



Ahmad A. M. Abushariah
Teddy Surya Gunawan

Speech Recognition System using MATLAB

Design, Implementation, and Samples Codes

**Ahmad A. M. Abushariah
Teddy Surya Gunawan**

Speech Recognition System using MATLAB

Design, Implementation, and Samples Codes

LAP LAMBERT Academic Publishing

Impressum/Imprint (nur für Deutschland/only for Germany)

Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

Alle in diesem Buch genannten Marken und Produktnamen unterliegen warenzeichen-, marken- oder patentrechtlichem Schutz bzw. sind Warenzeichen oder eingetragene Warenzeichen der jeweiligen Inhaber. Die Wiedergabe von Marken, Produktnamen, Gebrauchsnamen, Handelsnamen, Warenbezeichnungen u.s.w. in diesem Werk berechtigt auch ohne besondere Kennzeichnung nicht zu der Annahme, dass solche Namen im Sinne der Warenzeichen- und Markenschutzgesetzgebung als frei zu betrachten wären und daher von jedermann benutzt werden dürften.

Coverbild: www.ingimage.com

Verlag: LAP LAMBERT Academic Publishing GmbH & Co. KG
Dudweiler Landstr. 99, 66123 Saarbrücken, Deutschland
Telefon +49 681 3720-310, Telefax +49 681 3720-3109
Email: info@lap-publishing.com

Herstellung in Deutschland:

Schaltungsdienst Lange o.H.G., Berlin
Books on Demand GmbH, Norderstedt
Reha GmbH, Saarbrücken
Amazon Distribution GmbH, Leipzig
ISBN: 978-3-8465-0376-8

Imprint (only for USA, GB)

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

Any brand names and product names mentioned in this book are subject to trademark, brand or patent protection and are trademarks or registered trademarks of their respective holders. The use of brand names, product names, common names, trade names, product descriptions etc. even without a particular marking in this works is in no way to be construed to mean that such names may be regarded as unrestricted in respect of trademark and brand protection legislation and could thus be used by anyone.

Cover image: www.ingimage.com

Publisher: LAP LAMBERT Academic Publishing GmbH & Co. KG
Dudweiler Landstr. 99, 66123 Saarbrücken, Germany
Phone +49 681 3720-310, Fax +49 681 3720-3109
Email: info@lap-publishing.com

Printed in the U.S.A.

Printed in the U.K. by (see last page)

ISBN: 978-3-8465-0376-8

Copyright © 2011 by the author and LAP LAMBERT Academic Publishing GmbH & Co. KG and licensors
All rights reserved. Saarbrücken 2011

TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	v
LIST OF ABBREVIATIONS	vii
CHAPTER 1 Introduction	1
1.1 Background	1
1.2 Research Objectives	3
1.3 Book Scope	3
1.4 Project Platform, Hardware, and Software Requirements	4
1.5 Research Methodology	4
1.6 Outlines Of the Book	5
CHAPTER 2 Theoretical Background of Automatic Speech Recognition	7
2.1 Introduction	7
2.2 Automatic Speech Recognition Systems	7
2.3 Human Speech Production and Perception Mechanism	8
2.4 Definitions of Automatic Speech Recognition	10
2.5 History of Speech Recognition Technology	11
2.6 Characterizations of Speech Recognition Systems	15
2.7 Recent Speech Recognition Industrial Applications	16
2.7.1 Dragon NaturallySpeaking	17
2.7.2 IBM ViaVoice	18
2.7.3 Keystone SpeechMaster	18
2.7.4 Sphinx	18
2.8 Approaches to Speech Recognition System	19
2.8.1 The Acoustic-Phonetic Approach	19
2.8.2 The Statistical Pattern Recognition Approach	20
2.8.3 The Artificial Intelligence (AI) Approach	21
2.9 A Statistical Pattern Recognition Approach to ASR Systems	22
2.10 Summary	22
CHAPTER 3 English Digits Automatic Speech Recognition: Techniques and Algorithms	23
3.1 Introduction	23
3.2 Features Extraction Techniques	23
3.3 Features Classification/Matching and Pattern Recognition Techniques	27
3.4 Fundamentals of Hidden Markov Model (HMM)	28
3.4.1 Markov Chain	29
3.4.2 Hidden Markov Models	30
3.4.3 HMMs for Speech Recognition	34
3.5 Endpoint Detection	39
3.6 Comparison of Speech Recognition Speech Systems	41
3.7 Summary	42
CHAPTER 4 Design and Implementation	43
4.1 Introduction	43

4.2	System Architecture	43
4.3	Speech Samples Collection (Speech Recording).....	44
4.4	Graphical User Interface (GUI) of the System.....	47
4.5	Summary.....	58
CHAPTER 5 Experimental Results and Discussion.....		59
5.1	Introduction	59
5.2	Experimental Results of Speech Samples Collection (Speech Recording).....	59
5.2.1	Sound Files in Clean Environment	60
5.2.2	Sound Files in Noisy Environment.....	61
5.3	Experimental Results of Testing Sound Files in Clean Environment	64
5.3.1	Isolated Words Recognition Sound Files	64
5.3.2	Continuous Speech Recognition Sound Files	66
5.4	Experimental Results of Testing Sound Files in Noisy Environment	68
5.5	Summary.....	72
CHAPTER 6 Conclusions and Future Works.....		73
6.1	Conclusions	73
6.2	Future Research	74
REFERENCES.....		75
APPENDIX A MATLAB Source Codes		81