Statistical Methods For Speech Recognition

Robust Automatic Speech RecognitionNew Era for Robust Speech RecognitionRobustness in Automatic Speech RecognitionDeep Learning for NLP and Speech RecognitionSpeech RecognitionPrivacy-Preserving Machine Learning for Speech ProcessingDiscriminative Learning for Speech RecognitionStatistical Methods for Speech RecognitionAutomatic Speech RecognitionAutomatic Speech and Speaker RecognitionAdvances in Speech RecognitionRecent Advances in Robust Speech Recognition TechnologyDistant Speech RecognitionSpringer Handbook of Speech ProcessingDigital Speech ProcessingSpeech Technology at WorkAutomatic Speech and Speaker RecognitionSelf-Learning Speaker IdentificationReadings in Speech RecognitionTechniques for Noise Robustness in Automatic Speech Recognition Jinyu Li Shinji Watanabe Jean-Claude Junqua Uday Kamath Peter Foster Manas A. Pathak Xiadong He Frederick Jelinek Dong Yu Chin-Hui Lee Amy Neustein Javier Ramirez Matthias Woelfel Jacob Benesty A. Nejat Ince Jack Hollingum Joseph Keshet Tobias Herbig Alexander Waibel Tuomas Virtanen

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robust automatic speech recognition a bridge to practical applications establishes a solid foundation for automatic speech recognition that is robust against acoustic environmental distortion it provides a thorough overview of classical and modern noise and reverberation robust techniques that have been developed over the past thirty years with an emphasis on practical methods that have been proven to be successful and which

ARE LIKELY TO BE FURTHER DEVELOPED FOR FUTURE APPLICATIONS THE STRENGTHS AND WEAKNESSES OF ROBUSTNESS ENHANCING SPEECH RECOGNITION TECHNIQUES ARE CAREFULLY ANALYZED THE BOOK COVERS NOISE ROBUST TECHNIQUES DESIGNED FOR ACOUSTIC MODELS WHICH ARE BASED ON BOTH GAUSSIAN MIXTURE MODELS AND DEEP NEURAL NETWORKS IN ADDITION A GUIDE TO SELECTING THE BEST METHODS FOR PRACTICAL APPLICATIONS IS PROVIDED THE READER WILL GAIN A UNIFIED DEEP AND SYSTEMATIC UNDERSTANDING OF THE STATE OF THE ART TECHNOLOGIES FOR ROBUST SPEECH RECOGNITION LEARN THE LINKS AND RELATIONSHIP BETWEEN ALTERNATIVE TECHNOLOGIES FOR ROBUST SPEECH RECOGNITION BE ABLE TO USE THE TECHNOLOGY ANALYSIS AND CATEGORIZATION DETAILED IN THE BOOK TO GUIDE FUTURE TECHNOLOGY DEVELOPMENT BE ABLE TO DEVELOP NEW NOISE ROBUST METHODS IN THE CURRENT ERA OF DEEP LEARNING FOR ACOUSTIC MODELING IN SPEECH RECOGNITION THE FIRST BOOK THAT PROVIDES A COMPREHENSIVE REVIEW ON NOISE AND REVERBERATION ROBUST SPEECH RECOGNITION METHODS IN THE ERA OF DEEP NEURAL NETWORKS CONNECTS ROBUST SPEECH RECOGNITION TECHNIQUES TO MACHINE LEARNING PARADIGMS WITH RIGOROUS MATHEMATICAL TREATMENT PROVIDES ELEGANT AND STRUCTURAL WAYS TO CATEGORIZE AND ANALYZE NOISE ROBUST SPEECH RECOGNITION TECHNIQUES WRITTEN BY LEADING RESEARCHERS WHO HAVE BEEN ACTIVELY WORKING ON THE SUBJECT MATTER IN BOTH INDUSTRIAL AND ACADEMIC ORGANIZATIONS FOR MANY YEARS

THIS BOOK COVERS THE STATE OF THE ART IN DEEP NEURAL NETWORK BASED METHODS FOR NOISE ROBUSTNESS IN DISTANT SPEECH RECOGNITION APPLICATIONS IT PROVIDES INSIGHTS AND DETAILED DESCRIPTIONS OF SOME OF THE NEW CONCEPTS AND KEY TECHNOLOGIES IN THE FIELD INCLUDING NOVEL ARCHITECTURES FOR SPEECH ENHANCEMENT MICROPHONE ARRAYS ROBUST FEATURES ACOUSTIC MODEL ADAPTATION TRAINING DATA AUGMENTATION AND TRAINING CRITERIA THE CONTRIBUTED CHAPTERS ALSO INCLUDE DESCRIPTIONS OF REAL WORLD APPLICATIONS BENCHMARK TOOLS AND DATASETS WIDELY USED IN THE FIELD THIS BOOK IS INTENDED FOR RESEARCHERS AND PRACTITIONERS WORKING IN THE FIELD OF SPEECH PROCESSING AND RECOGNITION WHO ARE INTERESTED IN THE LATEST DEEP LEARNING TECHNIQUES FOR NOISE ROBUSTNESS IT WILL ALSO BE OF INTEREST TO GRADUATE STUDENTS IN ELECTRICAL ENGINEERING OR COMPUTER SCIENCE WHO WILL FIND IT A USEFUL GUIDE TO THIS FIELD OF RESEARCH

