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Monday, September 25, 11:00 - 12:30

COMMS-1 : WIRELESS COMMUNICATIONS - 01

Room: Bluewater -1
Chair: Yi Fang (Guangdong University of Technology, P.R. China)

11:00 *Performance Analysis and Comparison of Three Multiple-Access DCSK Cooperative Communication Systems over Multipath Fading Channels*

Yi Fang and Guofa Cai (Guangdong University of Technology, P.R. China); Guojun Han (Nanyang Technological University & Guangdong University of Technology, Singapore); Lin Wang (Xiamen University, P.R. China); Pingping Chen (Fuzhou University, P.R. China)

Differential-chaos-shift-keying (DCSK) modulation has drawn much attention in the past two decades due to its simple realization and excellent anti-multipath ability. In this paper, we conduct an in-depth study on the N-user DCSK cooperative communication (CC) systems over multipath Nakagami fading channels, where three multiple-access (MA) schemes, i.e., variant-delay MA (VDMA), code-division MA (CDMA), and Walsh-coded MA (WCMA), are considered. To be specific, we firstly introduce the frameworks of the aforementioned three MA-DCSK-CC systems, then analyze and compare the error performance of these MA-DCSK-CC systems. Analytical and simulated results illustrate that the WCMA-DCSK-CC system enables more desirable error performance with respect to the VDMA and CDMA ones. Consequently, the WC-based scheme stands out as a very good candidate for the low-power and low-complexity chaos-based cooperative networks.
pp. 1-5

11:15 *An Improved Adaptive Method of Power Amplifier Nonlinearity Simulation*

Zhonghua Wang and Wuyang Zhou (University of Science and Technology of China, P.R. China); Li Song (Beijing Institute of Technology, P.R. China)

Power amplifier takes on nonlinearity when it works at the saturated state, which can produce severe nonlinearity distortion of signals. In order to exactly evaluate performance of communication system, a channel simulator needs to simulate power amplifier nonlinearity. This paper proposes a novel simulation method based on adaptive learning structure. For the sake of enhancing convergence rate , this paper employs look-up table to store polynomial parameters which reduces the amount of complex multiplications. Simulation result indicates that the proposed method is easy to implement with less amount of computation, converges fast and provides high simulation precision. At the same time, this paper also provides an implementation scheme on FPGA.
pp. 6-10

11:30 *A Fast Method for Carrier Frequency Offset Estimation in Fully-Loaded Constant-Modulus OFDM Systems*

Qi Cheng (Western Sydney Unversity, Australia)

Based on a property of measurement correlations, a fast method is developed, for carrier frequency offset estimation in fully-loaded OFDM systems transmitting constant-modulus symbols. This method offers computational advantage over some relevant methods, at moderate accuracy loss, for a small number of OFDM symbols.
pp. 11-15

11:45 *Performance of Protograph LDPC Codes over Ergodic Nakagami Fading Channels*

Yi Fang, Guofa Cai and Zhaojie Yang (Guangdong University of Technology, P.R. China); Pingping Chen (Fuzhou University, P.R. China); Guojun Han (Nanyang Technological University & Guangdong University of Technology, Singapore)

The protograph low-density parity-check (LDPC) codes have drawn much attention in the past decade due to their simple structures and outstanding error performance. Unfortunately, the conventional protograph codes designed for additive white Gaussian noise (AWGN) channels can not perform well in ergodic Nakagami fading channels. To address this issue, we construct a new rate-1/2 protograph code, called improved accumulate-repeat-accumulate (IARA) code, by exploiting a modified PEXIT algorithm. We compare the decoding threshold and bit error rate (BER) of the IARA code with the existing protograph codes, the regular LDPC code and the irregular code over ergodic Nakagami fading channels. Both analytical and simulated results show that the proposed IARA code can achieve the lowest BER in the high signal-to-noise-ratio region. Hence, the IARA code can be considered as a good candidate for use in wireless communication systems with fast fading.
pp. 16-20

12:00 *Group Secret Key Generation in Physical Layer, Protocols and Achievable Rates*

Tianyu Tang (Beijing University of Posts and Telecommunications, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Weixia Zou (BUPT, P.R. China)

The secret group key generation based on physical layer security and information theory security has attracted increasing research interest. In this paper, we propose a scheme to establish the secret group key with the cooperation of all the nodes.

To ensure the security of the group communication, a protocol is proposed to implement the collaborative secret group key via circle network topology. We subsequently analyze the achievable theoretical upper bound of the secret group key rate for circle topology in the presence of an eavesdropper. The simulation result shows that the protocol doesn't only assign the computation and broadcast to each node, but also obviously increase the group key generation rate than a benchmark scheme. We further analyze the impact of node number and SNR on the achievable secrecy rate.
pp. 21-26

12:15 *SNR -Based Adaptive Computing Resource Allocation in Centralized Baseband Pool*

Zhang Baofeng (China Information Technology Security Evaluation Center, P.R. China); Xiong Qi and Yuan Xu (China Information Technology Secuirty Evaluation Center, P.R. China); Huayi Rao and Mao Junjie (China Information Technology Security Evaluation Center, P.R. China)

In this paper , we proposed a computing resource allocation scheme based on users' SNR condition, to achieve the maximal throughput of wireless network s. So far, most research on radio resource allocation assumed the computing ability is infinite for digital signal processing. In our paper, we assume that the computing resource is limited, and consider the centralized computing scenario, which is popular in the next generation wireless radio access network architecture. First we model the computing ability by iteration times, then we propose the adaptive allocation scheme based on SNR condition. Simulation results show that th e proposed scheme can obtain 0.5 dB improvement of system throughput compared with traditional scheme.
pp. 27-30

CS-1: CIRCUIT AND SYSTEMS - 01

Room: Bluewater -2
Chair: Yang Yang (University of Technology Sydney, Australia)

11:00 *Analysis of Adaptive Threshold Nonlinear Correlation Algorithm*

Shin'ichi Koike (Consultant, Japan)

This paper proposes an adaptation algorithm named Adaptive Threshold Nonlinear Correlation Algorithm (ATNCA) which makes adaptive filters robust against two types of impulse noise: impulsive observation noise at the filter output and impulse noise at the filter input. Analysis of the ATNCA is developed to theoretically calculate filter convergence behavior. Through experiments, we demonstrate the effectiveness of the proposed algorithm in realizing fast convergent and robust adaptive filters in impulsive noise environments. Good agreement between simulated and theoretical filter convergence curves shows the validity of the analysis.
pp. 31-35

11:15 *Gesture Recognition System Using Reconstructed Image from the Acceleration Sensor Signal*

Yanzhe Zhao and Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Weixia Zou (BUPT, P.R. China)

This paper presents a new method for recognizing handwritten motions in 3-D space based on the reconstructed image from the signal of the three-axis acceleration (ACC) sensor of the smart mobile device.The proposed method is composed of gesture detection,data reconstruction and recognition.In our method, the start and end points of the meaningful gesture motions are detected automatically and the undefined hand motions are filtered out.The three-axis ACC data of the gesture segment is directly converted and reconstructed into gray-scale image.By reconstructing the ACC signal as an image, the detected gesture segments having different lengths are normalized and compressed.The classification and recognition of the gray-scale images representing different gestures are further carried out based on Softmax regression model.The recognition algorithm can recognize a large number of complex letter gestures with low computational cost.A library of 26 letter gestures with over 3000 samples is created to evaluate the proposed method,and the evaluation shows that the method achieves accuracy of 99.23% and the implemented recognition system on smart-phone shows that the average recognition time for a letter gesture is 15ms.
pp. 36-41

11:30 *A Defect Level Monitor of Resistive Open Defect at Interconnects in 3D ICs by Injected Charge Volume*

Kouhei Ohtani, Naho Osato and Masaki Hashizume (Tokushima University, Japan); Hiroyuki Yotsuyanagi (Tokushima University); Shyue-Kung Lu (National Taiwan University of Science and Technology, Taiwan)

Resistive open defects may occur at interconnects among dies in 3D stacked ICs. A defect level monitor is proposed so as for the defects to be detected before they change into a hard open defect that generates logical errors. The changing process of resistive open defects is monitored by means of charge volume injected from the monitor. It is shown by Spice simulation that resistive open defects whose resistance is greater than 2Ω can be detected by online tests with the monitor before changing them to hard open defects in the field.
pp. 42-46

11:45 *SoC Design with HW/SW Co-Design Methodology for Wireless Communication System*

Nico Surantha (Bina Nusantara University, Indonesia); Nana Sutisna, Yuhei Nagao and Hiroshi Ochi (Kyushu Institute of Technology, Japan)

The rapid evolution and the popularity of wireless devices among worldwide users has made wireless communication as one of the main market of system-on-chip (SoC) development. The complexity of the design, the number of supported application,

time-to-market, design technology are some critical challenges that needs to be taken into consideration when designing the SoC for wireless communication. This paper reviews the design requirement of wireless communication system and the current SoC design technology. Finally, this paper propose the improved HW/SW design methodology that can tackle the critical challenges for wireless communication system design. As an example of the implementation of the proposed methodology, the design and verification result of our proposed IEEE 802.11n WLAN system SoC is presented.
pp. 47-52

12:00 *Research and Optimization for Adaptive Intra Frame Complexity Rate Control Based on HEVC*

Zhi Ma, Tao Tian, Junshi Xiao and Sun Songlin (Beijing University of Posts and Telecommunications, P.R. China)

It has been shown that the quality of multimedia video and the need of real time video transmission become widely increased in these days and high efficiency video coding (HEVC) becomes the newest standard. Based on the theory of rate-distortion coding, the R-λ model can describe the rate-distortion relationship more accurately in comparison with the existing traditional R-Q model. With the development of screen content coding, this paper proposes a new adaptive intra frame complexity measure method based on two complexity measure methods with a relative coefficient for intra bit rate control has been proposed, respectively are the gradient based complexity measure and edge based complexity measure. Then the paper proposes an improved rate control method for the intra-frame rate control, which merges the adaptive intra frame complexity measure with R-λ model based on HEVC. Along with this new adaptive rate control approach, it will show improved accuracy in rate control and enhanced performance in video coding which means better video quality. The proposed scheme can reduce the frame bit mismatch ratio by 2.8175% on average and the better B-D Rate which is 0.94% on average. Experimental results verify the effectiveness of the proposed intra frame complexity method based on λ-domain rate control algorithm.
pp. 53-57

Monday, September 25, 13:30 - 15:00

COMMS-2: WIRELESS COMMUNICATIONS - 02

Room: Bluewater -1
Chair: Hasini Abeywickrama (University of Technology Sydney, Australia)

