

READ [PDF] Matlab Code For Cognitive Radio Spectrum Sensing

Yang Xiao, Fei Hu

Joint Spatial-temporal Spectrum Sensing and Cooperative Relaying for Cognitive Radio Networks Tuan T. Do.2011 The number of wireless systems and services has grown tremendously over the last two decades. As a result, the availability of wireless spectrum has become extremely limited. Cognitive radio is a new technique to overcome the issue of spectrum scarcity. In cognitive radio networks, the licensed users of the spectrum are called primary users. Secondary users equipped with cognitive radios can opportunistically transmit via so-called spectrum holes which can be categorized as spatial or temporal spectrum holes. In this dissertation, we propose a joint spatial-temporal spectrum sensing scheme for cognitive radios. We show that our joint spatial-temporal spectrum sensing scheme outperforms pure temporal sensing schemes. In addition, joint spatial-temporal sensing increases the point-to-point transmission capacity of cognitive radio link compared to pure temporal or spatial sensing. We also propose a temporal spectrum sensing scheme that exploits multiuser diversity in wireless networks. In wireless networks with fading, multiuser diversity exists because different users experience peak channel quality at different times. By exploiting multiuser diversity, our spectrum sensing method can outperform the spectrum sensing schemes that do not exploit multiuser diversity. We develop and analyze a joint spatial-temporal sensing scheme that incorporates cooperative relaying to further increase the capacity of a cognitive radio network. We consider both amplify-and-forward and decode-and-forward cooperative transmission strategies. Finally, we study joint spatial-temporal spectrum sensing in a multichannel cognitive radio scenario and present randomized and maximized signal-to-noise ratio algorithms that improve performance in term of symbol error probability.

Cognitive Radio Rajeshree Raut, Ranjit Sawant, Shriraghavan Madbushi.2020-04-16 Globally considered as one of the key technologies in the field of wireless communications, cognitive radio has the capability to solve the issues related to radio spectrum scarcity with the help of dynamic spectrum allocation. It discusses topics including software defined radio architecture, linear predictive coding, variance fractal compression, optimal Codec design for mobile communication system, digital modulation techniques, spectrum sensing in cognitive radio networks and orthogonal frequency division multiplexing in depth. The text is primarily written for senior undergraduate and graduate students, in learning experimental techniques,

designing and implementing models in the field wireless communication.

Cooperative Spectrum Sensing and Resource Allocation Strategies in Cognitive Radio Networks Xavier Fernando,Ajmyery Sultana,Sattar Hussain,Lian Zhao.2018-05-22 Cognitive radio networks (CRN) will be widely deployed in the near future, and this SpringerBrief covers some important aspects of it, as well as highlighting optimization strategies in Resource Allocation and Spectrum Sensing in CRNs. The cognitive approach in radio access is introduced in the first part of this SpringerBrief, and then next the benefits of cooperative spectrum sensing are highlighted and a framework for studying it under realistic channel conditions is described. New exact closed-form expressions for average false alarm probability and average detection probability are derived in this scenario. A novel approximation to alleviate the computational complexity of the proposed models are also discussed. Once the spectrum opportunities are identified, efficient and systematic resource allocation (RA) shall be performed. The second part of this SpringerBrief describes the taxonomy for the RA process in CRN. A comprehensive overview of the optimization strategies of the CRN RA is also provided. The device-to-device (D2D) communication scenario is discussed, then as a case study and various optimization strategies for the application of the CR technology in the D2D realm is studied. The application of advanced geometric water-filling (GWF) approach in CRN D2D environment for optimum resource allocation is presented in detail. Numerical results provide more insight quantitatively. Overall, this book is suitable for a wide audience that include students, faculty and researchers in wireless communication area and professionals in the wireless service industry.

Cognitive Radio Techniques Kandeepan Sithamparanathan,Andrea Giorgetti.2012 Providing an in-depth treatment of the core enablers of cognitive radio technology, this unique book places emphasis on critical areas that have not been sufficiently covered in existing literature. You find expert guidance in the key enablers with respect to communications and signal processing. The book presents fundamentals, basic solutions, detailed discussions of important enabler issues, and advanced algorithms to save you time with your projects in the field. For the first time in any book, you find an adequately detailed treatment of spectrum sensing that covers nearly every aspect of the subject. Moreover, this valuable resource provides you with thorough working knowledge of localization and interference mitigation as enablers of cognitive radio technology. The book includes all the necessary mathematics, statistical and probabilistic treatments, and performance analysis to give you a comprehensive understanding of the material.

