Real-time Adaptive Concepts in Acoustics

Blind Signal Separation and
Multichannel Echo Cancellation

Daniël W.E. Schobben

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Real Time Adaptive Concepts In Acoustics Blind Signal Separation And Multichannel Echo Cancellation

Jacob Benesty,Constantin Paleologu,Tomas Gänsler,Silviu Ciochină

Real Time Adaptive Concepts In Acoustics Blind Signal Separation And Multichannel Echo Cancellation:
    Real-Time Adaptive Concepts in Acoustics D.E. Schobben,2012-12-06 Blind Signal Separation BSS deals with recovering filtered versions of source signals from an observed mixture thereof The term blind relates to the fact that there are no reference signals for the source signals and also that the mixing system is unknown This book presents a new method for blind signal separation which is developed to work on microphone signals Acoustic Echo Cancellation AEC is a well known technique to suppress the echo that a microphone picks up from a loudspeaker in the same room Such acoustic feedback occurs for example in hands free telephony and can lead to a perceived loud tone For an application such as a voice controlled television a stereo AEC is required to suppress the contribution of the stereo loudspeaker setup A generalized AEC is presented that is suited for multi channel operation New algorithms for Blind Signal Separation and multi channel Acoustic Echo Cancellation are presented A background is given in array signal processing methods adaptive filter theory and fast filtering in the frequency domain The included CD ROM can be played using any compact disc player to play the simulation results that are described in the text When inserted into a computer it furthermore gives Matlab implementations of the new algorithms along with audio data with which to experiment This makes the book suited to researchers engineers and university students who want to get acquainted with these emerging fields   The Journal of the Acoustical Society of America Acoustical Society of America,2004   **Fundamentals of Voice-Quality Engineering in Wireless Networks** Avi Perry,2007 Publisher description   *Adaptive Signal Processing* Jacob Benesty,Yiteng Huang,2013-03-09 By adaptive signal processing we mean in general adaptive ltering In known environments where we need to model identify or track time varying channels adaptive ltering has been proven to be an e ective and powerful tool As a result this tool is now in use in many di erent elds Since the invention by Widrow and Ho in 1959 of one of the rst ad tive lters the so called least mean square many applications appeared to have the potential to use this fundamental concept While the number of plications using adaptive algorithms has been and keeps ourishing with time thanks to several successes the need for more sophisticated adaptive algorithms became obvious as real world problems are more complex and more demanding Even though the theory of adaptive ltering is already a well established topic in signal processing new and improved concepts are discovered every year by researchers Some of these recent approaches are discussed in this book The goal of this book is to provide for the rst time a reference to the hottest real world applications where adaptive ltering techniques play an important role To do so we invited top researchers in di erent elds to c tribute chapters addressing their speci c topic of study Thousands of pages wouldprobablynotbe enoughto describeallthe practicalapplicationsutil ing adaptive algorithms Therefore we limited the topics to some important applications in acoustics speech wireless and networking where research is still very active and open   **American Book Publishing Record** ,2001   **Audio Signal Processing for Next-Generation Multimedia Communication Systems** Yiteng (Arden) Huang,Jacob Benesty,2007-05-08 Audio Signal

Processing for Next Generation Multimedia Communication Systems presents cutting edge digital signal processing theory and implementation techniques for problems including speech acquisition and enhancement using microphone arrays new adaptive filtering algorithms multichannel acoustic echo cancellation sound source tracking and separation audio coding and realistic sound stage reproduction This book s focus is almost exclusively on the processing transmission and presentation of audio and acoustic signals in multimedia communications for telecollaboration where immersive acoustics will play a great role in the near future   The British National Bibliography Arthur James Wells,2001   *Handbook on Array Processing and Sensor Networks* Simon Haykin,K. J. Ray Liu,2010-02-12 A handbook on recent advancements and the state of the art in array processing and sensor Networks Handbook on Array Processing and Sensor Networks provides readers with a collection of tutorial articles contributed by world renowned experts on recent advancements and the state of the art in array processing and sensor networks Focusing on fundamental principles as well as applications the handbook provides exhaustive coverage of wavelets spatial spectrum estimation MIMO radio propagation robustness issues in sensor array processing wireless communications and sensing in multi path environments using multi antenna transceivers implicit training and array processing for digital communications systems unitary design of radar waveform diversity sets acoustic array processing for speech enhancement acoustic beamforming for hearing aid applications undetermined blind source separation using acoustic arrays array processing in astronomy digital 3D 4D ultrasound imaging technology self localization of sensor networks multi target tracking and classification in collaborative sensor networks via sequential Monte Carlo energy efficient decentralized estimation sensor data fusion with application to multi target tracking distributed algorithms in sensor networks cooperative communications distributed source coding network coding for sensor networks information theoretic studies of wireless networks distributed adaptive learning mechanisms routing for statistical inference in sensor networks spectrum estimation in cognitive radios nonparametric techniques for pedestrian tracking in wireless local area networks signal processing and networking via the theory of global games biochemical transport modeling estimation and detection in realistic environments and security and privacy for sensor networks Handbook on Array Processing and Sensor Networks is the first book of its kind and will appeal to researchers professors and graduate students in array processing sensor networks advanced signal processing and networking   **Efficient Adaptive Multi-channel Concepts in Acoustics** Daniël Willem Elisabeth Schobben,1999   *Books In Print 2004-2005* Ed Bowker Staff,Staff Bowker, Ed,2004   **Index to IEEE Publications** Institute of Electrical and Electronics Engineers,1997   **Electrical & Electronics Abstracts** ,1997   Brinkman's cumulatieve catalogus van boeken, en verder in den boekhandel voorkomende artikelen ,2000 Voorts een alphabetische lijst van Nederlandsche boeken in Belgi uitgegeven   **Brinkman's catalogus van boeken en tijdschriften** ,2001 With 1901 1910 1956 1960 Repertoium is bound Brinkman s Titel catalohus van de gedurende 1901 1910 1956 1960 Title varies slightly   Science Abstracts ,1995   **Brinkman's cumulatieve catalogus van boeken**