13:30 *Intrinsic Interference-Aware Adaptive FBMC Transmission with Automatic Modulation Classification*

Lars Haering (University Duisburg-Essen, Germany)

This manuscript analyzes an adaptive filter bank multicarrier transmission system in which intrinsic interference arising from imperfect equalization is taken into account in the bit loading (BL) and automatic modulation classification (AMC) method. Designated for highly frequency-selective fading channels, a general filter design for a subcarrier-independent channel equalization is presented. Furthermore, this contribution investigates the influence of residual interference after multi-tap equalization on the signal-to-interference-and-noise power ratio in application to adaptive techniques such as BL and AMC which rely on the information about the subcarrier link quality. Simulation results for a typical indoor propagation setup reveal a considerable system performance improvement at high signal-to-noise power ratios (SNRs) when utilizing the information about the interference power in the considered BL and AMC method whereas a minor advantage is obtained at low SNRs.
pp. 58-63

13:45 *Optimal Strict Frequency Reuse in Cellular Networks-based Stochastic Geometry Model*

Sinh Cong Lam (University of Technology, Sydney & Vietnam National University, Hanoi, Australia); Kumbesan Sandy Sandrasegaran (University of Technology, Sydney, Australia)

This paper studies Strict Frequency Reuse algorithm which can be utilised to mitigate the InterCell Interference as well as improve the spectrum efficiency in cellular networks by dividing the users into two groups called Cell-Center Users (CCUs) and Cell-Edge Users (CEUs). The performance of the user, i.e. CCU and CEU, as well as the network system in Strict Frequency Reuse network with multi-users and multi-Resource Blocks (RBs) are derived. The analytical results which are verified by Monte Carlo simulation indicate that when SNR or SINR threshold increases, the system performance reaches the peak before steadily decreasing. Thus, the optimal value of SNR and SINR threshold are selected to maximise the performance of the network system.
pp. 64-70

14:00 *An SDN Controlled Self-Optimizing Approach in Circular Array Equipped Small Cells*

Na Chen, Xiaoguang Zhang and Zheng Zhou (Beijing University of Posts and Telecommunications, P.R. China); Xiaoxin Chen (Daqing People's Radio Station, P.R. China); Sun Songlin and Dongbin Wang (Beijing University of Posts and Telecommunications, P.R. China)

Software defined network (SDN) has been introduced for more scalability and flexibility in modern heterogeneous networks (HetNets). In this paper, we present a scheme that equip the small cells with circular array and manage the spectrum resource with soft fractional frequency reuse (SFFR) approach. By considering the users' demand that located in different directions and multiple layers, we reduce the power consumption by applying Stackelberg Game strategy. Simulation results show the proposed self-optimizing scheme can fulfill the traffic demands of the users with relatively low power utility.

14:15 *Energy Efficiency and Delay Tradeoff in Wireless Powered Communication Networks*

Jiangqi Hu and Qinghai Yang (Xidian University, P.R. China); Kyung Sup Kwak (Inha University, Korea)

Energy efficiency (EE) and delay are two crucial metrics in WPCN. In general, the transmitter always transmits the information in a good channel state to improve EE whilst may lead to delay due to waiting for a good channel state. Thus, there exists a tradeoff between EE and delay. In this paper, we investigate the EE and delay tradeoff with considering the time-varying channel and stochastic traffic arrivals.We formulate this problem as a stochastic optimization model, which optimizes the EE subject to both the data queue stability and the harvested energy availability. To solve the formulation, a general and effective algorithm, referred to as EE and delay tradeoff algorithm (EEDTA), is developed by employing the fractional programming method and Lyapunov optimization theory, which does not require any prior knowledge of channel states and data arrivals. Moreover, the theoretical analysis and simulation results show that the EEDTA achieves an EE-delay tradeoff, which mathematically depicted by [\emph{\textbf{O}}(1/V),\emph{\textbf{O}}(V)] with V as a control parameter, and can flexibly strike the tradeoff by simply tuning V. Simulation results verify the theoretical analysis.

14:30 *Performance Analysis of Joint Scheduling in Random Cellular Networks*

Sinh Cong Lam (University of Technology, Sydney & Vietnam National University, Hanoi, Australia); Kumbesan Sandy Sandrasegaran (University of Technology, Sydney, Australia)

In this paper, we proposed a model based on random cellular networks and 3GPP recommendations for LTE-Advanced to analyse the performance of Joint Scheduling in Rayleigh fading channel. The operation of Joint Scheduling is divided into two phases. during the establishment phase, a typical user measures received signals from K coordinated Base Station (BSs) and select the BS with the highest Signal-to-Interference-Noise Ratio. This is followed by the data transmission during the communication phase. The performance of the typical is defined as the conditional probability of coverage probability during the communication phase under condition of the establishment phase. The analytical results which are verified by Monte Carlo simulation can be expanded for both in the case of non-Joint Scheduling and the worst case user.

CS-2: CIRCUIT AND SYSTEMS - 02

Room: Bluewater -2
Chair: Yang Yang (University of Technology Sydney, Australia)

13:30 *Dynamic Body Postures Recognition with WiFi Based on Empirical Mode Decomposition (EMD)*

Min Ye (University(BUPT), P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China)

In this paper, a new method of dynamic posture recognition using WiFi signals based on empirical mode decomposition (EMD) is proposed. Totally different from computer vision approach and traditional sensor-based approach, the proposed novel posture recognition method does not require line-of-sight and sensors placed in the body. Furthermore, it has no effect on the quality of communication. The experimental result shows that, by recomposing the decomposition signal and extracting the features, nine predefined dynamic postures can be effectively recognized, with an average recognition accuracy of 92.4%.This method increased nearly five percentage points (5%) than no decomposition of the signal, which just extracting features. This accuracy is robust to the presence of other interfering humans.

13:45 *On Selection of Adjacent Lines in Test Pattern Generation for Delay Faults Considering Crosstalk Effects*

Yuuya Ohama, Hiroyuki Yotsuyanagi and Masaki Hashizume (Tokushima University, Japan); Yoshinobu Higami and Hiroshi Takahashi (Ehime University, Japan)

With miniaturization of semiconductor manufacturing process, line spacing becomes narrower and hence the influence of coupling capacitance cannot be ignored. The signal delay on a defective line is affected by the signal transitions on its adjacent lines through the coupling capacitance. In addition, the delay size depends on the timing skew between signal transitions on the defective line and its adjacent lines. In test pattern generation, not all adjacent lines are required to have signal transitions to excite the fault effect if a large relative timing skew exists between the faulty line and the adjacent line. In this paper, we propose a selection method of adjacent lines for assigning signal transitions in test pattern generation. The proposed method can reduce the number of adjacent lines used in test pattern generation without degrading the quality of test pattern that can excite the fault effect.

14:00 *A DNN-Based Object Detection System on Mobile Cloud Computing*

Buren Qi, Mengfei Wu and Lin Zhang (Beijing University of Posts and Telecommunications, P.R. China)

With the development of big data and the improvement of computing power, deep learning has made a very prominent breakthrough in computer vision. However, the computational overhead of the Deep Neural Network (DNN) for video processing in mobile devices is extremely high. To address the problem above, this paper combines smartphones with the cloud to realize

a DNN-based object detection system. Firstly, the system is divided into five modules: video capture and reading, distributed scheduling, video transmission, object detection, and video display. Then, the model scheduling algorithm and the process of training DNN models are presented in detail. Finally, the system is tested and evaluated from two aspects: run time and precision. The results show that our system has fast running speed and high detection accuracy.
pp. 97-102

14:15 *Design of On-chip Quadrature Hybrid (3dB) Branch-line Couplers in 0.13-μm SiGe Technology for Millimetre-wave Applications*

Meriam Gay Bautista (University of Technology Sydney, Australia); Jinbao Zhu (Jinlin University, P.R. China); Xi Zhu, Yang Yang and Eryk Dutkiewicz (University of Technology Sydney, Australia)
In this paper, design of miniaturized on-chip quadrature hybrid branch-line coupler is investigated. The motivation of this work is to minimize the footprint of the designed coupler while maintaining high performance of the circuit in the mm-wave band spectrum. Three examples are implemented in a standard (Bi)-CMOS process for millimetre wave applications. Excluding the pads, the chip size of the conventional design is 0.345mm2, and the proposed two other designs structures are 0.2587mm2 and 0.2128mm2, respectively, which indicates an area reduction by 13% and 30% respectively.
pp. 103-107

Monday, September 25, 15:30 - 17:00

WN-1: WIRELESS NETWORKING AND IOT - 01

Room: Bluewater -1
Chair: Lin Zhang (Beijing University of Posts and Telecommunications, P.R. China)

15:30 *Unsupervised Learning of Space-time Symmetric Patterns in RGB-D Videos for 4D Human Activity Detection*

Yun-Jue Chen and Shyi-Chyi Cheng (National Taiwan Ocean University, Taiwan); Chen-Kuei Yang (Ming Chuan University, Taiwan)
In this paper we present an approach for finding space-time activity map in a video shot using 3D moment methods. A RGB-D video involves a specific human activity is first regularly partitioned into multiple video shots in which human activities can be defined. For each video shot, we separate it into multiple video cubes which characterizes local object shape and motion. Given a local video cube, the proposed space-time pattern detector extracts both the spatial and temporal symmetric information which are further grouped together by hashing to construct an activity map that describes the distribution of motion vectors of objects in a video shot. The intrinsic human activity in a video consisting of multiple shots is finally represented by a set of activity maps. Next, to reduce the temporal dimensionality of an activity in terms of activity maps, the kernel PCA method is applied to transform the activity representation into a set of principal activity maps. Finally, regardless of the activity types of the training videos, all the training principal activity maps are clustered into multiple clusters to generate a principal activity map dictionary. This dictionary is used to solve the initial pose problem when we use dynamic programming to align two sequences of principal activity maps for recognizing human activities in RGB-D videos. The proposed approach was tested using publicly available datasets. Experimental results demonstrate the good performance of the proposed method in terms of activity detection accuracy and execution speed.
pp. 108-113

