The 23rd Wireless and Optical Communication Conference, WOCC 2014

May 9-10 2014

Campus Center, NJIT

Newark, New Jersey, U.S.A.

http://www.wocc.org

Welcome Message

On behalf of the Wireless and Optical Communications Conference (WOCC) Planning Committee, I welcome you to our 23rd annual event, the 2014 WOCC.

The 2014 WOCC is presenting invited and peer reviewed papers on this, our 23rd birthday. Papers presented will be published in the IEEE Conference Proceedings. The WOCC has become a major event for telecommunications professionals both in the U.S. and the Asia-Pacific region throughout the last two decades. This conference provides an excellent forum and opportunity for presenting new research results, discussing emerging technologies, innovative research ideas, and networking among telecommunications professionals. The conference theme this year is Promising Communications for "Big" Data, highlighting the proliferation and advances of high-speed Internet services and applications in inspiring new intelligent communication and computing capabilities for our society.

The 2014 technical program of the WOCC will feature four Parallel Symposiums:

- On Wireless Communications and Networking,
- On Optical Communications and Networking,
- On Emerging Networks and Future Internet,
- And on Big Data and Applications.

Exhibitions from sponsoring organizations and graduate student posters will be a further addition presented during the conference.

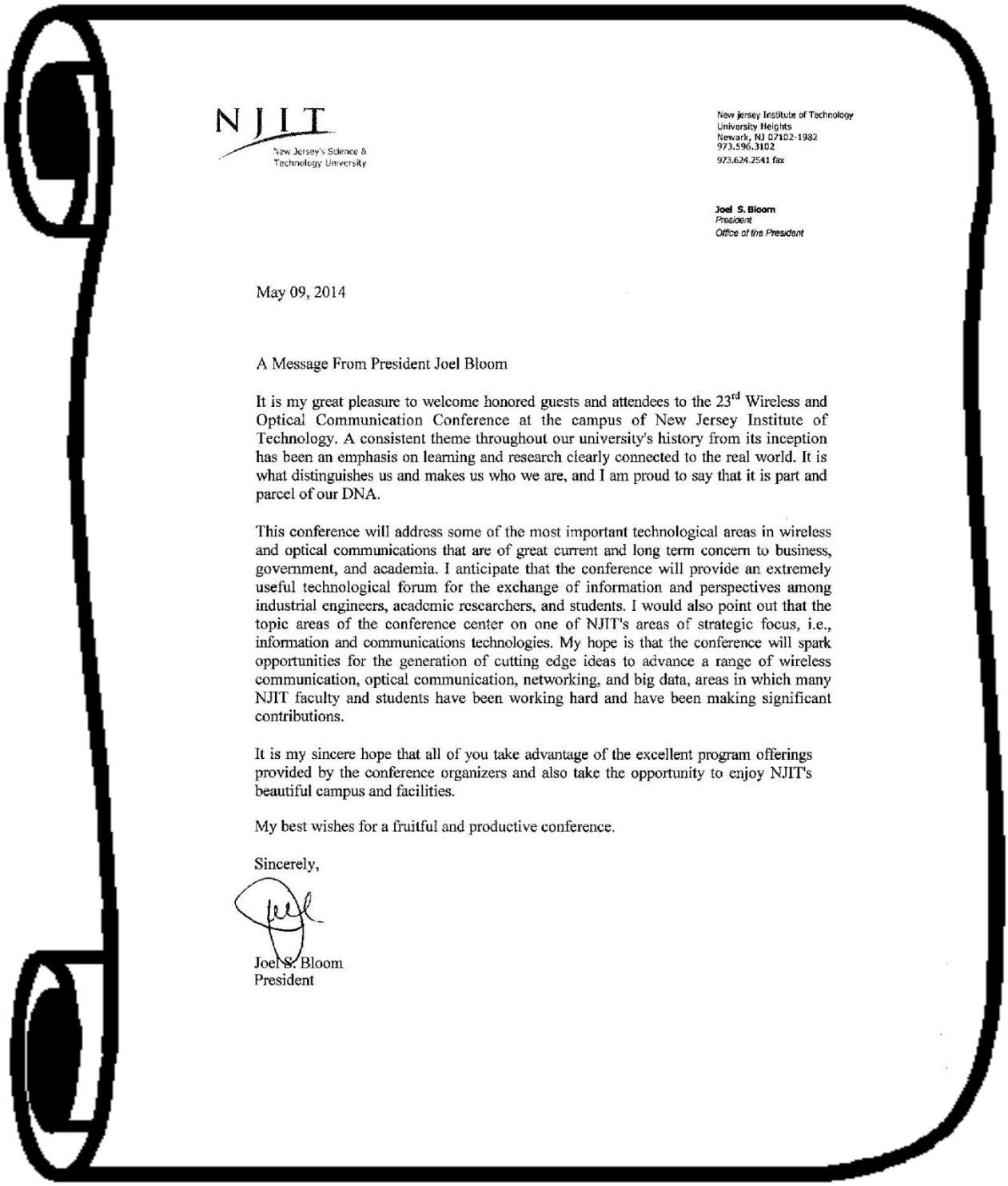
We hope your participation in the 2014 WOCC is a productive and rewarding experience. Thank you for your involvement and contribution in making our 2014 WOCC Conference a success.

Russell Sun
Conference Organizer

Grace Guiling Wang
Conference Coordinator

Russell Sun graduated from the Communication Science Institute of the University of Southern California and got Ph.D. in Electrical Engineering. Dr. Sun joined Network Wireless division of Lucent Technologies in 1996. He had led the TDMA radio performance team and been responsible for radio technology lab measurement, performance analysis and base band algorithm design. Then he worked at the Forward Looking and Advanced Technology Laboratory on CDMA2000, Mobile WiMAX, UMTS/WCDMA and LTE physical layer algorithm design/performance analysis. He worked at Chief Technology Officer (CTO) office on advanced wireless technology research. Currently he leads the algorithm design and performance analysis in system on chip (SOC) of the next generation Light Radio.

Grace Guiling Wang received the B.S. degree in Software from Nankai University. She received the Ph.D. degree in Computer Science and Engineering and a minor in Statistics from the Pennsylvania State University in 2006. After that, she joined the Department of Computer Science at New Jersey Institute of Technology, Newark, NJ, as an assistant professor. She was early promoted to be an associate professor with tenure in 2011. Her research interests are in mobile computing, intelligent on-road transportation, mobile health, wireless sensor networks, ad hoc networks, and network security. Her publications have been cited for more than 2000 times according to Google Scholar. She has been the PI of multiple NSF grants. Currently she is also the lead Technical Adviser to 4.0 Analytics.



NJIT
New Jersey's Science & Technology University

New jersey Institute of Technology
University Heights
Newark, NJ 07102-1982
973.596.3102
973.624.2541 fax

Joel S. Bloom
President
Office of the President

May 09, 2014

A Message From President Joel Bloom

It is my great pleasure to welcome honored guests and attendees to the 23rd Wireless and Optical Communication Conference at the campus of New Jersey Institute of Technology. A consistent theme throughout our university's history from its inception has been an emphasis on learning and research clearly connected to the real world. It is what distinguishes us and makes us who we are, and I am proud to say that it is part and parcel of our DNA.

This conference will address some of the most important technological areas in wireless and optical communications that are of great current and long term concern to business, government, and academia. I anticipate that the conference will provide an extremely useful technological forum for the exchange of information and perspectives among industrial engineers, academic researchers, and students. I would also point out that the topic areas of the conference center on one of NJIT's areas of strategic focus, i.e., information and communications technologies. My hope is that the conference will spark opportunities for the generation of cutting edge ideas to advance a range of wireless communication, optical communication, networking, and big data, areas in which many NJIT faculty and students have been working hard and have been making significant contributions.

It is my sincere hope that all of you take advantage of the excellent program offerings provided by the conference organizers and also take the opportunity to enjoy NJIT's beautiful campus and facilities.

My best wishes for a fruitful and productive conference.

Sincerely,

Joel S. Bloom
President

Symposium Chairs' Message

It is our great pleasure to welcome you to attend IEEE WOCC2014 – the 23rd Annual Wireless and Optical Communications Conference during May 9 – 10, 2014. This is another exciting event held in New Jersey in the United States since the birth of WOCC 23 years ago.

The IEEE WOCC2014 technical program committee put together an outstanding program, consisting of twenty-two technical sessions in four symposiums, one keynote session, four plenary sessions, and a students' poster session. The four symposiums cover: Wireless Symposium, Optical Symposium, Networks Symposium, and Big Data Symposium. The overall program includes 96 papers and presentations covering cutting edge research and developments in wireless communications and networking, optical communications and big data with speakers from North America, Asia, and Europe. There will be dozens of distinguished scholars and technology leaders invited to talk in the plenary sessions and technical sessions. Five excellent speakers from academics and industries will address recent developments and future challenges.
In addition to the invited talks, IEEE WOCC2014 received a total of 80 paper submissions. The technical program committee, including program chairs, symposium chairs, and more than 60 committee members, had a peer-review process for the submitted papers. As a result of the review process, 56 papers were accepted. Additionally, 13 invited papers were also reviewed and accepted. These papers will be published in the WOCC2014 conference proceedings and IEEE Xplore.

The technical program of IEEE WOCC2014 is the result of dedication and efforts of many volunteers in our technical program committee and planning committee. We are deeply thankful to all authors who submitted their latest research to the conference. We are most grateful to the symposium chairs, technical program committee members, and expert reviewers who spent tremendous time on the paper review process. We would also like to thank the general chair, organizer, coordinator and other planning committee members of the conference for their constant support.

We hope that IEEE WOCC 2014 will be a very rewarding experience for all attendees. Wish you all a productive and enjoyable conference!

Yours sincerely,

Wireless Symposium
Alexander Haimovich, NJIT
Meilong Jiang, InterDigital

Optical Symposium
Benyuan Zhu, OFS Labs
Xin Jiang, CUNY

Networks Symposiu:
R. (Mouli) Chandramouli, Stevens Inst. Tech.
Hong Zhao, FDU

Big Data
Ching-Yung Lin, IBM USA
Hong Man, Stevens Inst. Tech

The 23rd Annual
Wireless and Optical Communications Conference
Promising Communications for "Big" Data

May 9-10, 2014, Campus Center, NJIT, Newark, New Jersey, U.S.A.

Table of Contents

Conference Theme

Promising Communications for "Big" Data

The theme for WOCC-2014 is the Promising Communications for "Big" Data, built upon the success of new generations of communication services and the proliferation of the big data in our society.

WOCC 2014 provides a unique platform for attendees to present and discuss the impact of the Telecommunications in the Internet age. From the traditional wireless and optical communications to smart mobile device, from the applications of internet of things to the big data, researchers around the global will convene in New Jersey to disseminate their scientific findings and to exchange information on new developments related to the conference theme.

The conference organization team cordially invites people from industry, research organizations, academic and government labs interested in the subjects to participate in this exciting event, to be held at the Campus Center of New Jersey Institute of Technology in May 09 – 10, 2014.

Conference Technical Co-Sponsors

IEEE Photonics Society	http://photonicssociety.org/
IEEE North Jersey Section	http://web.njit.edu/~ieeenj/

Conference Financial Sponsors

IEEE North Jersey Section	http://web.njit.edu/~ieeenj/
WOCC, Inc.	http://www.wocc.org/

Conference Planning Committee

Conference Organizer

Russell Sun *Alcatel-Lucent*

Conference Coordinator

Grace Guiling Wang *NJIT*

Web and Publication Chair

Jie Tian *NJIT*

Wireless Symposium Program Co-Chairs

Alexander Haimovich *NJIT*
Meilong Jiang *InterDigital*

Optical Symposium Program Co-Chairs

Benyuan Zhu *OFS Labs*
Xin Jiang *CUNY*

Networks Symposium Program Co-Chairs

R. (Mouli) Chandramouli *Stevens Inst. Tech.*
Hong Zhao *FDU*

Big Data Symposium Program Co-Chairs

Ching-Yung Lin *IBM USA*
Hong Man *Stevens Inst. Tech.*

Advisory Committee

Xiang Liu *Alcatel-Lucent*
Chonggang Wang *InterDigital*
Yudong Yao *Stevens Inst. Tech*
Sigen Ye *Alcatel-Lucent*
Qinqing Zhang *John Hopkins Univ.*
Mengchu Zhou *NJIT*

Conference Technical Program Committee Members

WOCC2014 TPC Members

Wireless Symposium:

Ali Abedi, University of Maine

Mohammad Banat, Jordan University of Science and Technology

Mostafa Bassiouni, University of Central Florida

Jiannong Cao, Hong Kong Polytechnic Univ

Xianghui Cao, Illinois Institute of Technology

Zhuo Chen, InterDigital Communications

Julian Cheng, University of British Columbia

Shi Cheng, Silicon Image Inc.

Woong Cho, Jungwon University

Marco Di Renzo, French National Center for Scientific Research (CNRS)

George Efthymoglou, University of Piraeus

Asif Gandhi, Bell Laboratories

Shimin Gong, Nanyang Technological University

Visvasuresh Victor Govindaswamy, Concordia University

Sanqing Hu, Stevens Institute of Technology

Tangsen Huang, South China University of Technology

Bo Ji, AT&T Labs

Xianfu Lei, Utah State University

Hongkun Li, Interdigital

Peng Li, Halliburton

Ying Li, Samsung Telecommunications America

Yu Liu, University of California, Daivs

Ning Lu, University of Waterloo

Filippo Palumbo, Computer Science Department, University of Pisa.

Ioannis Psaras, University College London

Harry Skianis, University of the Aegean

Yue Tian, MVB, Woodland Road, University of Bristol

Athanasios Vasilakos, National Technical University of Athens

Akkari Wafa, National School of Computer Sciences, ENSI University of Manouba

Honggang Wang, University of Massachusetts, Dartmouth

Kunjie Xu, University of Pittsburgh

Qian Zhang, InterDigital

Zhanyang Zhang, College of Staten Island/City University of New York

Optical Symposium:

Long Chen, Acacia, Inc.

Benjamin Dingel, Nasfine Photonics Incorporated

Po Dong, Bell Labs. Alcatel-Lucent

Mark Feuer, College of Staten Island, CUNY

Lufeng Leng, New York City College of Technology, CUNY

Anhui Liang, Naijing University of Posts and Telecommunications (NJUPT), P.R. China

Xiaohong Ma, Tsinghua University, P.R. China

Nicholas Madamopoulos, City Collegeo of CUNY

Zhongqi Pan, University of Louisiana at Lafayette

Sasanthi Peiris, City College, City University of New York

Dwight Richards, College of staten Island, CUNY

Junyi Wang, LinkQuest Inc.

Chongjin Xie, Bell Labs, Alcatel-Lucent

Shan Zhong, CoAdna Photonics

Networks Symposium:

Zhiqiang Gao, Microsoft

Jingxuan Liu, AIG

Yuanqiu Luo, Huawei Technologies USA

Jungwoo Ryoo, The Pennsylvania State University-Altoona

Hui Wang, Stevens Institute of Technology

Kang Xi, Polytechnic Institute of New York University

Kevin Xu, EMC Corporation

Tan Yan, New Jersey Institute of Technology

Jingdi Zeng, DeVry University

Xiaowen Zhang, College of Staten Island / CUNY

Big Data Symposium:

Rong Duan, AT&T Labs

Sanqing Hu, Stevens Institute of Technology

Hong Man, Stevens Institute of Technology

Ye Ouyang, Verizon Wireless

Jin Xu, Behaviormatrix

PROGRAM AT A GLANCE

WOCC, Friday, May 9, 2014

08:00–17:00	Registration				
09:00–10:40	**O1** **High Speed Transmission** *Chair: (Jessica) Xin Jiang* *College of Staten Island, CUNY*	**W1** **Wireless Mobile Ad-hoc and Wireless Sensor Networks** *Chair: Qian Zhang* *Ohio University*	**N1** **Optical Networks** *Chair: Hong Zhao* *FDU*		Exhibition
10:40–11:00	Break				
11:00–11:10	**Opening Remarks/ Welcome Speech: Dr. Donald H. Sebastian, President, NJ Innovation Center ; Russell Pepe, Chair, IEEE N. Jersey Section**				
11:10–12:00	**P1** **Plenary Session** (*Chair: Russell Sun*) Rajendra Singh, Senior Regulatory Specialist, ICT Policy Division, The World Bank *"Next Generation Spectrum Management : Transition From Land to Sea Approach"*				
12:00–13:00	**K1** **Keynote Session** (*Chair: Russell Sun*) Dr. Junyi Li, VP of Engineering, Qualcomm *"Device-to-device Communications in LTE"*				
13:00–14:00	Lunch				
14:00–15:40	**O2** **Optical Interconnection and Networks** *Chair: Chongjin Xie* *Bell Labs, Alcatel-Lucent*	**W2** **4G/5G: Technology and Standard Development** *Chair: Ananth Kini* *InterDigital Communications*	**N2** **Internet of Things** *Chair: Xiaowen Zhang* *CUNY*	**B2** **Visual Analytics** *Chair: Wendy Wang* *Stevens Institute of Technology*	Exhibition
15:40–16:10	Break				
16:10–17:50	**O3** **System Design and Modeling** *Chair: Mark Feuer* *College of Staten Island, CUNY*	**W3** **PHY/MAC technologies for future wireless systems I** *Chair: V. K. Varma Gottumukkala* *Qualcomm, USA*	**N3** **Network Analysis in Systems Biology** *Chair: Hong Zhao* *FDU*	**B3** **Data Mining Methods and Applications** *Chair: Zhu Liu* *AT&T Labs Research*	Exhibiti

WOCC, Saturday, May 10, 2014

08:00–17:00	Registration				
09:00–10:40	**O4** **Optical Devices** *Chair: Benyuan Zhu* *OFS Labs*	**W4** **Wireless Cognitive Radio and Networks** *Chair: Yu-dong Yao* *Stevens Institute of Technology*	**N4** **Network Planning and QoS Provisioning** *Chair: Yuanqiu Luo* *Huawei Technologies*	Poster Session	Exhibition
10:40–11:00	Break				
11:00–11:40	**P2** **Plenary Session** (*Chair: Grace Wang*) Winston I. Way, Chief System Architect, NeoPhotonics *"A Pragmatic View of Optical Fiber Communication Systems and Components"*				
11:40–12:20	**P3** **Plenary Session** (*Chair: Grace Wang*) Dr. Chinlon Lin, Scientific Advisor, Lightel *"Photonics and Broadband Evolution"*				
12:20–13:00	**P4** **Plenary Session** (*Chair: Grace Wang*) Dr. Li-Chun Wang, ECE Dept., National Chiao Tung University *"5G Wireless: Trend and Challenges"*				
13:00–14:00	Lunch				
14:00–15:40	**O5** **Silicon Photonic Devices** *Chair: Nicholas Madamopoulos* *City College, CUNY*	**W5** **Emerging mobile applications and services** *Chair: Moutaz Saleh* *Qatar University*	**N5** **Cloud Computing** *Chair: : Yuanqiu Luo* *Huawei Technologies*	**B5** **Network Service Quality and Security** *Chair: Rong Duan* *AT&T Labs*	Poster Session / Exhibition
15:40–16:10	Break				
16:10–17:50	**O6** **OFDM and Visible Light Communications** *Chair: Zhongqi Pan* *Univ. of Louisiana at Lafayette*	**W6** **PHY/MAC technologies for future wireless systems II** *Chair: Ramiro Samano-Robles* *Instituto de Telecomunicações*	**N6** **Network Planning and Optimization** *Chair: Jungwoo Ryoo* *Penn State University*	**B6** **Data Sensing and Modeling** *Chair: Ye Ouyang* *Verizon Wireless*	Poster Session / Exhibiti

K – Keynote	P – Plenary	W – Wireless	N – Network	B –Big Data	O – Optical

WOCC Technical Sessions – Friday, May 09, 2014, 09:00 – 10:40

O1 High Speed Transmission

Chair: (Jessica) Xin Jiang
College of Staten Island, CUNY

Non-Data-Aided Chromatic Dispersion Estimation for Nyquist Spectrally Shaped Fiber Transmission Systems
Junyi Wang*, X. Jiang, Y. Weng, X. He, Z. Pan
***LinkQuest, Inc.**

High Spectral Efficiency Nyquist Optical Superchannel Transmission
Fan Zhang**(Invited)*, D. Wang, R. Ding, T. Zhang, Z. Zheng, Z. Chen
***Peking University, P.R.China**

Directly Modulated VCSELs for 100-Gb/s and Beyond Metro Network Applications
Chongjin Xie *(Invited)*
Bell Labs, Alcatel-Lucent

Terabit Superchannels: Enabling Next Generation Optical Transmission and Networking
S. Chandrasekhar *(Invited)*
Bell Labs, Alcatel-Lucent

W1 Wireless Mobile Ad-hoc and Wireless Sensor Networks

Chair: Qian Zhang
Ohio University

A Self Adaptive MAC Layer Protocol for Delay-Tolerant Underwater Wireless Sensor Networks,
Zhanyang Zhang (Invited)
City Univeristy of New York, US

Implementation of High Precision Synchronization Protocols in Wireless Sensor Networks
Djamel Djenouri, Miloud Bagaa
CERIST Research Center, Algeria

A Novel Collision Detection Scheme for Wireless Sensor Networks using Received Signal Dynamic Range Statistics
Fawaz Alassery **Stevens Tech, USA**
Walid Ahmed **Broadcom Inc., USA**
Mohsen Sarraf , **Applied Communication Sciences, USA**
Victor Lawrence, **Stevens Institute of Technology, USA**

Quantifying Performance of Duplexing, Multiplexing and Multiple Access in Mesh, Relay, and Ad-hoc Networks,
Qian Zhang , **Ohio University, USA**
David W Matolak, **University of South Carolina, USA**

Low Latency MAC Protocol with Adaptive Sleeping for Wireless Sensor Networks,
Lulu Liang; Jing Song; Yongtao Wang, Guang yang, Qi Zou; Xiaofang Ban, Li Zhang, **China Information Technology Security Evaluation Center, P.R. China**

N1 Optical Networks

Chair: Hong Zhao
Fairleigh Dickinson Univ.

