

Energy Detection Spectrum Sensing Matlab Code

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. This book constitutes the refereed post-conference proceedings of the 9th International Conference on Wireless Internet, WICON 2016, held in Haikou, China, in December 2016. The 30 full and 4 poster papers were selected from 62 submissions and are grouped into the following topics: sensor networks, security, wireless networks, Internet of Things.

The purpose of this graduate project is to design a real-time spectrum sensing system using software defined radio. The uniqueness of software defined radio is the concept of replacing many of the hardware components in a traditional radio communication system with software algorithms and coding. The scope of this project will be on spectrum sensing - to be able to automatically detect active signals in the desired frequency spectrum. The hardware components used in this graduate project are the Universal Software Radio Peripheral and the Agilent function generator. The graphical user interface and algorithm programming are performed in MATLAB. The spectrum sensing system will scan a portion of the frequency spectrum, determine the presence of signals, and display the three highest signal peaks in a given band. This paper will elucidate spectrum sensing's strengths and weaknesses as well as possible future work.

The Proceedings of The Second 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 The Second International Conference on Communications, Signal Processing, and Systems (CSPS) held September 2013 in Tianjin, China.

This book written for students of electronics and communication, students of computer science and communications engineers addresses topics such as Introduction of CRN, Advanced spectrum sensing techniques, Cooperative sensing techniques, Distributed sensing techniques, Issues in advanced sensing techniques, and Applications of 5G Networks. It provides new algorithms, explores recent results, and evaluates the performance of technologies in use in

this area. It also provides new research topics and sensing techniques related to 5G networks for researchers.

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

This book is a collection of the best research papers presented at the 8th International Conference on Innovations in Electronics and Communication Engineering at Guru Nanak Institutions Hyderabad, India. Featuring contributions by researchers, technocrats and experts, the book covers various areas of communication engineering, like signal processing, VLSI design, embedded systems, wireless communications, and electronics and communications in general, as well as cutting-edge technologies. As such, it is a valuable reference resource for young researchers.

This book contains a selection of refereed and revised papers of Intelligent Informatics Track originally presented at the third International Symposium on Intelligent Informatics (ISI-2014), September 24-27, 2014, Delhi, India. The papers selected for this Track cover several intelligent informatics and related topics including signal processing, pattern recognition, image processing data mining and their applications.

"This unique resource provides you with a practical approach to quickly learning the software-defined radio concepts you need to know for your work in the field. By prototyping and evaluating actual digital communication systems capable of performing "over-the-air" wireless data transmission and reception, this volume helps you attain a first-hand understanding of critical design trade-offs and issues. Moreover you gain a sense of the actual "real-world" operational behavior of these systems. With the purchase of the book, you gain access to several ready-made Simulink experiments at the publisher's website. This collection of laboratory experiments, along with several examples, enables you to successfully implement the designs discussed the book in a short period of time. These files can be executed using MATLAB version R2011b or later. "

This volume presents the second part of the proceedings of the Mediterranean Conference on Information & Communication Technologies (MedICT 2015), which was held at Saidia, Morocco during 7–9 May, 2015. MedICT provides an excellent international forum to the researchers and practitioners from both academia as well as

industry to meet and share cutting-edge development. The conference has also a special focus on enabling technologies for societal challenges, and seeks to address multidisciplinary challenges in Information & Communication Technologies such as health, demographic change, wellbeing, security and sustainability issues. The proceedings publish high quality papers which are closely related to the various theories, as well as emerging and practical applications of particular interest to the ICT community. This second volume provides a compact yet broad view of recent developments in Data, Systems, Services and Education, and covers recent research areas in the field including Control Systems, Software Engineering, Data Mining and Big Data, ICT for Education and Support Activities, Networking, Cloud Computing and Security, ICT Based Services and Applications, Mobile Agent Systems, Software Engineering, Data Mining and Big Data, Online Experimentation & Artificial Intelligence in Education, Networking, Cloud Computing and Security, ICT Based Education and Services ICT Challenges and Applications, Advances in ICT Modeling and Design ICT Developments.