15:45 *Trust Connectivity Analysis in Overlaid Unmanned Aerial Vehicle Networks*

Xin Yuan (Beijing University of Post and Telecommunications, P.R. China); Zhiqing Wei, Zhiyong Feng and Wenjun Xu (Beijing University of Posts and Telecommunications, P.R. China)
This paper analyzes the performance of overlaid unmanned aerial vehicle networks (UAVNs). In the considered system, two UAVNs, a primary UAVN with licensed spectrum and a secondary UAVN without licensed spectrum, i.e., the overlaid UAVN, coexist in a three-dimensional (3D) Euclidean space. In order to evaluate the connectivity of the considered system more realistically, the trust model is established and the concept of trust connectivity is proposed to jointly take the physical link and trust link into account. Moreover, the analytical expressions of the trust transmission probability and the packet delivery success probability are derived for the overlaid UAVN. Numerical results show that the proposed can effectively guarantee the secure and reliable communication between SUAVs and improve the packet delivery success probability when the overlaid UAVNs suffer network attacks and other security risks.
pp. 114-119

16:00 *Considering Switching Overhead for Transmit Power Allocation for GAA in Spectrum Access System*

Shubhekshya Basnet, Beeshanga Abewardana Jayawickrama, Ying He and Eryk Dutkiewicz (University of Technology Sydney, Australia)
To enable spectrum sharing the Federal Communication Commission (FCC) has proposed the Spectrum Access System (SAS). In the SAS system General Authorised Access (GAA) can opportunistically access any part of the 3.5 GHz band. In the SAS system prior information regarding the time usage of spectrum is not provided by PAL and when PAL operation starts the GAA needs to ensure they do not cause interference above a predetermined threshold. In this work we propose a method for GAA

CBSDs to switch to different channel considering the probability of spectrum utilisation of GAA. Switching overhead is the time delay when switching the channel from one to another. In our work we proposed the method to calculate switching overhead and maximised average sum capacity of GAA CBSDs considering switching overhead and RMS interference at PAL protection area. Simulation results shows that average sum capacity of GAA CBSDs can be maximised using the proposed method.
pp. 120-124

16:15 *A Frame-based Multiview Video Transmission System for Multi-user Environment*
Xinjue Hu, Xiaoyi Zhang and Lin Zhang (Beijing University of Posts and Telecommunications, P.R. China)
Multiview videos (MVV) offer an immersive experience by allowing users to freely observe scene from different angles. It also can meet the need of several friends experience videos together and communicate with each other at any time. Thus, such videos have been gaining substantial interest from people. Faced with the birth of MVV, the new video compression coding standard has been proposed. Although it can reduce the pressure of single-user transmission on the Internet, the transmission for multi-user on the mobile Internet is still a huge challenge. To address this challenge, we propose a novel framework to avoid transferring the entire video file to each user, but only the part that they are interested in. We send the video resource to the user group in units of frames. For each frame, the order of transmission is determined by the urgency of the user's demand. In order to accurately know which part of the video is interested by people, we introduce predictive models to understand the transfer of user's attention. Furthermore, we design the Frame-based Multiview Video System (FMTS) to implement our framework, and build the prototype system on Android platform. We compare FMTS with other conventional system, experimental results show that our system can save 40.9% of the network bandwidth and 44.2% of the local storage space for the device.
pp. 125-130

16:30 *Algorithm for Energy Efficient Inter-UAV Collision Avoidance*
Hasini Abeywickrama, Beeshanga Abewardana Jayawickrama, Ying He and Eryk Dutkiewicz (University of Technology Sydney, Australia)
Unmanned Aerial Vehicles (UAV) are fast gaining popularity. Due to their many desired features, in the near future, UAVs will be an inevitable part of many fields. This increased use of UAVs, has given rise to the idea of multi-UAV systems, commonly known as UAV swarms, where a number of UAVs ranging from two to hundreds have to collaborate with each other and perform a common shared task or tasks. When sharing a common air space and flying in close proximity of each other, inter-UAV collision avoidance becomes an important factor in UAV swarms. Thus, for effective use of UAV swarms, it is essential to have an efficient inter-UAV collision avoidance mechanism. Although there are a number of suggested techniques, avoiding inter-UAV collisions while minimising the energy consumption of the UAV system is a challenge. In this paper, a Potential Field Method based algorithm to avoid collisions of a UAV system, considering the minimising of system energy usage, is suggested. We consider the energy consumption of a UAV system to depend on the distance travelled and the turns - angular changes, in trajectories. Our method reduces the angular changes in trajectories by an average of 36% and total travel distance by 6-8%. The total time taken to achieve targets is reduced by 3-14% depending on the scenario.
pp. 131-135

SP-1: Special Sessions - 01

Room: Bluewater -2
Chair: Yang Yang (University of Technology Sydney, Australia)

15:30 *Flexible Control of Tranmission Zeros Using Doublet for Cavity Bandpass Filter Design*
Sai-Wai Wong (South China University of Technology, P.R. China); Jing-Yu Lin (South China University of Technology & University of Technology Sydney, P.R. China); Zai-Cheng Guo (South China University of Technology, P.R. China); Yang Yang (University of Technology Sydney, Australia)
On the basis of doublet and its properties, a class of multiple-mode narrow band bandpasss filer is designed and fabricated. The three resonant modes are excited in a single rectangular cavity, namely, TE101, TE011 and TM110 modes. The proposed filters are fed by coupling a microstrip line to a slot on one side of a rectangular cavity. Different modes are achieved by adjusting the position/shape of the two slots at the input and output of the rectangular cavity without any intra-cavity coupling. The proposed cavity filter achieves three poles and two transmission zeros (TZs), which can be controlled by setting the positions of the two TZs near the passband, e.g., at lower- and/or upper-stopband. Due to emergence of the three resonant modes and realization of a pair of TZs, a high attenuation and sharp filtering selectivity is achieved. In order to verify the proposed theory, two filter prototypes are fabricated and measured.
pp. 136-140

15:45 *Device-Free Sensing for Classification of Human Activities Using High-order Cumulant Algorithm*
Yi Zhong (Beijing University of Posts and Telecommunications, P.R. China); Jinbao Zhu (Jinlin University, P.R. China); Eryk Dutkiewicz (University of Technology Sydney, Australia); Zheng Zhou (Beijing University of Posts and Telecommunications, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China)
In this paper, the possibility of using an emerging approach, namely device-free sensing (DFS) technology, for classification of human activities is investigated. To fully evaluate this approach, a variety of the measured data has been taken in an outdoor open-field environment. Using the data along with support vector machine (SVM) classifier, an algorithm that based on the

extraction of the high-order cumulant (HOC) is presented, while the conventional received-signal strength (RSS) based one is used as a benchmark. The measurement results show that the classification accuracy of the HOC-based algorithm is better than the RSS-based one by at least 15%. To ensure the reliability of the presented approach, the impact on classification accuracy due to different numbers of training samples and different values of signal-to-noise ratio (SNR) are also extensively verified using experimentally recorded samples.
pp. 141-144

16:00 *Design of an Oscillator in a 0.25 µm GaN-on-SiC HEMT Technology for Long Range Remote Sensing Applications*

Hang Liu (Nanyang Technological University, Singapore); Jinbao Zhu (Jinlin University, P.R. China); Yi Zhong (Beijing University of Posts and Telecommunications, P.R. China); Meriam Gay Bautista (University of Technology Sydney, Australia)

The radar systems have been widely deployed in our daily life, from non-invasive vital sign detection to hand gesture recognition. Among these systems, there is no doubt that oscillator plays the most critical role. In this paper, design of an oscillator to achieve both high output power and low phase noise is investigated at the circuit level. A prototype oscillator is implemented in a 0.25-µm GaN-on-SiC HEMT technology. Based on the measured results, the phase noise of the designed oscillator can be achieved as low as -112 dBc/Hz and -143 dBc/Hz at 100 kHz offset and 1 MHz offset respectively from a 4.954 GHz carrier, with an output power of more than 14 dBm. Moreover, the output power can be enhanced up to 26 dBm, if a drain bias 16 V is used, while good phase noise of -132 dBc/Hz @ 1 MHz is still achievable. This work has successfully demonstrated that the oscillator designed in GaN-on-SiC HEMT technology might be very well suitable for long range remote sensing applications.
pp. 145-148

16:15 *A Ka-band Waveguide Bandpass Filter Designed by Transmission Zero Resonator Pairs (TZRPs)*

Jun Ye Jin and Quan Xue (City University of Hong Kong, Hong Kong)

In this paper, a Ka-band waveguide bandpass is designed by transmission zero resonator pairs (TZRPs). A waveguide TZRP is designed and analyzed with two transmission zeroes and a transmission pole. The lower transmission zero can be flexibly designed by the sizes of the C-shaped resonator while the upper one is determined by the sizes of the straight stripline resonator. Then, proposed bandpass filter is formed by coupling two waveguide TZRPs. Four transmission zeroes are induced by at both sides of the passband, for improving the band shirt. For enhancing the couplings, two short striplines are used between the TZRPs. The operating frequencies of the proposed bandpass filter can be flexibly deigned by adjusting the locations of transmission zeroes of the waveguide TZRPs. A good agreement between the simulated and measured results is obtained. The proposed filter has the properties of low cost, compact size and mass production.
pp. 149-151

16:30 *Miniaturized Bandpass Filter Using E-Stub Loaded CRLH-TL Resonator*

Mengze Li and Kaida Xu (Xiamen University, P.R. China)

A novel bandpass filter (BPF) using miniaturized E-shaped stub loaded composite right/left-handed transmission line (CRLH-TL) resonator has been presented. This CRLH-TL resonator consisting of two general CRLH-TL unit cells and a center loaded E-shaped stub with good resonance properties is analyzed and theoretically derived. Utilizing source-load magnetic cross coupling, a BPF is designed with wide upper stopband based on the CRLH-TL resonator. The bandwidth of the BPF can be adjusted by the E-stub length.
pp. 152-154

16:45 *Miniaturized Millimeter-Wave On-Chip Bandpass Filter Design in 0.13-µm SiGe BiCMOS Technology*

Hou Zhang Ju (City Uinversity of Hong Kong, Hong Kong); Quan Xue (City University of Hong Kong, Hong Kong); Yang Yang, Xi Zhu and Eryk Dutkiewicz (University of Technology Sydney, Australia)

The full potential of active device in current Si-based technology has almost reached its limit. However, the passive devices that are integrated with transistors in the same technology have yet been fully explored. Improving the quality of on-chip passive devices is not only beneficial for energy efficiency, but also has significant meaning in cost reduction for a system-on-chip (SoC) solution while the passive circuits are miniaturized. A review of on-chip circuit miniaturization techniques for bandpass filter (BPF) design is presented in this paper. Although the recently presented broadside-coupled meander line resonator (BCMLR) is very compact, the stopband attenuation is quite limited. To solve this issue, a ring-based structure is studied in this work. Using this approach, the size of the proposed millimeter-wave on-chip BPF can be significantly reduced due to the multi-mode characteristics of the proposed resonators, of which the equivalent circuits can be effectively modeled through the accurately extracted lumped components values. Our works exhibit excellent performance comparing with the state-of-the-art designs.
pp. 155-159

