Energy Detection For Spectrum Sensing In Cognitive Radio

Energy Detection for Spectrum Sensing in Cognitive RadioROBUST APPROACH FOR SPECTRUM SENSING AND SPECTRUM ALLOCATION APPROACH IN COGNITIVE RADIO WIRELESS SENSOR NETWORKSSpectrum Sensing for Cognitive RadioMultitaper Spectrum Based Detection for Spectrum Sensing in Cognitive Radio NetworksPerformance of Cooperative Spectrum Sensing in Cognitive Radio NetworksSpectrum Sensing in Cognitive Radio NetworksThreshold Setting Algorithms for Spectrum Sensing in Cognitive Radio NetworksImplementation of Spectrum Sensing Techniques for Cognitive Radio SystemsCooperative Spectrum Sensing and Resource Allocation Strategies in Cognitive Radio NetworksCognitive Radio TechniquesSpectrum Sensing Techniques and ApplicationsSensing Techniques for Next Generation Cognitive Radio NetworksEnergy Detection Based Spectrum Sensing in Cognitive RadioCombined Scheme for Cooperative Spectrum Sensing in Wireless NetworksCooperative Cognitive Spectrum Sensing Based on Optimized Time-Frequency Signal AnalysisSpectrum Sensing in Cognitive RadioDistributed Boundary Estimation for Spectrum Sensing in Cognitive Radio NetworksA Common Data Format for Spectrum Sensing InformationCognitive Radio Networks Optimization with Spectrum Sensing AlgorithmsCooperative Spectrum Sensing for Cognitive Radio Networks Saman Atapattu Dr. Ruksar Fatima, Dr. Shaikh Humera Tauseef, Mr. Mohammed Naveeduddin Kamal M. Captain [illegible] Chilakala Sudhamani Waleed Ejaz Nan Wang Nazar Mortada Radhi Xavier Fernando Kandeepan Sithamparanathan Marcelo Sampaio de Alencar Bagwari, Ashish Pranav Patel Sasidhar Polimetla Ubaid ur Rehman Andreas Bollig Carolina Fortuna Tanuja S. Dhope Praveen Kaligineedi

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Fernando Kandeepan Sithamparanathan Marcelo Sampaio de Alencar Bagwari, Ashish Pranav Patel Sasidhar Polimetla Ubaid ur Rehman Andreas Bollig Carolina Fortuna Tanuja S. Dhope Praveen Kaligineedi

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

future services and applications dependent on the internet of things iot stand to benefit significantly from the use of wireless sensor networks wsns however wsns operating in unlicensed frequency bands are increasingly vulnerable to interference due to spectrum congestion cognitive radio wireless sensor networks cr wsns provide a promising solution by allowing sensor nodes to opportunistically access licensed spectrum bands yet equipping energy constrained sensor nodes with cognitive capabilities such as channel sensing opportunistic access and channel switching poses significant performance and energy efficiency challenges the integration of wsns with the cognitive internet of things ciot demands the development of robust mac and spectrum access architectures that allow coexistence with legacy wireless systems existing spectrum access paradigms often suffer from increased energy consumption and higher collision rates due to interference from competing users moreover limited research has been conducted on multi channel cr wsns leading to suboptimal spectrum utilization this paper proposes an energy efficient spectrum access eesa model tailored for multi channel mobile cr wsns aimed at improving the overall performance of energy constrained cognitive radio networks experimental results demonstrate that eesa outperforms conventional models in terms of throughput and energy efficiency making more effective use of available spectrum resources to address the issue of dynamic spectrum access in mobile settings this study introduces the dynamic and efficient channel access deca method deca integrates both temporal and spatial information to minimize user interference and improve performance experimental evaluations show that deca significantly reduces packet collisions and enhances successful packet transmissions throughput and energy efficiency compared to existing techniques however deca does not inherently provide fairness in channel access to overcome this limitation the research introduces the throughput maximization channel access fairness tmcaf model which reduces interference by modeling secondary user behavior patterns tmcaf incorporates both shared and non shared channel access strategies to enhance network performance results indicate that tmcaf improves throughput and reduces network collisions compared to state of the art models however tmcaf still lacks optimal performance guarantees recent advances in deep learning dl reinforcement learning rl and game theory gt have been employed for intelligent channel access in cr wsns however these approaches typically face two key limitations lack of balance between maximizing secondary user su throughput and minimizing primary user pu interference in multi channel environments inability to ensure fair network access for sus in energy constrained

cr wsns to address these issues this study proposes a novel throughput maximization channel access fairness using game theory tmcaf gt approach the tmcaf gt method incorporates both shared and non shared access techniques leveraging game theoretic modeling to optimize spectrum usage while ensuring access fairness and energy efficiency