This book gathers a collection of papers by international experts presented at the International Conference on NextGen Electronic Technologies (ICNETS2-2016). ICNETS2 encompasses six symposia covering all aspects of the electronics and communications domains, including relevant nano/micro materials and devices. Highlighting the latest research on Optical And Microwave Technologies, the book will benefit all researchers, professionals, and students working in the core areas of electronics and their applications, especially in signal processing, embedded systems, and networking.

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.

The use of energy it is argued started about two million years ago when humans started cooking their food using firewood. As humans developed new skills with increased activities, energy interaction and usage emerged. Energy was used not only for domestic functions but also for space applications. With industrialization, humans

realized that energy was needed to move machines and do other things as well. In this quest, and without understanding the consequences of using fossil fuels extensively, many problems arose. Researchers in energy embarked on a journey to study different forms of energy. To understand different needs, researchers have tried to come up with ways in which small-scale energy harvesting can be adapted to different needs that do not require heavy-duty energy production. This book attempts to present a number of ideas regarding a few selected small-scale energy harvesting methods and techniques as well as theories and products that may be helpful in improving the quality of life. Some of the new products are still in the prototype stage, while others are already being utilized. Many researchers in small-scale energy harvesting and those aspiring to follow this path of research will find this book not only motivating but also a useful guide in their endeavors.

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 Fourth International Conference on Information and Communication Technology for Intelligent Systems, which was held in Ahmedabad, India. Divided into two volumes, the book discusses the fundamentals of various data analysis techniques and algorithms, making it a valuable resource for researchers and practitioners alike. The book provides insights from the 2nd International Conference on Communication, Computing and Networking organized by the Department of Computer Science and Engineering, National Institute of Technical Teachers Training and Research, Chandigarh, India on March 29–30, 2018. The book includes contributions in which researchers, engineers, and academicians as well as industrial professionals from around the globe presented their research findings and development activities in the field of Computing Technologies, Wireless Networks, Information Security, Image Processing and Data Science. The book provides opportunities for the readers to explore the literature, identify gaps in the existing works and propose new ideas for research.

This two-volume set LNICST 286-287 constitutes the post-conference proceedings of the First EAI International Conference on Artificial Intelligence for Communications and Networks, AICON 2019, held in Harbin, China, in May 2019. The 93 full papers were carefully reviewed and selected from 152 submissions. The papers are organized in topical sections on artificial intelligence, mobile network, deep learning, machine learning, wireless communication, cognitive radio, internet of things, big data, communication system, pattern recognition, channel model, beamforming, signal processing, 5G, mobile management, resource management, wireless position. Internet of Things (IoT) deals with the interconnection of devices that can communicate with each other over the internet. Currently, several smart systems have evolved with the evolution in IoT. Cognitive Radio - an enabler for Internet of Things is a research level subject for all communication engineering students at undergraduate, post graduate and research levels. The contents of the book are designed to cover the prescribed syllabus for one semester course on the subject prescribed by universities. Concepts have been explained thoroughly in simple and lucid language. Mathematical analysis has been used wherever

necessary followed by clear and lucid explanation of the findings and their implication. Key technologies presented include dynamic spectrum access, spectrum sensing techniques, IEEE 802.22 and different radio network architectures. Their role and use in the context of mobile broadband access in general is explained, giving both a high level overview and a detailed step by step explanation. The book includes a large number of diagrams, MATLAB examples, thereby enabling the readers to have a sound grasp of the concepts presented and their applications. This book is a must have resource for engineers and other professionals in the telecommunication industry working with cellular or wireless broadband technologies, helping comprehension of the process of utilization of the updated technology to enable being ahead competition.