Cognitive Radio Networks Yang Xiao,Fei Hu.2008-12-24 Fueled by ongoing and increasing consumer demand, the explosive growth in spectrum-based communications continues to tax the finite resources of the available spectrum. One possible solution, Cognitive Radio Network (CRN), allows unlicensed users opportunistic access to licensed bands without interfering with existing users. Although some initial study has been conducted in this field, researchers need a systematic reference book that presents clear definitions, functions, and current challenges of the CRNs. Cognitive Radio Networks

presents state-of-the-art approaches and novel technologies for cognitive wireless radio networks and sheds light on future developments in these areas. Comprising the contributions of many prominent world-wide cognitive radio researchers, this book covers all CRN essentials including spectrum sensing, spectrum handoff, spectrum sharing, and CRN routing schemes. Divided into five parts, the book addresses the physical layer, medium access control, the routing layer, cross-layer considerations and advanced topics in cognitive radio networks. The chapters also review research, management, support, and cognitive techniques such as position and network awareness, infrastructure and physical and link layer concerns. The editors of this volume are noted experts in the field of wireless networks and security. Dr. Yang Xiao's research has been supported by the U.S. National Science Foundation (NSF), U.S. Army Research, Fleet & Industrial Supply Center San Diego (FISCSD), and the University of Alabama's Research Grants Committee. Dr. Fei Hu has worked with NSF, Cisco, Lockheed Martin, Sprint, and other organizations. By bringing together the combined input of international experts, these editors have advanced the field of this nascent technology and helped to forge new paths of discovery for progressive communications possibilities.

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.

Spectrum Sharing in Cognitive Radio Networks Shweta Pandit,Ghanshyam Singh.2018-07-21 This book discusses the use of the spectrum sharing techniques in cognitive radio technology, in order to address the problem of spectrum scarcity for future wireless communications. The authors describe a cognitive radio medium access control (MAC) protocol, with which throughput maximization has been achieved. The discussion also includes use of this MAC protocol for imperfect sensing scenarios and its effect on the performance of cognitive radio systems. The authors also discuss how energy efficiency has been maximized in this system, by applying a simple algorithm for optimizing the transmit power of the cognitive user. The study about the channel fading in the cognitive user and licensed user and power adaption policy in this scenario under peak transmit power and interference power constraint is also present in this book.

Spectrum Sensing in Cognitive Radio Networks Waleed Ejaz, Mehak Basharat. 2011-04 Recent research shows that 70% of the available spectrum is not utilized efficiently. The bandwidth gets expensive owing to shortage of frequencies. For efficient utilization of spectrum, we need to sniff the spectrum to determine whether it is used by primary user or not. The term cognitive radio refers to the adoption of radio parameters using the sensed information of the spectrum. There are three major categories of spectrum sensing techniques; transmitter detection, receiver detection and interference temperature detection. This book presents a survey of techniques suggested in the literature for spectrum sensing with a performance analysis of transmitter-based detection techniques. A Fuzzy logic based technique for primary user detection has also been proposed. In comparison with transmitter detection techniques proposed technique provides good results under low SNR values.

Cognitive Radio Mobile Ad Hoc Networks F. Richard Yu. 2014-10-11 Cognitive radios (CR) technology is capable of sensing its surrounding environment and adapting its internal states by making corresponding changes in certain operating parameters. CR is envisaged to solve the problems of the limited available spectrum and the inefficiency in the spectrum usage. CR has been considered in mobile ad hoc networks (MANETs), which enable wireless devices to dynamically establish networks without necessarily using a fixed infrastructure. The changing spectrum environment and the importance of protecting the transmission of the licensed users of the spectrum mainly differentiate classical MANETs from CR-MANETs. The cognitive capability and re-configurability of CR-MANETs have opened up several areas of research which have been explored extensively and continue to attract research and development. The book will describe CR-MANETs concepts, intrinsic properties and research challenges of CR-MANETs. Distributed spectrum management functionalities, such as spectrum sensing and sharing, will be presented. The design, optimization and performance evaluation of security issues and upper layers in CR-MANETs, such as transport and application layers, will be investigated.

