histogram Of Original Image	72
4.28	Equalized Image	72
4.29	Equalized Histogram	73

LIST OF APPENDIX

NO	TITLE	PAGE
APPENDIX A	FLOW CHART OF PSM I	80
APPENDIX B	FLOW CHART OF PSM II	81
APPENDIX C	SOURCE CODE OF FINGERPRINT IDENTIFICATION	82
APPENDIX D	SOURCE CODE OF LOAD IMAGE	88
APPENDIX E	SOURCE CODE OF FAST FOURIER TRANSFORMATION	89
APPENDIX F	SOURCE CODE OF BINARIZATION IMAGE	91
APPENDIX G	SOURCE CODE OF DIRECTION	93
APPENDIX H	SOURCE CODE OF REGION OF INTEREST	97
APPENDIX I	SOURCE CODE OF REMOVE SPURIOUS MINUTIA	99
APPENDIX J	SOURCE CODE OF FingerTemplateRead	104
APPENDIX K	SOURCE CODE OF SHOW MINUTIA	105
APPENDIX L	SOURCE CODE OF READ IMAGE	107
APPENDIX M	SOURCE CODE OF FingerTestRead	107
APPENDIX N	SOURCE CODE OF MinuOriginTransRidge	108
APPENDIX O	SOURCE CODE OF MinuOrigin_TransAll	110
APPENDIX P	SOURCE CODE OF MATCH_END	112
APPENDIX Q	SOURCE CODE OF MARK_MINUTIA	116
APPENDIX R	SOURCE CODE OF InterRidgeWidth	119
APPENDIX S	SOURCE CODE OF getLocalTheta	121
APPENDIX T	SOURCE CODE OF Batch_Template	126
APPENDIX U	SOURCE CODE OF Batch_Match_Intra	128
APPENDIX V	SOURCE CODE OF Batch_Match_Inter	130

APPENDIX W	SOURCE CODE OF FINGERPRINT IDENTIFICATION (PSM I)	132
APPENDIX X	GANTT CHART	138

CHAPTER I

INTRODUCTION

1.1 Project Overview

Biometrics is the science and technology of authentication (i.e. establishing the identity of an individual) by measuring the person's physiological or behavioral features. The term is derived from the Greek words "bios" for life and "metron" for degree. In information technology (IT), *biometrics* usually refers to technologies for measuring and analyzing human physiological characteristics such as fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements, especially for authentication purposes. Examples of behavioral characteristics which can be measured include signature recognition, iris recognition, face recognition and voice recognition.

Fingerprint detection and recognition is applied in fingerprint scanning especially for security purpose because of the current security and authorization features. Fingerprint scanning is more efficient than the current security, passwords and authorization features. Furthermore there is no need to memorize as did for passwords.

A fingerprint is the feature pattern of one finger. It is believed with strong evidences that each fingerprint is unique. Each person has his own fingerprints with the permanent uniqueness. So fingerprints have being used for identification and

forensic investigation for a long time. Figure 1.1 shows a fingerprint image acquired by an optical sensor.



Figure 1.1: A Fingerprint Image Acquired by An Optical Sensor

A fingerprint is composed of many ridges and furrows. These ridges and furrows present good similarities in each small local window, like parallelism and average width.

However, fingerprints are not distinguished by their ridges and furrows, but by Minutia, which are some abnormal points on the ridges. Among the variety of minutia types that has been used in the project to detect and recognize a person is termination, which is the immediate ending of a ridge, the other is called bifurcation, which is the point on the ridge from which two branches derive. Figure 1.2 shows the two types of minutia.