FOREWORD LOOKING BACK THE PAST 30 YEARS WE HAVE SEEN STEADY PROGRESS MADE IN THE AREA OF SPEECH SCIENCE AND TECHNOLOGY I STILL REMEMBER THE EXCITEMENT IN THE LATE SEVENTIES WHEN TEXAS INSTRUMENTS CAME UP WITH A TOY NAMED SPEAK AND SPELL WHICH WAS BASED ON A VLSI CHIP CONTAINING THE STATE OF THE ART LINEAR PREDICTION SYNTHESIZER THIS CAUSED A SPEECH TECHNOLOGY FEVER AMONG THE ELECTRONICS INDUSTRY PARTICULARLY APPLICATIONS OF AUTOMATIC SPEECH RECOGNITION WERE RIGOROUSLY ATTEMPT ED BY MANY COMPANIES SOME OF WHICH WERE START UPS FOUNDED JUST FOR THIS PURPOSE UNFORTUNATELY IT DID NOT TAKE LONG BEFORE THEY

REALIZED THAT AUTOMATIC SPEECH REC OGNITION TECHNOLOGY WAS NOT MATURE ENOUGH TO SATISFY THE NEED OF CUSTOMERS THE FEVER GRADUALLY FADED AWAY IN THE MEANTIME CONSTANT EFFORTS HAVE BEEN MADE BY MANY RESEARCHERS AND ENGI NEERS TO IMPROVE THE AUTOMATIC SPEECH RECOGNITION TECHNOLOGY HARDWARE CAPABILITIES HAVE ADVANCED IMPRESSIVELY SINCE THAT TIME IN THE PAST FEW YEARS WE HAVE BEEN WITNESSING AND EXPERIENCING THE ADVENT OF THE INFORMATION REVOLUTION WHAT MIGHT BE CALLED THE SECOND SURGE OF INTEREST TO COM MERCIALIZE SPEECH TECHNOLOGY AS A NATURAL INTERFACE FOR MAN MACHINE COMMUNICATION BEGAN IN MUCH BETTER SHAPE THAN THE FIRST ONE WITH COMPUTERS MUCH MORE POWERFUL AND FASTER MANY APPLICATIONS LOOK REALISTIC THIS TIME HOWEVER THERE ARE STILL TREMENDOUS PRACTICAL ISSUES TO BE OVERCOME IN ORDER FOR SPEECH TO BE TRULY THE MOST NATURAL INTERFACE BETWEEN HUMANS AND MACHINES

THIS TEXTBOOK EXPLAINS DEEP LEARNING ARCHITECTURE WITH APPLICATIONS TO VARIOUS NLP TASKS INCLUDING DOCUMENT CLASSIFICATION MACHINE TRANSLATION LANGUAGE MODELING AND SPEECH RECOGNITION WITH THE WIDESPREAD ADOPTION OF DEEP LEARNING NATURAL LANGUAGE PROCESSING NLP AND SPEECH APPLICATIONS IN MANY AREAS INCLUDING FINANCE HEALTHCARE AND GOVERNMENT THERE IS A GROWING NEED FOR ONE COMPREHENSIVE RESOURCE THAT MAPS DEEP LEARNING TECHNIQUES TO NLP AND SPEECH AND PROVIDES INSIGHTS INTO USING THE TOOLS AND LIBRARIES FOR REAL WORLD APPLICATIONS DEEP LEARNING FOR NLP AND SPEECH RECOGNITION EXPLAINS RECENT DEEP LEARNING METHODS APPLICABLE TO NLP AND SPEECH PROVIDES STATE OF THE ART APPROACHES AND OFFERS REAL WORLD CASE STUDIES WITH CODE TO PROVIDE HANDS ON EXPERIENCE MANY BOOKS FOCUS ON DEEP LEARNING THEORY OR DEEP LEARNING FOR NLP SPECIFIC TASKS WHILE OTHERS ARE COOKBOOKS FOR TOOLS AND LIBRARIES BUT THE CONSTANT FLUX OF NEW ALGORITHMS TOOLS FRAMEWORKS AND LIBRARIES IN A RAPIDLY EVOLVING LANDSCAPE MEANS THAT THERE ARE FEW AVAILABLE TEXTS THAT OFFER THE MATERIAL IN THIS BOOK THE BOOK IS ORGANIZED INTO THREE PARTS ALIGNING TO DIFFERENT GROUPS OF READERS AND THEIR EXPERTISE THE THREE PARTS ARE MACHINE LEARNING NLP AND SPEECH INTRODUCTION THE FIRST PART HAS THREE CHAPTERS THAT INTRODUCE READERS TO THE FIELDS OF NLP SPEECH RECOGNITION DEEP LEARNING AND MACHINE LEARNING WITH BASIC THEORY AND HANDS ON CASE STUDIES USING PYTHON BASED TOOLS AND LIBRARIES DEEP LEARNING BASICS THE FIVE CHAPTERS IN THE SECOND PART INTRODUCE DEEP LEARNING AND VARIOUS TOPICS THAT ARE CRUCIAL FOR SPEECH AND TEXT PROCESSING INCLUDING WORD EMBEDDINGS CONVOLUTIONAL NEURAL NETWORKS RECURRENT NEURAL NETWORKS AND SPEECH RECOGNITION BASICS THEORY PRACTICAL TIPS STATE OF THE ART METHODS EXPERIMENTATIONS AND ANALYSIS IN USING THE METHODS DISCUSSED IN THEORY ON REAL WORLD TASKS ADVANCED DEEP LEARNING TECHNIQUES FOR TEXT AND SPEECH THE THIRD PART HAS FIVE CHAPTERS THAT DISCUSS THE LATEST AND CUTTING EDGE RESEARCH IN THE AREAS OF DEEP LEARNING THAT INTERSECT WITH NLP