Cognitive Radio Networks Shaowei Wang. 2014-08-29 This SpringerBrief presents a survey of dynamic resource allocation schemes in Cognitive Radio (CR) Systems, focusing on the spectral-efficiency and energy-efficiency in wireless networks. It also introduces a variety of dynamic resource allocation schemes for CR networks and provides a concise introduction of the landscape of CR technology. The author covers in detail the dynamic resource allocation problem for the motivations and challenges in CR systems. The Spectral- and Energy-Efficient resource allocation schemes are comprehensively investigated, including new insights into the trade-offs for operating strategies. Promising research directions on dynamic resource management for CR and the applications in other wireless communication systems are also discussed. *Cognitive Radio Networks: Dynamic Resource Allocation Schemes* targets computer scientists and engineers working in wireless communications. Advanced-level students in computer science and electrical engineering will also find this brief useful reading about the next generation of wireless communication.

Spectrum sensing techniques in cognitive radio Joydeep Dutta.2022-05-09 Document from the year 2022 in the subject Physics - Technical Physics, grade: A, , language: English, abstract: Cognitive Radio offers non-interfering use of spectrum which requires three main tasks: Spectrum Sensing, Spectrum Analysis and Spectrum Allocation. The aim of this study is to focus on spectrum sensing in cognitive radio which is a recently introduced technology in order to increase the spectrum efficiency. Increasing efficiency of the spectrum usage is an urgent need as the number of wireless users is increasing rapidly. Cognitive radio arises to be a good solution to spectral crowding problem by introducing the opportunistic usage of frequency bands that are not heavily occupied by licensed users (Primary user) since they cannot be utilized by users other (Secondary user) than the license owners at the moment. Cognitive radio can sense the spectrum and detect the idle frequency bands, thus secondary users can be allocated in those bands when primary users do not use those in order to avoid any interference to primary user by secondary users. Several Spectrum Sensing Methods proposed in the literature are theoretically analyzed and interpreted in the sense of advantages and drawbacks.

Cognitive Radio Networks Kaigui Bian,Jung-Min Park,Bo Gao.2014-07-10 This book gives a comprehensive overview of the medium access control (MAC) principles in cognitive radio networks, with a specific focus on how such MAC principles enable different wireless systems to coexist in the same spectrum band and carry out spectrum sharing. From algorithm design to the latest developments in the standards and spectrum policy, readers will benefit from leading-edge knowledge of how cognitive radio systems coexist and share spectrum resources. Coverage includes cognitive radio rendezvous, spectrum sharing, channel allocation, coexistence in TV white space, and coexistence of heterogeneous wireless systems.

Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management Kaabouch, Naima.2014-10-31 The inadequate use of wireless spectrum resources has recently motivated researchers and practitioners to look for new ways to improve resource efficiency. As a result, new cognitive radio technologies have been proposed as an effective solution. The Handbook of Research on Software-Defined and Cognitive Radio Technologies for Dynamic Spectrum Management examines the emerging technologies being used to overcome radio spectrum scarcity. Providing timely and comprehensive coverage on topics pertaining to channel estimation, spectrum sensing, communication security, frequency hopping, and smart antennas, this research work is essential for use by educators, industrialists, and graduate students, as well as academicians researching in the field.

Energy Detection Based Spectrum Sensing in Cognitive Radio Pranav Patel.2015-06-25 The rapid usage of wireless-communications in personal, commercial and governmental capacities, efficient spectrum utilization has become a prime topic of interest. Most of the licensed bands suffer from under-utilization and less spectral occupancy of spectrum. Cognitive radio technology promising solution to the problem of low spectral occupancy and inefficient utilization of the licensed radio spectrum. A prime constituent of the cognitive radio technology is spectrum sensing. Energy detection (ED) is one of the

popular spectrum sensing technique for cognitive radio. In this work, I Proposed RTL 2832U SDR stick is suitable for energy detection based spectrum sensing method. In this experiment, we capture the real time signal coming from the BTS over the different city in rural & urban area using an RTL 2832U SDR stick to decide the frequency band available or not. The GNU Radio software allows for the implementation of Energy detection spectrum sensing technique using the RTL-SDR.

