

Sudharman K. Jayaweera

SIGNAL PROCESSING FOR COGNITIVE RADIOS



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Signal Processing For Cognitive Radios

Bruce A. Fette



Signal Processing For Cognitive Radios:

Signal Processing for Cognitive Radios Sudharman K. Jayaweera, 2014-12-16 This book examines signal processing techniques for cognitive radios. The book is divided into three parts. Part I is an introduction to cognitive radios and presents a history of the cognitive radio (CR) and introduces their architecture, functionalities, ideal aspects, hardware platforms, and state of the art developments. Dr. Jayaweera also introduces the specific type of CR that has gained the most research attention in recent years: the CR for Dynamic Spectrum Access (DSA). Part II of the book, Theoretical Foundations, guides the reader from classical to modern theories on statistical signal processing and inference. The author addresses detection and estimation theory, power spectrum estimation, classification, adaptive algorithms, machine learning, and inference and decision processes. Applications to the signal processing inference and learning problems encountered in cognitive radios are interspersed throughout with concrete and accessible examples. Part III of the book, Signal Processing in Radios, identifies the key signal processing inference and learning tasks to be performed by wideband autonomous cognitive radios. The author provides signal processing solutions to each task by relating the tasks to materials covered in Part II. Specialized chapters then discuss specific signal processing algorithms required for DSA and DSS cognitive radios. **Flexible Adaptation in Cognitive**

Radios Shujun Li, Miécyslaw Kokar, 2012-11-06 This book provides an introduction to software defined radio and cognitive radio along with methodologies for applying knowledge representation, semantic web, logic reasoning, and artificial intelligence to cognitive radio, enabling autonomous adaptation and flexible signaling. Readers from the wireless communications and software defined radio communities will use this book as a reference to extend software defined radio to cognitive radio using the semantic technology described. Cognitive Radio Networks Ahmed Khattab, Dmitri Perkins, Magdy Bayoumi, 2012-08-27 This book describes a communication paradigm that could shape the future of wireless communication networks: Opportunistic Spectrum Access (OSA) in Cognitive Radio Networks (CRN). While several theoretical OSA approaches have been proposed, they are challenged by the practical limitations of cognitive radios; the key enabling technology of OSA. This book presents an unprecedented formulation of the OSA problem in CNR that takes into account the practical limitations encountered due to existing technologies. Based on such a problem formulation, this book presents a framework and protocol details implementing the analytically optimized solution of this problem. Unlike the state of the art of CRN implementations that typically target software defined radios which are not suitable for real systems, this book describes the implementation of distributed OSA using practical radio transceiver technologies. It provides a thorough characterization of the gains available to theoretical OSA approaches if the practical limitations are taken into consideration. Tackles the cognitive radio networks performance optimization problem taking into account the practical limitations of today's technologies. Provides thorough performance evaluation in arbitrary large scale networks as well as microscopic small scale performance evaluation using realistic hardware implementation. Presents an empirical study of the gains available over existing techniques by adopting