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

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

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 purposed technique provides good results under low snr values

this work presents a method for real time detection of secondary users at the cognitive wireless technologies base stations cognitive radios may hide themselves in between the primary users to avoid being charged for spectrum usage to deal with such scenarios a cyclostationary fast fourier transform accumulation method fam has been used to develop a new strategy for recognising channel users under perfect and different noise environment conditions channel users are tracked according to the changes in their signal parameters such as modulation techniques matlab simulation tool was used to run various modulation signals on channels and the obtained spectral correlation density function shows successful recognition between secondary and primary signals we are unaware of previous efforts to use the fam characteristics or other detection methods to make a distinction between channel users as presented in this thesis a novel combination of both cognitive radio technology and ultra wideband technology is interdicted in this thesis looking for an efficient and reliable spectrum sensing method to detect the presence of primary transmitters and a number of spectrum sensing techniques implemented in ultra wideband and cognitive radio component uwb cr under different awgn and fading settings environments the sensing performance of different detectors is compared in conditions of probability of detection and miss detection curves simulation results show that the selection of detectors rely on the different fading scenarios detector requirements and on a priori knowledge furthermore result showed that the matched filter detection method is suitable for detecting signals through uwb cr system under various fading channels a general observation is that the matched filter detector outperforms the other detectors in all scenarios by an average of snr 20 db in the level of probability of detection pd and the energy detector slightly outperforms the cyclostationary detector in the level pd at snr 20 db furthermore the thesis adapts novel detection models of cooperative and cluster cooperative wideband spectrum sensing in cognitive radio networks in the proposed schemes wavelet based multi resolution spectrum sensing and a proposed approach scheme are utilized for improving sensing performance of both models on the other hand cluster based cooperative spectrum sensing with soft combination equal gain combination egc scheme is proposed the proposed detection models could achieve improvement of transmitter signal detection in terms of higher probability of detection and lower probability of false alarm in the cooperative wideband spectrum sensing model using traditional fusion rule existing worst performance of false alarms by measurement is 78 of the sensing bands at an average snr 5 db this compares with the proposed model which is by measurement 19 false alarms of scanning spectrum at the same snr for cluster cooperative wideband spectrum sensing the proposed combining

methods shows improvements of results with a high probability of detection pd and low probability of false alarm pf at an average snr 16 db compared with other traditional fusion methods this is illustrated through numerical results

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

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

this deals with several subjects that range from statistical and probability theory to radio propagation and signal processing and cognitive radio is important to the evolution and dissemination of new applications on spectrum sensing the objective of this book is to present a connection among basic statistical formulation the fundamental concepts from signal detection and spectrum sensing and its integration to cognitive radio and dynamic spectrum access filling in the gaps from previous books and leading to an interesting robust and illustrative content with recent practical applications of cognitive radio and spectrum sensing recent applications based on spectrum sensing are presented including some fundamental distribution probabilities for the mathematical presentation of spectrum sensing theory and examples illustrations and graphics help the reader understand the theory

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

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

abstract the effectiveness of cognitive radio systems depends mainly on the techniques used for spectrum sensing the main aim of cognitive radio is effective spectrum utilization by sharing the spectrum with secondary users when a primary user is absent this project uses the periodogram and multi taper methods which are optimized to enhance the receiver operating characteristics the cooperative sensing techniques have been combined using weights based on the distance to the primary user in order to achieve improved performance the probability of detection and probability of false alarm have been derived using the optimized methods by incorporating multi antenna techniques for better reception and with prior knowledge of the primary user signal it is shown that spectrum performance has been improved

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

in a cognitive radio network a primary user pu shares its spectrum with secondary users sus temporally and spatially while allowing for some interference we consider the problem of estimating the interference coverage region of the pu i e the region outside of which sus may utilize the pu s spectrum regardless of whether the pu is transmitting or not we propose a distributed boundary estimation algorithm that allows sus to estimate the boundary of the coverage region collaboratively through message passing between sus we also propose a spatial spectrum sensing scheme based on the estimated boundary simulation results suggest that our proposed scheme has better estimation performance and communication cost trade offs compared to centralized boundary estimation methods and has better weighted throughputs than traditional fusion center based collaborative spectrum sensing methods

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 spacespectrum sensing in cognitive radiocooperative spectrum sensingdoa estimation algorithms

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