Introduction to Cognitive Radio Networks and Applications Geetam Tomar, Ashish Bagwari, Jyotshana Kanti. 2016-10-03 Cognitive radio is 5-G technology, comes under IEEE 802.22 WRAN (Wireless Regional Area Network) standards. It is currently experiencing rapid growth due to its potential to solve many of the problems affecting present-day wireless systems. The foremost objective of *Introduction to Cognitive Radio Networks and Applications* is to educate wireless communication generalists about cognitive radio communication networks. Written by international leading experts in the field, this book caters to the needs of researchers in the field who require a basis in the principles and the challenges of cognitive radio networks.

Interference-Aware Spectrum Occupancy Prediction for Cognitive Radio Networks Rana Al Halaseh. 2018-08-27 This work presents different hidden Markov model (HMM) based spectrum occupancy prediction schemes for filter bank based multi-carrier (FBMC) transmission applications. By employing a discrete Fourier transform-modulated filter bank (DFT-FB), the SU receiver can efficiently explore the time-frequency (TF) characteristics of the received signal to be utilized in a suitable prediction scheme.

Adaptive Weighting of Multi-taper Spectrum Sensing in Cognitive Radio Networks Anonym. 2020-02-28 Master's Thesis from the year 2019 in the subject Mathematics - Applied Mathematics, grade: Master Degree, language: English, abstract: This thesis discusses the performance enhancement of multi-taper spectrum sensing as a powerful technique for cognitive radio networks. In multi-taper spectrum sensing, regular detection of unused spectrum holes is performed to make cognitive radio networks aware of users' activities. As a result, more effective spectrum management is expected and unlicensed users could use unused spectrum holes. In this thesis, an analytical study was proposed in which reliable, simple, and computationally efficient mathematical expressions for the mean and variance of the probability density function (PDF) of the multitaper spectrum sensing techniques were derived. The proposed analytical study was evaluated by intensive simulations using MATLAB. The presence of Additive White Gaussian Noise is assumed. Many important aspects of spectrum sensing in cognitive radio networks are included such as, receiver operating characteristics, detection rate versus signal to noise ratio (SNR), and the minimum required sample points for a specific performance. All simulations were performed to include most factors affecting the efficiency of the proposed sensing methodology such as, number of tapers (K), number of sample points (N), and the probability of false alarm (Pf). A comparison with energy detection method was done. All simulation results and comparisons confirm that the proposed model is reliable and robust under all factors considered in the

simulation.

Spectrum Sensing in Cognitive Radio: Bootstrap and Sequential Detection Approaches Fiky Y. Suratman.2014

Principles of Cognitive Radio Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor. 2013 Expert authors draw on fundamental theory to explain the core principles and key design considerations for developing cognitive radio systems.

Spectrum Sensing Techniques: Comparative Analysis Atti Ur Rehman, Muhammad Asif. 2013 In order to efficiently utilize the spectrum, the role of spectrum sensing is essential in cognitive radio networks. The transmitter detection based techniques: energy detection, cyclostationary feature detection, and matched filter detection, is most commonly used for the spectrum sensing. The Energy detection technique is implemented in the 2-hop cooperative cognitive radio network. OSTBC is used for transmission of data in the 2-hop network. The Energy detection technique is simplest and gives good results at the higher Signal to Noise Ratio (SNR) values. However, at the low SNR values its performance degrades. Moreover, each transmitter detection technique has a SNR threshold, below which it fails to work robustly. This book aims to find the most reliable and accurate spectrum sensing technique in the 2-hop cooperative cognitive radio network. Using Matlab simulations, a comparative analysis of three transmitter detection techniques has been made in terms of higher probability of detection. In order to remove the shortcomings faced by all the three techniques a Fuzzy Combined Logic sensing approach is implemented and compared with Transmitter detection techniques.

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 book 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.

