



Pranav Patel

Energy Detection Based Spectrum Sensing In Cognitive Radio

Performance analysis of Energy Detection Spectrum
Sensing Using RTL-SDR & GNU Radio



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Energy Detection For Spectrum Sensing In Cognitive Radio

**Thanikanti Sudhakar Babu, Mallala
Balasubbareddy, Subramaniam
M, Nnamdi Nwulu, Vigna Kumaran
Ramachandaramurthy, Renu Sharma**

Energy Detection For Spectrum Sensing In Cognitive Radio:

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

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

Improve Performance Analysis of Energy Detection in Spectrum Sensing of Cognitive Radio Muhammad Syahmi Syazwan Abdul Halim,2012 [Analysis of Energy Detection in Cognitive Radio Networks](#) Saman U. B. Atapattu,2013 Cognitive radio is one of the most promising technologies to address the spectrum scarcity problem Cognitive radio requires spectrum sensing which is used by unlicensed users to opportunistically access the licensed spectrum Spectrum sensing using energy detection offers low cost and low complexity In this thesis a comprehensive performance analysis of energy detection based spectrum sensing is developed Detection performance over composite fading and shadowing channels is first investigated using the K and K_G channel models To further facilitate analysis of energy detection over different wireless channels a unified channel model based on a mixture gamma distribution is developed The unified model can accurately represent most existing channel models A single value performance metric the area under the receiver operating characteristic curve is proposed to measure the overall detection capability and is investigated over various wireless fading channels The energy detection based cooperative spectrum sensing is also studied which can largely improve the detection performance Since spectrum sensing is required to identify activities of licensed

users at a very low signal to noise ratio SNR performance of energy detection with low SNR is also analyzed in this thesis

Implementation of Energy Detector for Cognitive Radio Zahir A. Hussein Alsulaimawi, 2013 Cognitive radio is a technology that provides a promising new way to improve the efficiency of the use of the electromagnetic spectrum that available Spectrum sensing helps in the detection of spectrum holes unused channels of the band and instantly move into vacant channels while avoiding occupied ones A brief overview of the energy detection based spectrum sensing for cognitive radio technology is introduced An energy detector with baseband sampling for cognitive radio is presented with mathematical analyses for an additive white Gaussian noise AWGN channel Practical implementation issues on Texas Instruments TMS320C6713 floating point DSP board are presented A new multiple antenna technique based energy detector is proposed As well as several algorithms for generating white noise are implemented *Spectrum Sensing for Cognitive Radio* Kamal M. Captain, Manjunath V. Joshi, 2021-12-30 This comprehensive reference text discusses concepts of cognitive radio and the advances in the field of spectrum sensing This text discusses the concept of cognitive radio for next generation wireless communication and a very critical aspect of cognitive radio that is spectrum sensing in detail It covers important topics including narrowband spectrum sensing wideband spectrum sensing cooperative spectrum sensing system and channel models detection algorithms approximation of decision statistics and theoretical analysis of detection algorithms in detail Separate chapters are dedicated to discussing the analysis and use of detection algorithms for narrowband spectrum sensing wideband spectrum sensing and cooperative wideband spectrum sensing Aimed at graduate students and academic researchers in the fields of electrical engineering and electronics and communication engineering 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 algorithms from narrowband spectrum sensing to the more advanced wideband spectrum sensing 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 *Adaptive Spectrum Sensing for Cognitive Radio Networks* Arash Vakili, 2011 Spectrum sensing is an important functionality of cognitive radio as a means to detect the presence or absence of the primary user PU in a certain spectrum band Energy detection is a widely used spectrum sensing technique based on the assumption that the PU is either present or absent during the whole sensing period However this assumption is not realistic in a dynamic environment where the PU could appear or disappear at any time The performance of the conventional energy detector ED actually deteriorates in the scenario where the PU activity status changes during the sensing period Therefore it is crucial to design a detector which can adapt to such an environment and reliably detect a change in the PU activity Several sequential change detection techniques already exist in the literature however change detection in a fixed sensing duration has not been given enough attention In this dissertation three adaptive EDs are proposed to improve the **Energy Based Spectrum Sensing for Enabling Dynamic Spectrum Access in Cognitive Radios** Samson Sequeira, 2011 Spectrum scarcity is increasingly becoming an obstacle for the implementation of new wireless technologies On the contrary recent studies have discovered considerable under utilization of the allocated spectrum by the licensed users This suggests that the solution to the problem is a transition from static spectrum allocation policies to dynamic spectrum access methodologies This can be accomplished through the use of Cognitive Radio technology Cognitive Radio is considered as an intelligent radio which is capable of altering its transmission or reception parameters in accordance to the radio environment and the network state to use the available spectrum optimally Significant research efforts have furthered Cognitive Radios since the idea was first conceived by Joseph Mitola in 1998 Cognitive Radio technology allows for the licensed spectrum of the primary users to be used on an opportunistic basis by unlicensed secondary users A vital requirement of such an opportunistic scheme is that the licensed primary users be protected from detrimental interference from the secondary users while at the same time optimizing the performance for the secondary users Thus the reliable detection of primary users offers better secondary system throughput via increased spectral efficiency in addition to safeguarding the primary system Spectrum sensing is a technique used to detect the presence of primary users in the licensed spectrum It is the estimation of the instantaneous occupancy of the frequency spectrum and is a key enabling factor for Cognitive Radios Various techniques exist for performing spectrum sensing In addition to primary user detection spectrum sensing can also be employed for secondary detection and co existence interference analysis in multi radio environments etc In this thesis we study adaptive spectrum sensing based on energy detection with a purpose of demonstrating Dynamic Spectrum Access The major focus has been to evaluate algorithms that can allow for estimation of noise in the presence of the signal which is essential for energy detection based schemes We also present the system level implementation and evaluation of a Dynamic Spectrum Access setup developed using the USRP2 GNU Radio platform on the ORBIT Wireless Testbed at WINLAB as part of the WINLAB NEC Collaborative Cognitive Radio Project *Power Energy and*