,2000 Voorts een alphabetische lijst van Nederlandsche boeken in Belgi uitgegeven **Index to Theses with Abstracts Accepted for Higher Degrees by the Universities of Great Britain and Ireland and the Council for National Academic Awards** ,2004 Theses on any subject submitted by the academic libraries in the UK and Ireland **Advances in Network and Acoustic Echo Cancellation** J. Benesty,T. Gänsler,D.R. Morgan,M.M. Sondhi,S.L. Gay,2013-04-17 For many decades hybrid devices have been used to connect 2 wire local circuits and 4 wire long distance circuits in telephone lines This leads to a weIl known problem whereby echoes are generated The delay introduced by telecommunication satellites exacerbated this problem and the need for new methods of echo control soon became obvious The best solution to date for solving this problem was invented in the 1960s at Bell Labs by Kelly Logan and Sondhi and consists of identifying the echo path generated by the hybrid by means of an adaptive filter a technique that became known as an echo canceler The echo canceler allowed full duplex communication which was not possible with older echo suppression techniques Later with the development of hands free teleconferencing systems an other echo problem appeared but this time the echo was due to the coupling between the loudspeaker and microphone It is not surprising that the same solution was proposed to solve this problem and most of today s telecon ferencing systems have an acoustic echo canceler More recently attention has been given to the very interesting problem of multichannel acoustic echo cancellation which leads to more exciting applications that take advantage of our binaural auditory system System Approach to Robust Acoustic Echo Cancellation Through Semi-blind Source Separation Based on Independent Component Analysis Ted S. Wada,2012 We live in a dynamic world full of noises and interferences The conventional acoustic echo cancellation AEC framework based on the least mean square LMS algorithm by itself lacks the ability to handle many secondary signals that interfere with the adaptive filtering process e g local speech and background noise In this dissertation we build a foundation for what we refer to as the system approach to signal enhancement as we focus on the AEC problem We first propose the residual echo enhancement REE technique that utilizes the error recovery nonlinearity ERN to enhances the filter estimation error prior to the filter adaptation The single channel AEC problem can be viewed as a special case of semi blind source separation SBSS where one of the source signals is partially known i e the far end microphone signal that generates the near end acoustic echo SBSS optimized via independent component analysis ICA leads to the system combination of the LMS algorithm with the ERN that allows for continuous and stable adaptation even during double talk Second we extend the system perspective to the decorrelation problem for AEC where we show that the REE procedure can be applied effectively in a multi channel AEC MCAEC setting to indirectly assist the recovery of lost AEC performance due to inter channel correlation known generally as the non uniqueness problem We develop a novel computationally efficient technique of frequency domain resampling FDR that effectively alleviates the non uniqueness problem directly while introducing minimal distortion to signal quality and statistics We also apply the system approach to the multi delay filter MDF that suffers from the inter block correlation problem Finally

we generalize the MCAEC problem in the SBSS framework and discuss many issues related to the implementation of an SBSS system We propose a constrained batch online implementation of SBSS that stabilizes the convergence behavior even in the worst case scenario of a single far end talker along with the non uniqueness condition on the far end mixing system The proposed techniques are developed from a pragmatic standpoint motivated by real world problems in acoustic and audio signal processing Generalization of the orthogonality principle to the system level of an AEC problem allows us to relate AEC to source separation that seeks to maximize the independence hence implicitly the orthogonality not only between the error signal and the far end signal but rather among all signals involved The system approach for which the REE paradigm is just one realization enables the encompassing of many traditional signal enhancement techniques in analytically consistent yet practically effective manner for solving the enhancement problem in a very noisy and disruptive acoustic mixing environment

A Perspective on Stereophonic Acoustic Echo Cancellation Jacob Benesty,Constantin Paleologu,Tomas Gänsler,Silviu Ciochină,2011-07-25 Single channel hands free teleconferencing systems are becoming popular In order to enhance the communication quality of these systems more and more stereophonic sound devices with two loudspeakers and two microphones are deployed Because of the coupling between loudspeakers and microphones there may be strong echoes which make real time communication very difficult The best way we know to cancel these echoes is via a stereo acoustic echo canceller SAEC which can be modelled as a two input two output system with real random variables In this work the authors recast this problem into a single input single output system with complex random variables thanks to the widely linear model From this new convenient formulation they re derive the most important aspects of a SAEC including identification of the echo paths with adaptive filters double talk detection and suppression

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