Performance of Cooperative Spectrum Sensing in Cognitive Radio Networks Chilakala Sudhamani. 2020-10-08 Doctoral Thesis / Dissertation from the year 2020 in the subject Engineering - Communication Technology, grade: A, , language: English, abstract: Cooperative spectrum sensing technique is used to maximize the utilization of unused licensed spectrum. As the cooperation among the secondary users increases the detection performance increases, which increases the average channel throughput and energy efficiency but it depends on the number of cooperative secondary users, fusion rules, channel conditions and detection threshold. In this thesis average channel throughput, energy consumption and energy

efficiency are estimated for variable number of secondary users and detection thresholds using hard fusion rules i.e. AND, OR and MAJORITY fusion rules. From the results it has been observed that the performance of AND fusion rule is better at low detection thresholds and for less number of secondary users. The performance of OR fusion rule is better at high detection thresholds and for large number of secondary users. The performance of MAJORITY fusion rule follows the performance of AND fusion rule at low detection thresholds and it follows the performance of OR fusion rule at high detection thresholds. However as the number of cooperative secondary users increases the energy required for spectrum sensing and reporting sensing results to the fusion center increases, which increases the energy consumption and reduces the energy efficiency. Therefore energy efficiency can be improved by maximizing the average channel throughput or by minimizing the energy consumption. To minimize the energy consumption in cooperative spectrum sensing, optimization technique has been proposed in this thesis and it is used for further improvement of energy efficiency. With this optimization technique, optimal number of cooperative secondary users are derived by maximizing the energy efficiency using AND and OR fusion rules but not with MAJORITY fusion rule. Because it is very difficult to estimate the optimal number of cooperative secondary users using MAJORITY fusion rule, so optimization of final decision threshold was proposed in the existing methods to maximize the energy efficiency using MAJORITY fusion rule. Therefore AND and OR fusion rules are used in this work to optimize the number of cooperative secondary users.

Compressive Sensing for Wireless Communication Radha Sankararajan, Hemalatha Rajendran, Aasha Nandhini Sukumaran. 2022-09-01 Compressed Sensing (CS) is a promising method that recovers the sparse and compressible signals from severely under-sampled measurements. CS can be applied to wireless communication to enhance its capabilities. As this technology is proliferating, it is possible to explore its need and benefits for emerging applications. Compressive Sensing for Wireless Communication provides:

- A clear insight into the basics of compressed sensing
- A thorough exploration of applying CS to audio, image and computer vision
- Different dimensions of applying CS in Cognitive radio networks
- CS in wireless sensor network for spatial compression and projection
- Real world problems/projects that can be implemented and tested
- Efficient methods to sample and reconstruct the images in resource constrained WMSN environment

This book provides the details of CS and its associated applications in a thorough manner. It lays a direction for students and new engineers and prepares them for developing new tasks within the field of CS. It is an indispensable companion for practicing engineers who wish to learn about the emerging areas of interest.

Cognitive Radio Systems Wei Wang. 2009-11-01 Cognitive radio is a hot research area for future wireless communications in the recent years. In order to increase the spectrum utilization, cognitive radio makes it possible for unlicensed users to access the spectrum unoccupied by licensed users. Cognitive radio let the equipments more intelligent to communicate with each other in a spectrum-aware manner and provide a new approach for the co-existence of multiple wireless systems. The

goal of this book is to provide highlights of the current research topics in the field of cognitive radio systems. The book consists of 17 chapters, addressing various problems in cognitive radio systems.

Space-Time Spectrum Sensing for Cognitive Radio Mohamad, Usama Yusuf.2020-01-20 A cognitive radio (CR) system offers a more efficient spectrum utilization as compared to conventional wireless transmission systems. In particular, in a so-called interweave CR scenario, spectrum sensing is a crucial component responsible for acquiring information about the existence and strength of a primary user (PU) signal, since the subsequent spectral access depends on that information. A wide range of spectrum sensing techniques has been proposed to suit various requirements and system scenarios. These techniques differ in many respects like e. g. the computational complexity, the required observation frame length as well as the resulting sensing performance. Spectrum sensing in different scenarios and under various models is investigated in this thesis. Here, both temporal and spatial correlations of the received signals are considered for designing space-time sensing algorithms.

