(1)
COMPRESSED MEASUREMENTS BASED CYCLOSTATIONARY DETECTOR FOR WIDEBAND COGNITIVE RADIOS

Mohammed Y. Abdelsadek , Mohammed Farrag, and Taha A. Khalaf

Abstract:

Cyclostationary feature detection is one of the most powerful spectrum sensing techniques used for cognitive radio (CR) systems. This is because of its robustness against noise uncertainties. However, this technique needs high sampling rates, which is limited by the state-of the-art analog to digital converters (ADCs), especially in wideband regime. Comressive sensing (CS) was used by many researchers for solving this problem via sub-Nyquist sampling rates. However CS solves the high sampling rate problem, but it does not reduce complexity considerably. This is because spectrum sensing is performed in three steps: sensing compressed measurements, then reconstructing the Nyquist rate signal, and finally performing cyclostationary detection (CD) on the reconstructed signal. In this paper we suggest performing CD directly on the compressed measurements skipping the reconstruction step which is the most complex step in CS. This can be realized by designing the sensing matrix with constraints different from those used in the conventional CS. Results show that performance is improved relative to applying CD on the Nyquist rate signal. This is in addition to reduction in receiver complexity resulting from reducing sampling rates. A detection probability of 78.7% can be achieved with only 7% of samples used by the conventional cyclostationary detection technique that achieves a detection probability of 32.7%.

Keywords:

Cognitive radio, Spectrum Sensing, Cyclostationary Detector, Compressive Sensing.

Published In:

(2)
Energy Consumption and Lifetime Analysis for Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali and Osama Amin

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, we present an energy analysis technique for WSNs considering the physical layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. We show how the transmission power must be chosen in order to achieve energy-efficient communications over AWGN channel and provide a closed-form expression for optimum transmission power. We also find that, for each modulation scheme, there are optimal transmission power at which the energy consumption is minimized. The proposed model can be used to analyse the WSNs energy consumption, to evaluate communication protocols, and it can also use to estimate energy consumption and network lifetime which used for on-line energy accounting.

Keywords:

Wireless Sensor Network, Optimal Transmit Power, Minimum Energy Consumption, Energy Consumption Model, Lifetime, Physical layer.

Published In:

(3)
Compressed Measurements Based Spectrum Sensing for Wideband Cognitive Radio Systems

Taha A. Khalaf, Mohammed Y. Abdelsadek, and Mohammed Farrag

Abstract:

NULL

Keywords:

NULL

Published In:

(4)
Optimized bases compressive spectrum sensing for wideband cognitive radio

Mohammed Farrag, Mostafa El-Khamy, Mohamed El-Sharkawy

Abstract:

Abstract□Designing efficient spectrum sensing techniques with low power consumption is crucial for the success of cognitive radio (CR). This is particularly challenging when sensing a wideband spectrum due to the high sampling rate required. Compressive sensing (CS) theory states that a signal can be measured at a rate significantly lower than the Nyquist rate and consequently reconstructed from the measurements using an optimization process. The minimum number of measurements required for reliable reconstruction of the sampled ...

Published In:

(5)
C44. secure cooperative blindly-optimized compressive spectrum sensing for cognitive radio

Mohammed Farrag, Mostafa El-Khamy, Mohamed El-Sharkawy

Abstract:

ABSTRACT In this paper, we propose a reduced complexity secure cooperative cognitive radio spectrum sensing algorithm for wideband systems. The proposed scheme aims to reduce the receiver hardware complexity by minimizing the required sampling rates. The proposed scheme is immune to spectrum sensing data falsification attacks. Each cognitive radio node samples the analog wideband signal from the primary users using an analog-to-information converter and sends the compressed signal to the fusion center that makes a ...