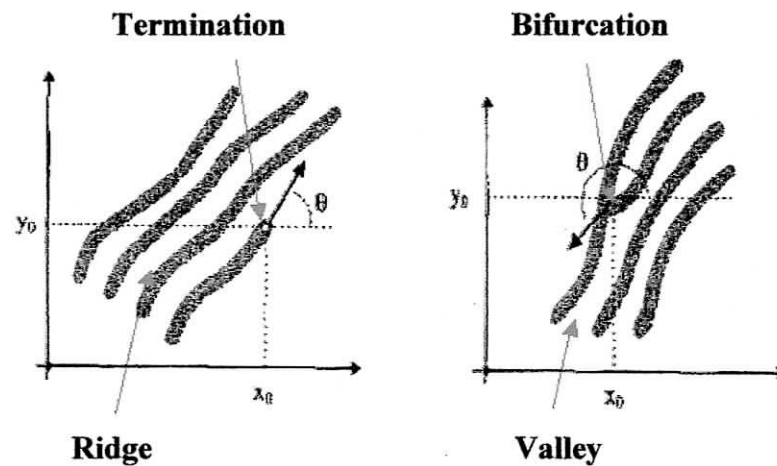


Figure 1.2: Minutia (Valley is also referred as Furrow, Termination is also called Ending, and Bifurcation is also called Branch)

Two representation forms for fingerprints separate the two approaches for fingerprint recognition. The first approach, which is minutia - based, represents the fingerprint by its local features, like terminations and bifurcations. This approach has been intensively studied, also is the backbone of the current available fingerprint recognition products. This approach has been concentrate in the project. The second approach, which uses image - based methods, tries to do matching based on the global features of a whole fingerprint image. It is an advanced and newly emerging method for fingerprint recognition. And it is useful to solve some intractable problems of the first approach. But the project does not aim at this method, so further study in this direction is not expanded in the thesis.

1.2 Project Objectives

The main objectives of conducting this project included:

- i) To develop fingerprint detection and recognition using MATLAB.
- ii) Able to apply the fingerprint detection and recognition for security purpose.
- iii) To verify by comparing the data of fingerprint with true owner fingerprint.

- iv) To apply several methods to build a minutia extractor and a minutia method.
- v) To determine the most suitable method to verify the genuinity of a fingerprint.

1.3 Problem Statement

Passwords, credit cards, smart cards, were widely used in the society. However, passwords could be forgotten and cards could be lost or illegally copied which implies that the traditional methods for identifying or verifying a person may not be valid again.

Nowadays, in order to identify a person conveniently with efficiency, some special features should be extracted to discriminate from one person to another. For instance, the way that people speak, the iris texture, the hand shape, the human face, and etc. The fingerprint is then playing the important role for the security purpose. The fingerprint can be identify to recognize a person among a group of known individuals.

In order to aid forensics in criminal identification, authentication in civilian applications and for preventing unauthorized there is a need to develop a fingerprint detection and recognition. Even though the sequential approach is efficient from design and processing point of view, it may introduce errors in the feature extraction and recognition stages. It is believed that by reexamining the original image data, some of the errors in the end – to - end sequential processing can be eliminated, resulting in an improvement in system accuracy.

Additionally, by attaching additional discriminative attributes to the features (feature refinement) and designing an appropriate similarity metric that exploits these attributes, the matching accuracy can be further improved. By using this method the system users could minimize their cost by cutting down the purchase of padlock or setting up a new and sophisticated security system. This method is easier to extract

the image compared to the other method. Thus, fingerprint detection and recognition for security purpose reduces these hustles.

1.4 Project Scope

In order to understand about this title, the scopes of the project are listed:

- i) Research and literature study on the most appropriate programming that has been used in the project and in order to achieve high detection accuracy and satisfactory. For an example MATLAB has been chosen because it is easier to extract data from the capture image. It also achieves high detection accuracy.
- ii) Analyze and study contemporary fingerprint detection and recognition implemented around the globe, thus explore and upgrade it.
- iii) Determine the most suitable concept that can be used and applied it.
- iv) Design a prototype that able to improve the existing system. This has been achieved by using MATLAB that is known as artificial intelligent which is a high performance language for technical computing.

1.5 Thesis Outlines

This thesis is represented by five chapters. The following is the outline of this Fingerprint Identification project in chapter by chapter. Chapter I discuss about the brief overview about the project such as introduction, objectives, problem statement and scope of the project.

Chapter II describes about the research and information about the project. Every facts and information, which found through journals or other references, will be compared and the better methods have been chosen for the project. This literature