Cognitive Radio Networks Optimization with Spectrum Sensing Algorithms Tanuja S. Dhope.2022-09-01 In recent years, a considerable amount of effort has been devoted, both in industry and academia, towards the efficient utilization of the available spectrum under the various propagation models which lead towards the design and dimensioning of the future network Internet of Things (IoT).This book focuses on Television White Space (TVWS) opportunities and regulatory aspects for cognitive radio applications, and includes case studies for the exploitation of TVWS depending on user's mobility, and the geo-location between user and the Base Station. The book presents recent advances in spectrum sensing, reflecting state of the art technology and research achievements in this area as well as a new insights in spectrum sensing of performance modeling, analysis and worldwide applications. Technical topics discussed include: • Novel Application of TV White Space • Spectrum Sensing in Cognitive Radio • Cooperative Spectrum Sensing • DoA Estimation Algorithms

Spectrum Sensing Techniques and Applications Marcelo Sampaio de Alencar,Fabricio Braga Soares de Carvalho,Waslon Terllizzie Araújo Lopes,Carlos Danilo Miranda Regis.2018-11-09 Spectrum sensing deals with several subjects, that range from statistical and probability theory to radio propagation and signal processing, with cognitive radio playing an important role to the evolution and dissemination of new applications in the area. The objective of this book is to connect the basic statistical formulation, the fundamental concepts from signal detection and spectrum sensing, cognitive radio and dynamic spectrum access, leading to an interesting, robust, and illustrative content, with recent practical applications of cognitive radio and spectrum sensing.

Energy Detection for Spectrum Sensing in Cognitive Radio Saman Atapattu,Chintha Tellambura,Hai Jiang.2014-02-15 This Springer Brief focuses on the current state-of-the-art research on spectrum sensing by using energy detection, a low-complexity and low-cost technique. It includes a comprehensive summary of recent research, fundamental

theories, possible architectures, useful performance measurements of energy detection and applications of energy detection. Concise, practical chapters explore conventional energy detectors, alternative forms of energy detectors, performance measurements, diversity techniques and cooperative networks. The careful analysis enables reader to identify the most efficient techniques for improving energy detection performance. Energy Detection for Spectrum Sensing in Cognitive Radio is a valuable tool for researchers and practitioners interested in spectrum sensing and cognitive radio networks. Advanced-level students studying wireless communication will also benefit from this brief.

Spectrum Management in Cognitive Radio Networks Mussaab Ibrahim Mohammed Ibrahim, Lufungula Kalemba Mosa Dadhy. 2012 One of the important point in cognitive radios is how those radios are going to be managed either externally or internally. Here is the solution one of the primary technique of spectrum allocation are used and implemented by MATLAB code simulation with full code details inside this thesis. In addition there is a proof of the FCC results about primary users usage of the spectrum which is 70% of the spectrum are unused, so for maximum utilization we are developed a management technique that can increase the utilization of the spectrum.

Spectrum Selection, Sensing, and Sharing in Cognitive Radio Networks Chittabrata Ghosh, Dharma P. Agrawal. 2010-06 Spectrum Selection, Sensing, and Sharing in Cognitive Radio Networks introduces the readers to a comprehensive idea about the evolution and functionality of Cognitive Radio from a network perspective. The book covers an efficient modeling technique of spectrum occupancy patterns of primary users in licensed bands, substantiating the results based on real-time experiments performed in Boston, MA, USA. The next chapter introduces a new idea for cognitive radio termed as Spectrum Selection, a concept of preferable selection of spectrum for further spectrum sensing. A separate chapter on application of Hidden Markov Models is discussed for efficient spectrum sensing techniques. Additionally, Game theoretic approaches are illustrated with examples in one chapter for spectrum sharing and coexistence of secondary and primary users in licensed bands. The concept of NC-OFDMA is also introduced as an option for efficient spectrum allocation in coexistence of secondary networks. Finally, the book ends with an invaluable concept on cross-layer architecture for future software defined radio based cognitive radio that are critical to the successful development of commercial products.