practical approaches Tackles the cognitive radio networks performance optimization problem taking into account the practical limitations of today s technologies Provides thorough performance evaluation in arbitrary large scale networks as well as microscopic small scale performance evaluation using realistic hardware implementation Presents an empirical study of the gains available over existing techniques by adopting practical approaches **Cognitive Radio Technology** Bruce A. Fette, 2009-04-28 This book gives a thorough knowledge of cognitive radio concepts principles standards spectrum policy issues and product implementation details In addition to 16 chapters covering all the basics of cognitive radio this new edition has eight brand new chapters covering cognitive radio in multiple antenna systems policy language and policy engine spectrum sensing rendezvous techniques spectrum consumption models protocols for adaptation cognitive networking and information on the latest standards making it an indispensable resource for the RF and wireless engineer The new edition of this cutting edge reference which gives a thorough knowledge of principles implementation details standards policy issues in one volume enables the RF and wireless engineer to master and apply today s cognitive radio technologies Bruce Fette PhD is Chief Scientist in the Communications Networking Division of General Dynamics C4 Systems in Scottsdale AZ He worked with the Software Defined Radio SDR Forum from its inception currently performing the role of Technical Chair and is a panelist for the IEEE Conference on Acoustics Speech and Signal Processing Industrial Technology Track He currently heads the General Dynamics Signal Processing Center of Excellence in the Communication Networks Division Dr Fette has 36 patents and has been awarded the Distinguished Innovator Award Foreword and a chapter contribution by Joe Mitola the creator of the field Discussion of cognitive aids to the user spectrum owner network operator Explanation of capabilities such as time position awareness speech and language awareness multi objective radio and network optimization and supporting database infrastructure Detailed information on product implementation to aid product developers Thorough descriptions of each cognitive radio component technology provided by leaders of their respective fields and the latest in high performance analysis implementation techniques Explanations of the complex architecture and terminology of the current standards activities Discussions of market opportunities created by cognitive radio technology **Principles of Cognitive Radio** Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, 2012-11-15 Widely regarded as one of the most promising emerging technologies for driving the future development of wireless communications cognitive radio has the potential to mitigate the problem of increasing radio spectrum scarcity through dynamic spectrum allocation Drawing on fundamental elements of information theory network theory propagation optimisation and signal processing a team of leading experts present a systematic treatment of the core physical and networking principles of cognitive radio and explore key design considerations for the development of new cognitive radio systems Containing all the underlying principles you need to develop practical applications in cognitive radio this book is an essential reference for students researchers and practitioners alike in the field of wireless communications and signal processing **Energy-efficient VLSI**

Signal Processing for Wideband Spectrum Sensing in Cognitive Radios Tsung-Han Yu, 2013 With the rapid increases in the number of wireless devices fixed spectrum allocation has shown to be a major limitation to the evolution of wireless technologies Cognitive radio CR allows opportunistic spectrum access by searching and utilizing temporally and spatially unused spectrum provided that CR users do not cause interference to the primary users of the spectrum Spectrum sensing over a wide bandwidth increases the probability of finding under utilized spectrum for cognitive radios However the realization of wideband sensing is challenging because strong primary users introduce large dynamic range and spectral leakage to adjacent unused bands This work presents an algorithm architecture co design framework for wideband spectrum sensing The suppression of spectral leakage is achieved by multitap windowed FFT processing which also enables reduced sensing time The sensing time and detection threshold are adapted according to channel specific spectral leakage enabling reliable wideband detection within constrained sensing time Power and area cost of the compute intensive FFT block is minimized by using parallelism radix factorization and compact delay lines A per channel floating point data processing for large dynamic range signal is employed for power and area saving A partial PSD estimation scheme that performs energy detection on only the band of interest further improves the energy efficiency Two chips have been designed to demonstrate these concepts These chips guarantee reliable weak signal detection with short sensing time and outperform the prior work by at least 22x in power bandwidth Techniques developed in this dissertation enable energy efficient chip implementation of advanced wideband signal processing for cognitive radios

Maximizing Available Spectrum for Cognitive Radios Shridhar Mubaraq Mishra, 2009 Academic Press Library in Signal Processing

Fulvio Gini, Nikolaos D. Sidiropoulos, 2013-09-10 This second volume edited and authored by world leading experts gives a review of the principles methods and techniques of important and emerging research topics and technologies in communications and radar engineering With this reference source you will Quickly grasp a new area of research Understand the underlying principles of a topic and its application Ascertain how a topic relates to other areas and learn of the research issues yet to be resolved Quick tutorial reviews of important and emerging topics of research in array and statistical signal processing Presents core principles and shows their application Reference content on core principles technologies algorithms and applications Comprehensive references to journal articles and other literature on which to build further more specific and detailed knowledge Edited by leading people in the field who through their reputation have been able to commission experts to write on a particular topic