Advances in Passive Optical Network Technologies for Broadband Access
Naresh Chand (Invited Speaker)
Huawei Technologies

Hybrid Birectional OFDM-PON Supporting 60/120 GHZ RoF using OQPSK
Chongfu Zhang
Chen Chen
Qiaoyan Zhang
University of Electronic Science and Technology of China

Latency Analysis of the Improved Fast Hand off for MIPv6
Hamid Taghizadeh
Middle East Technical University

WOCC Technical Sessions – Friday, May 09, 2014, 14:00 – 15:40

O2 Optical Interconnection and Networks

Chair: Chongjin Xie
Bell Labs, Alcatel-Lucent, USA

Space: Is It the Final Frontier of Photonics?
Mark D. Feuer *(Invited)*
College of Staten Island, CUNY

Optical Interconnect Architecture for Data Center Networks
Yawei Yin *(Invited)*
NEC Labs USA

Optical Virtual Switching (OvS): A Distributed Optical Switching Fabric for Intra-Data Center Networking
Shan Zhong *(Invited)*, Z. Zhu
CoAdna Phtonics

Flexible Ring-tree TWDM Network Architecture for Next Generation Optical Access Network
Xintian Hu*, X. Chen, Z. Zhang, L. Wang, J. Bei
***Beijing Univ. of Posts and Telecoms, P.R.China**

W2 4G/5G: Technology and Standard Development

Chair: Ananth Kini
InterDigital Communications

Mobile Broadband Evolution Roadmap: from 4G to 5G
Christopher Cave (Invited), Director, R&D, **InterDigital Communications**

Performance Analysis of Adjustable Discontinuous Reception (DRX) Mechanism in LTE Network,
Yu Liu **University of California, Daivs, USA;** Minh Huynh **AT&T Labs, USA**; Ashima Mangla **AT&T Labs,** USA; Dipak Ghosal **University of California, Davis, USA**

A Dynamic Subframe Set Power Control Scheme for Interference Mitigation in Reconfigurable TD-LTE Systems
Ananth Kini, Mohsen Hosseinian,Pouriya Sadeghi,Janet Stern-Berkowitz , **InterDigital Communications**

Significant Gains in Coverage and Downlink Capacity from Optimal Antenna Downtilt for Closely-spaced Cells in Wireless Networks
Asif Gandhi **Bell Laboratories, USA**

Hybrid Framework For No-Reference Video Quality Indication Over LTE Networks, Songqing Zhao **Alcatel-Lucent USA**
Hong Jiang , **Bell Labs, USA**

N2 Internet of Things

Chair: Xiaowen Zhang
CUNY

On the Role of Software Defined Networking in Mobile Networks
Harish Viswanathan
Colin Kahn (Invited Speaker)
Alcatel-Lucent

Identifying User Clicks Based on Dependency Graph
Jun Liu*,
Cheng Fang
Nirwan Ansari
***Beijing University of Posts and Telecommunications**

User Behavior Based Automatical Navigation System on Android Platform
Jie Tian,Guiling Wang
Xin Gao and Kaixuan Shi
NJIT

ARRP: An Augmented Reality 3D Ping-pong Game System on Android Mobile Platform
Xin Gao, Jie Tian, Xiaoyuan Liang and Guiling Wang
NJIT

B2 Visual Analytics

Chair: Wendy Wang
Stevens Institute of Technology

Bigger data and bigger models for visual recognition and social media
Liangliang Cao
IBM T. J. Watson Research Center

Video Event Detection By Temporal Sequence Modeling
Wireless Environments
Quanfu Fan
IBM T. J. Watson Research Center

Web-scale mobile content search
Zhu Liu
AT&T Labs Research

Computer Vision based Assistive Technology for Visually Impaired People
Yingli Tian
City University of New York

WOCC Technical Sessions – Friday, May 09, 2014, 16:10 – 17:50

O3 System Design and Modeling

Chair: Mark Feuer
College of Staten Island, CUNY

Frequency Domain Equalizer in Few-Mode Fiber SDM Systems
Zhongqi Pan *(Invited)*
University of Louisiana at Lafayette

System Performance Comparison of Various Fibers for Uncompensated Links
Lufeng Leng *(Invited)*
City College of Technology, CUNY

An Optical Power Efficient Asymmetrically Companded DCO-OFDM for IM/DD Systems
Fatima Barrami*, Y. L. Guennec, E. Novakov, P. Busson
***STMircroelectronics/IMEP-LAHC, France**

Theoretical Analysis and Numerical Simulation of Inter-Modal Four-Wave-Mixing in Few Mode Fibers
Yi Weng* , J. Wang, X. He, B. Zhu, Z. Pan
***University of Louisiana at Lafayette**

Performance Analysis of OOK Modulation Scheme with Spatial Diversity in Atmospheric Turbulence
Hemani Kaushal*, V.K. Jain, S. Kar, T. Joesph
ITM University, India

W3 PHY/MAC Technologies for Future Wireless Systems I

Chair: V. K. Varma Gottumukkala
Qualcomm, USA

Energy-harvesting wireless communications in fading channels
Zhe Wang, **Columbia Univ.;** Vaneet Aggarwal, **AT&T Labs**, Xiaodong Wang (Invited), **Columbia Univ.**

Throughput Optimized Multi-Source Cooperative Networks With Compute-and-Forward
Chen Zhi, **Tsinghua University**; Pingyi Fan **Tsinghua University, P.R. China**; Khaled B. Letaief , **The Hong Kong University of Science and Technology, Hong Kong**

Differential Space-Time Modulation Using DAPSK
Chi-Hua Huang, **National Taiwan University, Taiwan**; Char-Dir Chung **Communication Society, Taiwan**

Pilot-Data Power Allocation for OFDM Systems with Amplify and Forward Relays
V. K. Varma Gottumukkala, **Qualcomm, USA**; Hlaing Minn, **University of Texas at Dallas, USA**

Performance of Relay with Multilayer STBC Uplink Wireless Communication for Multiple Access Channel,
M M Kamruzzaman, **Southwest Jiaotong University, P.R. China**

N3 Network Analysis in Systems Biology

Chair: Hong Zhao
FDU

Tutorial: Network Analysis in Systems Biology
Avi Ma'ayan (Invited Speaker)
Icahn School of Medicine at Mount Sinai

B3 Data Mining Methods and Applications

Chair: Zhu Liu
AT&T Labs Research

A Cognitive Hierarchical Framework for Evaluating Emergency Response Activities
Mark Rahmes
Rick Pemble
Kevin Fox
John Delay
Harris Corporation

Verifiable Outsourcing of Big Data Mining Computations Wendy Wang
Stevens Institute of Technology

A case study for social media application
Jin Xu
Behaviormatrix

Detecting Asset Pricing Bubbles: From Small Data to Big Data Approaches
Haobo Lai
Mengchu Zhou
New Jersey Institute of Technology

WOCC Technical Sessions – Saturday, May 10, 2014, 09:00 – 10:40

O4 Optical Devices

Chair: Benyuan Zhu
OFS Laboratories, USA

Review and Challenges of High Frequency Cavity-assisted Electro-optic Modulator
Nicholas Madamopoulos *(Invited)*
City College, CUNY

Performance Improvement of Mapping Multiplexing Technique (MMT) Using Dual-drive Mach-Zehnder Modulator at 40Gb/s
Mohamed Asaad Elsherif, A. Malekmohammadi
The University of Nottingham, Malaysia

Tunable and flat optical frequency comb generated by two cascaded intensity modulators
Lei Shang*, G.Lin, A. Wen
***Xidian University, P.R.China**

Recent Advances in Optical Splicing and Glass Processing Technologies for Specialty Fibers and Photonic Devices
Baishi Wang *(Invited)*
Vytran, LLC.

W4 Wireless Cognitive Radio and Networks

Chair: Yu-dong Yao
Stevens Institute of Technology

Cooperative Routing for Cognitive Radio Networks using Mutual-Information Accumulation
Lingjia Liu (Invited) **University of Kansas, USA**; Hao Chen **The University of Kansas, USA**; John D. Matyjas **Air Force Research Laboratory**, **USA**; Michael Medley **Air Force Research Laboratory, USA**

FSMC-Based User Selection Scheme for Cooperative Spectrum Sensing
Hongzhi Luan, Ou Li, Xiaoyi Zhang
National Digital Switching System Engineering & Technology R&D Center, P.R. China

A Weighted Cooperative Spectrum Sensing Scheme Based on Dynamic Double Energy Thresholds In Cognitive Radio Networks
Tangsen Huang
South China University of Technology, P.R. China

Algorithm and Experimentation of Frequency Hopping, Band Hopping, and Transmission Band Selection Using a Cognitive Radio Test Bed
Hasan Shahid, Yu-Dong Yao
Stevens Institute of Technology, USA

Cooperative Spectrum Sensing with Energy-Efficient Sequential Decision Fusion Rule
Hongzhi Luan, Ou Li Xiaoyi Zhang
National Digital Switching System Engineering & Technology R&D Center

N4 Network Planning and QoS Provisioning

Chair: Yuanqiu Luo
Huawei Technologies

Message Passing Delay in Network Congestion Management
Hengky Susanto
Byung Guk Kim
University of Massachusetts at Lowell

Network-as-a-service in Software defined Networks for End-to-End QoS provisioning
Qiang Duan
Pennsylvania State University

Tree-Based Energy-Efficient Data Gathering in Wireless Sensor Networks Deploying Compressive Sensing
Minh Nguyen
Keith Teague
Oklahoma State University

Vector Quantization based QoS Evaluation in Cognitive Radio Networks
Osama Tameemi*
Mainak Chatterjee
Kevin Kwiat
***University of Central Florida**

RCM-BR:An Efficient Rate Control Protocol for Multimedia Delivery in Wireless Internet
Venkata Kumar,
Sudipta Mahapartra, Kinshuk Bairagi and Kantubukta Vasu
Indian Institute Technology

WOCC Technical Sessions – Saturday, May 10, 2014, 14:00 – 15:40

O5 Silicon Photonic Devices

Chair: Nicholas Madamopoulos
City College, CUNY

Monolithic Silicon Photonic Integrated Circuits for Coherent Optical Receivers and Transmitters
Po Dong*(Invited)*
Bell Labs, Alcatel-Lucent

Silicon Photonics for Telecommunications
Long Chen *(Invited)*
Acacia Communications

Function-Transformable Photonics Integrated Devices for Intelligent, Flexiblegrid, Multi-rate DWDM Optical Networks
Benjamin Dingel *(Invited)*
Nasfine Photonics Inc.

An Integrated Optical Interference Cancellation System
Matthew Chang, A. Tait, J. Chang, P. Prucnal
Princeton University

W5 Emerging Mobile Applications and Services

Chair: Moutaz Saleh
Qatar University

Distance Measurement using Narrowband ZigBee devices
Florian Barrau, **STMicroelectronics, France**;Bruno Paille **STMicroelectronics, France**; Edith Kussener **IM2NP/ISEN Toulon, France**; Didier Goguenheim **IM2NP/ISEN Toulon, France**

Use of Field and Lab-Calibrated Real-Time Communications Effects to Assess End-to-End System of Systems (SoS) Performance,
Dennis Bushmitch, **US Army CECOM, USA**; Kirk Chang, **Applied Communication Sciences, USA**; Vivek Agnish, **Army SOSI, USA**; Michael Badger **Army SOSI Directorate, USA**; Richard Cozby, **Army, USA**; Yevgeny Ivanyutin, **CERDEC S&TCD, USA**

Pervasive Mobile Gaming System for Obesity Treatment,
Moutaz Saleh, Jihad Mohamad Aljaam
Qatar University, Qatar

N5 Cloud Computing

Chair: Yuanqiu Luo
Huawei Technologies

A Centralized Trust Model Approach for Cloud Computing
Syed Rizi, Jungwoo Ryoo
Yuhong Liu, Dustin Zazworsky
Anthony Cappeta
Pennsylvania State University

Ensuring Data Confidentiality in Cloud Computing: An Encryption and Trust-based Solution
Yuhong Liu
Jungwoo Ryoo
Syed Rizi
Penn State University

Cloud Computing Security, Data, and Performance Issues
Neelu Sinha
Laila Khreisat
Fairleigh Dickinson University

Implementation of Randomize-then-Combine Constructed Hash Function
Chi Sing Chum, Changha Jun
Xiaowen Zhang
CUNY

B5 Network Service Quality and Security

Chair: Rong Duan
AT&T Labs

Predicting Web Service QoS via Matrix-factorization-based Collaborative Filtering under Non-negativity Constraint
Xin Luo
YunNi Xia
QingSheng Zhu
Chongqing University
Mengchu Zhou
New Jersey Institute of Technology

Estimation of Missing Measurements in Computer Networks: Matrix Completion vs. Compressed Sensing
Ziqian (Cecilia) Dong
New York Institute of Technology

A Study of LTE Network Performance based on Data Analytics and Statistical Modeling
Sangqing Hu
Ye Ouyang
Yu-dong Yao
M. Hosein Fallah
Wenyuan Lu
Stevens Institute of Technology

A Hidden Markov Model Detection of Malicious Android Applications at Runtime
Yang Chen
Mo Ghorbanzadeh
Kevin Ma
Charles Clancy
Robert McGwier
Virginia Tech

WOCC Technical Sessions – Saturday, May 10, 2014, 16:10 – 17:50

O6 OFDM and Visible Light Communications

Chair: Zhongqi Pan
Univ. of Louisiana at Lafayette

D-C ACO-OFDM and DCO-OFDM for Passive Optical Network: Performance Comparison in IM/DD Fiber Link
Max Frejus Sanya*, L. Djogbe, A. Vianou, C. Aupetit-berthelemot
***University of Limoges, France**

Brightness Control in Dynamic Range Constrained Visible Light OFDM Systems
Zhenhua Yu*, R.J.Baxley, G. T. Zhou
***Georgia Institute of Technology**

Using Delta-Sigma Modulators in Visible Light OFDM
Zhenhua Yu*, A.Redfern, G. T. Zhou
***Georgia Institute of Technology**

An Experiment Demonstration of A LED Driver Based on A 2nd Order Pre-emphasis Circuit for Visible Light
Minglun Zhang
Beijing University of Posts and Telecommunications, P.R. China

Optical Fibers in Human Body and Optical Communication Bionics
Anhui Liang *(Invited)*
Nanjing University of Posts and Telecommunications, P.R.China

W6 PHY/MAC Technologies for Future Wireless Systems II

Chair: Ramiro Samano-Robles
Instituto de Telecomunicações

Some Properties for Single Antenna Vector OFDM Systems
Xiang-Gen Xia (Invited)
University of Delaware

Linear Diversity Analyses for QAM in Rician Fading Channels,
Russell Sun
Alcatel-Lucent, USA

Trade-Off Performance Regions of Random Access Protocols with Multi-Packet Reception (MPR) via Multi-Objective Optimization, Ramiro Samano-Robles
Instituto de Telecomunicações, Portugal

A Low Complexity Physical-Layer Network Coding Scheme for Cellular Two-Way Relaying,
Zhaoxi Fang, Zunyi Wang, Shaozhong Zhang, Jiong Shi
Zhejiang Wanli University, P.R. China

N6 Network Planning and Optimization

Chair: Jungwoo Ryoo
Pennsylvania State University

Optimizing Fast Handover in MIPv6 Through Buffered Packet Forwarding & Out-of-Sequence Packet Reception
Sajida Imran
Ghulam Ishaq Khan Institute of Engineering Sciences and Tech.

High-Resolution Hardware-based Packet Capture with High- Layer Pass-Through on NetFPGA Card
Roberto Rojas-Cessa
Yaovi Kwasi
New Jersey Institute of Tech.

Information Centric Networks: Categorizations, Challenges, and Classifications
Mohammad Akbar, Kishwer Khaliq
Rao Naveed Rais, Amir Qayyum
Mohammad Ali Jinnah Univ.

Next Generation Hybrid Wireless-Optical Access with TWDM-PON
Yuanqiu Luo
Jianhe Gao and Frank Effenberger
Huawei Technologies

B6 Data Sensing and Modeling

Chair: Ye Ouyang
Verizon Wireless

Adjusted KNN Model in Estimating User Density in Small Areas with Poor Signal Strength
Rong Duan
AT&T Labs

Tracking Human Queues Using Single-Point Signal Monitoring
Yang Wang
Stevens Institute of Technology

Smartphone Based User Verification Leveraging Gait Recognition for Mobile Healthcare Systems
Yanzhi Ren
Stevens Institute of Technology

Activation Analysis on fMRI time series using Stochastic Context-Free Model
Xingzhong Xu
Stevens Institute of Technology

Keynote Talk WOCC 2014

Device-to-device Communications in LTE

Junyi Li

VP of Engineering, Qualcomm

ABSTRACT:

A major evolution in LTE Release 12 is the support of direct device-to-device (D2D) discovery and/or communication as an integrated part of the wireless communication system. This new capability enables many new use cases such as proximity-based commercial services, high rate, low latency, low power direct data communications between devices close to each other, and device-based relays for other user devices and machine nodes. The LTE platform uses the operator-controlled, licensed spectrum and therefore is expected to have the advantages over other D2D protocols such as Wi-Fi Direct and Bluetooth on a variety of performance metrics such as scalability, range, power/bandwidth efficiency, and quality of service. This talk will examine some of the new use cases, summarize the recent progress in 3GPP, and discuss the unique opportunities and challenges.