Spectrum Sensing Techniques in Cognitive Radio Mike Mekkanen. 2010-08 Cognitive Radios promise to be a major shift in wireless communications based on developing a novel approach which attempt to reduce spectrum scarcity that growing up in the past and waited to increase in the future. Since formulating stages for increasing interest in wireless application proves to be extremely challenging, it is growing rapidly. Initially this growth leads to huge demand for the radio spectrum. The novelty of this approach needs to optimize the spectrum utilization and find the efficient way for sharing the radio frequencies through spectrum sensing process. This research describes the fundamental cognitive radio system aspect based on design and implementation by connecting between the theoretical and practical issue. Efficient method for sensing and

detecting are studied and discussed through two fast methods of computing the spectral correlation density function, the FFT Accumulation Method and the Strip Spectral Correlation Algorithm. Several simulations have been performed to show the ability and performance of studied algorithms.

Cognitive Radio Networks Tao Jiang,Zhiqiang Wang,Yang Cao.2015-04-08 Resource allocation is an important issue in wireless communication networks. In recent decades, cognitive radio-based networks have garnered increased attention and have been well studied to overcome the problem of spectrum scarcity in future wireless communications systems. Many new challenges in resource allocation appear in cognitive radio-base

Spectrum Sensing for Cognitive Radio KAMAL M.. JOSHI CAPTAIN (MANJUNATH V.),Manjunath V Joshi.2021-11-04 This comprehensive reference text discusses concepts of cognitive radio and the advances in the field of spectrum sensing. The text discusses methodologies for unmixing or decomposing the hyperspectral data into its constituent entities and provides a unified framework for the complete spectral unmixing of the data. It covers important topics including narrowband spectrum sensing, wideband spectrum sensing, cooperative spectrum sensing, system and channel model, detection algorithms, approximation of decision statistics and theoretical analysis of detection algorithms in detail. A separate chapter discusses use of detection algorithm for cooperative wideband spectrum sensing. Aimed at graduate students and academic researchers in the field of electrical engineering, electronics and communication engineering and remote sensing, this text: Discusses concepts of cognitive radio and research in spectrum sensing. Presents mathematical analysis of algorithms considering practical environment. Explains novel wideband spectrum sensing algorithms with detailed analysis. Provides mathematical derivations to help readers. Discusses basic spectrum sensing algorithm for narrowband spectrum sensing to the more advanced wideband spectrum sensing.

Cooperative Cognitive Spectrum Sensing Based on Optimized Time-Frequency Signal Analysis Ubaid ur Rehman.2017-12-06 Spectrum sensing is used in cognitive radio to detect the free portions of spectrum in a licensed frequency band. We introduce a cooperative spectrum sensing scenario in which the decisions from the secondary users are combined for better sensing accuracy. Each secondary user sends its decision to a central node which combines all individual decisions. A discrete Fourier transform (DFT) filter bank based architecture is used by each secondary user for efficient detection of a primary user signal in a desired time-frequency slot. The prototype filters underlying the DFT filter banks are optimized to provide maximum time-frequency resolution. We formulate an objective function to represent the time-frequency distribution of signal energy and use numerical methods to obtain optimized prototype filter To address the problem of noise power uncertainty in cognitive radio systems, we introduce a method for denoising the received signal which is based on goodness-of-fit statistical test. We compare the performance of the proposed method with other spectrum sensing methods in terms of receiver operating characteristics (ROC). The spectrum sensing performance is also analyzed in

the presence of noise power uncertainty. Finally, the hardware implementation aspects of the proposed architecture are also analyzed using a field programmable gate array (FPGA).

Cognitive Radio Technology Applications for Wireless and Mobile Ad Hoc Networks Meghanathan, Natarajan.2013-06-30 Radio interference is a problem that has plagued air communication since its inception. Advances in cognitive radio science help to mitigate these concerns. Cognitive Radio Technology Applications for Wireless and Mobile Ad Hoc Networks provides an in-depth exploration of cognitive radio and its applications in mobile and/or wireless network settings. The book combines a discussion of existing literature with current and future research to create an integrated approach that is useful both as a textbook for students of computer science and as a reference book for researchers and practitioners engaged in solving the complex problems and future challenges of cognitive radio technologies.

Spectrum Sensing and Interference Mitigation in Cognitive Radio Networks Xitao Gong.2014

Cognitive Radio Sensor Networks: Applications, Architectures, and Challenges Rehmani, Mubashir Husain.2014-06-30 This book examines how wireless sensor nodes with cognitive radio capabilities can address these network challenges and improve the spectrum utilization, presenting a broader picture on the applications, architecture, challenges, and open research directions in the area of WSN research--Provided by publisher.