Tuesday, September 26, 11:00 - 12:30

NGN-1: NEXT-GENERATION NETWORKING - 01

Chair: Beeshanga Abewardana Jayawickrama (University of Technology Sydney, Australia)

11:00 *Spectrum Sharing in Femtocell Based Networks Using an Equal Priority Power Control Game*
Ahsan Saadat (Macquarie University, Australia); Wei Ni (CSIRO, Australia); Rein Vesilo (Macquarie University, Australia)
In order to keep pace with the rapid growth of wireless services and mobile data applications in recent years, next-generation mobile networks need to ensure flexible and efficient utilization of the radio spectrum. In this paper, a game-theoretic spectrum-sharing framework is presented, which considers coexistence of a set of femtocells, belonging to multiple networks, in a coverage area where all cells have an equal priority of accessing the spectrum. A non-cooperative transmit-power-control game is formulated, where all the femtocells share the spectrum by adjusting their transmit powers based on measured interference, until the transmit power is stabilized. We determine appropriate bounds for selection of the game parameters to ensure the existence and uniqueness of the Nash equilibrium of the proposed non-cooperative game. We propose a novel dual-mode solution for implementation of the game, which ensures that the coordination among the BSs required to reach an equilibrium point is minimized. The presented simulation results prove the convergence of the game to a Nash equilibrium and provide a throughput performance analysis.
pp. 160-165

11:15 *Detection of Contour Boundary for Sublicensing in Spectrum Access Systems*
Huiyang Wang (University of Technology Sydney & Australia, Australia); Eryk Dutkiewicz and Beeshanga Abewardana Jayawickrama (University of Technology Sydney, Australia); Markus Dominik Mueck (Intel Deutschland GmbH, Germany)
Associated to database and a local centralized system, the short-term spectrum sublicensing is one of the potential approaches to improve the spectrum efficiency in the 5G networks. If the sublicences are assigned to the heterogeneous base stations that are from different operators, the interference issue becomes challenging to tackle. In this paper, we propose a solution of contour boundary detection for sublicensing to coordinate the interference among heterogeneous base stations in the space domain. As the direct access points to sever the end users, the base stations know and even could predict the traffic requirements over their coverage areas. Therefore, we enable individual base station as a sublicensee based on self-reported protection contour and optimize the best allocation for the system to guarantee the interference-free operations among those who spatially use the same sublicense simultaneously. Considering the selfish behaviours of base stations, we employ the sensor networks to monitor and measure their contours. Then we estimate the contour boundary by detecting the inner and outer contour boundary. Finally we compare the estimation accuracies of different sensor networks and demonstrate an interference-free allocation for the sublicensees.
pp. 166-170

11:30 *A CTR Prediction Method Based on Feature Engineering and Online Learning*
Jiehao Chen, Xue Yi Li, Ziqian Zhao, Jiyun Shi and Qiu Hong Zhang (Beijing Institute of Technology, P.R. China)
Computational Advertising aims to advertise to specific group of audience and has been a hotspot issue in the field of emerging internet applications. The key problem is to predict the Click Through Rate(CTR) of an ad and it is usually done by machine learning ways. This essay proposed a method based on feature engineering and online training to predict the CTR of Search Ads. We use the Field-aware Factorization Machine(FFM) to abstract highly sparse feature vectors from the original ones and trained it with Follow-the-Regular-Leader(FTRL). Experiment results show that the method we proposed is 0.65%~6.44% more accurate than common prediction model, LR, and 29.72% more efficient than normal training methods.
pp. 171-176

11:45 *Energy-Efficient Joint Millimeter-Wave Fronthaul and OFDMA Resource Allocation for C-RANs*
Zewei Jing, Qinghai Yang and Meng Qin (Xidian University, P.R. China); Kyung Sup Kwak (Inha University, Korea)
As an emerging paradigm for the fifth generation mobile communication system, cloud radio access networks (C-RANs) with millimeter-wave (mmWave) wireless fronthauls have been proved with a strong capability in reducing both capital expenses and operating expenses, as well as providing high energy efficiency (EE). In this paper, we investigate the energy-efficient downlink resource allocation in an OFDMA-based C-RAN with TDMA-based mmWave fronthauls. We first formulate the energy efficiency maximization problem as a mixed-integer nonlinear fractional programming (MINLFP) problem with the constraint of mmWave fronthaul, and then transform the MINLFP problem into a subtractive optimization problem by means of the Dinkelbach method. Then, we work out the transformed problem using the Lagrangian dual decomposition method. Finally, we evaluate the EE performance of our proposed algorithm by comparing to several benchmark schemes, and it shows that our proposed algorithm can achieve great EE performance gain over the benchmark schemes.

12:00 *Classification of Internet Video Traffic Using Multi-fractals*

Ping-ping Tang (Nanjing University of Posts and Telecommunications); Yu-ning Dong (Nanjing University of Posts and Telecommunications, P.R. China); Zai-Jian Wang (Anhui Normal University, P.R. China); Yang Lingyun (Nanjing University of Posts and Telecommunications)

Video traffic is booming in the Internet, and the types of video traffic are numerous. So it is necessary and imminent to effectively classify video traffic. The existing methods of classifying video traffic depend heavily on extracted features, which are statistically accessed from given samples, and thus may not be effective for other types of video applications. Therefore, in this paper, we propose a novel classification method based on the theory of multi-fractals, and it relies on fractal characteristics obtained by physical calculations to classify video traffic, which is quite different from statistical features obtained by a long-term statistical analysis. A number of experiments are performed to demonstrate the feasibility of the proposed method and its adaptability to new environments. The results show that video traffic classification with multi-fractals, can effectively mitigate some of the defects of statistical features, and achieve a superior performance.
pp. 183-188

CS-3: CIRCUIT AND SYSTEMS - 03

Room: Bluewater -2
Chair: Ying He (University of Technology Sydney, Australia)

11:00 *A Sinusoidal Reference Signal Based High Accuracy Timing Skew Mismatch Estimation Scheme for Time Interleaved ADC*

Ruwu Xiao, Qiying Lei, Xuan Guo and Yuping Zhao (Peking University, P.R. China)

This paper proposed a reference signal based timing skew estimation scheme for time interleaved (TI) analog to digital convertor (ADC). A sinusoidal reference signal is employed to estimate the timing skew mismatch between the sub-channel ADCs. The reference signal is a filtered sinusoidal signal, thus it takes only a very small bandwidth to achieve better anti-interference capability. Generated by the same clock management unit which generates the sampling clock of the sub-ADCs, the reference signal dose not require additional circuits, and provides the system with real-time tracking capability against environmental changes. And there is no frequency error/jitter between the digital domain clock and the reference signal, thereby reducing the consumption of computaional resources for signal frequency synchronization. Simulation results shows that the estimation error is only 5.8 fs when the timing skew is 100 fs, which is comparable as the jitter performance of the TI ADC's typical sampling clock.
pp. 189-194

11:15 *Design of IIR Filters with Alternative Intensification and Diversification Ability Using PSO*

Kenzo Yamamoto and Kenji Suyama (Tokyo Denki University, Japan)

In this paper, a design method for IIR (Infinite Impulse Response) filters using PSO (Particle Swarm Optimization) is studied. In our method, an avoidance method of the local minimum stagnation is proposed, in which a penalty function is added to an objective function when the stagnation occurs. Then, it is important to decide a penalty range. In our previous method, a penalty range was determined by using multi-swarms. However, it requires high computational cost. In this study, a novel method which repeats a diversification and an intensification alternatively is proposed for a single-swarm PSO, in which a penalty range is fixed to a small value. Several design examples are shown to present the effectiveness of the proposed method.
pp. 195-198

11:30 *Design of Fifth-order Leap-frog 0.05° Linear Phase Low-pass Filter with Gain Boost Using Nauta OTA*

Yichuang Sun (University of Hertfordshire, United Kingdom (Great Britain)); Xi Zhu and Meriam Gay Bautista (University of Technology Sydney, Australia)

In this paper a leapfrog feedback filter architecture that uses only single-ended input and single-ended output (SISO) transconductors and grounded capacitors is described. The filter structure has all circuit nodes containing a grounded capacitor and requires only simple transconductors, thus suitable for higher frequency applications. To show the high frequency capability, a fifth-order linear phase UHF filter with gain boost has been designed using Nauta transconductor. This may be the first time that Nauta transcodunctors are used in HDD read channels.
pp. 199-202

11:45 *PID Design Optimization Using Flower Pollination Algorithm for A Buck Converter*

Theerayod Wiangtong (King Mongkut's Institute of Technology Ladkrabang & Faculty of Engineering, Thailand)

This paper presents the development of PID design optimization using Flower Pollination Algorithm (FPA) and Cuckoo Search Algorithm (CSA). The optimal PID coefficients are repeatedly searched for using in a buck converter (step-down converter) control process. The system including the PID controller and the conventional buck converter are modelled and implemented in Matlab/Simulink. Simulation results, comparing in terms of searching time and solution quality, reveal that FPA performs better. Additionally, we extend the capability FPA by adding hierarchical search, called HFPA. The quality of the results can be improved in the same searching time.
pp. 203-206

12:00 *The Comparison Between Linear Regression Derivings of 12-lead ECG Signals from 5-lead System and EASI-lead System*

Daranee Hormdee (Khon Kaen University, Thailand); Piroon Kaewfoongrungsi (Khon Kaen University & Faculty of Engineering, Thailand)

The measuring for diagnosis of heart disease typically used 12-lead Electrocardiogram (ECG) monitoring system with 10 electrodes, but measuring all 12 leads is often cumbersome and impractical especially on a long term monitoring. Various reduced number of lead systems have been proved to work in the past. A number of research have been explored on deriving the missing signals from these fewer measured leads. Two well-known aspects of reduced electrodes ECG systems are either using subset of the 12-lead system or using the complete new lead scheme called EASI-lead system. This paper presents the comparison between these 2 fewer-electrode aspects, 5-lead system with V1 and EASI-lead system. Due to its simplicity, Linear Regression is the choice for derivation along with 5-fold Cross-validation on data set from PhysioNet Database. Despite half of the signals can be measured straightforward in the 5-lead system with V1, the results show that the better RMSEs come from the EASI-lead system.
pp. 207-212

