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AN ENHANCED MODEL FOR USING ELECTROCARDIOGRAM (ECG) SIGNALS AS HUMAN BIOMETRIC

THESIS

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ الْحَمْدُ لِلَّهِ الَّذِي هَدَانَا لِهَذَا وَمَا كُنَّا لِنَهْتَدِيَ لَوْلَا أَنْ هَدَانَا اللَّهُ ﴾

صدق الله العظيم

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DEDICATION

I would like to dedicate this thesis to my mother, my father, my sisters and my brothers who provide me with love, care and support.

PUBLISHED WORK

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2. Anwar E.Ibrahim, Salah Abdel-Mageid, Nadra Nada, Marwa A. Elshahed, " ECG Signals for Human Identification Based on Fiducial and Non-Fiducial Approaches ", International Journal of Advanced Computer Research (IJACR), (accepted).

ABSTRACT

Biometrics is an interesting study due to the amazing progress in security technology and defined as a method of recognizing humans based on a physiological characteristics (as face, fingerprints, DNA, ECG, etc...) or behavioral characteristics(as voice, gait, keystroke, signature, etc...). The term biometrics comes from the Greek words 'bio' (life) and 'metrics' (measurement), so biometrics means life measurement. Electrocardiogram (ECG) signal analysis is an active research area for diagnoses which is a method to measure the change in electrical potential of the heart over time. This work investigates in ECG signals as a biometric trait which based on uniqueness represented by physiological and geometrical of ECG signal. Biometric systems based ECG classified into two categories fiducial and non-fiducial approaches depend on the feature extraction methods.

In this work, a proposed non-fiducial identification system is presented with a comparative study using Radial Basis Function (RBF) neural network, Back Propagation (BP) neural network and Support Vector Machine (SVM) as classification methods. The Discrete Wavelet Transform method is applied to

extract features from the ECG signal. Two datasets are used in this work (ECG-ID and MIT-BIH) databases. The experimental results show that using RBF neural network gives higher identification rate than other used classifiers. Also, the system accuracy by using the neural network as a classifier is better than that using the support vector machine for the first and the second datasets. The obtained results show that decreasing the number of subjects the system performance using SVM is improved. Furthermore, integrating the two classifiers RBF and BP achieves a higher human identification rate.

Also, we present an ECG human identification system with different feature extraction methods as Daubechies wavelets ('db3', 'db8' and 'db10'), Symlets wavelet 'sym7' and Biorthogonal wavelet 'bior2.6'. A combination of RBF and BP neural network is used as a classifier compared with SVM. The experimental results show that using Daubechies wavelet 'db8' achieves the higher identification rate than the others used methods with the combined classifier. The proposed system performance is improved by adding fiducial features (R-R intervals) to the used non-fiducial features.

LIST OF CONTENTS

1 Introduction

1.1	Introduction	1
1.2	Biometric Characteristics Requirements	3
1.3	Biometric Systems	4
1.4	Biometric System Errors	6
1.4.1	False Acceptance Rate	6
1.4.2	False Rejection Rate	6
1.5	Biometric Types	7
1.5.1	Physiological characteristics	7
1.5.2	Behavioural characteristics	16
1.6	Some Applications of Biometric Systems	19
1.7	Problem Statement	19
1.8	Thesis Outlines	20

2 ECG as a Biometric Trait

2.1	Heart Anatomy	21
2.2	ECG Signal Acquisition	22
2.3	ECG (Electrocardiogram)	24
2.4	ECG Signal Analysis	27
2.5	Classification of ECG Based Biometric Systems	28
2.5.1	Fiducial (analytical) Features Based Systems	29
2.5.2	Non- fiducial (appearance) Features Based Systems	29
2.6	The factors That Causes Variation in Normal ECG	30
2.7	ECG noise sources	31

3 Related Works

4 Proposed Human Identification System Based ECG Signal

4.1	Wavelet Transform	40
4.2	The System Architecture of Proposed scheme	41
4.2.1	Database Description	41
4.2.2	Pre-processing	42
4.2.3	Feature extraction	45
4.2.4	Classification	47
4.3	Experiments and Results	48

5 The Proposed System Based Non-Fiducial and Fiducial Approaches

5.1	The System Architecture of Proposed scheme -----	55
5.1.1	Pre-processing -----	55
5.1.2	Feature extraction -----	55
5.1.3	Classification-----	55
5.2	Experiments and Results -----	56

6 Conclusions and Future Work

6.1	Conclusions -----	68
6.2	Future work-----	69
	References-----	70

LIST OF FIGURES

Figure (1-1)	: Approaches of authentication -----	1
Figure (1-2)	: Biometric characteristics classification -----	2
Figure (1-3)	: Biometrics requirements -----	3
Figure (1-4)	: Enrolment, verification and identification processes -----	4
Figure (1-5)	: The relation between threshold and False Acceptance Rate (FAR) and False Rejection Rate (FRR) -----	7
Figure (1-6)	: Structure of iris -----	8
Figure (1-7)	: An iris scanner -----	8
Figure (1-8)	: (a) Retinal image and (b) Retinal vascular tree -----	9
Figure (1-9)	: Hand geometry sample -----	9
Figure (1-10)	: Palm print features -----	10
Figure (1-11)	: Structure of Face -----	11
Figure (1-12)	: Fingerprint -----	12
Figure (1-13)	: Structure of DNA -----	12
Figure (1-14)	: Anatomy of human ear -----	13
Figure (1-15)	: EEG Electrode transmission -----	14
Figure (1-16)	: Major veins of the hand area -----	14
Figure (1-17)	: Sensor scanning the vein pattern from the back of an individual's hand -----	15
Figure (1-18)	: Dental radiographs of the same person. (a) Acquired in the year 2000, (b) Acquired in the year 2003 -----	15
Figure (1-19)	: Keystroke -----	17
Figure (1-20)	: Samples recorded from a gait cycle -----	19
Figure (1-21)	: Lip biometric -----	18
Figure (1-22)	: A signature -----	18
Figure (2-1)	: Waveforms collected from each of the specialized cells found in the heart -----	22
Figure (2-2)	: The six precordial “chest” leads -----	22
Figure (2-3)	: The ECG patterns recorded by the chest leads -----	23
Figure (2-4)	: The limb leads and augmented limb leads -----	24