Collaborative Spectrum Sensing in Cognitive Radio Networks Hongjian Sun, David I. Laurenson, John S. Thompson, Chengxiang Wang.2011 The radio frequency (RF) spectrum is a scarce natural resource, currently regulated by government agencies. With the explosive emergence of wireless applications, the demands for the RF spectrum are constantly increasing. On the other hand, it has been reported that localised temporal and geographic spectrum utilisation efficiency is extremely low. Cognitive radio is an innovative technology designed to improve spectrum utilisation by exploiting those spectrum opportunities. This ability is dependent upon spectrum sensing, which is one of most critical components in a cognitive radio system. A significant challenge is to sense the whole RF spectrum at a particular physical location in a short observation time. Otherwise, performance degrades with longer observation times since the lagging response to spectrum holes implies low spectrum utilisation efficiency. Hence, developing an efficient wideband spectrum sensing technique is prime important. In this thesis, a multirate asynchronous sub-Nyquist sampling (MASS) system that employs multiple low-rate analog-to-digital converters (ADCs) is developed that implements wideband spectrum sensing. The key features of the MASS system are, 1) low implementation complexity, 2) energy-efficiency for sharing spectrum sensing data, and 3) robustness against the lack of time synchronisation. The conditions under which recovery of the full spectrum is unique are presented using compressive sensing (CS) analysis. The MASS system is applied to both centralised and distributed cognitive radio networks. When the spectra of the cognitive radio nodes have a common spectral support, using one low-rate ADC in each cognitive radio node can successfully recover the full spectrum. This is obtained by applying a hybrid matching pursuit (HMP) algorithm - a

synthesis of distributed compressive sensing simultaneous orthogonal matching pursuit (DCS-SOMP) and compressive sampling matching pursuit (CoSaMP). Moreover, a multirate spectrum detection (MSD) system is introduced to detect the primary users from a small number of measurements without ever reconstructing the full spectrum. To achieve a better detection performance, a data fusion strategy is developed for combining sensing data from all cognitive radio nodes. Theoretical bounds on detection performance are derived for distributed cognitive radio nodes suffering from additive white Gaussian noise (AWGN), Rayleigh fading, and log-normal fading channels. In conclusion, MASS and MSD both have a low implementation complexity, high energy efficiency, good data compression capability, and are applicable to distributed cognitive radio networks.

Sensing Techniques for Next Generation Cognitive Radio Networks Bagwari, Ashish, Bagwari, Jyotshana, Tomar, Geetam Singh. 2018-08-30 The inadequate use of wireless spectrum resources has recently motivated researchers and practitioners to look for new ways to improve resource efficiency. As a result, new cognitive radio technologies have been proposed as an effective solution. *Sensing Techniques for Next Generation Cognitive Radio Networks* is a pivotal reference source that provides vital research on the application of spectrum sensing techniques. While highlighting topics such as radio identification, compressive sensing, and wavelet transform, this publication explores the standards and the methods of cognitive radio network architecture. This book is ideally designed for IT and network engineers, practitioners, and researchers seeking current research on radio scene analysis for cognitive radios and networks.

Quantitative Analysis of Cognitive Radio and Network Performance Preston Marshall. 2010 Cognitive radio - a paradigm for wireless communication in which either a network or a wireless node changes its transmission or reception parameters to communicate more efficiently and avoid interference -- is one of the most exciting emerging fields in communications technology. Taking an integrated development approach, this cutting-edge book provides you with clear methods for performing quantitative analysis of cognitive radio techniques in a variety of environments. This detailed reference presents a quantitative structure that helps you determine the capability of cognitive radio to address a number of constraints of current radio design. Critical to understanding the operation of cognitive radio, the book develops an analytic model for a range of spectrum environments. Moreover, this unique resource offers you unique insight into the application of dynamic spectrum access (DSA) to improve the performance of all classes of wireless devices. DVD Included! Contains sample cognitive radio environments and closed form approximations of these environments in MATLAB file format. This data enables you to reproduce the analysis provided in the book, perform the exercises in each chapter, and extend the work through independent investigation and research.

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