Tuesday, September 26, 13:30 - 15:00

WN-2: WIRELESS NETWORKING AND IOT - 02

Room: Bluewater -1
Chair: Hajime Suzuki (CSIRO, Australia)

13:30 *Preserving Operational Information in Spectrum Access System with Dishonest Users*

Qingqing Cheng, Diep N. Nguyen and Eryk Dutkiewicz (University of Technology Sydney, Australia); Markus Dominik Mueck (Intel Deutschland GmbH, Germany)

Privacy has been regarded as one of the most critical issues in light of promoting the development of centralized spectrum management, hence attracting wide attention. However, researchers in the current literature are usually protecting users' privacy based on the assumption that all users are honest, which is reasonable but not practical. In this paper, we investigate the privacy issue among different tiers of users in the centralized spectrum access system (SAS), mainly focusing on honest Priority Access Licenses (PALs) and dishonest General Authorized Accesses (GAAs). To that end, we propose an authentication scheme to prevent GAAs from using other users' information by the aid of a public key cryptosystem. Moreover, we propose a ``punishment and forgiveness" scheme, which draws support from GAAs' reputation stores (RSs) and reputation histories (RHs), to encourage GAAs to engage in positive and true activities. Besides, we propose a privacy preservation scheme cooperating with the ``punishment and forgiveness" scheme (PS-PFS) in order to effectively mitigate the impact of dishonest users while fully preserving all users' privacy as well as successfully realizing spectrum sharing.
pp. 213-218

13:45 *Internet of Things Using Node-Red and Alexa*

Anoja Rajalakshmi and Hamid Shahnasser (San Francisco State University, USA)

The Internet of Things (IoT) means learning and interacting with millions of things including services, sensors, actuators, and many other objects on the Internet. This project enhances on how far IoT can connect devices on different platforms. This will effortlessly help humans in various fields like Home automation, networking, data monitoring and others. The evolution of human-machine user interface has drastically changed over the years. The path of advancement has been through keyboard, mouse, touch and now it is Voice. This new user interface can be achieved by Alexa Voice Service. Currently, we have very few devices that can be controlled using Alexa. Some of the examples are Philips Hue, WeMo, and Wink. But these are limited to certain hardware. The initial installation and maintenance is expensive. The proposed system connects and controls most of the IoT devices connected to it using Voice. As the number of devices on the cloud increase, there is need for updating firmware more frequently. This is tedious. It involves taking out the installed devices, changing the code and flashing it again. To overcome these, processing of data and response can be done elsewhere. Node-Red, a visual wiring tool helps in connecting devices with ease resulting in effortless and rapid connection setups.
pp. 219-222

14:00 *QoS Enhanced Channel Access in IEEE 802.11ah Networks*

Jeongin Kim (University of Sungkyunkwan, Korea); Ikjun Yeom (Sungkyunkwan University, Korea)

Recently, the IEEE 802.11ah protocol has been released for communication between low power IoT devices. IEEE 802.11ah is a wireless LAN technology that operates in the unlicensed low frequency band of 1GHz or lower and is a technology created for network communication between IoT devices. IEEE 802.11ah has a new feature called RAW (Restricted Access Window) to handle large numbers of nodes in a long range. The RAW mechanism groups the nodes and allows only the nodes belonging to the RAW selected by the access point (AP) to have channel access. The RAW mechanism is an effective way to reduce collisions between nodes. However, 802.11ah supports a long transmission range and many sensor nodes will try to access the channel. If RAW size is set small, there will be many collisions between nodes, and delays will occur. If RAW size is set large, delay will occur because RAW Turn Around time increases. As a result, the quality of service cannot be guaranteed. So we proposed two new algorithms. First, we propose a method to reduce the maximum delay by allocating the nodes that cannot access the channel to the reserved slots preferentially. Second, we propose a method to change reservation slot duration for nodes that cannot access

channel by detecting collision frequency. We implemented this through the NS-3 simulator and confirmed the effect of reducing the actual maximum delay.
pp. 223-228

14:15 *Saliency-based Football Offside Detection*

Sirimamayvadee Siratanita (King Mongkut's University of Technology Thonburi, Thailand); Kosin Chamnongthai (King Mongkut's University of Technology Thonburi, Thailand); Mitsuji Muneyasu (Kansai University, Japan)

In the automatic offside detection for football, an afterimage and occlusion sometime confuse the referee which cause a judging error. This paper proposes an automatic saliency-based offside detection method. Four cameras are installed at the both sides on the centerline for capturing scenes of players with a ball. In the scenes, offensive players who are playing the ball are estimated their movement by saliency, and the estimated motion is compared with the position of the defensive players for determining offside. The experiments performed video with 138 times offside in 33 tournaments of FIFA world football competitions held in Europe in 2016, and the results show 93.33% accuracy.
pp. 229-232

14:30 *TCP Congestion Control with MDP Algorithm for IoT over Heterogeneous Network*

Thongchai Toprasert and Woraphon Lilakiatsakun (Mahanakorn University of Technology, Thailand)

The expansion of Internet of Thing (IoT) is wildly gain available bandwidth to transmit the packet across networks. The heterogeneous networks included many types of the network topology which become interested in optimizing the congestion control in TCP Protocol. Due to the state that packets are the delay or lost in entire networks. We propose a Markov Decision Process (MDP) enhances the state of congestion avoidance which efficient to control to MIMD mechanism of congesting window sizes than the TCP-Illinois or TCP-Scalable. The new optimize in TCP congestion control protocol as TCP-Siam. The TCP Siam is applied based on the hybrid protocol as TCP-Illinois and modified with (MDP) to state and reward when congestion avoidance gets to next state. TCP-Siam adds the Co-Efficient to maximize congestion window (cWnd) and improve the performance when packet loss in a lossy link as WMN. TCP-Siam achieves good throughput, RTT-fairness, and utilization in heterogeneous networks.
pp. 233-237

W5G-1: WORKSHOP: 5G & BEYOND - ENABLING TECHNOLOGIES AND APPLICATIONS - 01

Room: Bluewater -2
Chair: Fangmin Xu (Beijing University of Posts and Telecommunications, P.R. China)

13:30 *Localization Techniques in Indoor Navigation System for Visually Impaired People*

Payal Tusharkumar Mahida, Seyed Shahrestani and Hon Cheung (Western Sydney University, Australia)

Indoor navigation is an active area to tackle the problems related to locate an object or person and to explore several domains ranging from emergency response to improving marketing strategies in micro indoor spaces. This paper aims to provide the review of emerging indoor technologies explored to resolve indoor navigation for visually impaired people. This paper discusses various positioning enabled technologies and methods used in real-world scenarios for providing indoor navigation with a comprehensive study about their advantages and disadvantages.
pp. 238-243

13:45 *Localization-assisted UAV Multiple Access for Future Dense Cellular Networks*

Yiwen Tao (Beijing University of Posts and Telecommunications, P.R. China); Bin Li (Beijing University of Posts and Telecommunications & Key Lab of Universal Wireless Communications, MOE, P.R. China); Chenglin Zhao (Beijing University of Posts and Telecommunications, P.R. China); Yongjun Zhang (Beijing University of Posts and Communications, P.R. China); Fangmin Xu (Beijing University of Posts and Telecommunications, P.R. China)

In order to cope with the growing pressure of existing base stations (BS) caused by dense terminal access and data transmission, in this study we propose to use a moving unmanned aerial vehicle (UAV) to assist the BS to provide multiple access for ground terminals. We are specially interested in the location-awareness UAV off-load scheme, which exploits the moving positions of UAV to optimize the accessing strategy and thereby the throughput. In order to acquire the real-time accurate location of UAV, a Bayesian statistical inference framework based UAV localization algorithm is proposed, which is implemented via particle filters and hence has a low complexity. Utilizing the estimation localization information, a distance-based time duplex multiple access mechanism is proposed to establish links between UAV and ground terminals. Numerical simulations demonstrate that the proposed Bayesian localization algorithm can acquire accurate UAV locations, and is superior to existing RSS-based schemes. Further relying on the location-awareness accessing scheme, the network throughput will be significantly improved.
pp. 244-248

14:00 *Physical Layer Security in Simultaneous Wireless Information and Power Transfer Networks*

Xiaoying Qiu (Beijing University of Posts and Telecommunications, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Weixia Zou (BUPT, P.R. China)

In this letter, we investigate physical-layer security (PLS) design in simultaneous wireless information and power transfer (SWIPT) system, where the energy receivers (ERs) may eavesdrop the confidential information send to the desired receivers (DRs). Specifically, we proposed a joint design of the AN-aided transmission and the power allocation to maximize the secrecy rate at the destination, under the harvested energy constraint at the ERs. To solve the formulated nonconvex problem, we decouple the original problem to the dual problem and proposed an alternating optimization algorithm. Finally, the efficacy of the proposed designs is demonstrated through simulations.
pp. 249-252

Tuesday, September 26, 15:30 - 17:00

COMMS-3: WIRELESS COMMUNICATIONS - 03

Room: Bluewater -1
Chair: Hajime Suzuki (CSIRO, Australia)

15:30 *FHD Loss-Less Video Communication over 8 x 8 MIMO-OFDM*

Yoshikazu Miyanaga and Hiroshi Tsutsui (Hokkaido University, Japan); Takashi Imagawa (Ritsumeikan University, Japan)

The developed system has achieved the data rate of 3Gbps by use of an 80-MHz baseband bandwidth and a 8 x 8 MIMO-OFDM scheme. This paper describes the VLSI implementation of the 8 x 8 MIMO-OFDM system. A low-latency and the optimum pipelined architecture are realized into all processing blocks. It provides the real-time operations on OFDM modulation and MIMO detection. The proposed architecture also realizes low power consumption. This system has been applied for high-quality video communication. With some of results on field experiments, the system performance for video communications is described under real environments.
pp. 253-257

15:45 *A Secure Lightweight Protocol for SMS Mutual Authentication Protocols Based on Symmetic-Key Encryption*

Chalee Thammarat, Werasak Kurutach and Suronapee Phoomvuthisarn (Mahanakorn University of Technology, Thailand)

Currently, short message service (SMS) is used in many life applications, including mobile payment, mobile banking, vote, and so on. A number of researchers proposed authentication techniques for SMS but they still lack some necessary security properties, especially mutual authentication. Mutual authentication is a security property that prevents replay and man-in-the-middle attack. This paper introduces new authentication protocols for SMS communication that provides mutual authentication between engaging parties. Our protocols not only satisfies necessary transaction security properties, but it is also simple and compatible to existing SMS infrastructure. The proposed protocols deploy limited-use offline session key generation and distribution technique to enhance security.
pp. 258-263