AND SPEECH TOPICS INCLUDING ATTENTION MECHANISMS MEMORY AUGMENTED NETWORKS TRANSFER LEARNING MULTI TASK LEARNING DOMAIN ADAPTATION REINFORCEMENT LEARNING AND END TO END DEEP LEARNING FOR SPEECH RECOGNITION ARE COVERED USING CASE STUDIES

DOCTORAL THESIS ACCEPTED BY CARNEGIE MELLON UNIVERSITY USA TITLE PAGE

IN THIS BOOK WE INTRODUCE THE BACKGROUND AND MAINSTREAM METHODS OF PROBABILISTIC MODELING AND DISCRIMINATIVE PARAMETER OPTIMIZATION FOR SPEECH RECOGNITION THE SPECIFIC MODELS TREATED IN DEPTH INCLUDE THE WIDELY USED EXPONENTIAL FAMILY DISTRIBUTIONS AND THE HIDDEN MARKOV MODEL A DETAILED STUDY IS PRESENTED ON UNIFYING THE COMMON OBJECTIVE FUNCTIONS FOR DISCRIMINATIVE LEARNING IN SPEECH RECOGNITION NAMELY MAXIMUM MUTUAL INFORMATION MMI MINIMUM CLASSIFICATION ERROR AND MINIMUM PHONE WORD ERROR THE UNIFICATION IS PRESENTED WITH RIGOROUS MATHEMATICAL ANALYSIS IN A COMMON RATIONAL FUNCTION FORM THIS COMMON FORM ENABLES THE USE OF THE GROWTH TRANSFORMATION OR EXTENDED BAUM WELCH OPTIMIZATION FRAMEWORK IN DISCRIMINATIVE LEARNING OF MODEL PARAMETERS IN ADDITION TO ALL THE NECESSARY INTRODUCTION OF THE BACKGROUND AND TUTORIAL MATERIAL ON THE SUBJECT WE ALSO INCLUDED TECHNICAL DETAILS ON THE DERIVATION OF THE PARAMETER OPTIMIZATION FORMULAS FOR EXPONENTIAL FAMILY DISTRIBUTIONS DISCRETE HIDDEN MARKOV MODELS HMMS AND CONTINUOUS DENSITY HMMS IN DISCRIMINATIVE LEARNING SELECTED EXPERIMENTAL RESULTS OBTAINED BY THE AUTHORS IN FIRSTHAND ARE PRESENTED TO SHOW THAT DISCRIMINATIVE LEARNING CAN LEAD TO SUPERIOR SPEECH RECOGNITION PERFORMANCE OVER CONVENTIONAL PARAMETER LEARNING DETAILS ON MAJOR ALGORITHMIC IMPLEMENTATION ISSUES WITH PRACTICAL SIGNIFICANCE ARE PROVIDED TO ENABLE THE PRACTITIONERS TO DIRECTLY REPRODUCE THE THEORY IN THE EARLIER PART OF THE BOOK INTO ENGINEERING PRACTICE TABLE OF CONTENTS INTRODUCTION AND BACKGROUND STATISTICAL SPEECH RECOGNITION A TUTORIAL DISCRIMINATIVE LEARNING A UNIFIED OBJECTIVE FUNCTION DISCRIMINATIVE LEARNING ALGORITHM FOR EXPONENTIAL FAMILY DISTRIBUTIONS DISCRIMINATIVE LEARNING ALGORITHM FOR HIDDEN MARKOV MODEL PRACTICAL IMPLEMENTATION OF DISCRIMINATIVE LEARNING SELECTED EXPERIMENTAL RESULTS EPILOGUE MAJOR SYMBOLS USED IN THE BOOK AND THEIR DESCRIPTIONS MATHEMATICAL NOTATION BIBLIOGRAPHY