Published In:

(6)
A blindly optimized compressive sensing receiver for cognitive radio

Mohammed Farrag, Mostafa El-Khamy, Mohamed El-Sharkawy

Abstract:

Abstract⎯This paper proposes a spectrum sensing algorithm for cognitive radio transceivers to save in sampling rates and receiver hardware complexity. The proposed receiver blindly optimizes its compressed sensing sparsifying bases and has improved receiver-operating characteristics. Keywords: Cognitive radio; Compressive sensing; Wavelet Packet; Blind Optimization, Entropy, sub-Nyquist sampling

Published In:

(7)
Wide-band secure compressed spectrum sensing for cognitive radio systems

Mostafa El-Khamy, Mohammed Farrag, Mohamed El-Sharkawy

Abstract:

Abstract: Cooperative wide-band spectrum sensing has been considered to enable cognitive radio operation of wireless regional area networks (WRAN) in the UHF and VHF TV broadcasting bands. In this paper, cooperative compressed spectrum sensing is considered to enable fast sensing of the wide-band spectrum. The speed and accuracy of spectrum sensing are improved by further optimization of the compressed sensing receiver, which is done blindly without any prior knowledge of the sensed signal. Enhanced ...

Published In:

(8)

Abstract: Cooperative wide-band spectrum sensing has been considered to enable cognitive radio operation of wireless regional area networks (WRAN) in the UHF and VHF TV broadcasting bands. In this paper, cooperative compressed spectrum sensing is consider

Mohammed Farrag, Mostafa El-Khamy, Osamu Muta, Mohamed El-Sharkawy, Hiroshi Furukawa

Abstract:

AbstractThis work proposes a reduced complexity secure cooperative cognitive radio spectrum sensing algorithm for wideband systems. The main goal of the proposed algorithm is to reduce the cognitive radio receiver hardware complexity by distributing the sensing work among the trustful nodes only. Each cognitive radio node uses its local sensing matrix, which is a part of a global sensing matrix at the fusion center, to sense the wideband analog signal. The fusion center selects and rearranges the compressed data from the trustful ...

Published In:

(9)
An Energy Consumption Model for Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali and Osama Amin

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, we provide an energy model for WSNs considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. We show how the transmission power must be chosen in order to achieve energy-efficient communications over AWGN channel. We also find that, for each modulation scheme, there are optimal transmission power at which the energy consumption is minimized. Moreover, we investigated the energy saving gained from optimizing the constellation size.

Keywords:

Wireless Sensor Network, Energy Consumption Model, Optimal Transmit Power, Minimum Energy Consumption.

Published In:

(10)
Wide-Band Cooperative Compressive Spectrum Sensing for Cognitive Radio Systems Using Distributed Sensing Matrix

Mohammed Farrag, Osamu Muta, Mostafa El-Khamy, Hiroshi Furukawa, Mohamed El-Sharkawy

Abstract:

Abstract—In this paper, cooperative compressive spectrum sens-ing is considered to enable accurate sensing of the wide-band spectrum. The proposed algorithm is based on compressive sensing theory and aims to reduce the hardware complexity of the cognitive radio receiver by distributing the sensing work among groups of sensing nodes. The proposed algorithm classifies the cooperated sensing nodes into different sensing groups depending on the quality of the reporting channel between the sensing node and the ...

Published In:

(11)
COMPRESSED MEASUREMENTS BASED CYCLOSTATIONARY DETECTOR FOR WIDEBAND COGNITIVE RADIOS

Mohammed Y Abdelsadek, Mohammed Farrag, Taha A Khalaf

Abstract:

ABSTRACT Cyclostationary feature detection is one of the most powerful spectrum sensing techniques used for cognitive radio (CR) systems. This is because of its robustness against noise uncertainties. However, this technique needs high sampling rates, which is limited by the state-of the-art analog to digital converters (ADCs), especially in wideband regime. Comressive sensing (CS) was used by many researchers for solving this problem via sub-Nyquist sampling rates. However CS solves the high sampling rate problem, but it does ...