Blind Signal Classification Algorithms for Cognitive Radios Barathram Ramkumar, Tamal Bose, Alireza Babaei, William H. Tranter, 2015-07-12 This book provides a comprehensive tutorial to signal classification an important signal processing technique that enables cognitive radios to identify the kind of users present in a frequency band helping a radio to characterize the environment in which it is operating Engineers involved in the design and implementation of cognitive radio receivers will benefit from this book s coverage of a newly developed multiuser signal classification algorithm as well as

techniques for design of other components to work in conjunction with the signal classifier such as blind equalizers blind channel estimators and cognitive engines

Advanced Sensing Techniques for Cognitive Radio Guodong Zhao, Wei Zhang, Shaoqian Li, 2016-11-09 This SpringerBrief investigates advanced sensing techniques to detect and estimate the primary receiver for cognitive radio systems Along with a comprehensive overview of existing spectrum sensing techniques this brief focuses on the design of new signal processing techniques including the region based sensing jamming based probing and relay based probing The proposed sensing techniques aim to detect the nearby primary receiver and estimate the cross channel gain between the cognitive transmitter and primary receiver The performance of the proposed algorithms is evaluated by simulations in terms of several performance parameters including detection probability interference probability and estimation error The results show that the proposed sensing techniques can effectively sense the primary receiver and improve the cognitive transmission throughput Researchers and postgraduate students in electrical engineering will find this an exceptional resource

Communications, Signal Processing, and Systems Qilian Liang, Xin Liu, Zhenyu Na, Wei Wang, Jiasong Mu, Baoju Zhang, 2019-05-04 This book brings together papers from the 2018 International Conference on Communications Signal Processing and Systems which was held in Dalian China on July 14 16 2018 Presenting the latest developments and discussing the interactions and links between these multidisciplinary fields the book spans topics ranging from communications signal processing and systems It is aimed at undergraduate and graduate electrical engineering computer science and mathematics students researchers and engineers from academia and industry as well as government employees

Cognitive Radios Danijela Branislav Čabrić, 2007

Foundation of Cognitive Radio Systems Samuel Cheng, 2012-03-16 The fast user growth in wireless communications has created significant demands for new wireless services in both the licensed and unlicensed frequency spectra Since many spectra are not fully utilized most of the time cognitive radio as a form of spectrum reuse can be an effective means to significantly boost communications resources Since its introduction in late last century cognitive radio has attracted wide attention from academics to industry Despite the efforts from the research community there are still many issues of applying it in practice This books is an attempt to cover some of the open issues across the area and introduce some insight to many of the problems It contains thirteen chapters written by experts across the globe covering topics including spectrum sensing fundamental cooperative sensing spectrum management and interaction among users

Machine Learning Methods for Signal, Image and Speech Processing M.A. Jabbar, MVV Prasad Kantipudi, Sheng-Lung Peng, Mamun Bin Ibne Reaz, Ana Maria Madureira, 2022-09-01 The signal processing SP landscape has been enriched by recent advances in artificial intelligence AI and machine learning ML yielding new tools for signal estimation classification prediction and manipulation Layered signal representations nonlinear function approximation and nonlinear signal prediction are now feasible at very large scale in both dimensionality and data size These are leading to significant performance gains in a variety of long standing problem domains like speech and Image analysis As

well as providing the ability to construct new classes of nonlinear functions e.g. fusion nonlinear filtering. This book will help academics, researchers, developers, graduate and undergraduate students to comprehend complex SP data across a wide range of topical application areas such as social multimedia data collected from social media networks, medical imaging data, data from Covid tests etc. This book focuses on AI utilization in the speech, image, communications and virtual reality domains.

