



EXTRACTING MFCC AND GTCC FEATURES FOR EMOTION RECOGNITION FROM AUDIO SPEECH SIGNALS

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Abstract

Emotion recognition from speech has an increasing interest in recent years given the broad field of applications. The recognition system developed here uses Mel Frequency Cepstrum Coefficient (MFCC) and Gammatone Cepstrum Coefficient (GTCC) as the feature vectors for recognizing emotions in a speech signal. MFCC is the most commonly used feature vector for classification. But, MFCC systems usually do not perform well under noisy conditions because extracted features are distorted by noise, causing mismatched likelihood calculation. By introducing a novel speaker feature, gammatone cepstral coefficient (GTCC), based on an auditory periphery model, and show that this feature captures speaker characteristics and performs substantially better than conventional speaker features under noisy conditions. An important finding in the study is that GTCC features outperform conventional MFCC features under noisy conditions. These features are then used to train the classifier. The classifier used for the system is a cascade feed forward back propagation neural network. The database consists of 240 speech samples. Among them, 180 samples are used for training the system and the remaining 60 samples are used for testing the system. This study compares the differences between MFCC and GTCC for recognizing emotion from speech. The error rate of the system corresponds to MFCC and GTCC is 0.009703 and 0.0090822 respectively.

Key words: Automatic speech recognition, Pre-processing, Feature extraction, Classification, Mel-frequency cepstral coefficient, Gammatone cepstral coefficient.

1. Introduction

Speech is a complex signal which contains information about the message, speaker, language and emotions. Speech is one of the most natural communication forms between human beings. Emotion on other side is an individual mental state that arises spontaneously rather than through conscious effort. Humans also express

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**De-Shuang Huang, Wei Chen, Chuanlei
Zhang, Yijie Pan, Qinhu
Zhang, Xiangzeng Kong**

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Acoustic Modeling for Emotion Recognition Koteswara Rao Anne, Swarna Kuchibhotla, Hima Deepthi Vankayalapati, 2015-03-14 This book presents state of art research in speech emotion recognition Readers are first presented with basic research and applications gradually more advance information is provided giving readers comprehensive guidance for classify emotions through speech Simulated databases are used and results extensively compared with the features and the algorithms implemented using MATLAB Various emotion recognition models like Linear Discriminant Analysis LDA Regularized Discriminant Analysis RDA Support Vector Machines SVM and K Nearest neighbor KNN and are explored in detail using prosody and spectral features and feature fusion techniques **Emotion recognition using brain-computer interfaces and advanced artificial intelligence** Yizhang Jiang, Maozhen Li, Pengjiang William Qian, Yaoru Sun, 2023-02-17

Robust Emotion Recognition using Spectral and Prosodic Features K. Sreenivasa Rao, Shashidhar G. Koolagudi, 2013-01-13 In this brief the authors discuss recently explored spectral sub segmental and pitch synchronous and prosodic global and local features at word and syllable levels in different parts of the utterance features for discerning emotions in a robust manner The authors also delve into the complementary evidences obtained from excitation source vocal tract system and prosodic features for the purpose of enhancing emotion recognition performance Features based on speaking rate characteristics are explored with the help of multi stage and hybrid models for further improving emotion recognition performance Proposed spectral and prosodic features are evaluated on real life emotional speech corpus

Pattern Recognition and Artificial Intelligence Yue Lu, Nicole Vincent, Pong Chi Yuen, Wei-Shi Zheng, Farida Cheriet, Ching Y. Suen, 2020-10-09 This book constitutes the proceedings of the Second International Conference on Pattern Recognition and Artificial Intelligence ICPRAI 2020 which took place in Zhongshan China in October 2020 The 49 full and 14 short papers presented were carefully reviewed and selected for inclusion in the book The papers were organized in topical sections as follows handwriting and text processing features and classifiers deep learning computer vision and image processing medical imaging and applications and forensic studies and medical diagnosis Human-Computer Interaction. Recognition and Interaction Technologies Masaaki Kurosu, 2019-07-10 The 3 volume set LNCS 11566 11567 11568 constitutes the refereed proceedings of the Human Computer Interaction thematic area of the 21st International Conference on Human Computer Interaction HCII 2019 which took place in Orlando Florida USA in July 2019 A total of 1274 papers and 209 posters have been accepted for publication in the HCII 2019 proceedings from a total of 5029 submissions The 125 papers included in this HCI 2019 proceedings were organized in topical sections as follows Part I design and evaluation methods and tools redefining the human in HCI emotional design Kansei and aesthetics in HCI and narrative storytelling discourse and dialogue Part II mobile interaction facial expressions and emotions recognition eye gaze gesture and motion based interaction and interaction in virtual and augmented reality Part III design for social challenges design for culture and

entertainment design for intelligent urban environments and design and evaluation case studies **Advances in Computing and Communications, Part III** Ajith Abraham,Jaime Lloret Mauri,John Buford,Junichi Suzuki,Sabu M. Thampi,2011-07-08 This volume is the third part of a four volume set CCIS 190 CCIS 191 CCIS 192 CCIS 193 which constitutes the refereed proceedings of the First International Conference on Computing and Communications ACC 2011 held in Kochi India in July 2011 The 70 revised full papers presented in this volume were carefully reviewed and selected from a large number of submissions The papers are organized in topical sections on security trust and privacy sensor networks signal and image processing soft computing techniques system software vehicular communications networks