BIOGRAPHY:

Junyi Li is a Vice President of Engineering at Qualcomm, responsible for conceptualizing and developing next-generation wireless networking solutions. He was a key inventor of Flash-OFDM, arguably the first commercially deployed OFDMA-based mobile broadband wireless communications system. He holds over 200 U.S. patents and has more than 400 pending patent applications. He was a founding member of Flarion Technologies, a startup acquired by QUALCOMM in 2006. Prior to that, he was with Bell-Labs research in Lucent Technologies. He has a Ph.D. degree in E.E. from Purdue University and an MBA from the Wharton School at University of Pennsylvania. He is a Fellow of the IEEE. He is a co-author of the book “OFDMA Mobile Broadband Communications” published by Cambridge University Press. He received the Outstanding Electrical and Computer Engineers award from Purdue University in 2012.

P1. Plenary Talk WOCC 2014

Next Generation Spectrum Management : Transition From Land to Sea Approach

Rajendra Singh

Senior Regulatory Specialist,
ICT Policy Division, The World Bank

ABSTRACT:

Telecom networks are already experiencing exponential growth in data and video traffic. With IoT and M2M communication the rate of exponential growth will further increase. The incremental revenue may not match with incremental cost and telecom operators will be under pressure to reduce their cost. Will the operators shift their focus from infrastructure to services? This presentation discusses whether new technology could offer a solution to this challenge? Policy makers and telecom regulators worldwide may have to think new ways of spectrum management so that radio networks could be shared for efficient utilisation of spectrum and also to reduce the cost. The possibility of transition from conventional Land based approach to Sea based approach is examined.

BIOGRAPHY:

Rajendra Singh is a Senior Regulatory Specialist in The World Bank's ICT Policy Division, where he focuses on various policy and regulatory issues in telecom sector in various developing countries. He also focuses on synergy between Telecom, Energy, Transport, and Water Sectors within The World Bank.

Prior to joining The Bank, Rajendra spent about 26 years with Government of India, where he focused on telecom industry, telecom networks, telecom policy and regulatory issues. Rajendra was Secretary, Telecom Regulatory Authority of India (TRAI), where he was associated right from the beginning with the reforms and growth in telecom sector in India. Rajendra was Director (Signaling and Telecom) and various other positions in the Ministry of Railways, Government of India. Rajendra also worked with defense telecom equipment manufacturer, BEL, India. Rajendra has published more than 50 papers in international journals and international conference proceedings.

Rajendra earned his B.S. and M.S. degrees in Electrical Engineering at Indian Institute of Technology (IIT), Roorkee and IIT, Delhi, India and MBA at University of Delhi, India. Rajendra is Senior Member IEEE; Fellow IET; and Fellow IETE.

P2. Plenary Talk WOCC 2014

A Pragmatic View of Optical Fiber Communication Systems and Components

Winston I. Way

NeoPhotonics Corporation
2911 Zanker Road, San Jose,
California, 95134 USA

ABSTRACT:

After a coalesce at a data rate of 10Gb/s for optical networks in early 2000, a fragmented 40Gb/s market was created due to an inordinate amount of innovations, until another coalesce occurred at a data rate of 100Gb/s around 2010. Even for 10Gb/s, there had been several generations of optical transceiver module form-factor, each one severely penalized the return-on-investment of its predecessors. Looking at metro and long-haul systems beyond 2014, it seems that history may repeat itself in the sense that there are already an excessive number of proposals for 100Gb/s module form factors, 200Gb/s and 400Gb/s modulation formats and module form-factors.

In regards to data center applications, the pace of data rate change for optical transceivers is about the same as that for telecom, although their economies of scale are at a totally different level. Unlike telecom systems which always require standardized optical components, a non- or semi-standard product with low cost, low power consumption, and small form-factor could find its way to a major market share. In addition, the commonly accepted optical module form-factor in data centers is much more stable than that of the telecom industry. However, there are currently too many technology choices and Multi-Source Agreements (MSAs) for the next-generation 100Gb/s optical modules, which will be briefly reviewed.

Next-generation colorless, directionless, and contentionless (CDC) ROADMs for metro optical networks and optical switches for data centers are on the horizon to be deployed. CDC ROADMs can be a key enabler for software-defined networks (SDNs). The commonly accepted network architectures and optical components will be reviewed.

In spite of telecom or data center networks, the two key technological enablers will be (a) photonic IC (with or without integrated electronics) and (b) digital-signal-processing. The various technology choices of (a) and (b) facing the industry will be critically reviewed from a pragmatic point of view.

BIOGRAPHY:

Winston I. Way (S'82–M'82–SM'88–F'01) is the Chief System Architect at NeoPhotonics Corporation. His current responsibility is to research and develop next-generation line/client100G/400G optical transceivers (based on coherent or direct-detection higher-order-modulation formats) and ROADM architecture, all using photonic integrated circuits. He pioneered subcarrier multiplexed optical-fiber systems research at Bellcore, and was a professor at National Chiao-Tung University, Taiwan. He founded OpVista Inc. in 2000, developed and deployed DWDM system products in major MSO networks in North America. He joined NeoPhotonics in 2009. He is the author of the book Broadband Hybrid/Fiber Coax System Technologies (New York: Academic, 1998), has published over 130 journal and conference papers, and owns 30 US patents. He received his Ph.D. from the University of Pennsylvania. He is a Fellow of the IEEE and the Optical Society of America.

Dr. Way has served on the technical program committees of OFC/NFOEC, MTT, OECC, LEOS, and OSA.

P3. Plenary Talk WOCC 2014

Photonics and Broadband Evolution

Chinlon Lin

Scientific Advisor, Lightel
e-mail: chinlon@ieee.org

ABSTRACT:

Since the 1960's the invention of lasers by Prof. Charles H. Townes and others have triggered significant worldwide R and D in optoelectronics devices for free-space and optical guided laser light communication systems, including the pioneering effort of Dr. Charles Kuen Kao in 1965 on low-loss optical fiber waveguides. Since 1970, R and D efforts worldwide have successfully developed very-high-capacity optical fiber communications networks for global broadband information infrastructures. Today broadband optical access with FTTH/FTTX (Fiber-to-the-Home) is a reality in many regions of the world. This has started the great broadband evolution and transformation of the modern societies. Broadband high-speed access to Global Broadband Internet has now changed the world beyond expectations. This talk will present a subjective, high-level historical perspective on the impact of photonics over the last 50+ years leading to this broadband transformation.

BIOGRAPHY:

Dr. Lin is now retired after 40+ years of research and teaching in the field of laser photonics technologies and broadband optical fiber communications systems. He was with AT&T Bell Labs, Holmdel, NJ and Bellcore, Red Bank, NJ. He is now Scientific Advisor of Lightel. He received his BSEE from National Taiwan University, and Ph. D. (EECS) from University of California, Berkeley. In 1974 he joined AT&T Bell Labs' Laser Sciences Research Department in Holmdel, New Jersey. His research was on advanced lasers and photonics technologies and nonlinear optical fiber transmission properties. In 1984 he was on leave from Bell Labs as a Visiting Guest Professor at the Tech. Univ. of Denmark in Lyngby, Denmark. He joined Bellcore in 1986, as Director of Broadband Lightwave Systems Research and directed a team of researchers working on Erbium-doped optical fiber amplifiers (EDFAs), DWDM photonics systems for lightwave video distribution and transmission for FTTH and HFC broadband access networks. In 1997 he joined Tyco Submarine Systems R & D Labs (formerly AT&T Submarine Systems) as Technical Director of Advanced Lightwave Technologies and worked on DWDM technologies, dispersion-slope compensation and wideband hybrid Raman/EDFA amplifiers for high-capacity global long-haul undersea fiber networks.

From 2003 to 2007 he was with Chinese University of Hong Kong (CUHK) as Chair Professor of Photonics and Director of Center for Advanced Research in Photonics. From April 2008 to April 2010 he was a Nanyang Professor at the School of EEE and also served as Director of Photonics Research Center, at Nanyang Technological University (NTU) in Singapore. In 2011-2013, he was a short-term visiting professor at KTH (Royal Institute of Technology), Sweden (2011), Technical University of Berlin, Germany (2012), and Institute of Femto-ST, in UCF, Besancon, France (2013).

Dr. Lin is a Life Fellow of IEEE's Photonics Society and Fellow of the Optical Society of America. He is also a Fellow of the Photonics Society of Chinese Americans and served as its President in 1994.

P4. Plenary Talk WOCC 2014

5G Wireless: Trend and Challenges

Li-Chun Wang, Ph.D

Professor and Chairman
Dept. of Electrical and Computer Engineering
National Chiao Tung University, Taiwan

ABSTRACT:

With 1,000 times higher data rates and more flexible spectrum use as compared with current 4G LTE systems, 5G wireless aims at delivering one gigabyte of mobile data for everyone daily by 2020. The challenge for 5G wireless is not just delivering one gigabyte per user daily, but personalizing every bit and being profitably.

In this talk we will discuss how 5G wireless systems can orchestrate the state-of-the-art technologies for creating holistic personalized cloud and communications services. First, we discuss the roles of smart phones in 5G wireless. Interestingly, a smart phone can act as the gateway to the cloud and the bridge of multiple sensors, and thus as a teacher to train the mobile network to be cognitive. Secondly, the cloud-based radio access network (C-RAN) management techniques for small cells are discussed. Changing the conventional concept of “cells” in mobile networks, new mobility management techniques in C-RAN aim at providing the always-best-connections (ABC) Radio Access Network as a service (RANaaS) so that each customer can effectively own a personalized access point everywhere. Last, we will talk about the role of software defined networking (SDN) in 5G wireless, and explain how SDN can help telecom operators deliver personalized network experiences to individuals in a new network paradigm supporting virtualization and programmability.

BIOGRAPHY:

Li-Chun Wang (M'96 -- SM'06 -- F'11) received the B.S. degree from National Chiao Tung University, Taiwan, R. O. C. in 1986, the M.S. degree from National Taiwan University in 1988, and the Ms. Sci. and Ph. D. degrees from the Georgia Institute of Technology , Atlanta, in 1995, and 1996, respectively, all in electrical engineering.

From 1990 to 1992, he was with the Telecommunications Laboratories of Chunghwa Telecom Co. In 1995, he was affiliated with Bell Northern Research of Northern Telecom, Inc., Richardson, TX. From 1996 to 2000, he was with AT&T Laboratories, where he was a Senior Technical Staff Member in the Wireless Communications Research Department. Since August 2000, he has joined the Department of Electrical and Computer Engineering of National Chiao Tung University in Taiwan and is the current Chairman of the same department. His current research interests are in the areas of radio resource management and cross-layer optimization techniques for wireless systems, heterogeneous wireless network design, and cloud computing for mobile applications.

Dr. Wang won the Distinguished Research Award of National Science Council, Taiwan in 2012, and was elected to the IEEE Fellow grade in 2011 for his contributions to cellular architectures and radio resource management in wireless networks. He was a co-recipient(with Gordon L. Stuber and Chin-Tau Lea) of the 1997 IEEE Jack Neubauer Best Paper Award for his paper ``Architecture Design, Frequency Planning, and Performance Analysis for a Microcell/Macrocell Overlaying System," IEEE Transactions on Vehicular Technology, vol. 46, no. 4, pp. 836-848, 1997. He has published over 200 journal and international conference papers. He served as an Associate Editor for the IEEE Trans. on Wireless Communications from 2001 to 2005, the Guest Editor of Special Issue on "Mobile Computing and Networking" for IEEE Journal on Selected Areas in Communications in 2005, "Radio Resource Management and Protocol Engineering in Future Broadband Networks" for IEEE Wireless Communications Magazine in 2006, and “Networking Challenges in Cloud Computing Systems and Applications,” for IEEE Journal on Selected Areas in Communications in 2013, respectively. He is holding 10 US patents.

W1. Wireless Mobile Ad-hoc and Wireless Sensor Networks
Friday, May 9, 9:00–10:40

Session Chair:

Qian Zhang

Ohio University, USA

BIOGRAPHY:

Qian Zhang received the M.S. degree and the Ph.D. degree both from Ohio University, U.S. in 2008 and 2012, respectively, in electrical engineering. Her M.S. thesis topic was wireless near-ground channel characterization in several unlicensed bands. During her master's degree, she interned at Alcatel-Lucent Inc. in summer 2007. Her Ph.D. dissertation topic was comparing duplexing, multiplexing and multiple access techniques in ad hoc networks. During her Ph.D. degree, she worked as a research intern at the National Institute of Standards and Technology (NIST) in 2009 and was awarded a NIST grant for the 2009-2010 academic year. She was also awarded an Ohio University named graduate fellowship from 2011 to 2012 for innovative research. She has interned at InterDigtial Inc. in 2011 and worked on the project of cellular networks with device-to-device communications. In 2012, Dr. Zhang joined InterDigital Inc. as a senior engineer. She is currently working on the area of small cell millimeter wave backhaul mesh networking. Dr. Zhang has published many research papers in IEEE journals and conferences and has also been selected as peer review for many times for the top transactions, journals and conferences. Her areas of expertise and current interest are wireless channel measurement and modeling, ad hoc networking, device-to-device communications and millimeter wave mesh networking.

W1. Technical Session: Wireless Mobile Ad-hoc and Wireless Sensor Networks

A Self Adaptive MAC Layer Protocol for Delay-Tolerant Underwater Wireless Sensor Networks

Zhanyang Zhang

Computer Science Department
City University of New York
New York City, USA
Zhanyang.zhang@csi.cuny.edu

ABSTRACT:

The propagation speed of an acoustic signal is much slower than the speed of a terrestrial radio signal due to the physical characteristics of an underwater acoustic channel. This large delay can impact the throughput of the channel. There is also a very high delay variance which presents unique challenges to the designs of efficient MAC protocols. The long and inconsistent delay renders many traditional protocols insufficient since they rely on multiple handshakes and accurate estimations of the round trip time (RTT) between two nodes. We proposed a novel approach to develop a Cluster based delay-tolerant protocol (CBDTP) to address these problems by eliminating RTS/CTS and ACK handshaking while avoiding collision. In addition, our CBDTP protocol uses a self-adaptive algorithm to address the inconsistent delay problem and its impact on RTT estimation. Our simulation study shows that CBDTP can improve channel throughput and resource utilization in a volatile deployment environment for many underwater wireless sensor network applications.

BIOGRAPHY:

Dr. Zhanyang Zhang acquired his PhD degree in computer science from the City University of New York. He received a MS degree in computer science from the College of Staten Island and a BE degree in computer engineering from Jilin University, China. He is currently a faculty member of Computer Science Department at both College of Staten Island and Graduate Center, the City University of New York (CUNY). His current research interests include wireless ad hoc networks, sensor networks, RFID and its applications, underwater sensor networks, and mobile computing and database. He is also a visiting professor at several Universities in China, including Hebei University, North China Electrical Power University and Jilin University. Before joining CUNY, he was a member of technical staff (MTS) at Bell Labs, Lucent Technology. He also worked as an IT consultant at different companies in New York City and New Jersey State.

W1. Technical Session: Wireless Mobile Ad-hoc and Wireless Sensor Networks

Implementation of High Precision Synchronization Protocols in Wireless Sensor Networks

Djamel Djenouri

CERIST Research center

ABSTRACT:

Microsecond-level time synchronization is needed in realtime applications of wireless sensor networks. While several synchronization protocols have been proposed, most performance evaluations have been limited to theoretical analysis and sim-ulation, with a high level of abstraction by ignoring several practical aspects, e.g. packet handling jitters, clock drifting, packet loss, etc. Effective implementation in real motes faces several challenges due to motes' limitations and the unreliable lossy channels. These issues affect the protocol performance and precision. Authors of some pragmatic solutions followed empirical approaches for the evaluation, where the proposed solutions have been implemented on real motes and evaluated in testbed experiments. While there are several survey articles presenting the protocols from the conception perspectives, and others dealing with mathematical and signal processing issues of the estimators, a survey on aspects related to the practical implementation is missing. This article throws light on issues related to the imple-mentation of synchronization protocols in WSN. The challenges related to WSN environment are presented, the importance of real implementation and the testbed evaluation are motivated by some experiments that we conducted. Finally, some relevant implementations of the literature that meet microsecond-level precision are discussed.

BIOGRAPHY:

Djamel Djenouri obtained the PhD in Computer Science from the University of Science and Technology USTHB Algiers, Algeria, in 2007. During his PhD, he has been granted an internship at John Moors University, Liverpool, UK, where he carried out collaborative work with the "Distributed Multimedia Systems and Security" group. From 2008 to 2009, he was granted a post-doctoral fellowship from the European Research Consortium on Informatics and Mathematics (ERCIM), and he worked at the Norwegian University of Science and Technology (NTNU), in Trondheim, Norway, where he participated in the MELODY project supported by the Norwegian Research Council. Currently, Dr Djamel Djenouri is a permanent full-time senior researcher at the CERIST research center in Algiers. He is working on topics related to wireless and sensor networking, with focus on quality of service, power management, routing protocols, MAC protocols, time synchronization, fault tolerance, sensor and actuator networks, vehicular applications, and the Internet of things. He participated in many international conferences. He published more than 50 papers in international peer-reviewed journals and conference proceedings, and two books. He is a professional member of the ACM and chaired workshops held in conjunction with DCOSS 2010/2011 and GlobCom 2010-2013. He also served as TPC member of many international conferences, guest editor of a special issue with Int. J. Communication Networks and Distributed Systems, and reviewer for many international Journals. In 2008, Djamel Djenouri was granted the best publication award from ANDRU, supported by the Algerian government, and the CERIST best researcher awards in 2010.

W1. Technical Session: Wireless Mobile Ad-hoc and Wireless Sensor Networks

A Novel Collision Detection Scheme for Wireless Sensor Networks using Received Signal Dynamic Range Statistics

Fawaz Alassery

Stevens Institute of Technology, Electrical & Computer Engineering Department

ABSTRACT:

Wireless Sensor Networks (WSNs) have a limited power source which is a small battery installed in each node. The main concern in designing WSNs is how to extend the lifetime of network nodes. Power consumption in WSNs has been investigated in a lot of research. In this paper we propose a novel power saving algorithm which has a low computational complexity in comparison with existing coding/decoding schemes. Instead of decoding every received signal our proposed algorithm avoid the high computational complexity via analyzing the sanity of the received packet. So, the receiver can detect collisions and determine when the transmitted signals need to be decoded. Our proposed algorithm achieves a significant power saving due to avoid decoding of transmitted signals which involve in collisions. Based on two proposed algorithm metrics, thresholds, modulation schemes and different scenarios, we use MATALB to show performance gains of our proposed algorithm.

BIOGRAPHY:

Name: Fawaz Alassery
Address: North Bergen, New Jersey, USA
Date of Birth: July 8, 1983
Education:
Stevens Institute of Technology, Hoboken, NJ, USA
Doctoral Candidate in Electrical and Computer Engineering Department
Expected date of graduation , December 2015
University of Melbourne, Melbourne, Victoria, Australia
MS in Telecommunication Engineering, December 2010
Umm Al-Qura University, Mecca, Saudi Arabia
BS in Computer Engineering, January 2006

Employment:
Lecturer in Computer Science and Information Technology Collage, Taif University, Saudi Arabia
Teaching Assistant (TA), Electrical and Computer Engineering, Stevens Institute of Technology

Awards:
Award from the president of Taif University for the best teaching staffs
Award for excellent student, Computer Engineering Department, Umm Alqura University.
Award of good conduct from the dean of students affairs, Umm Alqura University
Award for creative students in mathematics from Ministry of Education, Saudi Arabia
Award for graduation with 1st honor, Computer Engineering Department, Umm Alqura University.