Secure Smart Technologies Thanikanti Sudhakar Babu, Mallala Balasubbareddy, Subramaniam M, Nnamdi Nwulu, Vigna Kumaran Ramachandaramurthy, Renu Sharma, 2025-07-16 This Book of Proceedings presents the collective research and insights shared at the conference on Power Energy and Secure Smart Technologies The event brings together leading minds from academia industry and research to explore innovations and address challenges in modern power systems sustainable energy solutions and secure smart technologies The papers compiled here reflect the latest developments case studies and forward looking ideas that contribute to the evolving landscape of intelligent and resilient energy systems We trust this volume will serve as a valuable resource for researchers professionals and students committed to advancing technology for a sustainable and secure energy future

Recent Trends in Communication and Intelligent Systems Aditya Kumar Singh Pundir, Anupam Yadav, Swagatam Das, 2023-10-27 The book presents best selected research papers presented at the Fourth International Conference on Recent Trends in Communication and Intelligent Systems ICRTCIS 2023 organized by Arya College of Engineering and IT Jaipur on April 28 29 2023 It discusses the latest technologies in communication and intelligent systems covering various areas of communication engineering such as signal processing VLSI design embedded systems wireless communications and electronics and communications in general Featuring work by leading researchers and technocrats the book serves as a valuable reference resource for young researchers and academics as well as practitioners in industry

Proceedings of the International Conference on Advanced Intelligent Systems and Informatics 2020 Aboul Ella Hassanien, Adam Slowik, Václav Snášel, Hisham El-Deeb, Fahmy M. Tolba, 2020-09-19 This book presents the proceedings of the 6th International Conference on Advanced Intelligent Systems and Informatics 2020 AISI2020 which took place in Cairo Egypt from October 19 to 21 2020 This international and interdisciplinary conference which highlighted essential research and developments in the fields of informatics and intelligent systems was organized by the Scientific Research Group in Egypt SRGE The book is divided into several sections covering the following topics Intelligent Systems Deep Learning Technology Document and Sentiment Analysis Blockchain and Cyber Physical System Health Informatics and AI against COVID 19 Data Mining Power and Control Systems Business Intelligence Social Media and Digital Transformation Robotic Control Design and Smart Systems

ICT for Intelligent Systems Jyoti Choudrie, Parikshit N. Mahalle, Thinagaran Perumal, Amit Joshi, 2025-11-22 This book gathers papers addressing state of the art research in all areas of information and communication technologies and their applications in intelligent computing cloud storage data mining and software analysis It presents the outcomes of the 9th International Conference on Information and Communication Technology for Intelligent Systems ICTIS 2025 held in Bangkok Thailand The book discusses the fundamentals of various data analysis techniques and algorithms making it a valuable resource for researchers and practitioners alike

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

Applications of Advanced Computing in Systems Rajesh Kumar,R. K. Dohare,Harishchandra Dubey,V. P.