THIS BOOK REFLECTS DECADES OF IMPORTANT RESEARCH ON THE MATHEMATICAL FOUNDATIONS OF SPEECH RECOGNITION IT FOCUSES ON UNDERLYING STATISTICAL TECHNIQUES SUCH AS HIDDEN MARKOV MODELS DECISION TREES THE EXPECTATION MAXIMIZATION ALGORITHM INFORMATION THEORETIC GOODNESS CRITERIA MAXIMUM ENTROPY PROBABILITY ESTIMATION PARAMETER AND DATA CLUSTERING AND SMOOTHING OF PROBABILITY DISTRIBUTIONS THE AUTHOR S GOAL IS TO PRESENT THESE PRINCIPLES CLEARLY IN THE SIMPLEST SETTING TO SHOW THE ADVANTAGES OF SELF ORGANIZATION FROM REAL DATA AND TO ENABLE THE READER TO APPLY THE TECHNIQUES

THIS BOOK PROVIDES A COMPREHENSIVE OVERVIEW OF THE RECENT ADVANCEMENT IN THE FIELD OF AUTOMATIC SPEECH RECOGNITION WITH A FOCUS ON DEEP LEARNING MODELS INCLUDING DEEP NEURAL NETWORKS AND MANY OF THEIR VARIANTS THIS IS THE FIRST AUTOMATIC SPEECH RECOGNITION BOOK DEDICATED TO THE DEEP LEARNING APPROACH IN ADDITION TO THE RIGOROUS MATHEMATICAL TREATMENT OF THE SUBJECT THE BOOK ALSO PRESENTS INSIGHTS AND THEORETICAL FOUNDATION OF A SERIES OF HIGHLY SUCCESSFUL DEEP LEARNING MODELS

RESEARCH IN THE FIELD OF AUTOMATIC SPEECH AND SPEAKER RECOGNITION HAS MADE A NUMBER OF SIGNIFICANT ADVANCES IN THE LAST TWO DECADES INFLUENCED BY ADVANCES IN SIGNAL PROCESSING ALGORITHMS ARCHITECTURES AND HARDWARE THESE ADVANCES INCLUDE THE ADOPTION OF A STATISTICAL PATTERN RECOGNITION PARADIGM THE USE OF THE HIDDEN MARKOV MODELING FRAMEWORK TO CHARACTERIZE BOTH THE SPECTRAL AND THE TEMPORAL VARIATIONS IN THE SPEECH SIGNAL THE USE OF A LARGE SET OF SPEECH UTTERANCE EXAMPLES FROM A LARGE POPULATION OF SPEAKERS TO TRAIN THE HIDDEN MARKOV MODELS OF SOME FUNDAMENTAL SPEECH UNITS THE ORGANIZATION OF SPEECH AND LANGUAGE KNOWLEDGE SOURCES INTO A STRUCTURAL FINITE STATE NETWORK AND THE USE OF DYNAMIC PROGRAMMING BASED HEURISTIC SEARCH METHODS TO FIND THE BEST WORD SEQUENCE IN THE LEXICAL NETWORK CORRESPONDING TO THE SPOKEN UTTERANCE AUTOMATIC SPEECH AND SPEAKER RECOGNITION ADVANCED TOPICS GROUPS TOGETHER IN A SINGLE VOLUME A NUMBER OF IMPORTANT TOPICS ON SPEECH AND SPEAKER RECOGNITION TOPICS WHICH ARE OF FUNDAMENTAL IMPORTANCE BUT NOT YET COVERED IN DETAIL IN EXISTING TEXTBOOKS ALTHOUGH NO EXPLICIT PARTITION IS GIVEN THE BOOK IS DIVIDED INTO FIVE PARTS CHAPTERS 1 2 ARE DEVOTED TO TECHNOLOGY OVERVIEWS CHAPTERS 3 12 DISCUSS ACOUSTIC MODELING OF FUNDAMENTAL SPEECH UNITS AND LEXICAL MODELING OF WORDS AND PRONUNCIATIONS CHAPTERS 13 15 ADDRESS THE ISSUES RELATED TO FLEXIBILITY AND ROBUSTNESS CHAPTER 16 18 CONCERN THE THEORETICAL AND PRACTICAL ISSUES OF SEARCH CHAPTERS 19 20 GIVE TWO EXAMPLES OF ALGORITHM AND IMPLEMENTATIONAL ASPECTS FOR RECOGNITION SYSTEM REALIZATION AUDIENCE A REFERENCE BOOK FOR SPEECH RESEARCHERS AND GRADUATE STUDENTS INTERESTED IN PURSUING POTENTIAL RESEARCH ON THE TOPIC MAY ALSO BE USED AS A TEXT FOR ADVANCED COURSES ON THE SUBJECT