Scholarship: Scholarship from Saudi Arabia Government for higher education degrees (master/PhD)
Training: Saudi Aramco, IT Department, 2003.
Jeraisy Computer and Communication Services Company, 2004
Saudi Electricity Company, IT department, 2005.
Research: Designing of a new cellular network in rural area - WCDMA based network. Melbourne University

W1. Technical Session: Wireless Mobile Ad-hoc and Wireless Sensor Networks

Quantifying Performance of Duplexing, Multiplexing and Multiple Access in Mesh, Relay, and Ad-hoc Networks

Qian Zhang

Ohio University, USA

ABSTRACT:

Decentralized wireless ad hoc networks have become attractive in several settings. The choice of duplexing, multiplexing, and multiple access (D/M/MA) techniques in ad hoc networks is critical to important network characteristics. Yet determining the "optimum" D/M/MA technique is still an open problem, and to our knowledge very few works directly compare available D/M/MA techniques. In this paper we extend previous comparisons of mesh and relay networks to include a simple ad hoc network. In addition, in contrast to our previous work that uses an equal peak power constraint, here we apply two different constraints: an equal average power, and an equal energy constraint. Our comparison method is illustrated with the mesh network, and results for relay networks are summarized. We then investigate D/M/MA performance for an example ad hoc network. We show that one's conclusions regarding the different D/M/MA schemes depend upon the comparison constraint, but for all three constraints, results illustrate that specific types of hybrid time-frequency resource allocation schemes are equivalent to or better than pure time division or pure frequency division in terms of data rate, signal-to-noise ratio, and throughput, in all network topologies. Moreover, the hybrid time-frequency schemes offer more flexibility than the pure time and frequency division schemes in terms of bit-error-ratio and range.

BIOGRAPHY:

Qian Zhang received the M.S. degree and the Ph.D. degree both from Ohio University, U.S. in 2008 and 2012, respectively, in electrical engineering. Her M.S. thesis topic was wireless near-ground channel characterization in several unlicensed bands. During her master's degree, she interned at Alcatel-Lucent Inc. in summer 2007. Her Ph.D. dissertation topic was comparing duplexing, multiplexing and multiple access techniques in ad hoc networks. During her Ph.D. degree, she worked as a research intern at the National Institute of Standards and Technology (NIST) in 2009 and was awarded a NIST grant for the 2009-2010 academic year. She was also awarded an Ohio University named graduate fellowship from 2011 to 2012 for innovative research. She has interned at InterDigtial Inc. in 2011 and worked on the project of cellular networks with device-to-device communications. In 2012, Dr. Zhang joined InterDigital Inc. as a senior engineer. She is currently working on the area of small cell millimeter wave backhaul mesh networking. Dr. Zhang has published many research papers in IEEE journals and conferences and has also been selected as peer review for many times for the top transactions, journals and conferences. Her areas of expertise and current interest are wireless channel measurement and modeling, ad hoc networking, device-to-device communications and millimeter wave mesh networking.

Low-Latency MAC Protocol with Adaptive Sleeping for Wireless Sensor Networks

Lulu Liang

China Information Technology Security Evaluation Center

ABSTRACT:

Duty-cycle operation MAC (medium access control)protocols, which work on sleep or wake states by turns, are very efficient to conserve energy for resource-constrained wireless sensor networks. However, traditional sleep-wake scheduling mechanisms either require broadcasting periodic synchronization beacons or cause high end-to-end delivery latency with the asynchronous schemes. In this paper, we propose a low latency MAC protocol by adjusting the Sleep Window (SW-MAC) considering traffic patterns. Nodes in SW-MAC transmit a sequence of scout packets to wake up the next hop, and adjust sleep window dynamically by estimating the traffic arrival interval from upstream nodes. Particularly, for the traffic load with large variance of bit rate, we adjust the sleep window using additive increase/multiplicative decrease (AIMD) mechanism. Then we design a scout-based scheduling mechanism with the above algorithms to shorten the delivery latency. Our simulation results indicate that SW-MAC can significantly reduce the end-to-end packet delivery latency without sacrificing the energy efficiency.

BIOGRAPHY:

Liang Lulu, reveived the B.S and Ph.D. degree from Beijing Jiaotong University, China in 2007, and 2012 respectively. Since 2012, he has been with China Information Technology Security Evaluation Center as a researcher.His current research interests include wireless sensor networks, risk assessment, web security. E-mail:leung.bjtu@gmail.com

W2. 4G/5G: Technology and Standard Development
Friday, May 9, 14:00–15:40

Session Chair:

Ananth V. Kini

InterDigital Communications, LLC

BIOGRAPHY:

Ananth V. Kini was born in Bombay, Maharashtra, India. He received his B.S. in Electrical Engineering from the University of Bombay, India, in May 1998, his M.S. in Telecommunications from the Department of Information Sciences at the University of Pittsburgh, Pittsburgh, PA in May 2002, and his Ph.D. in Computer Engineering from the Department of Electrical and Computer Engineering at Drexel University in January 2009. His research interests have spanned several areas of Computer and Wireless Networking, including evolution of various 3GPP related standards, distributed algorithms for wireless networks, multicasting and broadcasting in wireless networks, transmission coordination for ad hoc networks. He is currently employed at Interdigital Com

W2. Technical Session: 4G/5G: Technology and Standard Development

Mobile Broadband Evolution Roadmap: from 4G to 5G

Christopher Cave

Director, Innovation Labs
InterDigital Communications

ABSTRACT:

3GPP LTE/LTE-A has emerged as the mainstream technology for 4G mobile broadband access, with well over 200 million subscribers worldwide to date and growing. As the need for additional wireless capacity and support for new device types and services increases, LTE systems are expected to continue evolving and become one of the key building blocks for 5G systems.

This presentation provides an overview of 3GPP LTE and LTE-A systems, with a focused look at some of the new features and enhancements that are being considered for upcoming LTE releases. These include, among others, Device-to-Device Discovery and Communications, 3D MIMO, WiFi Offloading, Small Cell Enhancements and support for M2M communication. We will also discuss key market drivers for 5G systems and how they translate into requirements for further evolution of LTE/LTE-A. Finally, we will discuss potential enabling technologies to evolve LTE towards 5G.

BIOGRAPHY:

Mr. Christopher Cave is Director Innovation Labs at InterDigital Communications, where he leads the development of advanced wireless technologies targeting future cellular systems. Since joining InterDigital in 2001, Mr. Cave has held a variety of engineering and R&D management positions, focusing in the design and development of 3G, 4G, 5G cellular and WiFi systems. As an innovative leader within InterDigital, Mr. Cave has been granted more than 90 patents for his inventions in the areas of wireless technology and devices. Mr. Cave received his Bachelor's and Master's degrees in electrical engineering from McGill University in Montreal, Canada.

W2. Technical Session: 4G/5G: Technology and Standard Development

Performance Analysis of Adjustable Discontinuous Reception (DRX) Mechanism in LTE Network

Yu Liu

Department of Electrical and Computer Engineering
University of California Davis

ABSTRACT:

Long Term Evolution (LTE) is being widely deployed to support real-time applications, such as voice over IP and video games. These power consuming applications require low latency guarantee since a long latency can severely impact user satisfaction. Thus, providing low latency as well as extending user equipment's (UE) battery lifetime is two of the main goals in LTE. The Discontinuous Reception (DRX) mechanism, which is widely adopted in LTE to conserve the mobile phone's battery resources, results in higher latency due to its sleep period. In this paper, we first present the analytical model of DRX mechanism, then propose an adjustable DRX mechanism which can tune the DRX sleep period dynamically. We consider the percentage of time that UE spends in sleep state and wake-up delay as two main performance metrics. Our study concludes that by choosing $\alpha = 1$ and $\beta = 2$ in adjustable DRX mechanism, the wake-up delay decreases by approximately 66.7% for the case that DRX short sleep period equals to 200ms. The smaller value of α and β are suggested for delay sensitive applications. While larger values of α and β are more suitable for applications such as background traffic and social networking.

BIOGRAPHY:

Yu Liu is currently a Ph.D. Candidate in Electrical and Computer Engineering Department at University of California, Davis. For Ph.D. study, she is focused on the power saving mechanism for 4G/LTE Network. Yu has done multiple internships at AT&T Labs, working on 4G/LTE core network analysis and performance optimization. She was awarded a M.Sc. degree in Electrical Engineering from the University of Massachusetts, Lowell in 2010. Her recent awards include the Department Fellowship from Department of Computer Science at UC Davis and Motorola Innovation Fellowship at UMass Lowell.

A Dynamic Subframe Set Power Control Scheme for Interference Mitigation in Reconfigurable TD-LTE Systems

Ananth V. Kini

InterDigital Communications, LLC

ABSTRACT:

In 3GPP LTE, TDD spectrum allocation for uplink (UL) and downlink (DL) use is a function of a cell's TDD UL/DL configuration which designates which time resources (i.e., subframes) are for UL and which are for DL. TDD dynamic UL/DL reconfiguration, under discussion in LTE Release 12, enables cells to quickly adapt the ratio of allocated UL and DL subframes to changing traffic patterns which can be different for neighboring cells. Having different UL/DL directions for the same subframe in adjacent cells can result in new destructive interference components, i.e., eNB-to-eNB and UE-to-UE, with levels that can significantly differ from one subframe to another. In this paper, UL power control mechanisms are considered to manage such interference, where different sets of UL subframes use different UL power control parameters. In particular, two schemes are studied where, in one, fixed subframe sets are chosen based on expected interference and, in the other, the eNB monitors interference levels in the subframes and dynamically reconfigures the subframe sets accordingly. The performance of each scheme is evaluated through system level simulations and it is shown that the UL power control with dynamic UL subframe set configuration outperforms the one with static UL subframe sets, with significant improvement achieved at cell edge.

BIOGRAPHY:

Ananth V. Kini was born in Bombay, Maharashtra, India. He received his B.S. in Electrical Engineering from the University of Bombay, India, in May 1998, his M.S. in Telecommunications from the Department of Information Sciences at the University of Pittsburgh, Pittsburgh, PA in May 2002, and his Ph.D. in Computer Engineering from the Department of Electrical and Computer Engineering at Drexel University in January 2009. His research interests have spanned several areas of Computer and Wireless Networking, including evolution of various 3GPP related standards, distributed algorithms for wireless networks, multicasting and broadcasting in wireless networks, transmission coordination for ad hoc networks. He is currently employed at Interdigital Communications, LLC, where his work focuses on researching future enhancements to 3GPP LTE standards.

Significant Gains in Coverage and Downlink Capacity from Optimal Antenna Down Tilt for Closely-spaced Cells in Wireless Networks

Asif D. Gandhi

Alcatel-Lucent Bell Labs
Wireless Business Unit
Murray Hill, NJ 07974
asif.gandhi@alcatel-lucent.com

ABSTRACT:

This paper focuses on the impact of antenna down tilt for closely placed cells. The results show the need for small to no down tilt in coverage-limited scenarios, otherwise (for the case of close placement of cells), down tilt improves performance significantly. The most important conclusion of this study is that there is a large gain in downlink coverage and capacity due to down-tilting to the correct range of values; in fact, without the correct down tilt, all the gain in coverage due to the close placement of cells is lost. The simulations demonstrate that all in-building penetration advantage (up to 40 dB for the examples simulated in this paper) and up to 60% of the capacity can be lost if the tilts are off by 4° to 5° from the optimal for closely placed cells. In-building coverage is one of the challenges for current cellular systems, and it is shown that the same range of down tilt is optimal whether the users are in-building or on-street; hence the concern that down tilt will reduce in-building coverage is demonstrated as in-accurate for closely placed cells.

Another question that this paper addresses is: Are the down tilts which have been optimized for 3G systems also optimal for the 4G system? It is shown that the tilts that are optimal for 3G and voice systems are very good (if not optimal, at least near optimal) for the 4G LTE system. The simulations show that optimal down tilts can substantially reduce the number of basestations (and hence capital investment) needed from the point of view of capacity. Given the capacity constraints in 4G LTE systems, the study suggests that antenna design and down tilts must receive much more than nominal focus for urban areas.

BIOGRAPHY:

ASIF D. GANDHI is a distinguished member of technical staff in Alcatel-Lucent's Wireless Business Unit. His current focus is on CDMA/EVDO and OFDMA technologies, and he has been the customer technical prime for a Tier 1 customer since the last 2 years. He has led several cross-functional teams to solve complex technical problems in CDMA systems. He specialized expertise is in the area of RF performance, capacity, and coverage of wireless systems. He holds more than 15 U.S. patents and has several other patents pending, all in the area of wireless technologies. Several of these innovations have found their way into Alcatel-Lucent CDMA and UMTS products. Dr. Gandhi has published several journal and conference papers and numerous technical memorandums on the above topics, and is the author of a chapter in the book, “Handbook of CDMA System Design, Engineering and Optimization.” He received his bachelor of technology (B. Tech.) degree in electrical engineering from the Indian Institute of Technology (IIT), Mumbai, India, and an M.S. and Ph.D. in electrical and computer engineering from the University of Massachusetts, Amherst.

W2. Technical Session: 4G/5G: Technology and Standard Development

Hybrid Framework For No-Reference Video Quality Indication Over LTE Networks

Hong Jiang

Bell Labs, Alcatel-Lucent

ABSTRACT:

This paper proposes an efficient hybrid no-reference video quality indication framework for video transmission over LTE networks. Taking the easily obtained PCAP file from an LTE network node as input, we analyze various header information in the IP packets, extract H.264 payload, and save the payload in a bitstream conforming to the H.264 Annex B format. The H.264 bitstream is further decoded and the quality of the decoded video is measured with no- reference algorithms. Packet level metrics such as packet loss and packet size, bitstream level metrics such as frame error and frame duration, and image level metrics such as blockiness and blur, are obtained using respective efficient and novel algorithms. The metrics from this hybrid framework are crucial for predicting video quality MOS score. Furthermore, the IP packets are mapped to respective video frame, which enables to monitor the effect of network impairments on video quality, troubleshoot network issues, and eventually improve end user QoE.

BIOGRAPHY:

HONG JIANG is a researcher and project leader with Alcatel-Lucent Bell Labs in Murray Hill, New Jersey. He received his B.S. degree from Southwest Jiaotong University, Chengdu, China; M. Math. from the University of Waterloo, and Ph.D. from the University of Alberta, Canada. His research interests include signal processing, digital communications, and image and video compression. He invented key algorithms for VSB demodulation and HDTV video processing in the first generation ATSC system. He pioneered hierarchical modulation for satellite communication that resulted in commercialization of video transmission. He has published more than 50 articles in peer reviewed scientific and engineering journals, and more than 40 U.S. patents in digital communications and video processing.

W3. PHY/MAC Technologies for Future Wireless Systems I
Friday, May 9, 16:10–17:50

Session Chair:

V. K. Varma Gottumukkala

University of Texas at Dallas

BIOGRAPHY:

V.K. Varma Gottumukkala received the B.Tech. degree from the Indian Institute of Technology Delhi, New Delhi, India, the Master's degree in electrical engineering from Texas A&M University, College Station, Texas and the Ph.D. degree in electrical engineering from the University of Texas at Dallas, Richardson, Texas. He is currently working in Qualcomm, San Diego as a Senior Engineer. His research interests are in the broad areas of wireless communications, software engineering, algorithms, and networking.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I

Energy-harvesting wireless communications in fading channels

Xiaodong Wang

Columbia Univ.

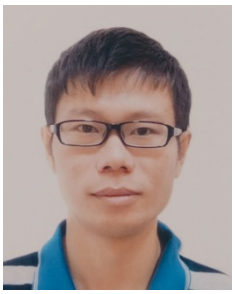
ABSTRACT:

Wireless communications powered by renewable energy sources in terms of energy harvesting devices have attracted significant recent interest. We consider the transmitter energy scheduling for a fading channel with energy harvesting, constrained by the availability of the energy, the capacity of the battery, and the maximum power of the transmitter. We give an overview on our recent works related to the energy scheduling algorithms for energy harvesting transmitters, obtaining the optimal (or approximately optimal) energy schedules with low computational complexity for various cases, including both the single-user and multiple-user cases, and under both the non-causal and the causal channel state information.

BIOGRAPHY:

Xiaodong Wang received the Ph.D degree in Electrical Engineering from Princeton University. He is a Professor of Electrical Engineering at Columbia University in New York. Dr. Wang's research interests fall in the general areas of computing, signal processing and communications, and has published extensively in these areas. Among his publications is a book entitled ``Wireless Communication Systems: Advanced Techniques for Signal Reception", published by Prentice Hall in 2003. His current research interests include wireless communications, statistical signal processing, and genomic signal processing. Dr. Wang received the 1999 NSF CAREER Award, the 2001 IEEE Communications Society and Information Theory Society Joint Paper Award, and the 2011 IEEE Communication Society Award for Outstanding Paper on New Communication Topics. He has served as an Associate Editor for the IEEE Transactions on Communications, the IEEE Transactions on Wireless Communications, the IEEE Transactions on Signal Processing, and the IEEE Transactions on Information Theory. He is a Fellow of the IEEE and listed as an ISI Highly-cited Author.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I



Throughput Optimized Multi-Source Cooperative Networks With Compute-and-Forward

Zhi Chen

University of Waterloo

ABSTRACT:

In this work, we investigate a multi-source multi-cast network with the aid of multiple relays, where it is assumed that no direct link is available at each S-D pair. The aim is to maximum the common multicast throughput of all source nodes. A transmission protocol employing the relaying strategy, namely, compute-and-forward (CPF), is proposed. Both the delay-stringent transmission and the delay-tolerant transmission applications are investigated. The associated optimization problems to maximum the short-term and long-term common multicast throughput are formulated and solved. Performance comparisons show that the CPF strategy outperforms conventional decode-and-forward (DF) strategy.

BIOGRAPHY:

Zhi Chen received the B.S. degree in electrical and computer engineering from the University of Electronic Science and Technology of China, ChengduChina, in 2006 and the Ph.D. degree in electrical and computer engineering from Tsinghua University, Beijing, China, in 2011. From 2012 to 2014, he was a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore, Singapore. In 2014, he joined the University of Waterloo, Waterloo, ON, Canada, as a Postdoctoral Fellow. His research interests include two-way relaying, cognitive radio, energy harvesting, green communication, and other topics on wireless communication.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I

Differential Space-Time Modulation Using DAPSK

Chi-Hua Huang

Graduate Institute of Communication Engineering
National Taiwan University

ABSTRACT:

A new differential space-time modulation using diversity-encoded differential amplitude and phase shift keying (DAPSK) is proposed for the multiple-input multiple-output (MIMO) system over independent and identically distributed (iid) time-correlated Rayleigh fading channels. An asymptotic maximum-likelihood (AML) receiver is developed for diversity-encoded DAPSK. The bit error probability (BEP) upper bound is analyzed over iid time-correlated Rayleigh fading channels. Moreover, an approximate BEP upper bound is also derived for iid time-invariant Rayleigh fading channels with high received signal-to-noise power ratio. A design criterion in terms of this approximate bound is developed to determine the appropriate diversity encoding coefficients for the proposed DAPSK MIMO system. Performance results show that the AML receiver for diversity-encoded DAPSK offers the best error performance among conventional noncoherent MIMO systems.