This two-volume book presents outcomes of the 7th International Conference on Soft Computing for Problem Solving, SocProS 2017. This conference is a joint technical collaboration between the Soft Computing Research Society, Liverpool Hope University (UK), the Indian Institute of Technology Roorkee, the South Asian University New Delhi and the National Institute of Technology Silchar, and brings together researchers, engineers and practitioners to discuss thought-provoking developments and challenges in order to select potential future directions. The book presents the latest advances and innovations in the interdisciplinary areas of soft computing, including original research papers in the areas including, but not limited to, algorithms (artificial immune systems, artificial neural networks, genetic algorithms, genetic programming, and particle swarm optimization) and applications (control systems, data mining and clustering, finance, weather forecasting, game theory, business and forecasting applications). It is a valuable resource for both young and experienced researchers dealing with complex and intricate real-world problems for which finding a solution by traditional methods is a difficult task.

Automatic Real-time Spectrum Sensing Using Energy Detection in Software Defined Radio

Cognitive Radio can smartly sense and adapts with the changing environment by altering its transmitting parameters, such as modulation, frequency, frame format etc. The main challenges with cognitive radios are that it should not interfere with the licensed users and should vacate the band when required. For this it should sense the signals faster. For this purpose various detection schemes like energy detector, matched filter and cyclostationary feature detector are discussed in this report and performance evaluation of these is calculated. Besides this a performance evaluation is done between cooperative and non cooperative spectrum sensing schemes which uses Amplify-and-Forward algorithm is also discussed. All simulations are done in MATLAB.

This book presents cutting-edge research contributions that address various aspects of network design, optimization, implementation, and application of cognitive radio technologies. It demonstrates how to make better utilization of the

available spectrum, cognitive radios and spectrum access to achieve effective spectrum sharing between licensed and unlicensed users. The book provides academics and researchers essential information on current developments and future trends in cognitive radios for possible integration with the upcoming 5G networks. In addition, it includes a brief introduction to cognitive radio networks for newcomers to the field.

This book provides an insight for students, researchers and practitioners on the area of vehicular communications explaining and presenting solutions for some of the most critical issues in this field and, hopefully, inspiring new research directions. The book is organized in Sections, which respond to different layers and aspects of the vehicular technology: infrastructures, cells deployment and its integration with the V2V part, access procedures, advanced services and applications as localization, spectrum sensing, relay-based cooperative networks. 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.

The International Conference on Communications, Management, and Information Technology (ICCMIT'16) provides a discussion forum for scientists, engineers, educators and students about the latest discoveries and realizations in the foundations, theory, models and applications of systems inspired on nature, using computational intelligence methodologies, as well as in emerging areas related to the three tracks of the conference: Communication Engineering, Knowledge, and Information Technology. The best 25 papers to be included in the book will be carefully reviewed and selected from numerous submissions, then revised and expanded to provide deeper insight into trends shaping future ICT.

This volume contains 60 papers presented at ICTIS 2015: International Conference on Information and Communication Technology for Intelligent Systems. The conference was held during 28th and 29th November, 2015, Ahmedabad, India and organized communally by Venus International College of Technology, Association of Computer Machinery, Ahmedabad Chapter and Supported by Computer Society of India Division IV – Communication and Division V – Education and Research. This volume contains papers mainly focused on ICT and its application for Intelligent Computing, Cloud Storage, Data

Mining, Image Processing and Software Analysis etc.

Due to the complexity, and heterogeneity of the smart grid and the high volume of information to be processed, artificial intelligence techniques and computational intelligence appear to be some of the enabling technologies for its future development and success. The theme of the book is “Making pathway for the grid of future” with the emphasis on trends in Smart Grid, renewable interconnection issues, planning-operation-control and reliability of grid, real time monitoring and protection, market, distributed generation and power distribution issues, power electronics applications, computer-IT and signal processing applications, power apparatus, power engineering education and industry-institute collaboration. The primary objective of the book is to review the current state of the art of the most relevant artificial intelligence techniques applied to the different issues that arise in the smart grid development.

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.

This monograph presents a collection of major developments leading toward the implementation of white space technology - an emerging wireless standard for using wireless spectrum in locations where it is unused by licensed users. Some of the key research areas in the field are covered. These include emerging standards, technical insights from early pilots and simulations, software defined radio platforms, geo-location spectrum databases and current white space spectrum usage in India and South Africa.