TWO TOP INDUSTRY LEADERS SPEAK OUT JUDITH MARKOWITZ WHEN AMY ASKED ME TO CO AUTHOR THE FOREWORD TO HER NEW BOOK ON ADVANCES IN SPEECH RECOGNITION I WAS HONORED AMY S WORK HAS ALWAYS BEEN INFUSED WITH C ATIVE INTENSITY SO I KNEW THE BOOK WOULD BE AS INTERESTING FOR ESTABLISHED SPEECH PROFESSIONALS AS FOR READERS NEW TO THE SPEECH PROCESSING INDUSTRY THE FACT THAT I WOULD BE WRITING THE FOREWARD WITH BILL SCHOLZ MADE THE JOB EVEN MORE ENJOYABLE BILL AND I HAVE KNOWN EACH OTHER SINCE HE WAS AT UNISYS DIRECTING PROJECTS THAT HAD A PROFOUND IMPACT ON SPEECH RECOGNITION TOOLS AND APPLICATIONS BILL SCHOLZ THE OPPORTUNITY TO PREPARE THIS FOREWORD WITH JUDITH PROVIDES ME

WITH A RARE OPPOR NITY TO COLLABORATE WITH A SEASONED SPEECH PROFESSIONAL TO IDENTIFY NUMEROUS SIGNI CANT CONTRIBUTIONS TO THE FIELD OFFERED BY THE CONTRIBUTORS WHOM AMY HAS RECRUITED JUDITH AND I HAVE HAD OUR EYES OPENED BY THE IDEAS AND ANALYSES OFFERED BY THIS COLLECTION OF AUTHORS SPEECH RECOGNITION NO LONGER NEEDS BE RELEGATED TO THE CA GORY OF AN EXPERIMENTAL FUTURE TECHNOLOGY IT IS HERE TODAY WITH SUFFICIENT CAPABILITY TO ADDRESS THE MOST CHALLENGING OF TASKS AND THE POINT CLICK TYPE APPROACH TO GUI CONTROL IS NO LONGER SUFFICIENT ESPECIALLY IN THE CONTEXT OF LIMITATIONS OF MODE DAY HAND HELD DEVICES INSTEAD VUI AND GUI ARE BEING INTEGRATED INTO UNIFIED MULTIMODAL SOLUTIONS THAT ARE MATURING INTO THE FUNDAMENTAL PARADIGM FOR COMPUT HUMAN INTERACTION IN THE FUTURE

NO DETAILED DESCRIPTION AVAILABLE FOR RECENT ADVANCES IN ROBUST SPEECH RECOGNITION TECHNOLOGY

A COMPLETE OVERVIEW OF DISTANT AUTOMATIC SPEECH RECOGNITION THE PERFORMANCE OF CONVENTIONAL AUTOMATIC SPEECH RECOGNITION ASR SYSTEMS DEGRADES DRAMATICALLY AS SOON AS THE MICROPHONE IS MOVED AWAY FROM THE MOUTH OF THE SPEAKER THIS IS DUE TO A BROAD VARIETY OF EFFECTS SUCH AS BACKGROUND NOISE OVERLAPPING SPEECH FROM OTHER SPEAKERS AND REVERBERATION WHILE TRADITIONAL ASR SYSTEMS UNDERPERFORM FOR SPEECH CAPTURED WITH FAR FIELD SENSORS THERE ARE A NUMBER OF NOVEL TECHNIQUES WITHIN THE RECOGNITION SYSTEM AS WELL AS TECHNIQUES DEVELOPED IN OTHER AREAS OF SIGNAL PROCESSING THAT CAN MITIGATE THE DELETERIOUS EFFECTS OF NOISE AND REVERBERATION AS WELL AS SEPARATING SPEECH FROM OVERLAPPING SPEAKERS DISTANT SPEECH RECOGNITIONPRESENTS A CONTEMPORARY AND COMPREHENSIVE DESCRIPTION OF BOTH THEORETIC ABSTRACTION AND PRACTICAL ISSUES INHERENT IN THE DISTANT ASR PROBLEM KEY FEATURES COVERS THE ENTIRE TOPIC OF DISTANT ASR AND OFFERS PRACTICAL SOLUTIONS TO OVERCOME THE PROBLEMS RELATED TO IT PROVIDES DOCUMENTATION AND SAMPLE SCRIPTS TO ENABLE READERS TO CONSTRUCT STATE OF THE ART DISTANT SPEECH RECOGNITION SYSTEMS GIVES RELEVANT BACKGROUND INFORMATION IN ACOUSTICS AND FILTER TECHNIQUES EXPLAINS THE EXTRACTION AND ENHANCEMENT OF CLASSIFICATION RELEVANT SPEECH FEATURES DESCRIBES MAXIMUM LIKELIHOOD AS WELL AS DISCRIMINATIVE PARAMETER ESTIMATION AND MAXIMUM LIKELIHOOD NORMALIZATION TECHNIQUES DISCUSSES THE USE OF MULTI MICROPHONE CONFIGURATIONS FOR SPEAKER TRACKING AND CHANNEL COMBINATION PRESENTS SEVERAL APPLICATIONS OF THE METHODS AND TECHNOLOGIES DESCRIBED IN THIS BOOK ACCOMPANYING WEBSITE WITH OPEN SOURCE SOFTWARE AND TOOLS TO CONSTRUCT STATE OF THE ART DISTANT SPEECH RECOGNITION SYSTEMS THIS REFERENCE WILL BE AN INVALUABLE RESOURCE FOR RESEARCHERS DEVELOPERS ENGINEERS AND OTHER PROFESSIONALS AS WELL AS ADVANCED STUDENTS IN SPEECH TECHNOLOGY SIGNAL PROCESSING ACOUSTICS STATISTICS AND ARTIFICIAL INTELLIGENCE FIELDS