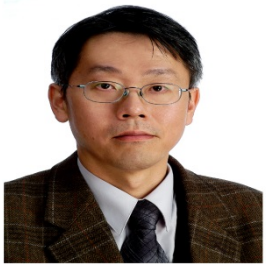
BIOGRAPHY:

Chi-Hua Huang was born in Kaohsiung, Taiwan, in 1984. He received the B.S. degree in electrical engineering from the National Cheng Kung University, Tainan, Taiwan, ROC, in 2006. He is currently working toward the Ph.D. degree in communication engineering at the National Taiwan University. His current research interests include digital communication theory and wireless communications.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I

Char-Dir Chung

Department of Electrical Engineering
National Taiwan University



BIOGRAPHY:

Char-Dir Chung received the B.S. degree in electrical engineering from the National Taiwan University (NTU), Taipei, in 1983, and the M.S. and Ph.D. degrees in electrical engineering from the University of Southern California, Los Angeles, in 1986 and 1989, respectively.

From 1989 to 1992, Dr. Chung was with the LinCom Corporation, Los Angeles, where he worked on analytical and simulation modeling of scientific and military satellite communication systems. From 1992 to 2005, he joined the faculty of the National Central University (NCU) in Taiwan. At NCU, he founded the Advanced Communication Laboratory in 1998, the Graduate Institute of Communication Engineering in 2000 and the Communication Engineering Department in 2003, and was the founding heads of these organizations. Since 2005, he has been on the faculty of the National Taiwan University, where he is now a Distinguished Professor of the Electrical Engineering Department and the Graduate Institute of Communication Engineering. Prof. Chung was endowed with the SiS Technology Chair for the 2009 academic year at NTU. His current research interests include digital modulation theory, wireless communications, spread spectrum communications and statistical signal processing. He has published more than 80 journal and conference papers and holds 6 patent rights in these areas.

Dr. Chung received the Group Achievement Award from the National Aeronautics and Space Administration, USA, in 1991; the Young Scientists Award from the International Union of Radio Science in 1993; the annual Research Award from the National Science Council, ROC, in 1992 and from 1994 to 2001, the Kentucky Colonel grade from the Commonwealth of Kentucky, USA, in 2003, and the FORMOSAT-2 Satellite Project Award from the National Space Center, ROC, in 2005. In 2005, Dr. Chung was ranked as the first-grade project investigator by the National Science Council, ROC. He served as the Chairman of IEEE Information Theory Society, Taipei Chapter, from 1997 to 1999, and the Secretary of Taipei Section from 2007 to 2008. He was an editor for the Journal of the Chinese Institute of Electrical Engineering from 2000 to 2004 and an editor for the Magazine of the same organization from 2003 to 2008. He was a guest co-editor for the IEEE Transactions on Vehicular Technology (Special Issue on Intelligent Transportation Systems and Telematics Applications) in 2008. Dr. Chung is a Fellow of the IEEE.

Dr. Chung has been very active in the industrial development and government services in ROC. From 2004 to 2008, he served as the chairman of the Taiwan Broadband Wireless Communications Industrial Alliance and the chair of the Wireless System Group of the National Science and Technology Program for Telecommunications. In 2001, Dr. Chung joined the Technology Review Board of the Ministry of Economic Affairs, and acted as the Chairman of the Commissioner Group of Computer, Consumer Electronics, Communications, Optoelectronics, and Semiconductor Electronics from 2005 to 2008. Dr. Chung acted as the Deputy Executive Secretary of the Science and Technology Advisory Group, the National Information and Communication Initiative Committee, and the National Information and Communication Security Taskforce from 2008 to 2011, and as the Executive Secretary of the Digital Convergence Taskforce from 2011 to 2012, all under the Executive Yuan (the Cabinet) in ROC and was involved in cross-ministry national policy making and coordination in the science and technology areas including information and communications, information security, digital convergence, and electronics.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I

Pilot-Data Power Allocation for OFDM Systems with Amplify and Forward Relays

V. K. Varma Gottumukkala

University of Texas at Dallas

ABSTRACT:

A three node amplify and forward (AF) relay system over a frequency-selective channel employing OFDM modulation is considered and the pilot-data power allocation that maximizes a lower bound on system capacity is obtained. The source transmits pilot tones, which are multiplexed with data tones, so that the destination can estimate the overall equivalent channel and perform data detection. Assuming no channel state information (CSI) at the transmitter and as in a practical system, allowing for imperfect channel estimation, a closed-form solution for the pilot-data power allocation is obtained at high SNR regime. An expression for the pilot-data power allocation is obtained for low SNR regime which can be solved numerically for the general case of arbitrary power delay profiles. For the special case of uniform power delay profile of the equivalent channel, a closed-form solution is provided. Simulations are used to verify the derived results and show performance comparisons of capacity bound and symbol error rate.

BIOGRAPHY:

V.K. Varma Gottumukkala received the B.Tech. degree from the Indian Institute of Technology Delhi, New Delhi, India, the Master's degree in electrical engineering from Texas A&M University, College Station, Texas and the Ph.D. degree in electrical engineering from the University of Texas at Dallas, Richardson, Texas. He is currently working in Qualcomm, San Diego as a Senior Engineer. His research interests are in the broad areas of wireless communications, software engineering, algorithms, and networking.

W3. Technical Session: PHY/MAC Technologies for Future Wireless Systems I

Performance of Relay with Multilayer STBC Uplink Wireless Communication for Multiple Access Channel

M.M.Kamruzzaman

Key Lab of Information Coding & Transmission, Southwest Jiaotong University, China

ABSTRACT:

In this paper, performance of Multi-Layered STBC (MLSTBC) is investigated in the presence of rayleigh fading for relay assisted Multiple-Input Multiple-Output (MIMO) system. Space Time Block Coding (STBC) is used for encoding the information at user's handset because the channel from handset to relay is bad-state channel and STBC is more suitable for bad-state channel to obtain low BER. On the other hand, MLSTBC is used to re-encode the data at relay. STBC provides diversity gain but does not provide multiplexing gain. On the other hand, MLSTBC provides both diversity and multiplexing gain. So we can install large number of antennas at relay by using MLSTBC to improve the capacity of second hop. The capacity of whole system also increases for using large number of antennas at relay with acceptable BER. Simulation and analytical results are presented to show the performance of the proposed system.

BIOGRAPHY:

M. M. Kamruzzaman was born in Bangladesh in 1978. He received B.E. degree in Computer Science and Engineering from Bangalore University, Bangalore, India in 2001, M.S. degree in Computer Science and Engineering from United International University, Dhaka, Bangladesh in 2009. At present he is studying PhD in the department of Information & Communication Engineering at Southwest Jiaotong University, Chengdu, Sichuan, China.

After completing B.E, he worked several universities as a faculty. He worked in Islamic Institute of Technology, Bangalore, India and Leading University, Dhaka, Bangladesh. And before studying PhD, he was working as a faculty of Presidency University, Dhaka, Bangladesh. He is a member of TPC of several international conferences and reviewer of few international journals and conferences.

His areas of interest include wireless communications, modern coding theory, Turbo coding, Space Time Coding, VBLAST, MIMO, OFDM, Relay, Multi-User MIMO System, WCDMA, WiMAX and LTE system.

W4. Wireless Cognitive Radio and Networks
Saturday, May 10, 9:00–10:40

Session Chair:

Yu-dong Yao

Department of Electrical and Computer Engineering
Stevens Institute of Technology
Hoboken, NJ 07030

BIOGRAPHY:

Yu-Dong Yao received B.Eng. and M.Eng. degrees from Nanjing University of Posts and Telecommunications, Nanjing, China, in 1982 and 1985, respectively, and the Ph.D. degree from Southeast University, Nanjing, China, in 1988, all in electrical engineering. He has been with Stevens Institute of Technology, Hoboken, New Jersey, since 2000 and is currently a professor and department director of electrical and computer engineering. Previously, from 1989 to 1990, he was at Carleton University, Ottawa, Canada, as a Research Associate working on mobile radio communications. From 1990 to 1994, he was with Spar Aerospace Ltd., Montreal, Canada, where he was involved in research on satellite communications. From 1994 to 2000, he was with Qualcomm Inc., San Diego, CA, where he participated in research and development in wireless code-division multiple-access systems.

Dr. Yao's research interests include wireless communications and networks, spread spectrum and CDMA, antenna arrays and beamforming, cognitive and software defined radio (CSDR), and digital signal processing for wireless systems. He holds one Chinese patent and thirteen U.S. patents. Dr. Yao was an Associate Editor of IEEE Communications Letters (2000-2008) and IEEE Transactions on Vehicular Technology (2001-2006), and an Editor for IEEE Transactions on Wireless Communications (2001-2005). He was elected an IEEE Fellow in 2011 for his contributions to wireless communications systems. In 2013, he received the Advancement of Invention Award from New Jersey Inventors Hall of Fame.

W4. Technical Session: Wireless Cognitive Radio and Networks

Cooperative Routing for Cognitive Radio Networks using Mutual-Information Accumulation

Lingjia Liu, Ph.D.

Assistant Professor
Electrical Engineering and Computer Science Department
University of Kansas, Lawrence, KS, 66044, USA

BIOGRAPHY:

Lingjia Liu, received the Ph.D. degree at Texas A&M University in Electrical and Computer Engineering, the B.S. degree with highest honor at Shanghai Jiao Tong University in Electronic Engineering. He is currently working as an Assistant Professor in the Electrical Engineering and Computer Science Department at the University of Kansas (KU). Prior to joining the EECS at KU, he spent more than three years in Samsung Research America (SRA) leading Samsung's work on downlink multi-user MIMO, Coordinated multipoint (CoMP) transmission, and Heterogeneous Networks for 3GPP LTE/LTE-Advanced standards. His research is currently funded by National Science Foundation (NSF), U.S. Air Force Office of Scientific Research, U.S. Air Force Research Laboratory, Samsung Research America, and University of Kansas Center for Research Inc.

Lingjia Liu is a recipient of the Texas Telecommunications Engineering Consortium (TxTEC) Fellowship from the Department of Electrical and Computer Engineering at Texas A&M University in 2003 - 2004. He received the Global Samsung Best Paper Award in 2008 and 2010 respectively. He is the best paper finalist for the ICC 2012 Wireless Communication Symposium (5/508). In 2013 and 2014, he has been selected as the Air Force Summer Faculty Fellow. He has also been selected by the National Engineers Week Foundation Diversity Council as New Faces of Engineering 2011.

Lingjia Liu is currently serving as Technical Program Committee (TPC) co-chairs and Members of various international conferences and workshops. He is the TPC co-chair of three consecutive international workshops on 5G technologies. He has been frequently invited to serve on the NSF proposal review panels. He is also serving as an Editor for *IEEE Transactions on Wireless Communications*, and as Associate Editors for EURASIP Journal on Wireless Communications and Networking as well as Wiley's International Journal on Communication Systems. He has 15+ journal publications, 25+ conference papers, 10+ US patents, 30+ US patent applications, 10+ essential intellectual property rights (IPRs), and numerous technical contributions to major wireless standards including both 3GPP LTE/LTE-Advanced and *IEEE 802.16m*.

A Weighted Cooperative Spectrum Sensing Scheme Based on Dynamic Double Energy Thresholds In Cognitive Radio Networks

Tangsen Huang

South China University of Technology

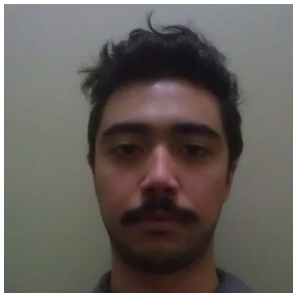
ABSTRACT:

Energy detection is a promising spectrum sensing method. Setting suitable threshold is very important to the performance of the spectrum sensing. To improve the global spectrum sensing performance, this paper proposes a novel weighted cooperative spectrum sensing scheme based on dynamic double energy thresholds. Firstly, an optimal energy threshold is obtained by minimizing the sum of probabilities of false alarm and detection. Then, a control parameter is introduced to accurately fine tune the double energy thresholds. Finally, a new fusion method which applies weighted and majority rule in cooperative sensing is presented. Simulation results demonstrate that the probability of detection is improved significantly by our spectrum sensing scheme under different signal to noise ratio.

BIOGRAPHY:

Tangsen Huang received B.Eng. degree in Electronic Information Engineering from Hunan University of Technology, China in 2004, He received M. Eng. Degree in Signal and Information Processing from Guilin University of Electronic Science and Technology, China in 2007. He worked as a teacher in Hunan Institute of Science and Technology, China. He is pursuing Ph.D. in the School of Electronic and Information Engineering, South China University of Technology, Guangzhou, China. His research interests are wireless communication, cognitive radio, ultra-wideband and wireless sensor networks.

W4. Technical Session: Wireless Cognitive Radio and Networks



Algorithm and Experimentation of Frequency Hopping, Band Hopping, and Transmission Band Selection Using a Cognitive Radio Test Bed

Hasan Shahid

Stevens Institute of Technology
One Castle Point on Hudson, Hoboken, NJ 07030
Hshahid126@gmail.com

ABSTRACT:

A cognitive radio test bed was designed and developed using an Ettus Research USRP and GNU Radio. Experimentations were performed to test cognitive radio algorithms and features of frequency hopping, band hopping, and transmission band selection for interference avoidance. A secondary user device scans a 200 MHz frequency range, which contains five 40 MHz bands. The secondary user performs frequency band selection based on system noise and interference characteristics. Experiments demonstrate good channel selection and interference avoidance performance.

BIOGRAPHY:

Hasan Shahid is an undergraduate student at Stevens Institute of Technology, majoring in Electrical Engineering, concentrating in Wireless Communications, and minoring in Music and Technology. He is expected to earn his B.E. in Electrical Engineering in May 2014. He is a brother of Phi Sigma Kappa Fraternity, a student member of IEEE, and a member of the Eta Kappa Nu Honor Society. His research interests include cognitive radio, spectrum allocation and management, spectrum sensing, and signal processing.

W4. Technical Session: Wireless Cognitive Radio and Networks

Cooperative Spectrum Sensing with Energy-Efficient Sequential Decision Fusion Rule

Hongzhi Luan

National Digital Switching System Engineering & Technology R&D Center
Zhengzhou, P.R. China

ABSTRACT:

Energy efficiency is an important issue in Cooperative Spectrum Sensing (CSS). In this paper, an energy-efficient Sequential Decision Fusion (SDF) scheme based on K-out-of-N rule is proposed. By fusing the received decisions sequentially, Fusion Center (FC) may achieve a global decision before receiving all individual decisions. We verify that the performance of CSS using the proposed scheme is completely equal to the conventional CSS where FC adopts all decisions. Average number of decisions required at FC is also investigated. Numerical results show that SDF reduces the average number of decisions required dramatically without any loss in sensing performance.

BIOGRAPHY:

Hongzhi Luan, received the B.E. degree in Electrical and Electronic Engineering from Tsinghua University, China, in 2011. He is currently pursuing his PhD in Communication Engineering at National Digital Switching System Engineering & Technology R&D Center, China. His research interests are in the areas of wireless communications and signal processing, especially in cognitive radio networks.

W5. Emerging Mobile Applications and Services
Saturday, May 10, 14:00–15:40

Session Chair:

Moutaz Saleh

Department of Computer Science & Engineering , Qatar University

BIOGRAPHY:

Moutaz Saleh is serving at Qatar University as both Lecturer of computer science in the department of computer science & engineering and Cisco instructor in the Cisco Regional Academy. He earned his PhD in Computer Networks in 2008 from the National University of Malaysia (UKM). Dr. Saleh is a Cisco Certified Internetwork Expert (CCIE) who served various networking positions and published over 30 research papers in reputable international journals and conferences. His main research interests include assistive technology for special needs and quality of service (QoS) scheduling for packet networks. On assistive technology, his research work focuses on designing edutainment systems with tangible user interface (TUI) aimed at promoting both learning and physical activities for children with intellectual challenges. On network scheduling the focus is on investigating the effect of considering hierarchical scheduling for providing significant enhancements on QoS guarantees in packet network.

W5. Technical Session: Emerging Mobile Applications and Services

Distance Measurement using Narrowband ZigBee Devices

Florian BARRAU

STMicroelectronics, 850 Rue Jean Monnet 38920 Crolles, France
IM2NP/ISEN, Place Georges Pompidou, 83000 Toulon, France

ABSTRACT:

Zigbee, also known as IEEE 802.15.4 is a popular wireless communication standard developed for simple low-power and low-cost wireless applications. One of these applications is local positioning, which consists in inferring the position of a device in real time. In this presentation, a new approach to precisely measure distance using standard ZigBee devices is presented. The measurement uses only a 2 MHz bandwidth channel and compensate the lack of bandwidth by using an original technique for measuring Time Of Arrival. Simulations show that our method achieves a standard deviation of 33 cm, which is better than other approaches in the same testing conditions. The technique is tested under a real indoor environment, and the results are finally compared with the simulations.

BIOGRAPHY:

Florian BARRAU was born in Toulon, France, in 1987. He received his Electronic Engineering Degree from the ISEN-Toulon engineering school. He is currently working toward the Ph.D degree at the Institute of Micro and Nanoelectronics of Provence (IM2NP), Aix-Marseille University. In 2012, he joined the Department of Central CAD Design Solutions, STMicroelectronics where he is working in R&D. His research interests are low-cost localization systems for ZigBee and sensor network applications.

W5. Technical Session: Emerging Mobile Applications and Services

Use of Field and Lab-Calibrated Real-Time Communications Effects to Assess End-to-End System of Systems (SoS) Performance

Dennis Bushmitch

US Army

ABSTRACT:

It is critical for the ARMY to have robust capability to test and evaluate the operational capabilities of the newly-developed mission command systems in a realistic tactical communication environment. Performance of the modern tactical transport networks of radios heavily depends on the scale of the network amongst other factors. This presents challenges to procuring enough radio assets for testing activities, especially if the radio waveform is early in its development cycle. To address this, many network emulators have been developed and are capable of producing the real-time communications effect of the transport network. The common approach taken is to "instantiate" the transport network either by developing simulation models in the emulator or by porting the actual waveform code into the emulator. This significantly increases the cost and time, both in developing the emulator and in running the tests. For example, behavior change in the waveform or adding a new waveform into the emulator becomes a costly and time consuming M&S development activity requiring verification and validation (V&V). In this paper we describe a new transport network emulator: the Communications Effect Server PLUS (CES+). In CES+, instead of instantiating waveforms, the end-to-end waveform behavior in terms of its packet loss, latency and their distribution are stored in a database as a function of the network loading and other networking conditions. The database obtains values from either field/lab data or from high-fidelity simulation models that have in turn been calibrated against field and lab test data. As such, waveform update becomes an activity of database update with new measurements, not an M&S model development activity. Novel principles described in this paper are utilized in CES+ to approximate the tactical transport networks performance at scale with most accuracy. To date, CES+ has been extensively used by the Army in various design and developmental test activities, including evaluation of the network integration readiness levels (NIRLs) and integrated performance of the digital Fires systems.

BIOGRAPHY:

Dr. Dennis Bushmitch is an inventor, prolific technical author and has been a chief analyst for several Army programs. He holds a Master of Science degree and a Doctorate in Electrical Engineering from the Polytechnic Institute of the New York University. He is a member of the Army Acquisition Corps and is L3 SPRDE Systems Engineering certified.