16:00 *A Novel Rotating Phase Shift Technique Based Peak-to-Average Power Ratio Reduction in OFDM System*

Muamer Mohammed (Universiti Malaysia Pahang, Malaysia); Omar A. Hammood (UMP, Malaysia); Ali Kareem (University of Technology, Iraq); Ahmed Abdalla (Huaiyin Institute of Technology, P.R. China)

In general, several benefits of orthogonal frequency division multiplexing (OFDM) are emerging making it an attractive standard for various digital data over radio systems. However, OFDM is still suffering from peak to average power ratio (PAPR), which is a major drawback in most of the multicarrier communication systems. The exhaustive search of phase factors using conventional PTS scheme leads to subblock increases in terms of multiplications and complex additions. In this paper, a novel rotating phase shift (RPS) technique based signal scrambling is proposed to reduce PAPR in OFDM systems. The pilot phase signal is chosen by RPS technique, while the search algorithm is used to solve the convex optimization problem. The transmitted signal of OFDM is tested with IEEE 802.11a standard. The RPS compared various PAPR reduction schemes such as selective mapping (SLM) technique and partial transmission sequence (PTS), and a different phase shift with a slight computational complexity is analyzed. The simulation result shows that the RSP at 1.5 dB proved significant at approximately 85% and 72% PAPR reduction when compared with PTS and SLM techniques, respectively. In the best cases, the result of RPS with respect to an original OFDM signal at pilot-assisted QAM is capable of reducing the electrical PAPR by about 4.5 times at a modest complementary cumulative distribution function (CCDF) point of 10-3 for M=4 low complexity. In addition, the best phase-shift factor was selected to reduce the cost of computational complexity.
pp. 264-269

16:15 *A Secure Lightweight and Fair Exchange Protocol for NFC Mobile Payment Based on Limited-Use of Session Keys*

Chalee Thammarat, Werasak Kurutach and Suronapee Phoomvuthisarn (Mahanakorn University of Technology, Thailand)

The number of users of NFC mobile payment protocol has increased rapidly and this results in the growth of the world economy over the past few years. Plenty of researchers suggested NFC mobile payment protocol for NFC communications, however, they

still not sufficient necessary security properties and fairness. In this paper, we recommend a novel NFC mobile payment protocol for m-payment that offer both fair exchange and information security in sale transaction processing. Moreover, methods of offline session key generation and distribution are implemented to be able to improve the security while keeping the property that is lightweight. According to our analysis, it has been shown which our protocol tends to be more efficient and effective than the others' with regards to security and fairness.
pp. 270-275

16:30 *Channel Complexity Reduction in Massive MISO Using Principal Component Analysis*

Muhammad Tausif Afzal, Rana and Rein Vesilo (Macquarie University, Australia)

Massive multiple-input-multiple-output (MIMO) has the potential to offer a high throughput in today's fast wireless communication systems, however, the large number of antennas at the transmitter brings the challenge of high channel complexity and hardware energy consumption. In this paper channel complexity in massive MISO systems is reduced with a negligible loss of sum-capacity by using Principal Component Analysis (PCA). Zero Forcing (ZF) and Minimum Mean Square Error (MMSE) precoding schemes are used and users are equipped with a single antenna. The results are simulated using MATLAB. Numerical results verify that, the channel complexity in terms of floating-point operations (FLOPs) has been reduced by more than 80% by using the proposed technique.
pp. 276-281

SP-2: Special Sessions - 02

Room: Bluewater -2
Chair: Hang Li (University of Technology Sydney, Australia)

15:30 *A Low Cost Interpolation Based Detection Algorithm for Medium-size Massive MIMO-OFDM Systems*

Licai Fang (the University of Western Australia, Australia); Hang Li (University of Technology Sydney, Australia); Defeng Huang (University of Western Australia, Australia); Xiaojing Huang (University of Technology, Sydney, Australia)

The great potential of exploiting millimeter wave (mmwave) frequency spectrum for emerging fifth-generation (5G) wireless networks has motivated the study of massive multipleinput multiple-output (MIMO) for achieving high data rate. For medium-size massive MIMO with orthogonal frequency division multiplexing (OFDM) uplink systems, the minimum mean square error (MMSE) based soft-output detector is often used due to its better bit error rate (BER) performance compared to the matched filter detector. Although the multipath channel can be converted into a set of parallel flat-fading channels by using OFDM thus reducing the complexity of receiver design, the tone by tone (per subcarrier) detection methods based on the state-of-the-art low complexity MMSE still incur considerably high computational complexity since the number of tones is typically very large. To reduce the complexity, the interpolation-based matrix inversion algorithms for small-size MIMO-OFDM systems have been proposed, which compute the matrix inversion by interpolating separately the adjoint and determinant. In this paper, we find that the (regularized) Gram matrix inversions have strong correlation between different subcarriers. By exploiting this strong correlation, we propose a linear interpolation based MMSE detection algorithm that directly interpolates the inverted MMSE matrices for a small number of subcarriers to obtain matrix inversions for all other subcarriers, thereby significantly reducing the number of matrix inversion required. Extensive simulations show that with small BER performance loss compared to the exact MMSE detector, the proposed algorithm can reduce the complexity to the level of the matched filter algorithm.
pp. 282-286

15:45 *Mobility Handover Optimization in Millimeter Wave Heterogeneous Network*

Shizhe Zang (University of Sydney, Australia); Wei Bao (The University of Sydney, Australia); Phee Lep Yeoh, He Chen, Zihuai Lin, Branka Vucetic and Yonghui Li (University of Sydney, Australia)

In this paper, we develop a new mobility-aware handover algorithm for users in microwave and millimeter wave (mmWave) heterogeneous networks. The proposed handover algorithm applies a Markov decision process (MDP) and a Gauss-Markov mobility model to optimize handovers based on user velocity, location, SNR and estimated time spent in the mmWave small cell (known as the small cell dwell time). Practical mmWave beam alignment overheads and blockage effects are also taken into account in the MDP formulation and optimization. Simulation results verify that the proposed MDP-based handover algorithm achieves significantly higher data rates compared with traditional SNR-based handovers for low to high velocity users.
pp. 287-292

Wednesday, September 27

Wednesday, September 27, 09:00 - 10:30

COMMS-4: WIRELESS COMMUNICATIONS - 04

Room: Bluewater -1

09:00 *Throughput Analysis Based on Antenna Downtilt Design in Coordinated Multi-cell 3D MIMO System*

Chaonan He (Beijing University of Posts and Telecommunications, P.R. China); Zeyu Zhao (China Railway Economic and Planing Research Institute, P.R. China); Xuefei Zhang, Jin Xu and Xiaofeng Tao (Beijing University of Posts and Telecommunications, P.R. China)

The explosive increase of mobile traffic due to the popularity of mobile devices demands higher throughput for future wireless communications. Three-dimension multiple-input multiple-output (3D MIMO) is one of the commonly accepted techniques to improve cell average throughput by designing an appropriate antenna downtilt benefiting from the freedom of vertical dimension. In this paper, we provide an analytical expression of cell average throughput of downlink coordinated 3D MIMO system for the first time, by incorporating coordination among multi-cell. Secondly, in order to maximize the cell average throughput, we utilize genetic algorithm (GA), together with cell splitting to get both the inner and outer sector beam downtilts under the quality of service (QoS) constraint. Finally, simulation results show that the proposed method effectively improves cell average throughput by 50.294% and cell edge throughput by 70.180% compared with non-coordinated 3D MIMO system.
pp. 293-298

09:15 *Efficient and Accurate Channel Feedback for Multi-User MIMO-OFDMA*

Hajime Suzuki, Rodney Kendall, Chang Kyung Sung and David Humphrey (CSIRO, Australia)

Multi-user multiple-input multiple-output (MU-MIMO) system operating in frequency division duplex (FDD) mode has an advantage over that operating in time division duplex (TDD) mode in achieving a lower return time latency as both the uplink and downlink data streaming can occur simultaneously. However, unlike TDD, the reciprocity of the uplink and downlink channels does not hold and hence the system typically needs to rely on channel feedback which reduces the uplink channel capacity. Reducing the channel feedback while maintaining the channel estimation accuracy is a critical factor for a successful implementation of MU-MIMO FDD. In addition, when combined with orthogonal frequency division multiple access (OFDMA), channel feedback needs to occur independently for different sub-channels assigned to different user terminals. This paper proposes the use of discrete cosine transformation (DCT) based channel compression for the purpose of MU-MIMO-OFDMA channel feedback and shows its advantage over conventional discrete Fourier transform (DFT) based method. Compared to ideal channel feedback without channel estimation or compression errors, the proposed method achieves within 1 dB loss in uncoded bit error performance for a MU-MIMO-OFDMA system using 32 antennas at the central access point supporting 16 user terminals each with a single antenna.
pp. 299-304

09:30 *Performance Analysis of Multi-User MIMO Downlink System in Time-Varying Channels*

Maneesha Sharma (Queensland University of Techology, Australia); Dhammika Jayalath (Queensland University of Technology, Australia); Hajime Suzuki and Chang Kyung Sung (CSIRO, Australia)

The channel state information (CSI) at the base station (BS) in multi-user multiple-input multiple-output (MU-MIMO) downlink system can provide a significant performance enhancement in terms of data transmission rate and interference reduction. However due to the time varying nature of the channel the available CSI at the BS can be outdated and this leads to the performance loss. This paper provides an analysis of the effect of outdated CSI on MU-MIMO downlink system when mobile stations (MSs) experience different speeds and how the channel prediction algorithms can be used to compensate for these delays in the time-varying channel. The simulation results show that even few samples delay can have a profound effect on bit error rate (BER) performance in MU-MIMO downlink system and the channel prediction algorithms can be used to compensate these delays to improvise the performance. For the first time, we propose to use normalized least mean square (NLMS) and recursive least square (RLS) adaptive filters for predicting the channels in MU-MIMO downlink system. Compared to the conventional linear extrapolation channel prediction method, both NLMS and RLS provided better performance, with RLS performing better with an increased computational complexity.
pp. 305-310

09:45 *A Simple Design for Large Girth LDPC Matrix*

Somsak Choomchuay (King Mongkut's Institute of Technology Ladkrabang, BKK, Thailand)