THIS HANDBOOK PLAYS A FUNDAMENTAL ROLE IN SUSTAINABLE PROGRESS IN SPEECH RESEARCH AND DEVELOPMENT WITH AN ACCESSIBLE FORMAT AND WITH ACCOMPANYING DVD ROM IT TARGETS THREE CATEGORIES OF READERS GRADUATE STUDENTS PROFESSORS AND ACTIVE RESEARCHERS IN ACADEMIA AND ENGINEERS IN INDUSTRY WHO NEED TO UNDERSTAND OR IMPLEMENT SOME SPECIFIC ALGORITHMS FOR THEIR SPEECH RELATED PRODUCTS IT IS A SUPERB SOURCE OF APPLICATION ORIENTED AUTHORITATIVE AND COMPREHENSIVE INFORMATION ABOUT THESE TECHNOLOGIES THIS WORK COMBINES THE ESTABLISHED KNOWLEDGE DERIVED FROM RESEARCH IN SUCH FAST EVOLVING DISCIPLINES AS SIGNAL PROCESSING AND COMMUNICATIONS ACOUSTICS COMPUTER SCIENCE AND LINGUISTICS

AFTER ALM OST THREE SCORES OF YEARS OF BASIC AND APPLIED RESEARCH THE FIELD OF SPEECH PROCESSING IS AT PRESENT UNDERGOING A RAPID GROWTH IN TERMS OF BOTH PERFORMANCE AND APPLICATIONS AND THIS IS FUEHED BY THE ADVANCES BEING MADE IN THE AREAS OF MICROELECTRONICS COMPUTATION AND ALGORITHM DESIGN SPEECH PROCESSING RELATES TO THREE ASPECTS OF VOICE COMMUNICATIONS SPEECH CODING AND TRANSMISSION WHICH IS MAINLY CONCERNED WITH MAN TO MAN VOICE COMMUNICATION SPEECH SYNTHESIS WHICH DEALS WITH MACHINE TO MAN COMMUNICATION SPEECH RECOGNITION WHICH IS RELATED TO MAN TO MACHINE COMMUNICATION WIDESPREAD APPLICATION AND USE OF LOW BIT RATE VOICE CODEC SYNTHESIZERS AND RECOGNIZERS WHICH ARE ALL SPEECH PROCESSING PRODUCTS REQUIRES IDEAHY INTERNATIONALLY ACCEPTED QUALITY ASSESSMENT AND EVALUATION METHODS AS WEH AS SPEECH PROCESSING STANDARDS SO THAT THEY MAY BE INTERCONNECTED AND USED INDEPENDENTLY OF THEIR DESIGNERS AND MANUFACTURERS WITHOUT COSTLY INTERFACES THIS BOOK PRESENTS IN A TUTORIAL MANNER BOTH FUNDAMENTAL AND APPLIED ASPECTS OF THE ABOVE TOPICS WHICH HAVE BEEN PREPARED BY WEH KNOWN SPECIALISTS IN THEIR RESPECTIVE AREAS THE BOOK IS BASED ON LECTURES WHICH WERE SPONSORED BY AGARD NATO AND DELIVERED BY THE AUTHORS IN SEVERAL NATO COUNTRIES TO AUDIENCES CONSISTING MAINLY OF ACADEMIC AND INDUSTRIAL R D ENGINEERS AND PHYSICISTS AS WEH AS CIVIL AND MILITARY C3I SYSTEMS PLANNERS AND DESIGNERS

SPEECH TECHNOLOGY THE USE OF SPEECH AS A MEANS OF SENDING INFORMATION TO AND RECEIVING INFORMATION FROM COMPUTER SYSTEMS HAS BEEN IN USE AS A RESEARCH TOOL FOR MANY YEARS ONLY RECENTLY HAS IT BEGUN TO MOVE OUT OF THE LABORATORY AND INTO COMMERCIALLY WORTHWHILE APPLICATIONS FIRST WITH COMPRESSED AND SYNTHESISED SPOKEN MESSAGES THEN WITH COMPUTER RECOGNITION OF SPOKEN MESSAGES AND TODAY WITH DIVERSE APPLICATIONS INVOLVING BOTH RECOGNITION AND REPRODUCTION OF HUMAN SPEECH WE HAVE WRITTEN THIS BOOK BECAUSE WE BELIEVE THE TECHNOLOGY HAS NOW ADVANCED TO THE POINT WHERE MANY MORE APPLICATIONS OF VOICE RECOGNITION AND RESPONSE ARE BOTH FEASIBLE AND ECONOMICALLY ATTRACTIVE COMPUTERS THAT CAN UNDERSTAND EVERYDAY SPEECH ARE STILL A DISTANT PROSPECT BUT PROVIDED THE LIMITATIONS OF PRESENT DAY EQUIPMENT ARE CLEARLY UNDERSTOOD THERE IS MUCH THAT CAN BE