W5. Technical Session: Emerging Mobile Applications and Services

Pervasive Mobile Gaming System for Obesity Treatment

Moutaz Saleh

Department of Computer Science & Engineering , Qatar University

ABSTRACT:

Obesity is one of the rise and among the top health risk factors in the world affecting people of all ages. It can lead to many problems including increased risk of cardiovascular disease, diabetes, functional limitations, and disabilities which adversely affect the social and physical abilities of the obese person in daily affairs. While the rising trend of obesity in adults is a serious problem, the rise of obesity in youths is even more severe. Various recent studies have indicated that youth obesity has become so widespread that, if left unaddressed, it would have severe implications on the society's health, productivity, and economy. This paper proposes a multiplayer pervasive gaming system which unveil the hidden potential within obese youth and improve their skills and physical activities and get them healthy. This is intended to be done through the use of wireless sensors on smart phones, to provide real time monitoring of the patient's bio signals and to suggest suitable actions in terms of physical activity. The system is aimed to engage and encourage youth, particularly in the State of Qatar, in their obesity rehabilitation process, increase their social activities, and help them get healthy in an entertaining way while reinforcing positive exercise habits.

BIOGRAPHY:

Moutaz Saleh is serving at Qatar University as both Lecturer of computer science in the department of computer science & engineering and Cisco instructor in the Cisco Regional Academy. He earned his PhD in Computer Networks in 2008 from the National University of Malaysia (UKM). Dr. Saleh is a Cisco Certified Internetwork Expert (CCIE) who served various networking positions and published over 30 research papers in reputable international journals and conferences. His main research interests include assistive technology for special needs and quality of service (QoS) scheduling for packet networks. On assistive technology, his research work focuses on designing edutainment systems with tangible user interface (TUI) aimed at promoting both learning and physical activities for children with intellectual challenges. On network scheduling the focus is on investigating the effect of considering hierarchical scheduling for providing significant enhancements on QoS guarantees in packet network.

W6. PHY/MAC Technologies for Future Wireless Systems II
Saturday, May 10, 16:10–17:50

Session Chair:

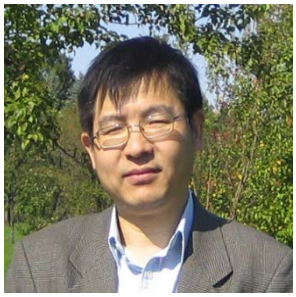
Ramiro Sámano Robles

Instituto de Telecomunicações, Aveiro, Portugal

BIOGRAPHY:

Ramiro Samano Robles received his Bachelor degree in Telecommunications in 2001 from the National Autonomous University of Mexico. In 2003, he received his MSc degree in Telecommunications and Information Systems from the University of Essex, UK, and the PhD degree in cross-layer design and signal processing for wireless networks from the University of Leeds in 2007. He currently holds a post-doctoral position at the Instituto de Telecomunicações in Aveiro, Portugal. His main interests lie in the areas of MAC-PHY cross-layer design, random access protocols, distributed antenna systems, radio frequency identification, and shaped reflectors design for satellite communications. He has over 20 technical papers in international journals and conferences. He also has professional experience in major telecommunication carriers in Mexico. He has been involved in several national and European projects, namely the CODIV, FUTON, ASPIRE, UNITE, CADWIN, and QoSMOS.

W6. Technical Session: PHY/MAC Technologies for Future Wireless Systems II



Some Properties for Single Antenna Vector OFDM Systems

Xiang-Gen Xia

Department of Electrical and Computer Engineering
University of Delaware
Newark, DE 19716

ABSTRACT:

Over the past decades, dealing with intersymbol interference (ISI) has been the main subject in physical layer communications systems, such as in wireline computer modem designs and wireless cellular and WiFi systems. The increasing of a channel bandwidth causes the increasing of the ISI channel length. In this talk, I will talk about single antenna vector OFDM (V-OFDM) systems. V-OFDM is a bridge of the OFDM and the single carrier frequency domain equalizer (SC-FDE) that are used in LTE as downlink and uplink, respectively. V-OFDM provides the flexibility of choosing a level of ISI for any fixed channel length (or channel bandwidth). I will talk about linear receivers and their properties for V-OFDM systems.

BIOGRAPHY:

Xiang-Gen Xia received his B.S. degree in mathematics from Nanjing Normal University, Nanjing, China, and his M.S. degree in mathematics from Nankai University, Tianjin, China, and his Ph.D. degree in electrical engineering from the University of Southern California, Los Angeles, in 1983, 1986, and 1992, respectively. He is currently the Charles Black Evans Professor, Department of Electrical and Computer Engineering, University of Delaware, Newark, Delaware, USA. Dr. Xia was the Kumar's Chair Professor Group Professor (guest) in Wireless Communications, Tsinghua University, during 2009-2011, the Chang Jiang Chair Professor (visiting), Xidian University, during 2010-2012, and the WCU Chair Professor (visiting), Chonbuk National University, during 2009-2013. Dr. Xia's current research interests include space-time coding, MIMO and OFDM systems, digital signal processing, and SAR and ISAR imaging. He has over 270 refereed journal articles published and accepted, and 7 U.S. patents awarded and is the author of the book Modulated Coding for Intersymbol Interference Channels (New York, Marcel Dekker, 2000).

Dr. Xia received the National Science Foundation (NSF) Faculty Early Career Development (CAREER) Program Award in 1997, the Office of Naval Research (ONR) Young Investigator Award in 1998, and the Outstanding Overseas Young Investigator Award from the National Nature Science Foundation of China in 2001. He also received the Outstanding Junior Faculty Award of the Engineering School of the University of Delaware in 2001. He is currently serving and has served as an Associate Editor for numerous international journals including IEEE Transactions on Signal Processing, IEEE Transactions on Wireless Communications, IEEE Transactions on Mobile Computing, and IEEE Transactions on Vehicular Technology. Dr. Xia is Technical Program Chair of the Signal Processing Symp., Globecom 2007 in Washington D.C. and the General Co-Chair of ICASSP 2005 in Philadelphia. He is a Fellow of IEEE.

W6. Technical Session: PHY/MAC Technologies for Future Wireless Systems II

Linear Diversity Analysis for QAM in Rician Fading Channels

Russell Sun

Alcatel-Lucent Technologies
Murray Hills, NJ 07974

ABSTRACT:

An exact and general closed-form expression of the Bit Error Rates (BER) for rectangular type of Quadrature Amplitude Modulation (QAM) over slow, flat, Rician fading channels are derived analytically when the Maximal-Ratio Combining (MRC) technique is applied to mitigate degradation from multipath fading and fluctuation. The paper starts with a non-traditional expression of BER for a single-link QAM signal in AWGN channel, followed by averaging over the additional effects of channel fading and diversity combining to complete the analysis. The analysis for Rayleigh fading is included as a special case. Finally, the derivation also covers the more popular square type of QAM systems as degenerated case.

BIOGRAPHY:

Dr. Russell Sun graduated from the Communication Science Institute of the University of Southern California and got Ph.D. in Electrical Engineering.

While at USC, he was a Research Assistant with Communication Science Institute (CSI) and worked on the advanced study of the advanced radar systems for several military projects principally investigated by Dr. Irving S. Reed. Dr. Sun joined Network Wireless division of Lucent Technologies in 1996. He had led the TDMA radio performance team and been responsible for radio technology lab measurement, performance analysis and base band algorithm design. Then he worked at the Forward Looking and Advanced Technology Laboratory on CDMA2000, IEEE802.16e/Mobile WiMAX, UMTS/WCDMA and LTE physical layer algorithm design/performance analysis. He worked at Chief Technology Officer (CTO) office on advanced wireless technology research. Currently he leads the algorithm design and performance analysis in system on chip (SOC) of the next generation Light Radio. His professional interests include RF performance measurements/testing, statistical communication theory, digital signal processing techniques, channels coding, spread spectrum communications, OFDMA systems, MIMO, channel estimation, SINR estimation and transceiver design.

W6. Technical Session: PHY/MAC Technologies for Future Wireless Systems II

Trade-off performance regions of random access protocols with multi-packet reception via multi-objective optimization

Ramiro Sámano Robles

Instituto de Telecomunicações, Aveiro, Portugal

ABSTRACT:

This paper revisits the study of random access protocols enabled with multi-packet reception capabilities (MPR) using multi-objective optimization tools. The work is focused on the characterization of the boundary (envelope) or the Pareto front curve of different types of trade-off performance region: the conventional throughput region, sum-throughput vs. fairness, and sum-throughput vs. power consumption. Fairness is evaluated by means of the Gini-index, which is a metric used in economics to measure income inequality. Transmit power is directly linked to the global transmission rate. For simplicity in the analysis, this paper focuses on a two-user Slotted ALOHA (S-ALOHA) system enabled with MPR. The results provide useful insights into the operation of MPR protocols under different reception scenarios. In weak MPR conditions, it is observed that the system has problems in achieving simultaneously good fairness and high sum-throughput, due to a non-convex throughput region. On the contrary, in scenarios with strong MPR, good fairness and high sum-throughput can be simultaneously achieved at the expense of high power consumption.

BIOGRAPHY:

Ramiro Samano Robles received his Bachelor degree in Telecommunications in 2001 from the National Autonomous University of Mexico. In 2003, he received his MSc degree in Telecommunications and Information Systems from the University of Essex, UK, and the PhD degree in cross-layer design and signal processing for wireless networks from the University of Leeds in 2007. He currently holds a post-doctoral position at the Instituto de Telecomunicações in Aveiro, Portugal. His main interests lie in the areas of MAC-PHY cross-layer design, random access protocols, distributed antenna systems, radio frequency identification, and shaped reflectors design for satellite communications. He has over 20 technical papers in international journals and conferences. He also has professional experience in major telecommunication carriers in Mexico. He has been involved in several national and European projects, namely the CODIV, FUTON, ASPIRE, UNITE, CADWIN, and QoSMOS.

W6. Technical Session: PHY/MAC Technologies for Future Wireless Systems II

A Low Complexity Physical-Layer Network Coding Scheme for Cellular Two-Way Relaying Systems

Zhaoxi Fang

Zhejiang Wanli University

ABSTRACT:

This paper considers transceiver design for multiuser cellular two-way relay network (cTWRC), where a multi-antenna base station (BS) exchanges information with multiple single-antenna mobile stations (MSs) with the help of a multi-antenna relay station (RS). We propose a low complexity two-way relaying scheme for cTWRC via signal space alignment. In our scheme, the precoders at the BS and MSs are jointly designed that the two data streams delivered to and from the same MS fall in the same spatial direction at the RS. With such signal space alignment, interference-free physical-layer network coding can be performed at the relay. We analyze the end-to-end sum bit error rate (BER) performance of the proposed scheme and investigate the optimal power allocation at the BS and RS to improve the BER performance. Numerical results demonstrate that our scheme is superior to the existing amplify-and-forward based signal alignment schemes.

BIOGRAPHY:

Zhaoxi Fang received the B. Eng. in communication engineering and the Ph.D. degree in electrical engineering from Fudan University, Shanghai, China, in 2004 and 2009, respectively. In June 2009, he joined the School of Electronic and Information Engineering, Zhejiang Wanli University, Ningbo, China, where he is now an Associate Professor. His research interests include iterative detection, frequency domain equalization, and cooperative communications.

O1. High Speed Transmission
Friday, May 9, 9:00–10:40

Session Chair:

(Jessica) Xin Jiang

Dept. of Engineering Science and Physics
College of Staten Island
City University of New York, NY 10314
Jessica.jiang@csi.cuny.edu

BIOGRAPHY:

(Jessica) Xin Jiang is an associate professor in Engineering Science and Physics Department at the College of Staten Island (CSI), the City University of New York (CUNY). Dr. Jiang received her B.S. M.S., and Ph.D. degrees in Electrical Engineering from Tshinghua University, Beijing, China. She continued her research works at the University of Southern California on high speed optical systems and networks, and later worked for the Photonic Research and Test Center of Corning Corporate as a senior research scientist, where her research concentrated on linear and nonlinear impairments in high data rate transmission. Prior to joining the CSI faculty, Dr. Jiang has held multiple engineering and management positions in several high-tech companies, such as Hitachi, Opvista, Corvis, and Tyco Electronics, involved in state-of-the-art telecommunication products developments, which covered areas of transoceanic systems, long-haul backbone systems, metro networks, and access networks. She has gained significant advanced and practical working experience in both academic and industrial fields. At CSI, Dr. Jiang continues her research on broadband communication technology and has built an advanced optical communication system lab to explore the methods and apparatus to enhance and optimize the high speed telecommunication and data communication systems and networks.

O1. Technical Session: High Speed Transmission

Non-Data-Aided Chromatic Dispersion Estimation for Nyquist Spectrally Shaped Fiber Transmission Systems

Junyi Wang[1], Xin Jiang[2], Yi Weng[3], Xuan He[3], and Z. Pan[3]

[1.] LinkQuest Inc., 6749 Top Gun Street, San Diego, CA 92121, USA.
[2.] Department of Engineering Science and Physics, College of Staten Island, New York, NY 10314, USA.
[3.] Department of Electrical and Computer Engineering, University of Louisiana at Lafayette, Lafayette, LA 70504, USA.

ABSTRACT:

We investigate a non-data-aided chromatic dispersion estimation based on a polynomial fitting algorithm for root-raised-cosine (RRC) Nyquist spectrally shaped fiber transmission systems. We compare the performances of the estimation method on RRC spectrally shaped systems and regular non-return-to-zero systems. At a same symbol rate, a signal with a narrower spectrum has a lower estimation accuracy using a same estimation time window. The estimation accuracy can be improved by increasing the time window. With an OSNR at a bit error rate at a FEC-limit or 3.8×10^{-3}, 112 Gbit/s Nyquist PDM-QPSK with RRC 0.1 spectral shaping requires 8192 symbols to achieve a measured standard deviation below 200 ps/nm, and 224 Gbit/s Nyquist PDM-16QAM with the same spectral shape requires 4096 symbols to achieve a measured standard deviation below the same level.

BIOGRAPHY:

Junyi Wang received his M.Sc. degree from the Huazhong University of Science and Technology, Wuhan, China, in 2007. He received his Ph.D. degree from the Department of Electrical and Computer Engineering, University of Louisiana at Lafayette, Lafayette, in 2013. From 2007 to 2008, he was with Huawei Technologies Co. Ltd. He had two summer internships and one summer collaboration in Bell Labs, Alcatel-Lucent, Holmdel, New Jersey, USA. In 2013, he joined LinkQuest Inc., San Diego, California, USA. His research focuses on digital signal processing in coherent optical fiber communications, including wavelength-division-multiplexing systems with Nyquist spectral shaping, chromatic dispersion and polarization mode dispersion monitoring with coherent receivers, maximum a posteriori detection, etc. Dr. Wang was a reviewer for Optics Express and IEEE Journal of Lightwave Technology.

O1. Technical Session: High Speed Transmission

High Spectral Efficiency Nyquist Optical Superchannel Transmission

Fan Zhang

Peking university

ABSTRACT:

In this paper, we briefly review high spectral efficiency optical superchannel transmission with Nyquist pulse shaping. Afterwards we present the principle of coherent optical Nyquist single carrier (SC) systems with frequency domain channel estimation and time domain equalization (FDTDE) with nonlinear compensation scheme coordinated. With this technique, Terabit polarization division multiplexed (PDM) 32 quadrature amplitude modulation (QAM) superchannel with Nyquist pulse shaping is generated and transmitted experimentally.

BIOGRAPHY:

Fan Zhang received the Ph.D. degree in optical communication from Beijing University of Posts and Telecommunications in 2002. He was a senior research associate with City University of Hong Kong from 2002 to 2004, a Humboldt research fellow with Technische Universität Berlin From 2004 to 2006. He joined Peking university in May 2006, where his is now a full professor with school of electronics engineering and computer science. His current research interests include various aspects of long-haul optical transmission and photonic networking technologies, especially coherent communication and digital signal processing. He has authorized or co-authorized more than seventy academic articles in peer-reviewed international journals and prestigious conferences. Dr. Zhang is a senior member of the IEEE photonics society and a member of the Optical Society.

O1. Technical Session: High Speed Transmission

Directly Modulated VCSELs for 100-Gb/s and Beyond Metro Network Applications

Chongjin Xie

Bell Labs, Alcatel-Lucent
791 Holmdel-Keyport Road, Room L-141, Holmdel, NJ 07733
chongjin.xie@alcatel-lucent.com

ABSTRACT:

The rapid growth of Internet and cloud computing drives a huge demand for the capacity of communication networks. Systems operating at 100 Gb/s using polarization-division-multiplexed quadrature-phase-shift-keying (PDM-QPSK) and digital coherent detection have been deployed in optical transport networks, and 400-Gb/s and 1-Tb/s are being rolled out or are under development. There is also an urgent need to upgrade existing metro networks, currently operating at 10 Gb/s, to 100 Gb/s and beyond in order to adapt to increasing traffic demands.

A transparent channel in metro networks typically covers up to 600 km, much shorter than that in long haul networks. However, legacy metro network fibers have high polarization mode dispersion (PMD) and large variations of residual chromatic dispersion (CD), and moreover signals may need to go through many reconfigurable optical add-drop multiplexers (ROADMs) before reaching their destinations. Therefore, metro systems operating at 100-Gb/s and beyond are also required to have large tolerance to PMD, CD and ROADM filtering effects. Compared with optical transport networks, metro networks are much more sensitive to cost, footprint, and power consumption. One solution for 100-Gb/s and beyond metro systems is to leverage coherent technologies in transport networks, trading off cost and power consumption with performance. Significant developments have to be done to achieve small form factors, low power consumption and low cost to make them suitable for metro applications.

Vertical-cavity surface-emitting lasers (VCSELs) dominate short-reach and low-data-rate applications due to their low cost, energy efficiency, and footprint. Recently we showed the potentials of VCSELs for 100-Gb/s and beyond metro networks. Using 3-level pulse-amplitude modulation (3PAM) and 4PAM, polarization-division-multiplexing and digital coherent detection, we demonstrated hundreds of kilometers transmission over standard single-mode-fiber (SSMF) at a line rate of 100 Gb/s using directly modulated 1.55-μm single-mode VCSELs. A 400-Gb/s system using a directly modulated monolithic VCSEL array over 400 km SSMF has been demonstrated.

In this talk, we first briefly review a few 100-Gb/s technologies for metro applications and then present our recent studies on VCSEL modulation and detection techniques for 100-Gb/s and beyond metro networks.

BIOGRAPHY:

Dr. Chongjin Xie received his MSc and Ph. D from Beijing University of Posts and Telecommunications, China in 1996 and 1999, respectively. From 1999 to 2001, he worked at Photonics laboratory, Chalmers University of Technology in Gothenburg, Sweden for one and half years to conduct post-doctorate research. He joined Bell Laboratories, Lucent Technologies (now Alcatel-Lucent) in Holmdel, New Jersey, USA as a Member of Technical Staff in 2001, and was promoted to a Distinguished Member of Technical Staff in 2013. His research interests are in fiber optical communication systems and networks, including high-speed lightwave transmission, advanced modulation, detection and digital signal processing for optical communication systems, fiber nonlinearities and compensation, polarization effects and mitigation, optical performance monitoring, optical signal processing, etc. He has authored and co-authored more than 190 journal and conference publications, and two book chapters. He is an associate editor of Journal of Lightwave Technology, and has served in various conferences as chairs, TPC chairs or TPC members. Dr. Xie is a senior member of IEEE and a member of OSA.