Computational Intelligence in Communications and Business Analytics Somnath Mukhopadhyay,Sunita Sarkar,Paramartha Dutta,Jyotsna Kumar Mandal,Sudipta Roy,2022-07-21 This book constitutes the refereed proceedings of the 4th International Conference on Computational Intelligence Communications and Business Analytics CICBA 2022 held in Silchar India in January 2022 The 21 full papers and 13 short papers presented in this volume were carefully reviewed and selected from 107 submissions The papers are organized in topical sections on computational intelligence computational intelligence in communication and computational intelligence in analytics Information and Communication Technology for Intelligent Systems (ICTIS 2017) - Volume 2 Suresh Chandra Satapathy,Amit Joshi,2017-08-16 This volume includes 73 papers presented at ICTIS 2017 Second International Conference on Information and Communication Technology for Intelligent Systems The conference was held on 25th and 26th March 2017 in Ahmedabad India and organized jointly by the Associated Chambers of Commerce and Industry of India ASSOCHAM Gujarat Chapter the G R Foundation the Association of Computer Machinery Ahmedabad Chapter and supported by the Computer Society of India Division IV Communication and Division V Education and Research The papers featured mainly focus on information and communications technology ICT and its applications in intelligent computing cloud storage data mining and software analysis The fundamentals of various data analytics and algorithms discussed are useful to researchers in the field *Advances in Signal Processing and Intelligent Recognition Systems* Sabu M. Thampi,Sri Krishnan,Juan Manuel Corchado Rodriguez,Swagatam Das,Michal Wozniak,Dhiya Al-Jumeily,2017-09-12 This Edited Volume gathers a selection of refereed and revised papers originally presented at the Third International Symposium on Signal Processing and Intelligent Recognition Systems SIRS 17 held on September 13 16 2017 in Manipal India The papers offer stimulating insights into biometrics digital watermarking recognition systems image and video processing signal and speech processing pattern recognition machine learning and knowledge based systems Taken together they offer a valuable resource for all researchers and scientists engaged in the various fields of signal processing and related areas *Affective Information Processing* Jianhua Tao,Tieniu Tan,2008-12-02 Affective information processing assigns computers the human like capabilities of observation interpretation and generation of affect features It is an important topic for harmonious human computer interaction by increasing the quality of human computer communication

and improving the intelligence of the computer. Discussing state of art of the research in affective information processing, this book summarises key technologies researched such as facial expression recognition, face animation, emotional speech synthesis, intelligent agent and virtual reality. The detailed discussion covers a wide range of topics including hot topics which look to challenge and improve current research work. Written to provide an opportunity for scientists, engineers and graduate students to learn problems, solutions and technologies in the topic area, this book will provide insight and prove a valuable reference tool.

Affective Computing and Intelligent Interaction Jianhua Tao, Tieniu Tan, 2005-10-27. This book constitutes the refereed proceedings of the First International Conference on Affective Computing and Intelligent Interaction ACII 2005 held in Beijing, China, in October 2005 as an associated event of ICCV 2005, the International Conference on Computer Vision. The 45 revised full papers and 81 revised poster papers presented were carefully reviewed and selected from 198 submissions. They cover a wide range of topics such as facial expression recognition, face animation, emotional speech synthesis, intelligent agent and virtual reality. The papers are organized in topical sections on affective face and gesture processing, affective speech processing, evaluation of affective expressivity, affective database annotation and tools, psychology and cognition of affect and affective interaction and systems and applications.

Advanced Applications in Osmotic Computing Revathy, G., 2024-03-04. The interaction of various service models including edge computing and cloud computing are quickly changing to better support microservices. This intricate weave of technology and information sharing is necessary to build systems that run faster and more efficiently. The interplay between these computing methods and microservices is emerging as the field of Osmotic Computing. Experts can now embark on an intellectual journey into data driven exploration and ingenuity with the guidance of the book *Advanced Applications in Osmotic Computing*. As ethical considerations become rising concerns, the potential biases, privacy encumbrances and equitable conundrums of osmotic computing are investigated. This book offers judicious strategies to navigate these quandaries conscientiously, adding a layer of responsibility to the discourse. Within these pages, the very fabric of understanding in IoT, Cloud, Edge, Fog and Machine Learning is redefined, marking a pivotal shift in the paradigm of technological comprehension. This book is an epicenter for the latest evolutions in osmotic computing, unfurling unconventional methodologies that shape the trajectory of data driven decision making. Readers will plunge into the theoretical bedrock, simultaneously witnessing pragmatic applications that adeptly bridge the schism between the theoretical constructs and pragmatic realization. The intended audience is multifaceted, encompassing data scientists, machine learning engineers, researchers, academics, educators, students, industry practitioners, interdisciplinary experts and technology and business leaders.