Published In:

(12)
A Survey on Protocols, Platforms and Simulation Tools for Wireless Sensor Networks

Mohammed Abo-Zahhad*, Osama Amin, Mohammed Farrag and Abdelhay Ali

Abstract:

Wireless Sensor Networks (WSNs) are becoming very common technology which combine sensing, processing, and wireless multi-hop networking. This paper provides a wide review of the present state about WSNs at the time of its writing. Following a top-down approach, WSNs concept, definition and applications is provided. Furthermore, an overview of WSNs constrains and judgment metrics such as lifetime and latency is given. Then, the communication protocol stack for WSNs is described, and protocols developed for each layer are discussed. Finally, this paper provides review and comparisons of current simulation programs All of these features make the paper valuable for an extensive variety of possible readers, researchers in WSNs, students stating research in WSNs, specialists wanting to offer WSN solutions, and WSN application designers.

Keywords:

Wireless sensor networks; communication protocol stack; Platforms; Simulator Tools; Ad hoc networks

Published In:

(13)
Survey on Energy Consumption Models in Wireless Sensor Networks

Mohammed Abo-Zahhad, Osama Amin, Mohammed Farrag, Abdelhay Ali

Abstract:

Wireless Sensor Network (WSN) is one of the most important areas of research in the twenty- first century. WSN aims to sense a certain natural phenomenon and sends sensed data to sink using a multi - hop network. In order to increase the lifetime of the battery-based sensing nodes, it is essential to minimize the consumed energy in the sensing process. The first step to achieve this goal is to know completely the sources of energy consumption in WSNs. In this paper, sources of energy consumption at various communication layers have been studied and investigated. Furthermore, survey has been provided for existing energy models and the classification of these models into physical layer, MAC layer and cross-layer energy models. Finally, a comparison between existing available energy models has been provided.

Keywords:

Energy Consumption Models; Wireless Sensor Networks; ad hoc Networks; Networking Layer; Data Link Layer; Medium Access Control; Physical Layer; Cross-layer

Published In:

(14)
A comparative approach between cepstral features for human authentication using heart sounds

M. Abo-Zahhad, Mohammed Farrag, Sherif N. Abbas, and Sabah M. Ahmed

Abstract:

The main objective of this paper is to provide a comparative study between different cepstral features for the application of human recognition using heart sounds. In the past 10 years, heart sound, which is known as phonocardiogram, has been adopted for human biometric authentication tasks. Most of the previously proposed systems have adopted mel-frequency and linear frequency cepstral coefficients as features for heart sounds. In this paper, two more cepstral features are proposed. The first one is based on wavelet packet decomposition where a new filter bank structure is designed to select the appropriate bases for extracting discriminant features from heart sounds. The other is based on nonlinear modification for mel-scaled cepstral features. The four cepstral features are tested and compared on two databases: One consists of 21 subjects, and the other consists of 206 subjects. Based on the achieved results over the two databases, the two proposed cepstral features achieved higher correct recognition rates and lower error rates in identification and verification modes, respectively.

Keywords:

Heart sounds; PCG biometric authentication; Wavelet denoising; Cepstral features; Wavelet packet decomposition; Linear discriminant analysis.

Published In:

Signal, Image and Video Processing , NULL , NULL

(15)
Modeling and Minimization of Energy Consumption in Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag and Abdelhay Ali

Abstract:

Design of energy-efficient wireless sensor networks (WSNs) has become an important area of scientific research. In this regard, modeling and minimizing of energy consumption are the main objectives for designing WSNs. In this paper, an energy consumption model for WSNs based on physical layer parameters is proposed by calculating the total energy that is required for successfully received one bit over Rayleigh fading channels. The proposed energy consumption model is validated with real measurements. Results show a good agreement between proposed model and experimental measurements with a mean absolute percentage error less than 5.5%. The validated model is used to optimize transmitted power to achieve minimum energy consumption. Finally, a closed-form expression for optimum transmitted power is derived for M-QAM modulation scheme

Keywords:

Wireless Sensor Network, Energy Consumption Model, Optimal Transmit Power, Minimum Energy Consumption, Physical layer

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International Conference on Electronics, Circuits, and Systems , NULL , NULL

(16)
Design and Implementation of Building Energy Monitoring and Management System based on Wireless Sensor Networks

Mohammed Abo-Zahhad, Sabah M Ahmed, Mohammed Farrag, Mohammed F A Ahmed, Abdelhay Ali

Abstract:

Wireless sensor networks (WSNs) play a key role in extending the smart grid implementation towards residential premises and energy management applications. Efficient supply and demand balance, and consequently reducing the electricity expenses and carbon emissions, is an immediate benefit of implementing smart grids. In this paper, design and implementation of an energy management system (EMS) for efficient load management are proposed. The EMS reduces the consumption of the consumers at the peak load hours and thus reduces the carbon emissions of the household. The proposed system consists of two main parts. The first part is an Energy Management Unit (EMU) which has a graphical user interface for runtime monitoring and control. The second part is sensor nodes which measure the power consumption of the different loads and transfer it to the EMU via multi-hop network. The EMU is implemented using NI LABVIEW software and XBee-PRO ZigBee module to communicate with sensor nodes. Hardware model is implemented using Arduino Uno microcontroller, XBee-PRO ZigBee module and the ACS712 current sensor. The EMS is applied to building of Electrical Engineering Department at Assiut University as a case study

Keywords:

NULL

Published In:

(17)
Modeling and Optimization of Energy Consumption in Wireless Sensor Networks

Mohammed Abo-Zahhad, Mohammed Farrag, Abdelhay Ali ·

Abstract:

Energy consumption and energy modeling are important issues in designing and implementing of Wireless Sensor Networks (WSNs), which help the designers to optimize the energy consumption in WSN nodes. Good knowledge of the sources of energy consumption in WSNs is the first step to reduce energy consumption. Therefore, an accurate energy model is required for the evaluation of communication protocols. In this paper, an energy model for WSNs is provided considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error over AWGN channel. This model has been tested with real data and and NS-2 simulator. Results show good agreement between proposed model, experimental measurements and NS-2 simulator with mean absolute percentage error less than 5.18%. Furthermore, the proposed model is exploited to optimize transmitted power to achieve minimum energy consumption. Finally, a closed-form expression for optimum transmitted power is derived for M-QAM modulation scheme

Keywords:

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10th IEEE International Conference on Computer Engineering and Systems (ICCES 2015) , NULL , NULL

(18)
Different Aspects of Localization Problem for Wireless Sensor Networks: A Review

Mohammed Farrag, Mohammed Abo-Zahhad, Magdy.M. Doss and Joseph V. Fayez

Abstract:

This paper describes the wireless sensor networks, which is widely used in the last few decades. The hardware architecture of sensor node as a construction unit for WSN is illustrated with sensor applications. The localization process and its challenges are mentioned. A comparison between algorithms and techniques for sensor localization is presented. The factors that affect design issues including different topologies, mobility matter of sensor nodes, security issues, and finally future work and new trends for wireless sensor network localization.

Keywords:

Wireless Sensor Networks, Localization, Mobility, Security.

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(19)
Detection of primary user signal in wideband cognitive radio networks exploiting DCT as sensing matrix

Abo-Zahhad, M.; Ahmed, Sabah M.; Farrag, Mohammed; Baali, Khaled Ali

Abstract:

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Keywords:

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(20)
A fast accurate method for calculating symbol error probabilities for AWGN and Rayleigh fading channels

Abo-Zahhad, Mohammed; Farrag, Mohammed; Ali, Abdelhay

Abstract:

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Keywords:

NULL

Published In:

(21)
Heart-ID: Human identity recognition using heart sounds based on modifying mel-frequency cepstral features

Abbas, Sherif N.; Abo-Zahhad, Mohammed; Ahmed, Sabah M.; Farrag, Mohammed

Abstract:

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Keywords:

NULL

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