O1. Technical Session: High Speed Transmission

Terabit Superchannels: Enabling Next Generation Optical Transmission and Networking

S. Chandrasekhar

Bell Labs, Alcatel-Lucent, Holmdel, NJ 07733

ABSTRACT:

Optical fiber transmission technologies with per-channel data rates beyond 100 Gb/s and up to 1 Tb/s are being actively researched worldwide for next generation transport systems to meet ever increasing capacity demands. To increase the overall network capacity of wavelength-division multiplexed (WDM) systems, high spectral efficiency (SE) modulation formats in conjunction with advanced digital signal processing (DSP) both at the transmitter and at the receiver with coherent digital reception are key enablers. In order to achieve net information rates in the 400-Gb/s to 1-Tb/s range, clever synthesis and detection approaches are being pursued. One approach draws its strength from the power of parallel processing. In this approach, multiple optical carriers are modulated individually at relatively lower symbol rates, and then combined to result in a multi-carrier system delivering the desired net data rate. Net information rates from 400-Gb/s to 10-Tb/s have been demonstrated using multi-carrier schemes. This method exploits the benefits of mature technologies at lower speeds and uses optical parallelization in the frequency domain to achieve high aggregate data rates beyond the limits of the electronics. A second approach follows traditional methods, where the modulation rate (or equivalently the symbol rate) of a single carrier has been progressively increased up to 100-Gbaud with both quadrature phase-shift keying (QPSK) and 16-level quadrature amplitude modulation (16-QAM) to achieve net information rates in excess of 600-Gb/s. This approach relies on ultra high speed analog-to-digital converters (ADCs) with very high sampling rates to achieve the desired performance.

This talk will review the different solutions that have been experimentally demonstrated, covering a range of approaches that include coherent optical orthogonal frequency division multiplexing (CO-OFDM), electronic pre-filtering (Nyquist-pre-filtered) single carrier, and high symbol rate modulation and reception. The talk will also briefly examine optical networking with superchannels in the emerging “flex-grid” re-configurable optical add/drop multiplexer (ROADM) architectures.

BIOGRAPHY:

S. Chandrasekhar received the Ph.D. degrees in physics from the University of Bombay, Bombay, India, in 1985. He joined Bell Labs in 1986. He initially worked on compound semiconductor devices for high-speed optoelectronic integrated circuits (OEIC's) and later in WDM Optical Networking at 40Gb/s and 100Gb/s. His current interests include coherent optical transmission systems for high spectral efficiency transport and networking beyond 100Gb/s, multi-carrier superchannels, and electronic digital signal processing for software-defined transponders. He is a DMTS at Bell Labs, a Fellow of the IEEE, a member of the IEEE Photonics Society and a Fellow of the Optical Society of America He was awarded the IEEE LEOS Engineering Achievement for 2000 and the OSA Engineering Excellence Award for 2004 for his contributions to OEICs and WDM systems research.

O2. Optical Interconnection and Networks
Friday, May 9, 14:00–15:40

Session Chair:

Chongjin Xie

Bell Labs, Alcatel-Lucent
791 Holmdel-Keyport Road, Room L-141, Holmdel, NJ 07733
chongjin.xie@alcatel-lucent.com

BIOGRAPHY:

Dr. Chongjin Xie received his MSc and Ph. D from Beijing University of Posts and Telecommunications, China in 1996 and 1999, respectively. From 1999 to 2001, he worked at Photonics laboratory, Chalmers University of Technology in Gothenburg, Sweden for one and half years to conduct post-doctorate research. He joined Bell Laboratories, Lucent Technologies (now Alcatel-Lucent) in Holmdel, New Jersey, USA as a Member of Technical Staff in 2001, and was promoted to a Distinguished Member of Technical Staff in 2013. His research interests are in fiber optical communication systems and networks, including high-speed lightwave transmission, advanced modulation, detection and digital signal processing for optical communication systems, fiber nonlinearities and compensation, polarization effects and mitigation, optical performance monitoring, optical signal processing, etc. He has authored and co-authored more than 190 journal and conference publications, and two book chapters. He is an associate editor of Journal of Lightwave Technology, and has served in various conferences as chairs, TPC chairs or TPC members. Dr. Xie is a senior member of IEEE and a member of OSA.

O2. Technical Session: Optical Interconnection and Networks

Space: Is It the Final Frontier of Photonics?

Mark D. Feuer

Department of Engineering Science & Physics
CUNY – The College of Staten Island, Staten Island, NY 10314
mark.feuer@csi.cuny.edu

ABSTRACT:

From 3D movies at 8K resolution to big data for urban planning to Internet thermostats, the future of our society depends on the transmission of ever-larger amounts of data at ever-increasing speeds. For decades, the photonics community has been meeting that challenge with a series of evolutionary and revolutionary changes that let us exploit the huge inherent capacity of optical fiber. The most recent of these fiber-optic revolutions have been photonic switching to attain optically-routed networks and coherent detection, which has brought a host of improvements in data rate, reach, and impairment tolerance. Coherent detection, and the advanced modulation techniques enabled by it, have also improved the spectral efficiency of optical transmission to near the theoretical limits. In essence, we have nearly filled the low-loss window of optical fiber, and are in need of a new revolution.

Space-division multiplexing (SDM), using novel fiber with multiple cores or multiple transverse modes in a large-core fiber, is being widely studied as the brightest hope for the next wave of fiber optics. In an idealized case, each spatial mode could carry as much information as a single-mode fiber, 10-20 spatial modes might be sufficient to sustain a decade's worth of traffic growth. Both multicore and multimode approaches have been successfully demonstrated in research, with multicore fibers reaching > 1 Pb/s, the highest throughput ever achieved in a fiber. 'Hero experiments' notwithstanding, the challenges facing SDM are numerous and daunting. Multicore fibers are difficult to fabricate and cannot easily be scaled beyond ~15 cores without incurring inter-core crosstalk. Inter-modal crosstalk is endemic in multimode systems, leading to a heavy signal-processing burden at the receivers. Both types of SDM need development on mode multiplexers, amplifiers, connectors and all of the other components of a photonic communications ecosystem, and research progress in several of these topics is beginning to appear.

Finally, networking aspects of SDM cannot be neglected. Flexible lightpath routing has become an essential tool for network operators, and SDM offers a number of ways to apportion those lightpaths among wavelengths and spatial modes. Since reduction in the cost per bit is a key technology driver, advanced functional integration will be needed for transceivers, amplifiers, and routing nodes. Yet another network necessity is a deployment strategy that supports interworking of SDM and non-SDM sections to maintain economic viability at all stages of the SDM introduction.

In this talk, I will review the past, present, and future of SDM research, and discuss the criteria for a successful commercial introduction of SDM technology.

BIOGRAPHY:

Mark D. Feuer is an Associate Professor of Engineering Science and Physics at the College of Staten Island, City University of New York, where his research focuses on transforming society through advanced optical and communications technologies. In his recent role at AT&T Labs - Research, he was internationally recognized for work on dynamic photonic networks, with publications in the areas of space-division multiplexing, reconfigurable optical add/drop multiplexer (ROADM) architectures, and lightpath verification. His prior work at JDS Uniphase, AT&T Labs, and Bell Labs included the world's first reflective semiconductor optical amplifiers (RSOAs), self-tuning optical filters, and optoelectronic wafer probes capable of calibrated microwave measurements at 300 GHz.

Dr. Feuer holds B.A. and Ph.D. degrees in physics from Harvard University and Yale University, respectively. He is a member of the OSA and the APS and a Senior Member of the IEEE, has served as General Chair of the Optical Fiber Communications conference OFC/NFOEC2009, and is an Adjunct Professor of Electrical Engineering at Columbia University.

O2. Technical Session: Optical Interconnection and Networks

Optical Interconnect Architecture for Data Center Networks

Yawei Yin

Optical Networking Department
NEC Laboratories America, Inc., Princeton, NJ 08536

ABSTRACT:

As data centers getting more and more pervasive in the Internet infrastructure, it is more critical to run data centers efficiently. A typical data center consists of the computation power, the storage capacity and the interconnect network infrastructure. While the computation and storage devices are easily replaceable with off-the-shelf components and can be upgraded every 3-5 years, the network interconnect architecture of a data center is expected to be stable and can support several generations of servers and storages. Unfortunately there's no off-the-shelf network architecture which enables plug-and-play, and therefore the network planning problem inside and between datacenters draws a lot of attentions in both academia and industry.

Optical interconnect technologies has won the battle with Cu at 25 Gbaud and beyond in the inter-rack, inter-pod/cluster and inter-datacenter networks. While there's a constant debate about whether to move optics into the rack and the backplane, there's also a trend of applying optical switching technologies in the inter-rack and inter-pod/cluster network. Optical switches has the intrinsic nature of high capacity, low power consumption and transparency to transceiver upgrades, and the only drawback is their switching speed which will only allow for circuit granularity switching. There have been various academic and industrial efforts that trying to take advantage of the merits of optical switching technologies while mitigating or solving their drawbacks in data centers. An incomplete list of which include the projects and/or papers named as Proteus, c-Through, Helios, Mordia, OSA, DOS, Data vortex, OFDM-DCN, etc.

In this talk, I will review the major approaches that focused on applying optical interconnect technologies in data center networks, and provide my insights of what type of optical technologies are really in need for data center interconnect networks.

BIOGRAPHY:

Dr. Yawei Yin is currently a Postdoctoral Scientist at NEC Laboratories America, Inc. Before Joining NEC Labs, he worked at the Next Generation Networking Systems Laboratory, University of California, Davis as a research scientist, where he participated and led research projects on optical datacenter switches, elastic optical networking algorithms and software defined networking. His current research focus on low-latency, high-throughput and scalable interconnect architectures for datacenter networks and software defined networking in datacenters. He received the B.S. degree in applied physics from National University of Defense Technology (NUDT), Changsha, China, in 2004 and the Ph.D degree in Electrical Engineering from Beijing University of Posts and Telecommunications (BUPT), Beijing, China, in 2009. He served as the Technical Program Committee (TPC) Member of IEEE International Conference on Computing, Networking and Communications (ICNC 2013, 2014, 2015), and IEEE GLOBECOM Conference 2013, 2014, and as a regular reviewer for IEEE Journal of Lightwave Technology, IEEE Photonic Technology Letters, IEEE Journal of Selected Areas in Communications, IEEE Communications Letters, IEEE Transactions on Networking, IEEE/OSA Journal of Optical Communication and Networking, IEEE Communications Magazine, OSA Optics Express and Elsevier Optical Switching and Networking, etc.

O2. Technical Session: Optical Interconnection and Networks

Optical Virtual Switching (OvS): A Distributed Optical Switching Fabric for Intra-Data Center Networking

Shan Zhong

CoAdna Photonics
733 Palomar Ave., Sunnyvale, CA 94085
shanz@coadna.com

ABSTRACT:

Today, big data concept is prevailing, which pushes the scale of a ware-house level data center up to thousands of racks and millions of servers. Conventional data center network typically have hierarchical architecture. The hierarchical architecture of the data center network generally suffers from its increasing complexity along with the increase of data center size and the increase of switch port line rate. Especially, the cabling and power consumption due to electrical switching become an un-resolvable burden. All the above is driving new technology to be applied into data center networking. Researchers have reported that large persistent data flows is becoming more popular in high-performance data center due to new applications such as data migration between the clouds or MapReduce within Hadoop parallel processing, which makes it meaningful to exploit the optical switching technology into the data-center networking. A number of efforts have been carried out to pioneer the optical switching solution in the data center networking. However, in the previous studies, the core optical switching is centralized where the switching capacity and scalability is still limited by the centralized switching fabric. And did not introduce DWDM optical switching in the design and still rely on electrical packet switching, thus suffer from static and limited node to node optical link capacity.

In this paper, we propose a scalable and topology adaptable architecture for intra-datacenter networking exploiting the existing optical technologies. By adopting DWDM and SDM technology (mainly through the ribbon fiber cable), we introduce a unified optical switching node with simple cabling feature. The solution is flexible and scalable to support from tens of racks to a couple of thousands of racks. The proposed architecture also provides rich path diversity and features with low deployment and maintenance cost as well as low power consumption by the merit of optical technology.

BIOGRAPHY:

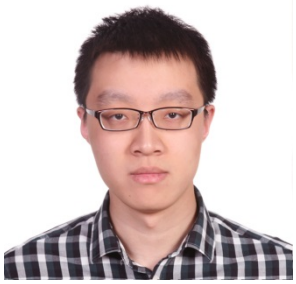
Dr. Shan Zhong currently serve as the Technology Director in CoAdna Photonics, where he is responsible for defining and driving the strategic technology roadmap for WSSs and other agile optical components for ROADM application in next generation optical networking. Recently, he is taking the lead on the optical networking solution for next generation intra-data center networking. Before he joined CoAdna, he worked as the Principal Engineer in Photonics Group of CIENA Corporation from 2001 to 2011, where he was engaged in next generation optical networking product design and development. Before 2001, he worked in Tyco Electronics from 1998 to 2000, developing optical planar waveguide components for DWDM application. In 2000, he joined Sycamore Networks as Senior Optical Engineer, leading the effort on subsystem development for Sycamore's ultra long-haul DWDM transport product line. Dr. Zhong received his B.S. and Ph.D. degrees in electrical engineering from Tsinghua University, Beijing, China and University of Maryland, Baltimore County in 1992 and 2001, respectively. He is a Senior Member of IEEE Photonics Society. He has published tens of papers on technical journals and conferences. He holds 10 awarded U.S. patents and about 6 more on pending.

O2. Technical Session: Optical Interconnection and Networks

Flexible Ring-tree TWDM Network Architecture for Next Generation Optical Access Network

Xintian Hu

Beijing University of Posts and Telecommunications



ABSTRACT:

In this paper, a ring-tree TWDM optical access network architecture is proposed to achieve higher capacity, longer reach and flexible on-demand wavelength and timeslot provision. Using active remote nodes (RNs) along fiber ring, the pressures from large split and high fiber loss are eased and add/drop wavelengths at different RNs can be dynamically assigned. By simulations, it is verified that the architecture can provide access services to 8192 ONUs of 70km reach at 10Gbps, and dynamic wavelength and bandwidth allocation (DWBA) can reduce queuing delay and packet loss.

BIOGRAPHY:

Hu Xintian, is a Ph.D. candidate in the State Key Laboratory of Information of Photonics and Optical Communications, Beijing University of Posts and Telecommunications (BUPT). He received his B.S. degree from BUPT in 2009. His current research interests are in the next generation optical access network and the related key technologies including resource scheduling, power saving and survivability. Email: athlon.hu@gmail.com

O3. System Design and Modeling
Friday, May 9, 16:10–17:50

Session Chair:

Mark D. Feuer

Department of Engineering Science & Physics
CUNY – The College of Staten Island, Staten Island, NY 10314
mark.feuer@csi.cuny.edu

BIOGRAPHY:

Mark D. Feuer is an Associate Professor of Engineering Science and Physics at the College of Staten Island, City University of New York, where his research focuses on transforming society through advanced optical and communications technologies. In his recent role at AT&T Labs - Research, he was internationally recognized for work on dynamic photonic networks, with publications in the areas of space-division multiplexing, reconfigurable optical add/drop multiplexer (ROADM) architectures, and lightpath verification. His prior work at JDS Uniphase, AT&T Labs, and Bell Labs included the world's first reflective semiconductor optical amplifiers (RSOAs), self-tuning optical filters, and optoelectronic wafer probes capable of calibrated microwave measurements at 300 GHz.

Dr. Feuer holds B.A. and Ph.D. degrees in physics from Harvard University and Yale University, respectively. He is a member of the OSA and the APS and a Senior Member of the IEEE, has served as General Chair of the Optical Fiber Communications conference OFC/NFOEC2009, and is an Adjunct Professor of Electrical Engineering at Columbia University.

O3. Technical Session: System Design and Modeling

Frequency Domain Equalizer in Few-Mode Fiber SDM Systems

Zhongqi Pan

Dept. of Electrical and Computer Engineering
University of Louisiana at Lafayette, LA 70504
zpan@louisiana.edu

ABSTRACT:

Few-mode fiber (FMF) communication system has been emerging as a promising space-division-multiplexing (SDM) technology to overcome the next-generation capacity crunch. The key challenges of FMF system are intermodal crosstalk due to random mode coupling and large differential mode group delay (DMGD). Adaptive frequency domain least mean square (FD-LMS) algorithm has been proposed and demonstrated as the most hardware efficient method in compensating large DMGD and random mode coupling. Except for hardware complexity, convergence speed of the adaptive FD-LMS algorithm in FMF system is another important consideration. In this paper, we propose a noise power directed adaptive FD-LMS algorithm, which adopts variable step size to render the posterior error of each frequency bin converge to the background noise level in the additive white Gaussian noise (AWGN) channel. Our simulation result shows that, in a 3000 km two-mode transmission system with 35 ps/km DMGD, noise power directed algorithm can improve the convergence speed by 34% and 54% compared to signal power spectrum density (PSD) dependent adaptive FD-LMS method and conventional fixed step-size adaptive FD-LMS method, with the hardware complexity (number of complex multiplication) increased by only 5.7% and 8.1% respectively. We also propose to use a single-stage adaptive equalizer for compensating both chromatic dispersion (CD) and DMGD simultaneously, for further decreasing the overall hardware complexity of digital signal processor (DSP) in coherent receivers. We show that such single-stage equalizer may have a slower convergence speed due to a larger mean square error (MSE) induced by uncompensated CD in equalizer's initial condition. We extend the proposed noise power directed algorithm to increase the convergence speed of the single stage equalizer; and the simulation results show that the noise power directed algorithm can achieve 51% faster convergence speed than conventional algorithm in a 3000 km transmission system with DMGD of 35 ps/km and CD of 20 ps/nm/km.

BIOGRAPHY:

Zhongqi Pan received the B.S. and M.S. degrees from Tsinghua University, China, and the Ph.D. degree from the University of Southern California, Los Angeles, all in Electrical Engineering. He has worked as a Lecturer and Assistant Professor at Tsinghua University, and a Medical Image Processing System Engineer at 301 Hospital, Beijing. He joined the University of Louisiana (UL) at Lafayette in 2003, and currently is an Associate Professor at the Department of Electrical and Computer Engineering. He also holds BORSF Endowed Professorship in Electrical Engineering II, and BellSouth/BoRSF Endowed Professorship in Telecommunications. Dr. Pan's research is in the area of optical fiber communications, including photonic devices, wavelength-divisionmultiplexing (WDM) technologies, optical performance monitoring, coherent optical communications, and space-divisionmultiplexing (SDM) technologies. He has authored/co-authored over 120 publications on optical devices, nonlinear optics, and fiber communications systems, including 5 book chapters. He also holds 5 U. S. patents and 1 China patent. He has received the award for Excellence in Academic Advising in 2012 and Outstanding Academic Advisor Award in 2006 from UL Lafayette, and National Invention Award in China in 1998. Dr. Pan is an OSA and IEEE senior. He currently serves as a member of OSA's External Relations Advisory Committee. He also has served as Committee member and the session Chair for SPIE Photonics West, Subcommittee Co-Chair for the International Conference on Optical Communications and Networks (ICOCN), the Technical Program Committee for the IEEE International Conference on Communications Systems, the IEEE Photonics Global Conference, and the IEEE Annual Wireless & Optical Communications Conference (WOCC), and as reviewers for numerous IEEE and OSA journals.