Thesis Contents (List of figures)

Figure (2-5)	: ECG signals -----	25
Figure (2-6)	: Generation of an ECG from electrical activities of the heart -----	26
Figure (2-7)	: Basic steps for ECG processing -----	28
Figure (2-8)	: ECG feature extraction approaches -----	28
Figure (2-9)	: Electrocardiogram (ECG) signal and fiducial characteristic points ----	29
Figure (4-1)	: Block diagram of proposed system -----	41
Figure (4-2)	: ECG-ID subject 31 original signal (filtered)-----	42
Figure (4-3)	: MIT-BIH subject 103 original signal -----	43
Figure (4-4)	: MIT-BIH subject 103 filtered signal -----	43
Figure (4-5)	: Pan and Tompkins algorithm steps for a normal ECG signal (person 8)-----	44
Figure (4-6)	: A selected R-R interval (MIT-BIH subject 103)-----	45
Figure (4-7)	: The 5-level discrete wavelet decomposition using Daubechies wavelet 'db8'-----	46
Figure (4-8)	: Wavelet coefficient structure of the selected R-R interval.-----	47
Figure (4-9)	: Radial Basis Neural Network for the first dataset -----	48
Figure (4-10)	: Back Propagation Neural Network for the first dataset.-----	49
Figure (4-11)	: Radial Basis Neural Network for the second dataset -----	49
Figure (4-12)	: Back Propagation Neural Network for the second dataset -----	49
Figure (4-13)	: The obtained values of accuracy, precision, recall and f-score for the first dataset -----	52
Figure (4-14)	: The obtained values of accuracy, precision, recall and f-score for the second dataset -----	53
Figure (4-15)	: The obtained FRR with the different used classification methods for the first and the second datasets -----	54
Figure (4-16)	: The obtained FAR with the different used classification methods for the first and the second datasets -----	54
Figure (5-1)	: The 5-level discrete wavelet decomposition using Daubechies wavelet 'db3'-----	56
Figure (5-2)	: The 5-level discrete wavelet decomposition using Daubechies wavelet 'db10'-----	57
Figure (5-3)	: The 5-level discrete wavelet decomposition using Symlets wavelet 'sym7'-----	58
Figure (5-4)	: comparison between SVM and the combination of RBF and BP neural network for the used feature extraction methods for the first dataset -----	60

Thesis Contents (List of figures)

Figure (5-5)	: The obtained FRR for all the used wavelets using the combined and the SVM classifiers for the first dataset -----	61
Figure (5-6)	: The obtained FAR for all the used wavelets using the combined and the SVM classifiers for the first dataset -----	61
Figure (5-7)	: comparison between SVM and the combination of RBF and BP neural network for the used feature extraction methods for the second dataset -----	63
Figure (5-8)	: The obtained FRR for all the used wavelets using the combined and the SVM classifiers for the second dataset -----	64
Figure (5-9)	: The obtained FAR for all the used wavelets using the combined and the SVM classifiers for the second dataset -----	64
Figure (5-10)	: The f-score values for the used feature extraction methods before and after adding the R-R intervals to the wavelet coefficients for the first dataset -----	66
Figure (5-11)	: The obtained FRR for all the used wavelets before and after adding the R-R intervals (fiducial features) to the non-fiducial features using the combined classifier -----	67
Figure (5-12)	: The obtained FAR for all the used wavelets before and after adding the R-R intervals (fiducial features) to the non-fiducial features using the combined classifier -----	67

LIST OF TABLES

Table (4-1)	:	Comparison between the used classification methods for the first and second datasets.-----	51
Table (4-2)	:	The system performance for the first and the second datasets using the two combining classifiers -----	53
Table (5-1)	:	The system performance for the used feature extraction methods using the combination of RBF and BP neural network and the SVM as classifiers for the first dataset -----	59
Table (5-2)	:	The system performance for the used feature extraction methods using the combination of RBF and BP neural network and the SVM as classifiers for the second dataset -----	62
Table (5-3)	:	The system performance for the used wavelets for the first dataset after adding the fiducial features to the non-fiducial features -----	65

LIST OF ABBREVIATION

ECG	Electrocardiogram
EEG	Electroencephalogram
PPG	phonocardiogram
BVP	Blood Volume Pressure
FAR	False Acceptance Rate
FRR	False Rejection Rate
RBF	Radial Basis Function neural network
BP	Back Propagation neural network
SVM	Support Vector Machine
DWT	Discrete Wavelet Transform
PCA	Principle Component Analysis
LDA	Linear Discriminant Analysis
WPD	Wavelet Packet Decomposition
LPC	Linear Predictive Coding
TM	Template Matching
FFT	Fast Fourier Transform
AC	Autocorrelation

Chapter One

INTRODUCTION