ACHIEVED WITH IT OUR AIM IS TO SHOW IN NON TECHNICAL LANGUAGE WHAT IS NOW POSSIBLE WITH THE HELP OF SPEECH TECHNOLOGY THE TEXT INCLUDES MANY EXAMPLES OF CURRENT APPLICATIONS IN INDUSTRY COMMERCE AND OTHER FIELDS AND WE HAVE SELECTED FIVE CURRENT INDUSTRIAL APPLICATIONS COMBINING SPEECH RECOGNITION AND RESPONSE FOR MORE DETAILED ATTENTION INDUSTRIAL CASES HAVE BEEN CHOSEN BOTH BECAUSE WE SEE INDUSTRY AS AN IMPORTANT GROWTH AREA FOR SPEECH APPLICATIONS IN THE NEXT FEW YEARS AND BECAUSE IT PRESENTS SOME OF THE GREATEST DIFFICULTIES IN SPEECH RECOGNITION IF YOU CAN MAKE IT WORK IN INDUSTRY THEN YOU CAN MAKE IT WORK ALMOST ANYWHERE

THIS BOOK DISCUSSES LARGE MARGIN AND KERNEL METHODS FOR SPEECH AND SPEAKER RECOGNITION SPEECH AND SPEAKER RECOGNITION LARGE MARGIN AND KERNEL METHODS IS A COLLATION OF RESEARCH IN THE RECENT ADVANCES IN LARGE MARGIN AND KERNEL METHODS AS APPLIED TO THE FIELD OF SPEECH AND SPEAKER RECOGNITION IT PRESENTS THEORETICAL AND PRACTICAL FOUNDATIONS OF THESE METHODS FROM SUPPORT VECTOR MACHINES TO LARGE MARGIN METHODS FOR STRUCTURED LEARNING IT ALSO PROVIDES EXAMPLES OF LARGE MARGIN BASED ACOUSTIC MODELLING FOR CONTINUOUS SPEECH RECOGNIZERS WHERE THE GROUNDS FOR PRACTICAL LARGE MARGIN SEQUENCE LEARNING ARE SET LARGE MARGIN METHODS FOR DISCRIMINATIVE LANGUAGE MODELLING AND TEXT INDEPENDENT SPEAKER VERIFICATION ARE ALSO ADDRESSED IN THIS BOOK KEY FEATURES PROVIDES AN UP TO DATE SNAPSHOT OF THE CURRENT STATE OF RESEARCH IN THIS FIELD COVERS IMPORTANT ASPECTS OF EXTENDING THE BINARY SUPPORT VECTOR MACHINE TO SPEECH AND SPEAKER RECOGNITION APPLICATIONS DISCUSSES LARGE MARGIN AND KERNEL METHOD ALGORITHMS FOR SEQUENCE PREDICTION REQUIRED FOR ACOUSTIC MODELING REVIEWS PAST AND PRESENT WORK ON DISCRIMINATIVE TRAINING OF LANGUAGE MODELS AND DESCRIBES DIFFERENT LARGE MARGIN ALGORITHMS FOR THE APPLICATION OF PART OF SPEECH TAGGING SURVEYS RECENT WORK ON THE USE OF KERNEL APPROACHES TO TEXT INDEPENDENT SPEAKER VERIFICATION AND INTRODUCES THE MAIN CONCEPTS AND ALGORITHMS SURVEYS RECENT WORK ON KERNEL APPROACHES TO LEARNING A SIMILARITY MATRIX FROM DATA THIS BOOK WILL BE OF INTEREST TO RESEARCHERS PRACTITIONERS ENGINEERS AND SCIENTISTS IN SPEECH PROCESSING AND MACHINE LEARNING FIELDS

CURRENT SPEECH RECOGNITION SYSTEMS ARE BASED ON SPEAKER INDEPENDENT SPEECH MODELS AND SUFFER FROM INTER SPEAKER VARIATIONS IN SPEECH SIGNAL CHARACTERISTICS THIS WORK DEVELOPS AN INTEGRATED APPROACH FOR SPEECH AND SPEAKER RECOGNITION IN ORDER TO GAIN SPACE FOR SELF LEARNING OPPORTUNITIES OF THE SYSTEM THIS WORK INTRODUCES A RELIABLE SPEAKER IDENTIFICATION WHICH ENABLES THE SPEECH RECOGNIZER TO CREATE ROBUST SPEAKER DEPENDENT MODELS IN ADDITION THIS BOOK GIVES A NEW APPROACH TO SOLVE THE REVERSE PROBLEM HOW TO IMPROVE SPEECH RECOGNITION IF SPEAKERS CAN BE RECOGNIZED THE SPEAKER IDENTIFICATION ENABLES THE SPEAKER ADAPTATION TO ADAPT TO DIFFERENT SPEAKERS WHICH RESULTS IN AN OPTIMAL LONG TERM