This paper describes an alternative method for designing regular quasi-cyclic LDPC codes with large girths. The permutation matrix was designed based on the geometric sequence and prime number field. The design starts with a portion of the full-range matrix with column weight of 3. With a decided code rate, elements in the rows are extended by adding a certain column of the same full-range matrix into the designing matrix. Resulted codes can offer relatively good performance compared to the published literatures.
pp. 311-314

10:00 *Performance of an Integer Carrier Frequency Offset Estimation Method in OFDM Systems*

Qi Cheng (Western Sydney Unversity, Australia)

In this paper, an integer carrier frequency offset estimation method, based on the shift property of null subcarrier indices, was studied and compared with the method, based on the null subspace of a measurement covariance matrix, by theoretical analysis and simulation. The impact of the fractional carrier frequency offset estimation is also studied. Contrary to the conclusion drawn by the authors of the former method, our finding is that the former performs much worse than the latter for SUI-3 channels and Rayleigh channels, because its selection rule on null subcarriers is more sensitive to channel deep fades.
pp. 315-320

CS-4: CIRCUIT AND SYSTEMS - 04

Room: Bluewater -2
Chair: Lin Zhang (Beijing University of Posts and Telecommunications, P.R. China)

09:00 *An Improved Differential N-path Filter with Sampling Computation for Increased Stopband Rejection Ability*

Zi Hao Ong and Takahide Sato (University of Yamanashi, Japan)

An implementation of a differential N-path filter with sampling computation design method is proposed. It offers the ability to eliminate the harmonic passbands of the clock frequency. On top of that, the proposed method enables the scale of the whole filter to be reduced by approximately half for easier realization. By using the proposed method, previous work involving a 8-path filter can be reduced to 5-path, which reduces the scale of the circuit and at the same time has the performance of a 10-path filter if designed with the method proposed by previous work. An example of differential 7-path filter using the same proposed design method is also stated in comparison of the differential 5-path filter. The differential 7-path filter offers the ability to eliminate all the passbands below 10 times the clock frequency with a tradeoff of a slight increase of circuit scale.
pp. 321-326

09:15 *Parameter-Free Outlier Removal of 3D Point Clouds with Large-Scale Noises*

Bibo Zhang, Bin Xiang and Lin Zhang (Beijing University of Posts and Telecommunications, P.R. China)

3D point clouds derived from either multi-view-based techniques or direct laser scanners are inevitably contaminated with severe outliers. This paper presents a parameter-free density-based outlier removal approach for point clouds corrupted by large-scale noises. The main contributions are three-fold. (i) A local consistency factor (LCF) is proposed to indicate the local density similarity of points. Based on LCF, consistency checking is performed to estimate parameters and screen outlier clusters. A new distance measure incorporating color factors is proposed to facilitate separating inliers and outliers apart. (ii) Unlike most of the density-based methods requiring user interactions for parameter determination, the proposed approach realizes automated parameter estimation. (iii) This work is independent of the prior knowledge of the distribution of points. Experimental results on synthetic and real point clouds demonstrate that our approach outperforms the state-of-the-art in both accuracy and computation time.
pp. 327-332

09:30 *Multiple Sound Source Tracking Using Low Complexity Directional Estimation*

Kenta Omiya and Kenji Suyama (Tokyo Denki University, Japan)

In this paper, a method for sound source trackingby two microphones is studied. Then, it is often assumed to be implemented on DSP (Digital Signal Processor). In this case, it is required to reduce the calculation cost. In our method, a sequential updating histogram based on the instantaneous phase difference is used for estimating the sound source direction. Moreover, for attaining more tracking accuracy, the microphone width is expanded for enhancing a spatial resolution. Several experimental results in a real environment are shown to present the effectiveness of the our method.
pp. 333-338

09:45 *Quad-Band Antenna for GSM/WSN/WLAN/LTE-A Application in IoT Devices*

Thanh Tu Duong (Posts and Telecommunications Institute of Technology, Vietnam); Ngoc Nguyen (Posts and Telecommunications Institute of Technology, Vietnam); Van Yem Vu (Hanoi University Of Science and Technology & School of Electronics and Telecommunications, Vietnam); Xi Zhu, Diep N. Nguyen and Eryk Dutkiewicz (University of Technology Sydney, Australia)

We designed, fabricated, and experimented a quad-band Double-PIFA (Planar Inverted-F Antenna) for Internet of Things (IoT) applications. Using the Double-PIFA structure allowed us to fabricate the antenna easily and optimize the operating bands for desired frequencies. Combining DGS (Defected Ground Structure) and two shorting pin of PIFA structure, the antenna is compact in size with radiating patch of 184 mm2 basing on RO4350B substrate with height of 1.52 mm. Operating at 900MHz, 1.8GHz, 2.6GHz and 5GHz with large bandwidth of 6.67%, 11.11%, 5.77% and 16%, respectively. As the proposed antenna can operate for ZigBee, Z-Wave, RFID (Radio-Frequency Identification), WLAN (Wireless Local Area Network), and LTE-A (Long Term Evolution - Advanced), it is suitable for both IoT devices and wide-band wireless communication systems.
pp. 339-343

Wednesday, September 27, 11:00 - 12:30

NGN-2: NEXT-GENERATION NETWORKING - 02

Room: Bluewater -1
Chair: Xu Wang (Beijing University of Posts and Telecommunications, P.R. China)

11:00 *Solutions to Cold-start Problems for Latent Factor Models*

Jun Yao Zhao, Ziqian Zhao, Ji Yun Shi and Jiehao Chen (Beijing Institute of Technology, P.R. China)

In the data age, the "information overload" problem severely impact the precise of people to choose what they prefer. However, recommendation systems are able to provide people related information from huge amounts of data, and effectively solve the "information overload" problem. Currently, Latent Factor Models(LFM) have become dominant in the recommendation field. For example, Matrix Factorization performs excellently on rating prediction problem. By optimizing a ranking criterion, LFM also has an outstanding performance on top-N recommendation problem, such as Bayesian Personalized Ranking. But LFM can't solve the cold-start problem. Aiming at the cold-start problem, we use the mapping concept to construct a hybrid model, in which we map new entity (e.g. user or item) attributes to its latent features vector. Experiments on the cold-start problem show that the hybrid model provides much better recommendation precision.

pp. 344-348

11:15 *A Grid-based Energy Saving Scheme with Traffic Map in Heterogeneous Dense 5G Network*

Fangmin Xu, Zongjian Tong, Fan Yang and Chenglin Zhao (Beijing University of Posts and Telecommunications, P.R. China)

Due to the development of Internet of Things (IoT) which leads to the upsurge of traffic requirement as well as global energy resources shortage, the concept of 'Green communication and Networking' becomes a hot research topic. Energy saving in dense cellular network could be achieved by many approaches. The algorithm of base station switch ON-OFF algorithm with grid-based traffic map is proposed to achieve higher efficiency and lower power consumption in this paper. The algorithm includes network model, power consumption model and operation model. After constructing the heterogeneous networks (HetNet) and getting the traffic map by using Voronoi tessellation and Sibson natural neighbor interpolation algorithm, different power consumption models of macro-cell base stations (MBS) and small-cell base stations (SBS) are considered. Since the power consumption of SBSs in HetNet are huge, to reduce the total power consumption of the HetNet, the operation modes of SBSs are dynamically changed and the MBSs are set active to avoid service failure and provide seamless coverage. The SBSs are automatically switched on/off based on the traffic characteristic, load condition and power consumption model. The simulations are implemented to show the energy saving performance of proposed scheme.

pp. 349-354

11:30 *LEO Satellite Routing Algorithm in Software Defined Space Terrestrial Integrated Network*

Andong Guo, Chenglin Zhao and Fangmin Xu (Beijing University of Posts and Telecommunications, P.R. China); Chao Qiu (Beijing University of Post and Telecommunication, P.R. China)

SDN technology is applied to the LEO satellite network constituting software defined space terrestrial integrated network. Utilizing the advantage of SDN centralize control and the characteristic of LEO satellite network topology, this paper proposes the shortest path algorithm from source satellite to destination satellite.

pp. 355-360

11:45 *Analytic Model on Data Security in VANETs*

Xuan Zha and Xu Wang (Beijing University of Posts and Telecommunications, P.R. China); Wei Ni (CSIRO, Australia); Ren Ping Liu (University of Technology Sydney, Australia); Y. Jay Guo (University of Technology, Sydney, Australia); Niu Xinxin and Kangfeng Zheng (Beijing University of Posts and Telecommunications, P.R. China)

Fast-changing topologies and uncoordinated transmissions are two critical challenges of implementing data security in vehicular ad-hoc networks (VANETs). We propose a new protocol, where transmitters adaptively switch between backing off retransmissions and changing keys to improve success rate. We also develop a new 3-dimensional (3-D) Markov model which can analyze the proposed protocol with symmetric or asymmetric keys in terms of data security and connectivity. Analytical results, validated by simulations, show that the proposed protocol achieves substantially improved resistance against collusion attacks.

pp. 361-366

W5G-2: WORKSHOP: 5G & BEYOND - ENABLING TECHNOLOGIES AND APPLICATIONS - 02

Room: Bluewater -2
Chair: Weixia Zou (BUPT, P.R. China)

11:00 *A Survey of Information-Centric Wireless Networks*

Chao Fang (Beijing University of Technology, P.R. China); Fangmin Xu (Beijing University of Posts and Telecommunications, P.R. China); Xiaoning Jin (Beijing University of Technology, P.R. China)

Recently, with the explosive increase of mobile devices, it is difficult for the traditional Internet to support the increasing mobile data traffic. Therefore, innovative information-centric networking (ICN) architectures have recently been proposed to better cope with the shift from host-centric end-to-end communication to receiver-driven content retrieval services. Although several significant research challenges remain to be addressed before widespread deployment of ICN, the potential advantages make it suitable for mobile wireless environments. In this paper, we present a brief survey on the works that have already applied ICN to the wireless networks, and discuss the related research issues and challenges.

11:15 *A Novel Physical Layer Security Communication Method Based on Dual Base Station*
Ziyi Chen (Beijing University of Posts and Telecommunications, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Weixia Zou (BUPT, P.R. China)
Due to the widespread usage of wireless devices，how to securely transmit the data on physical layer has been paid much attention. Recently, a Physical Layer Security algorithm called Directional Modulation came up, which can avoid the information leakage in any direction except the desired direction. On the basis of Directional Modulation, we propose a Physical Layer Security scheme by using dual base station. What's more, we employ the Multiple Directional Direction Modulation on two base stations to transmit data stream modulated by the improved QAM program. Compared to the traditional Directional Modulation Scheme, this scheme ensure the data stream can only be properly demodulated in the specific location where the legitimate user is, instead of all the area in a certain direction. In addition, we propose a simulation model to show the bit-error-rate (BER) of the received signal in the coverage area of the two BS. From the simulation result, it is obvious that our scheme can effectively narrow the range of the low BER area, which means can be correctly demodulated, to a specific area.