Singh,2021-04-24 This book covers advances in system control and computing This book gathers selected high quality research papers presented at the International Conference on Advances in Systems Control and Computing AISCC 2020 held at MNIT Jaipur during February 27 28 2020 The first part is advances in systems and it is dedicated to applications of the artificial neural networks evolutionary computation swarm intelligence artificial immune systems fuzzy system autonomous and multi agent systems machine learning other intelligent systems and related areas In the second part machine learning and other intelligent algorithms for design of control control analysis are covered The last part covers advancements modifications improvements and applications of intelligent algorithms

Wideband Spectrum Sensing for Cognitive Radios in the Presence of Correlation Between Subband Occupancy Khalid Shamsuddin Hossain,2010 **Implementation of**

Cognitive Radio Spectrum sensing circuit using TSPRT algorithm Neha Pal,2017-03-07 Master s Thesis from the year 2012 in the subject Engineering Communication Technology Indian Institute of Technology Delhi IIT Delhi course M Tech Communications language English abstract To ensure that cognitive radios would not interfere with primary users spectrum

sensing is required to be efficient and accurate by reliably detecting primary user signals In this work we implemented a spectrum sensing methodology based on the Truncated Sequential Probability Ratio Test TSPRT The TSPRT is a combination of SPRT and Neyman Pearson We created and simulated the model and observed the variation of quantization error noise variance and dynamic range of the signal to achieve the minimum average sample number ASN and desired error probabilities of detection and false alarm for sine wave and similar input signals This report comprises of theoretical analysis and practical implementation of spectrum sensing circuit in Xilinx system generator Simulations are done to observe the effect of various parameters on ASN and shown

Communication and Computing Systems B.M.K. Prasad,Krishna Kant Singh,Neelam Ruhil,Karan Singh,Richard O'Kennedy,2017-02-15 This book is a collection of accepted papers that were presented at the International Conference on Communication and Computing Systems ICCCS 2016 Dronacharya College of Engineering Gurgaon September 9 11 2016 The purpose of the conference was to provide a platform for interaction between scientists from industry academia and other areas of society to discuss the current advancements in the field of communication and computing systems The papers submitted to the proceedings were peer reviewed by 2 3 expert referees This volume contains 5 main subject areas 1 Signal and Image Processing 2 Communication Computer Networks 3 Soft Computing Intelligent System Machine Vision and Artificial Neural Network 4 VLSI Embedded System 5 Software Engineering and Emerging Technologies

Cooperative Spectrum Sensing and Resource Allocation Strategies in Cognitive Radio Networks Xavier Fernando,Ajmery 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

An Efficient Hardware Implementation of an Energy Detection-based Spectral Estimator for Cognitive Radios ,2016 With the

rapid growth in the field of wireless communication effective spectrum utilization techniques are required In the urban areas which are rich with wireless communication devices we will find some frequency bands that are only partially occupied and some other bands that are essentially unused To avoid the underutilization of scarce radio spectrum cognitive radio CR has been proposed as one effective solution to enhance the utilization of the radio spectrum A CR system detects radio frequency RF channels that are vacant and switches into these unoccupied channels to enhance frequency spectrum utilization The ability of CR systems to sense the availability of RF communication channels is governed by the use of the spectrum sensing technique Therefore spectrum sensing is a fundamental requirement in CR systems In this thesis we explore various techniques for spectrum sensing We investigate the energy detection based spectrum sensing for efficient hardware implementation We utilize signal processing expertise such as window selection window overlap window size transform size averaging and thresholding to develop a robust spectrum sensing module We then model the energy detection based spectrum sensing in Matlab Its synthesizable model is developed in Verilog hardware description language The architecture of the designed spectrum sensing module is implemented on a Xilinx Virtex 7 field programmable gate array FPGA and its cycle accurate bit true hardware simulation results are verified against its fixed point simulation results An ASIC architecture of the designed spectrum sensing module is developed using a standard 45 nm CMOS technology

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