Applied Intelligence De-Shuang Huang, Wei Chen, Chuanlei Zhang, Yijie Pan, Qinhu Zhang, Xiangzeng Kong, 2025-02-23. This 2 volume set CCIS 2387, 2388 constitutes the proceedings of the Second International Conference on Applied Intelligence ICAI 2024 held in Zhengzhou, China, during November 22-25, 2024. The 72 full papers presented in this proceedings were carefully reviewed and selected from 228 submissions. The papers cover a

wide range on theoretical aspects of biomedical data modeling and mining computer vision and deep learning They were organized in topical sections as follows Part I Biomedical data modeling and mining information security pattern recognition Part II Image Processing intelligent data analysis and prediction machine learning

Artificial Intelligence and Speech Technology Arun Sharma,Ritu Rani,2025-05-29 This two volume set CCIS 2389 and CCIS 2390 constitutes selected papers presented at the 6th International Conference on Artificial Intelligence and Speech Technology AIST 2024 held in Delhi India during November 13 14 2024 The 40 full papers and 15 short papers presented in these proceedings were carefully reviewed and selected from 398 submissions These papers focus on Speech Technology using AI and AI innovations for CV and NLP They have been categorized under the following topical sections Part I Trends and Applications in Speech Processing Recent Trends in Speech and NLP Emerging trends in Speech Processing Advances in Computational Linguistics and NLP Part II Recent Trends in Machine Learning and Deep Learning Analysis using Hybrid technologies with Artificial Intelligence Exploring New Horizons in Computer Vision Research

Information and Communication Technology for Competitive Strategies (ICTCS 2022) M. Shamim Kaiser,Juanying Xie,Vijay Singh Rathore,2023-05-15 This book contains best selected research papers presented at ICTCS 2022 Seventh International Conference on Information and Communication Technology for Competitive Strategies The conference will be held in Chandigarh India during December 9 10 2022 The book covers state of the art as well as emerging topics pertaining to ICT and effective strategies for its implementation for engineering and managerial applications This book contains papers mainly focused on ICT for computation algorithms and data analytics and IT security The work is presented in two volumes

Handling Emotions in Human-Computer Dialogues Johannes Pittermann,Angela Pittermann,Wolfgang Minker,2009-10-28 In this book a novel approach that combines speech based emotion recognition with adaptive human computer dialogue modeling is described With the robust recognition of emotions from speech signals as their goal the authors analyze the effectiveness of using a plain emotion recognizer a speech emotion recognizer combining speech and emotion recognition and multiple speech emotion recognizers at the same time The semi stochastic dialogue model employed relates user emotion management to the corresponding dialogue interaction history and allows the device to adapt itself to the context including altering the stylistic realization of its speech This comprehensive volume begins by introducing spoken language dialogue systems and providing an overview of human emotions theories categorization and emotional speech It moves on to cover the adaptive semi stochastic dialogue model and the basic concepts of speech emotion recognition Finally the authors show how speech emotion recognizers can be optimized and how an adaptive dialogue manager can be implemented The book with its novel methods to perform robust speech based emotion recognition at low complexity will be of interest to a variety of readers involved in human computer interaction

Inclusive Smart Cities and Digital Health Carl K. Chang,Lorenzo Chiari,Yu Cao,Hai Jin,Mounir Mokhtari,Hamdi Aloulou,2016-05-20 This book constitutes the proceedings of the 14th International Conference on Smart Homes and Health Telematics ICOST