Security-aware Cooperation in Cognitive Radio Networks Ning Zhang, Jon W. Mark, 2014-01-29. This brief investigates spectrum efficient and energy efficient strategies known as cognitive radio networks (CRNs) to ensure secure cooperation between licensed and unlicensed users. The authors address issues of spectrum scarcity, spectrum sensing, transmission performance, trust-aware cooperation and secure communications. Two security-aware cooperation-based spectrum access schemes are presented. The first is a trust-aware cooperative framework for CRNs to improve the throughput or energy efficiency of licensed users and offer transmission opportunities to unlicensed users taking into consideration the trustworthiness of unlicensed users. The second scheme is a cooperative framework to enhance secure communications of licensed users. An introduction to CRNs and literature survey enhance the discussion while numerical results are provided to demonstrate the viability of the proposed schemes. The brief is designed for researchers and professionals working with cognitive radio networks or interested in cooperation-based access. Advanced level students studying computer communication networks and communications engineering will also find this brief useful.

Cognitive Radio Networks Kwang-Cheng Chen, Ramjee Prasad, 2009-03-30. Giving a basic overview of the technologies supporting cognitive radio, this introductory level text follows a logical approach starting with the physical layer and concluding with applications and general issues. It provides a background to advances in the field of cognitive radios and a new exploration of how these radios can work together as a network. Cognitive Radio Networks starts with an introduction to the fundamentals of wireless communications, introducing technologies such as OFDM, MIMO. It moves on to cover software-defined radio and explores and contrasts wireless cooperative and cognitive networks and communications. Spectrum sensing, medium access control and network layer design are examined before the book concludes by covering the topics of trusted cognitive radio networks and spectrum management. Unique in providing a brief but clear tutorial and reference to cognitive radio networks, this book is a single reference written at the appropriate level for newcomers as well as providing an encompassing text for those with more knowledge of the subject. One of the first books to provide a systematic description of cognitive radio networks. Provides pervasive background knowledge including both wireless communications and wireless networks. Written by leading experts in the field. Full network stack investigation.

Soft Computing and Signal Processing Hushairi Zen, Naga M. Dasari, Y. Madhava, S. Srinivasa Rao, 2025-05-16. This book presents selected research papers on current developments in the fields of soft computing and signal processing from the Seventh International Conference on Soft Computing and Signal Processing (ICSCSP 2024) organized by Malla Reddy College of Engineering Technology, Hyderabad, India. The book covers

topics such as soft sets rough sets fuzzy logic neural networks genetic algorithms and machine learning and discusses various aspects of these topics e g technological considerations product implementation and application issues **Signal Processing and Machine Learning Theory** Paulo S.R. Diniz,2023-07-10 Signal Processing and Machine Learning Theory authored by world leading experts reviews the principles methods and techniques of essential and advanced signal processing theory These theories and tools are the driving engines of many current and emerging research topics and technologies such as machine learning autonomous vehicles the internet of things future wireless communications medical imaging etc Provides quick tutorial reviews of important and emerging topics of research in signal processing based tools Presents core principles in signal processing theory and shows their applications Discusses some emerging signal processing tools applied in machine learning methods References content on core principles technologies algorithms and applications Includes references to journal articles and other literature on which to build further more specific and detailed knowledge

The Proceedings of the Third International Conference on Communications, Signal Processing, and Systems Jiasong Mu,Qilian Liang,Wei Wang,Baoju Zhang,Yiming Pi,2015-06-12 The Proceedings of The Third International Conference on Communications Signal Processing and Systems provides the state of art developments of Communications Signal Processing and Systems The conference covered such topics as wireless communications networks systems signal processing for communications This book is a collection of contributions coming out of Third International Conference on Communications Signal Processing and Systems held on July 2014 in Hohhot Inner Mongolia China **Software Radio** Elettra Venosa,fredric j. harris,Francesco A. N. Palmieri,2011-10-17 This book describes the design of Software Radio SWR Rather than providing an overview of digital signal processing and communications this book focuses on topics which are crucial in the design and development of a SWR explaining them in a very simple yet precise manner giving simulation results that confirm the effectiveness of the proposed design Readers will gain in depth knowledge of key issues so they can actually implement a SWR

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