ADAPTATION

SPEECH RECOGNITION BY MACHINE A REVIEW D R REDDY THE VALUE OF SPEECH RECOGNITION SYSTEMS W A LEA DIGITAL REPRESENTATIONS OF SPEECH SIGNALS R W SCHAFER AND L R RABINER COMPARISON OF PARAMETRIC REPRESENTATIONS FOR MONOSYLLABIC WORD RECOGNITION IN CONTINUOUSLY SPOKEN SENTENCES S B DAVIS AND P MERMELSTEIN VECTOR QUANTIZATION R M GRAY A JOINT SYNCHRONY MEAN RATE MODEL OF AUDITORY SPEECH PROCESSING S SENEFF ISOLATED AND CONNECTED WORD RECOGNITION THEORY AND SELECTED APPLICATIONS L R RABINER AND S E LEVINSON MINIMUM PREDICTION RESIDUAL PRINCIPLE APPLIED TO SPEECH RECOGNITION F ITAKURA DYNAMIC PROGRAMMING ALGORITHM OPTIMIZATION FOR SPOKEN WORD RECOGNITION S HAKOE AND S CHIBA SPEAKER INDEPENDENT RECOGNITION OF ISOLATED WORDS USING CLUSTERING TECHNIQUES L R RABINER AND OTHERS TWO LEVEL DP MATCHING A DYNAMIC PROGRAMMING BASED PATTERN MATCHING ALGORITHM FOR CONNECTED WORD RECOGNITION H SAKOE THE USE OF A ONE STAGE DYNAMIC PR

AUTOMATIC SPEECH RECOGNITION ASR SYSTEMS ARE FINDING INCREASING USE IN EVERYDAY LIFE MANY OF THE COMMONPLACE ENVIRONMENTS WHERE THE SYSTEMS ARE USED ARE NOISY FOR EXAMPLE USERS CALLING UP A VOICE SEARCH SYSTEM FROM A BUSY CAFETERIA OR A STREET THIS CAN RESULT IN DEGRADED SPEECH RECORDINGS AND ADVERSELY AFFECT THE PERFORMANCE OF SPEECH RECOGNITION SYSTEMS AS THE USE OF ASR SYSTEMS INCREASES KNOWLEDGE OF THE STATE OF THE ART IN TECHNIQUES TO DEAL WITH SUCH PROBLEMS BECOMES CRITICAL TO SYSTEM AND APPLICATION ENGINEERS AND RESEARCHERS WHO WORK WITH OR ON ASR TECHNOLOGIES THIS BOOK PRESENTS A COMPREHENSIVE SURVEY OF THE STATE OF THE ART IN TECHNIQUES USED TO IMPROVE THE ROBUSTNESS OF SPEECH RECOGNITION SYSTEMS TO THESE DEGRADING EXTERNAL INFLUENCES KEY FEATURES REVIEWS ALL THE MAIN NOISE ROBUST ASR APPROACHES INCLUDING SIGNAL SEPARATION VOICE ACTIVITY DETECTION ROBUST FEATURE EXTRACTION MODEL COMPENSATION AND ADAPTATION MISSING DATA TECHNIQUES AND RECOGNITION OF REVERBERANT SPEECH ACTS AS A TIMELY EXPOSITION OF THE TOPIC IN LIGHT OF MORE WIDESPREAD USE IN THE FUTURE OF ASR TECHNOLOGY IN CHALLENGING ENVIRONMENTS ADDRESSES ROBUSTNESS ISSUES AND SIGNAL DEGRADATION WHICH ARE BOTH KEY REQUIREMENTS FOR PRACTITIONERS OF ASR INCLUDES CONTRIBUTIONS FROM TOP ASR RESEARCHERS FROM LEADING RESEARCH UNITS IN THE FIELD

GETTING THE BOOKS STATISTICAL METHODS FOR SPEECH RECOGNITION NOW IS NOT TYPE OF INSPIRING MEANS. YOU COULD NOT BY YOURSELF GOING TAKING INTO ACCOUNT BOOKS STORE OR LIBRARY OR BORROWING FROM YOUR FRIENDS TO GET INTO THEM. THIS IS AN NO QUESTION SIMPLE MEANS TO SPECIFICALLY GET GUIDE BY ON-LINE. THIS ONLINE NOTICE STATISTICAL METHODS FOR SPEECH RECOGNITION CAN BE ONE OF THE OPTIONS TO ACCOMPANY YOU NEXT HAVING FURTHER TIME. IT WILL NOT WASTE YOUR TIME. BELIEVE ME, THE E-BOOK WILL UTTERLY TUNE YOU NEW EVENT TO

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