2016 held in Wuhan China in May 2016 The 39 regular papers 5 short papers and 1 poster paper included in this volume were carefully reviewed and selected from 83 submissions They were organized in topical sections named smart homes smart urban spaces and new assistive living space concepts in the smart city e health for future smart cities context awareness and autonomous computing home networks and residential gateways middleware support for smart homes and health telematic services e health and chronic disease management e health technology assessment and impact analysis tele assistance and tele rehabilitation modeling of physical and conceptual information in intelligent environments medical big data collection processing and analysis human machine interfaces wearable sensors and continuous health monitoring social privacy and security issues mobile health services and smart rehabilitation technologies *Machine Intelligence and Signal Processing* Sonali Agarwal,Shekhar Verma,Dharma P. Agrawal,2020-02-25 This book features selected high quality research papers presented at the International Conference on Machine Intelligence and Signal Processing MISP 2019 held at the Indian Institute of Technology Allahabad India on September 7 10 2019 The book covers the latest advances in the fields of machine learning big data analytics signal processing computational learning theory and their real time applications The topics covered include support vector machines SVM and variants like least squares SVM LS SVM and twin SVM TWSVM extreme learning machine ELM artificial neural network ANN and other areas in machine learning Further it discusses the real time challenges involved in processing big data and adapting the algorithms dynamically to improve the computational efficiency Lastly it describes recent developments in processing signals for instance signals generated from IoT devices smart systems speech and videos and addresses biomedical signal processing electrocardiogram ECG and electroencephalogram EEG

Intelligent Systems and Applications Yaxin Bi,Rahul Bhatia,Supriya Kapoor,2019-08-23 The book presents a remarkable collection of chapters covering a wide range of topics in the areas of intelligent systems and artificial intelligence and their real world applications It gathers the proceedings of the Intelligent Systems Conference 2019 which attracted a total of 546 submissions from pioneering researchers scientists industrial engineers and students from all around the world These submissions underwent a double blind peer review process after which 190 were selected for inclusion in these proceedings As intelligent systems continue to replace and sometimes outperform human intelligence in decision making processes they have made it possible to tackle a host of problems more effectively This branching out of computational intelligence in several directions and use of intelligent systems in everyday applications have created the need for an international conference as a venue for reporting on the latest innovations and trends This book collects both theory and application based chapters on virtually all aspects of artificial intelligence presenting state of the art intelligent methods and techniques for solving real world problems along with a vision for future research it represents a unique and valuable asset

Technologies for Digital Transformation Alessio Maria Braccini,Jessie Pallud,Ferdinando Pennarola,2024-05-28 Digital technologies can have a profound impact on modern organisations changing the way they operate communicate cooperate

and deliver value to stakeholders This book gathers the selected and revised best papers presented at the annual conference of the Italian Chapter of AIS which took place in Catanzaro in October 2022 It offers a comprehensive overview of the impacts of emerging digital technologies such as AI machine learning blockchain and Industry 4 0 on organisations and industries In this book these digital technologies are explored in relation to the digital transformation process for business organisations and industries It investigates how emerging technologies influence the digital transformation of diverse business organisations pointing out research trajectories implications opportunities and challenges Covering a wide range of topics related to digital transformation it offers valuable insights into the latest research on the opportunities and challenges that accompany emerging digital technologies

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Table of Contents Extracting Mfcc Features For Emotion Recognition From

1. Understanding the eBook Extracting Mfcc Features For Emotion Recognition From
 - The Rise of Digital Reading Extracting Mfcc Features For Emotion Recognition From
 - Advantages of eBooks Over Traditional Books
2. Identifying Extracting Mfcc Features For Emotion Recognition From
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Extracting Mfcc Features For Emotion Recognition From
 - User-Friendly Interface
4. Exploring eBook Recommendations from Extracting Mfcc Features For Emotion Recognition From
 - Personalized Recommendations
 - Extracting Mfcc Features For Emotion Recognition From User Reviews and Ratings
 - Extracting Mfcc Features For Emotion Recognition From and Bestseller Lists
5. Accessing Extracting Mfcc Features For Emotion Recognition From Free and Paid eBooks
 - Extracting Mfcc Features For Emotion Recognition From Public Domain eBooks
 - Extracting Mfcc Features For Emotion Recognition From eBook Subscription Services
 - Extracting Mfcc Features For Emotion Recognition From Budget-Friendly Options
6. Navigating Extracting Mfcc Features For Emotion Recognition From eBook Formats
 - ePub, PDF, MOBI, and More
 - Extracting Mfcc Features For Emotion Recognition From Compatibility with Devices
 - Extracting Mfcc Features For Emotion Recognition From Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Extracting Mfcc Features For Emotion Recognition From
 - Highlighting and Note-Taking Extracting Mfcc Features For Emotion Recognition From
 - Interactive Elements Extracting Mfcc Features For Emotion Recognition From

8. Staying Engaged with Extracting Mfcc Features For Emotion Recognition From
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Extracting Mfcc Features For Emotion Recognition From
9. Balancing eBooks and Physical Books Extracting Mfcc Features For Emotion Recognition From
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Extracting Mfcc Features For Emotion Recognition From
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Extracting Mfcc Features For Emotion Recognition From
 - Setting Reading Goals Extracting Mfcc Features For Emotion Recognition From
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Extracting Mfcc Features For Emotion Recognition From
 - Fact-Checking eBook Content of Extracting Mfcc Features For Emotion Recognition From
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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