11:30 *Animal Intrusion Detection Based on Convolutional Neural Network*
Wenling Xue (Beijing University of Posts and Telecommunications, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Jiong Shi (Zhejiang Wanli University, P.R. China)
The conflict between humans and animals is seen across the country in a variety of forms, including monkey menace in the urban areas, crop raiding by wild pigs and so on. Providing effective solutions for human-animals conflict is now one of the most significant challenges all over the world. In this paper, a wireless sensor network based on UWB technology is used to deploy intrusion detection. By analyzing the characteristics of UWB signals, the phase space reconstruction of the signal is used as the convolutional neural. The signal characteristics are extracted automatically using CNN, and finally the SVM or Softmax classifier is used to classify human beings from animals. Several experiments are tested in corn field and the experimental results show that the method proposed in this paper can detect human and animal invasion very effectively and improve the accuracy of detection by nearly 16% compared to the traditional manual extraction.

Wednesday, September 27, 13:30 - 15:00

WN-3: WIRELESS NETWORKING AND IOT - 03

Room: Bluewater -1
Chair: Guanglou Zheng (Edith Cowan University, Australia)

13:30 *A New Method of Dynamic Gesture Recognition Using WiFi Signals Based on Adaboost*
Xue Ding (BUPT, P.R. China); Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China); Weixia Zou (BUPT, P.R. China)
In order to find a method for dynamic gesture recognition without adjusting parameters according to different gestures and different training environment, a new method based on Adaptive Boosting (Adaboost) classification method is proposed to implement dynamic gesture recognition in this paper. The combination of Gaussian filter and Median filter is applied to preprocess the data. Six predefined dynamic gestures were tested in our experiment. A large number of experiments show that our method can achieve high accuracy of gesture recognition, with the average recognition rate of 95.20%. Also, the comparison between the proposed and the traditional classification method was discussed. According to the obtained results, the method presented in this paper is more effective with less time cost for dynamic gesture recognition.

13:45 *Location Optimization for Data Concentrator Unit in IEEE 802.15.4 Smart Grid Networks*
Chaiyod Pirak, Songserm Tanakornpintong, Natthanan Tangsunantham and Tanayoot Sangsuwan (King Mongkut's University of Technology North Bangkok, Thailand)
In the smart grid system, an advanced meter infrastructure (AMI) is an integral subsystem mainly used to collect monthly consumption and load profile. Hence, a large amount of information will be exchanged within these systems. Data concentrator unit (DCU) is used to collect the information from smart meters before forwarding to meter data management system. In order to meet the AMI's QoS such as throughput and delay, the optimal placement for DCU has to be thoroughly investigated. This paper aims at developing an optimal location algorithm for the DCU placement in a non-beacon-mode IEEE 802.15.4 smart grid network. The optimization algorithm preliminarily computes the DCU position based on a minimum hop count metric. Nevertheless, it is possible that multiple positions achieving the minimum hop count may be found; therefore, the additional performance metric, i.e. the averaged throughput and delay, will be used to select the ultimately optimal location. In this paper, the maximum throughput with the acceptable averaged delay constraint is proposed by considering the behavior of the AMI meters which is almost stationary in the network. From the simulation results, it is obvious that the proposed methodology is significantly effective.

14:00 *From WannaCry to WannaDie: Security Trade-offs and Design for Implantable Medical Devices*

Guanglou Zheng (Edith Cowan University, Australia); Guanghe Zhang (School of Computer and Information Engineering, Jiangxi Normal University, P.R. China); Wencheng Yang and Craig Valli (Edith Cowan University, Australia); Rajan Shankaran and Mehmet A Orgun (Macquarie University, Australia)

Healthcare sectors are increasingly facing cyber security challenges and threats from adversaries due to numerous security flaws and the lack of security safeguards in medical devices. Among these medical devices and systems, security issues on implantable medical devices (IMDs) have attracted attentions from both academia and industries. In this paper, we discuss security vulnerabilities in current IMD products by presenting security tests and demonstrations performed by researchers. Based on this, three critical trade-offs in the IMD security design are analyzed, including security vs. accessibility in medical emergencies, emergency access vs. checkup access and strong security requirements vs. limited IMD resources. Biometrics based security solutions can provide support for emergency access and thus are surveyed, including those using electrocardiogram signals, iris and fingerprints. During the design, we propose to adopt the concept of decoupled design and usable security in order to develop a viable scheme for the IMDs.
pp. 392-396

14:15 *Mobility Management of D2D Communication for the 5G Cellular Network System: A Study and Result*

Shouman Barua (University of Technology Sydney, Australia); Robin Michael Braun (University of Technology, Sydney, Australia)

Wireless devices connected to the networks have been increasing remarkably for the last couple of decades. Ubiquitous voice and data connection are the key requisite for the next generation of wireless technology. Device to Device communication is widely known as D2D communication which is a new paradigm of cellular communication, and it was initially proposed to boost the network performance. It takes place when two devices communicate directly without taking significant help from the base station. Similar to other wireless communication systems, mobility management for the D2D communication is a big challenge which is yet to explore properly. Mobility management of D2D communications was enlightened in few papers. It should be managed in such a smart way in a cellular network that should enable lower latency, lower power consumptions, less complexity and last but not the least possible uninterrupted data connections which are primarily the requirements of next generations mobile cellular network. This paper extends our algorithm paradigm of mobility management of D2D communication that was proposed and published previously. We come up with the simulation results in this paper that validate our proposed model. However, we also highlight the D2D communications and mobility issues within it.
pp. 397-402

WIOT: WORKSHOP: INNOVATIVE COMMUNICATION SOLUTIONS FOR INDUSTRIAL IOT

Room: Bluewater -2

Chairs: Ting Jiang (Beijing University of Posts & Telecommunications, P.R. China), Weixia Zou (BUPT, P.R. China)

13:30 *A Smart Parking System Based on NB-IoT and Third-party Payment Platform*

Jiong Shi, L. Jin, Jun Li and Zhaoxi Fang (Zhejiang Wanli University, P.R. China)

In recent years, with the increasing number of vehicles and insufficient parking spaces, the urban traffic congestion has become a great challenge that cannot be neglected. In order to mitigate problems such as high power consumption of sensor node and high deployment costs of wireless network, a smart parking system is proposed in this paper. In the proposed system, the data of the sensor node is transmitted by Narrowband Internet of Things (NB-IoT) module, which is a new cellular technology introduced for Low-Power Wide-Area (LPWA) applications. Basic information management, charge management, sensor node surveillance, task management and business intelligence modules are implemented on the cloud server side. With integrated third-party payment platform and parking guide service, the mobile application developed for drivers are easy and convenient to use. Currently, the proposed system is deployed in two cities to effectively improve the utilization of existing parking facilities.
pp. 403-407

13:45 *Reliable and Energy-Efficient Transmission on the Internet-of-Video-Things*

Yuichiro Mori and Xuan-Thuan Nguyen (The University of Electro-Communications, Japan); Pham Cong-Kha (The University of Electro-Commununications (UEC), Japan)

Due to the rapid development of smart homes, smart grid, and intelligent transportation, Internet-of-Video-Things have become increasingly important. IoVT is considered as a part of Internet-of-Things (IoT) that can effectively deal with large volumes of data, such as image and video. In IoVT, reliable and energy-efficient transmission is extremely important. The reliability guarantees all data are properly transferred in the network, while the energy efficiency allows a large amount of data to be processed at low power consumption. In this paper, a hardware platform based on Raspberry Pi Zero (RPZ) is proposed. RPZ is exploited due to its integrated H.264 hardware encoder/decoder. A source node is composed of a RPZ, a camera, and an Atmel RF, whereas a sink node excludes the camera. The input is a $640 \times 480@30fps$ video, and the output is the 300-Kbps H.264 encoded bit stream. Based on various experiments, we concluded that data are properly transferred and the energy per bit is approximately 6.4 nJ/bit.
pp. 408-411

14:00 *A Comparative Study on Visual Cryptography Method for Handwriting Image Security*

Suharjito Suharjito (Bina Nusantara University, Indonesia); Sugianto Sugianto (Institute of Business Development Indonesia, Indonesia); Nico Surantha (Bina Nusantara University, Indonesia)

The Secret Sharing Protocol is a method used to divide or break a secret message to 2 (two) or more recipients, so that the results of these shares are not known to the secret recipients unless the recipient exchanges shares for Reconstructing the secret. This study aims to analyze the performance of the Asmuth-Bloom secret sharing protocol, secret splitting and visual cryptography. Although the attacker gets shares shadow at the share exchange, the party must merge the share shadow. It would be impossible for the attacker to know the correct share, despite having adequate computer resources. In this study also, the problem is to analyze the results of the comparison of the three methods: Secret Splitting, Secret Sharing and Recursive Threshold Visual Cryptography for Image Handwriting Security. Simulation results show the difference in execution time among three methods.

pp. 412-416

14:15 *Node-centric Route Mutation for Large-scale SDN Based on 3D Earth Mover's Distance Model*

Yang Zhou (Beijing University of Posts and Telecommunications, P.R. China); Wei Ni (CSIRO, Australia); Kangfeng Zheng (Beijing University of Posts and Telecommunications, P.R. China); Ren Ping Liu (University of Technology Sydney, Australia); Yixian Yang (Beijing University of Posts and Telecommunications, P.R. China)

Exploiting software-defined networking techniques, randomly and instantly mutating routes can disguise strategically important infrastructure, and protect the integrity of data networks. Route mutation has been to date formulated as NPcomplete constraint satisfaction problems where feasible sets of routes need to be generated with exponential computational complexities, limiting algorithmic scalability to large-scale networks. In this paper, we propose a novel node-centric route mutation method which interprets route mutation as a signature matching problem. We formulate the route mutation problem as a threedimensional earth mover's distance (EMD) model and solve it by using a binary branch and bound method. Considering the scalability, we further propose a heuristic method yields significantly lower computational complexities with marginal loss of robustness against eavesdropping. Simulation results show that our proposed methods can effectively disguise key infrastructure by reducing the difference of historically accumulative traffic among different switches. With significantly reduced complexities, our algorithms are of particular interest to safeguard large-scale networks.

pp. 417-422