This book constitutes the thoroughly refereed post-conference proceedings of the 7th International ICST Conference on Mobile Multimedia Communications (MOBIMEDIA 2011) held in Cagliari, Italy, in September 2011. The 26 revised full papers presented were carefully selected from numerous submissions and focus topics such as quality of experience, dynamic spectrum access wireless networks in the TV white spaces, media streaming, mobile visual search, image processing and transmission, and mobile applications.

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.

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.

This book brings together papers from the 2019 International Conference on Communications, Signal Processing, and Systems, which was held in Urumqi, China, on July 20–22, 2019. Presenting the latest developments and discussing the interactions and links between these multidisciplinary fields, the book spans topics ranging from communications to signal processing and systems. It is chiefly intended for undergraduate and graduate students in electrical engineering, computer science and mathematics, researchers and engineers from academia and industry, as well as government employees.

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.

This proceedings book presents the latest research in the fields of information theory, communication system, computer science and signal processing, as well as other related technologies. Collecting selected papers from the 3rd Conference on Signal and Information Processing, Networking and Computers (ICSINC), held in Chongqing, China on September 13-15, 2017, it is of interest to professionals from academia and industry alike.

This, the 29th issue of the Transactions on Computational Science journal, is comprised of seven full papers focusing on the area of secure communication. Topics covered include weak radio signals, efficient circuits, multiple antenna sensing techniques, modes of inter-computer communication and fault types, geometric meshes, and big data processing in distributed environments.

This book includes a selection of papers from the 2018 World Conference on Information Systems and Technologies (WorldCIST'18), held in Naples, Italy on March 27-29, 2018. WorldCIST is a global forum for researchers and practitioners to present and discuss recent results and innovations, current trends, professional experiences and the challenges of modern information systems and technologies research together with their technological development and applications. The main topics covered are: A) Information and Knowledge Management; B) Organizational Models and Information Systems; C) Software and Systems Modeling; D) Software Systems, Architectures, Applications and Tools; E) Multimedia Systems and Applications; F) Computer Networks, Mobility and Pervasive Systems; G) Intelligent and Decision Support Systems; H) Big Data Analytics and Applications; I) Human-Computer Interaction; J) Ethics, Computers & Security; K) Health Informatics; L) Information Technologies in Education; M) Information Technologies in Radiocommunications; N) Technologies for Biomedical Applications.

With the rapid growth of new wireless devices and applications over the past decade, the demand for wireless radio spectrum is increasing relentlessly. The development of cognitive radio networking provides a framework for making the best possible use of limited spectrum resources, and it is revolutionising the telecommunications industry. This book presents the fundamentals of designing, implementing, and deploying cognitive radio communication and networking

systems. Uniquely, it focuses on game theory and its applications to various aspects of cognitive networking. It covers in detail the core aspects of cognitive radio, including cooperation, situational awareness, learning, and security mechanisms and strategies. In addition, it provides novel, state-of-the-art concepts and recent results. This is an ideal reference for researchers, students and professionals in industry who need to learn the applications of game theory to cognitive networking.

This book contains a selection of articles from The Europe, Middle East and North Africa Conference on Technology and Security to Support Learning 2016 (EMENA-TSSL'16), held between the 3th and 5th of October at Saidia, Oujda, Morocco. EMENA-TSSL'16 is a global forum for researchers and practitioners to present and discuss recent results and innovations, current trends, professional experiences and challenges in Information & Communication Technologies, and Security to support Learning. The main topics covered are: A) Online Education; B) Emerging Technologies in Education; C) Artificial Intelligence in Education; D) Gamification and Serious games; E) Network & Web Technologies Applications; F) Online experimentation and Virtual Laboratories; G) Multimedia Systems and Applications; H) Security and Privacy; I) Multimedia, Computer Vision and Image Processing; J) Cloud, Big Data Analytics and Applications; K) Human-Computer Interaction; L) Software Systems, Architectures, Applications and Tools; M) Online Languages and Natural Language Processing N) E-content Development, Assessment and Plagiarism; O) Secure E-Learning Development and Auditing; P) Internet of Things and Wireless Sensor Networks.

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.

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