System Performance Comparison of Various Fibers for Uncompensated Links

L. Leng

New York City College of Technology, City University of New York

ABSTRACT:

The introduction of coherent technologies with digital signal processing in optical transmission systems has made it possible to completely remove dispersion compensation from the link. In uncompensated links, the characteristics of signal evolution and nonlinearity generation have been drastically altered. To support such systems, next generation optical fibers are expected to have low attenuation coefficients and large effective areas compared with the widely deployed standard single-mode fiber. Distributed Raman amplification is also identified as an approach to achieving the desired level of system performance. In this talk, the Gaussian noise model is applied to the analysis of the nonlinear power generation, and the effective optical signal-to-noise ratio, incorporating both the amplified spontaneous emission noise and nonlinear interference, is computed to evaluate the system performance. A performance comparison of various fiber parameters and amplification schemes is discussed, and recommendations are provided for the optimal design of future transmission systems of 100 Gb/s and beyond.

BIOGRAPHY:

Lufeng Leng received her M. S. and Ph. D. in physics from Princeton University in 1996 and 1999, respectively. In 1999, she joined the long-haul and metro systems research lab of Lucent Technologies (later became a research lab of OFS in 2001) as a member of technical staff and conducted research on 10- and 40-Gb/s terrestrial DWDM systems. In 2004, she joined the New York City College of Technology of the City University of New York as an assistant professor, and has been conducting research on nonlinear fiber-based devices, Raman amplification techniques, and fiber optical transmission systems.

O3. Technical Session: System Design and Modeling

An Optical Power Efficient Asymmetrically Companded DCO-OFDM for IM/DD Systems

Fatima BARRAMI

STMircroelectronics/IMEP-LAHC, France

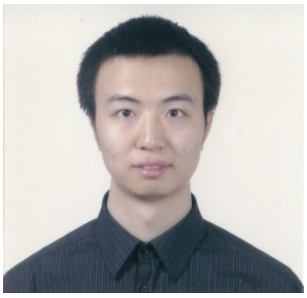
ABSTRACT:

Unipolar forms of orthogonal frequency division multiplexing (OFDM) such as DC biased optical OFDM (DCOOFDM) and asymmetrically clipped optical OFDM (ACOOFDM) are widely used in intensity-modulated and direct detection (IM/DD) systems. At low data rate, ACO-OFDM is more efficient in terms of optical power but it suffers from spectral inefficiency. For large constellations, DCO-OFDM with large DC bias has more optical power efficiency, since it requires lower constellation size than ACO-OFDM. However, the required DC bias to obtain an acceptable clipping noise degrades the optical power efficiency. To overcome these drawbacks, we propose an optimized DCO-OFDM technique capable to transmit large constellations with a moderate DC bias. To reduce the clipping impact, a linear companding function is used in order to compress the negative part of the bipolar signal and therefore to reduce the amount of the clipped peaks and the loss of information. We demonstrate that the proposed technique has better bit error rate and optical power performances than conventional DCO-OFDM and ACO-OFDM. For a bit rate/normalized bandwidth of 6, a gain of 4dB in optical power is reached.

BIOGRAPHY:

Fatima Barrami received the M.Sc. degree (with honors) in electronic engineering and signal processing from the Electronic Engineering School of Bordeaux (ENSEIRB), France, in 2010. She is currently a third-year Ph.D. student in STMicroelectronics, France, in collaboration with the Microelectronic Electromagnetism and Photonics Institute (IMEP-LAHC), Grenoble, France. Her research interests include high speed serial links, digital communications and OFDM for wireless and optical systems. Her works on these topics has led to a number of publications.

O3. Technical Session: System Design and Modeling



Theoretical Analysis and Numerical Simulation of Inter-Modal Four-Wave-Mixing in Few Mode Fibers

Yi Weng

Department of Electrical and Computer Engineering, University of Louisiana at Lafayette, Lafayette, LA 70504, USA.

ABSTRACT:

We investigate the inter-modal four-wave mixing (IM-FWM) between spatial modes in few-mode fibers (FMF). Both differential mode group delay (DMGD) and chromatic dispersion (CD) play significant roles for the phase-matching conditions of three different FWM processes. We theoretically propose a simplified model of IM-FWM generated power as a function of DMGD, CD and wavelength spacing. The mixed impact of DMGD and CD upon IM-FWM power distribution has been fully examined through numerical simulation. We analyze the IM-FWM generated spectrum power efficiency by adjusting the appropriate combination of DMGD and CD in FMF. Moreover, retrieval of IM-FWM power mapping with a high spatial resolution is presented, as guidance for the upcoming IM-FWM related experiments and applications.

BIOGRAPHY:

Mr. Yi Weng received the B.S. degree from the Department of Applied Physics in 2009 from Shanghai Jiaotong University, Shanghai, China, and the M.S. degree in Physics from Louisiana State University in 2012 respectively. He is currently working toward the Ph.D. degree in System Engineering from the Department of Electrical and Computer Engineering, University of Louisiana at Lafayette, Lafayette. His Ph.D. dissertation focuses on fiber nonlinearity and its applications. Mr. Weng was a reviewer for Optical Fiber Technology. He is a student member of the Optical Society of America.

O3. Technical Session: System Design and Modeling

Performance Analysis of OOK Modulation Scheme with Spatial Diversity in Atmospheric Turbulence

Thomas Joseph[1], Hemani Kaushal[2], V. K. Jain[3], Subrat Kar[3]

[1.] Adi Shankara Institute of Engineering and Technology
[2.] ITM Univeristy
[3.] Indian Institute of Technology, Delhi

ABSTRACT:

Abstract— Free space optical (FSO) communication is a cost effective and high bandwidth access technique. A major impairment in FSO links is turbulence induced fading which severely degrade the link performance. Spatial diversity is one of the mitigation techniques for atmospheric turbulence to improve the bit error rate performance. In this paper, spatial diversity technique using OOK modulation scheme with equal gain combining (EGC) and direct detection at the receiver is considered. The results have been analyzed for weak as well as strong atmospheric turbulence conditions. A significant improvement in the performance is observed with receiver diversity when the turbulence level is high.

BIOGRAPHY:

Hemani Kaushal is presently working as Associate Professor in ITM University, Gurgaon, India. She received her Bachelor's degree in Electronics and Communication Engineering from Punjab Technical University, India in 2001. She completed her Master's degree from Punjab Engineering College, Chandigarh, India in 2004. She received her doctorate degree from Electrical Engineering Department of Indian Institute of Technology Delhi in 2012. She has total 27 publications in various International/National journals and conferences (6 journals + 21 conferences) to her credit. She has received second best poster award on National Science Day held at Indian Institute of Technology Delhi in February 2009. She has got best oral presentation award in an International Conference- OPTICS'11 in May 2011. She has worked on two sponsored projects. One was from Aeronautical Development Agency (ADA), Department of Defense, R&D with title, “Design and Development of Array-of-Arrays MOEM based Free Space Optical Link for Ground to Satellite Communication,” from September 2010 till March 2013. The second project was from Indian Space Research Organization (ISRO), Ahmedabad, India with title, “Simulation and Analysis of System Design Requirements for Ground to Satellite and Inter-Satellite Free Space Optical Communication Link,” from January 2012 till date. She is member of ISTE and IEEE. Her areas of interest are Free Space Optical Communication, Digital Communication and Optical Networking.

O4. Optical Devices
Saturday, May 10, 9:00–10:40

Session Chair:

Benyuan Zhu

OFS Laboratories, Somerset NJ, 08873
e-mail: bzhu@ofsoptics.com

BIOGRAPHY:

Benyuan Zhu joined Bell Laboratories at Holmdel, NJ USA in 1999, and he is currently a Distinguished Member of Technical Staff in OFS Laboratories, Somerset, NJ USA. He has performed record-breaking optical transmission experiments including the first demonstration of terabit long haul WDM transmission at channel rate of 40Gb/s. He has investigated GPON reach extension techniques, EDF/ Raman amplifiers, unrepeatered transmission, multiple-level modulation, coherent detection, and spacing-division-multiplexing. More recently, he has demonstrated 112-Tb/s transmissions. He is presently involved in the study of new transmission fibers, novel optical amplifier technique, 400Gb/s and above DWDM transmission. He has authored/ coauthored more than 150 journal and conference papers, one book chapter, and +10 patents in the field of optical fiber communications.

Benyuan Zhu received the Ph.D. degree in applied physics from Bath University, Bath, UK, in 1996.

O4. Technical Session: Optical Devices

Review and challenges of high frequency cavity-assisted electro-optic modulators

N. Madamopoulos[1], B. Dingel[2], A. Prescod[3]

[1.] Department of Electrical Engineering, The City College of CUNY, New York, 10031, nmadamopoulos@ccny.cuny.edu
[2.] Nasfine Photonics, Painted Post, NY
[3.] ManTech International Corporation, Washington, DC

ABSTRACT:

External ultra-linear modulators have become vital components in broadband networks. Their utilization is critical both in digital as well as analog fiber optic communication systems. Standard and advanced modulation formats have made use of single and multiple (e.g., a cascaded or parallel configuration) electro-optic modulator elements, which achieve amplitude and/or phase modulation for increasing the capacity of digital communication systems. On the other hand, single and/or multiple electro-optic modulator designs, as well as modulators assisted by other elements (e.g., optical micro-ring resonators-MRR), find applications in RF photonic applications.

Under this context, ultra linear optical modulators with high spurious-free-dynamic-range (SFDR > 130 dB $Hz^{4/5}$) are important elements in microwave fiber optic links for applications in antenna-remoting and signal distribution for phased array antennas, as well as commercial applications, such as cable television (CATV), subcarrier multiplexing (SCM) optical communication systems, Radio-over-Fiber (RoF) communications, distributed antennas for cellular networks, and satellite communications.

In the recent years, optical micro-ring resonator (MRR) assisted Mach-Zehnder interferometer (MZI) modulators have been proposed and demonstrated that can lead to high spurious dynamic range. Nevertheless, these modulators come with strict manufacturing tolerances and operational limitations that can limit the SFDR performance. We have proposed and developed the theoretical base for a new improved performance electro-optic modulator that makes use of a combination of a RF-driven phase-modulator (PM) and a MRR within a MZI modulator structure.

In this invited presentation, we describe the basic theory of the ultra linear electropotic modulator and show that its added flexibility of tuning two external parameters the RF power split ratio (F) and the RF phase (ξ_{pm}) control of the driving signals to the PM and MRR, allows for (1) High SFDR performance (e.g., > 130 dB $Hz^{4/5}$) at high operation frequencies (e.g., 70 GHz).(2) Manufacturing tolerance relaxation.

This cavity assisted electro-optic modulator design opens up a new direction that can lead to wideband, high SFDR flexible electro-optic modulator designs that will enable high speed, high bandwidth applications.

BIOGRAPHY:

Nicholas Madamopoulos is an Associate Professor of Electrical Engineering at the City College of the City University of New York (CUNY). He received his PhD from the School of Optics, the Center for Education in Optics and Lasers (CREOL) in 1998. His Ph.D. specialization was in photonic information processing systems, where he introduced novel photonic delay lines for phased array antenna applications, as well as photonic processing modules for fiber-optic communications. Prior to joining the City College of CUNY was a Research Associate at the Department of Electrical and Computer Engineering, University of California-Santa Barbara, Sr. Research Engineer for Calient Networks, Inc. (Santa Barbara, CA), Member of Technical Staff for Lucent-Bell Labs (Somerset, NJ), and Sr. Research Scientist for Corning, Inc. (Corning, NY and Somerset, NJ). Prof. Madamopoulos' research interests have been in microwave photonics, photonic information processing, optics for energy and displays. He is a reviewer for IEEE and OSA publications and he has served as General Chair, technical chair and program committee member of a variety of conferences. He received a New Focus Student Essay Prize in 1996, the SPIE Educational Scholarship in Optical Engineering in 1997, the Graduate Merit Fellowship Award in 1998 and the New Focus/OSA Student Award in 1998.

O4. Technical Session: Optical Devices

Performance Improvement of Mapping Multiplexing Technique (MMT) Using Dual-Drive Mach-Zehnder Modulator at 40 Gb/s

Amin Malekmohammadi

The University of Nottingham

ABSTRACT:

A methodology to control the eye opening distribution of Mapping Multiplexing Technique (MMT) system is proposed and presented. We modeled and analyzed a method to enhance the receiver sensitivity of MMT system by using optimized Dual- Drive Mach-Zehnder Modulator (DD-MZM). The proposed method offers larger eye opening for distorted higher-level eyes. Based on the numerical calculation the optimization leads towards minimal eye closure in comparison to conventional MMT system. In comparison to the conventional MMT system, the optimization leads in to the 6 dB improvement in terms of receiver sensitivity.

BIOGRAPHY:

Dr. Amin is a fellow of the UK Higher Education Academy and a member of Engineering Council (CEng), IEEE, IET and Optical Society of America (OSA), received his M.Sc. in Electronic Engineering from Indian Institute of Science (IISc.), Bangalore, India in 2006 and PhD degree in Computer System Engineering (Optical Fiber Communications) at University Putra Malaysia, 2009. Currently he is working at the Department of Electrical and Electronic Engineering, University of Nottingham as an associate professor. He has authored and co-authored 50 technical papers which include journals articles and conference proceedings. He has filed 4 patents for his inventions and scientific works.

Mohamed Asaad Elsherif

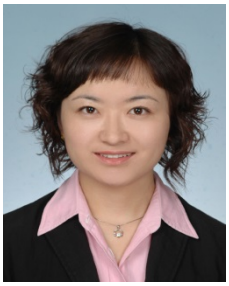
PhD Candidate, The University of Nottingham

BIOGRAPHY:

Mohamed A. Elsherif received his M.Sc. in Electronic Communication and Computer Engineering with honor from The University of Nottingham, United Kingdom. He is currently working towards a Ph.D. degree in Electrical Engineering from The University of Nottingham. His current research area includes Fiber Optic Communication Systems, Advanced Modulation Formats and Electronic Signal Processing.

O4. Technical Session: Optical Devices

Tunable and flat optical frequency comb generated by two cascaded intensity modulators



Lei Shang

Department of Telecommunications Engineering, State Key Laboratory on Integrated Services Networks, Xidian University, Xi'an 710071, China

ABSTRACT:

An optical frequency comb generator based on two cascade intensity modulators is proposed and experimentally demonstrated. By carefully adjusting the DC bias and the drive amplitudes of the RF signals of the two intensity modulators, 3, 5, 9, 15 and 25 comb lines with the comb flatness within 1 dB can be generated. The scheme is relatively simple and adjustable, where the frequencies spacing vary with microwave frequency applied on modulators. The generated spectrums can meet the requirement of OFDM modulation, and can be used for high capacity optical transmission systems in the future.

BIOGRAPHY:

Lei Shang received the PhD degree in Optics from Fudan University, China, in 2009. She joined Department of Telecommunications Engineering, State Key Laboratory on Integrated Services Networks, Xidian University, in 2009. And she was promoted to the associate professor in 2011. Her research has focused on microwave photonics, which includes photonic processing of microwave signals, photonic generation of microwave, mm-wave and THz, radio over fiber, UWB over fiber, and optically controlled phased array antenna. Her research also covers integrated optical device. Her works has been published in numerous national and international journals such as Applied Physics Letters, Optics Letter, Journal of Optics, and Optics Communications.

O4. Technical Session: Technical Session: Optical Devices

Recent advances in optical splicing and glass processing technologies for specialty fibers and photonic devices

Baishi Wang

Vytran LLC
1400 Campus Drive
Morganville, NJ 07751, USA

ABSTRACT:

We will present recent advances of optical fusion splicing and glass processing technologies, which are important for processing specialty fibers and fabrication of photonic devices. In this talk, we will review specialty fiber and photonics device applications, especially for advanced fiber laser and medical sensing applications. We will then discuss and compare fiber glass processing technologies, which provide solutions to these emerging needs and challenges. We will further describe fundamental fiber mode coupling theory and fabrication techniques for producing high performance fused fiber components including mode-field adapters, fiber tapers, fused fiber combiners, and other all-fiber devices for high power fiber laser and medical sensing applications with some application examples.

BIOGRAPHY:

BAISHI WANG is currently a Director of Technology at Vytran LLC in New Jersey, USA. He received his Ph.D from State University of New York at Stony Brook on Engineering. His research focus is on fiber lasers and amplifier, rare-earth doped specialty fibers, and on fiber fusion and glass processing, fused component fabrication, and precision fiber optics instrumentation. His research work with his team held a power record in all-fiber and all-passive coherent beam combining. Prior to joining Vytran, he was a member of technical staff in Specialty Fiber Division at Lucent Technologies Bell Labs and then OFS. He has published over 20 papers in referred journals and conferences and journals and has filed several US and world patents. He has provided numerous invited talks in SPIE and other conferences. He is a lecturer of a short course with a focus on fiber fusion process fused fiber component technologies in SPIE Photonics West Conference. He was a technical committee member for SPIE/OSA conferences and is a regular paper reviewer for leading photonics journals. He is an active member of SPIE and OSA.

O5. Silicon Photonic Devices
Saturday, May 10, 14:00–15:40

Session Chair:

Nicholas Madamopoulos

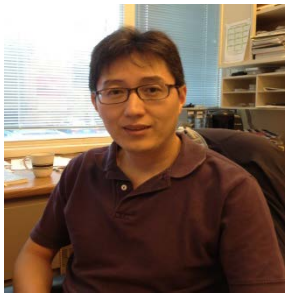
Department of Electrical Engineering, The City College of CUNY,
New York, 10031, nmadamopoulos@ccny.cuny.edu

BIOGRAPHY:

Nicholas Madamopoulos is an Associate Professor of Electrical Engineering at the City College of the City University of New York (CUNY). He received his PhD from the School of Optics, the Center for Education in Optics and Lasers (CREOL) in 1998. His Ph.D. specialization was in photonic information processing systems, where he introduced novel photonic delay lines for phased array antenna applications, as well as photonic processing modules for fiber-optic communications. Prior to joining the City College of CUNY was a Research Associate at the Department of Electrical and Computer Engineering, University of California-Santa Barbara, Sr. Research Engineer for Calient Networks, Inc. (Santa Barbara, CA), Member of Technical Staff for Lucent-Bell Labs (Somerset, NJ), and Sr. Research Scientist for Corning, Inc. (Corning, NY and Somerset, NJ). Prof. Madamopoulos' research interests have been in microwave photonics, photonic information processing, optics for energy and displays. He is a reviewer for IEEE and OSA publications and he has served as General Chair, technical chair and program committee member of a variety of conferences. He received a New Focus Student Essay Prize in 1996, the SPIE Educational Scholarship in Optical Engineering in 1997, the Graduate Merit Fellowship Award in 1998 and the New Focus/OSA Student Award in 1998.

O5. Technical Session: Silicon Photonic Devices

Monolithic Silicon Photonic Integrated Circuits for Coherent Optical Receivers and Transmitters



Po Dong

Bell Labs, Alcatel-Lucent, NJ, USA
po.dong@alcatel-lucent.com

ABSTRACT:

Global information communication networks demand optical transmission systems with high capacity and low cost. This translates into the need for increasing spectral efficiency in addition to increasing the channel data rate and transceiver density. Recent advances in optical modulation formats, together with wavelength- and polarization-division multiplexing, are key enablers to increase both the spectral efficiency and the data rate. Optical coherent transmission, using electronic digital signal processing, has become a key technology for long-haul communications with channel data rates at 100 Gb/s and beyond. Polarization-division-multiplexed quadrature phase-shift keying (PDM-QPSK) is utilized in the current networks for 100-Gb/s transponders. Next-generation networks may utilize even higher modulation formats, such as 16-ary quadrature amplitude modulation (16-QAM). Coherent transponder technology is also well suited for metro and shorter reach networks since it provides high capacity, cost-effective electronic equalization of fiber impairments, and network monitoring capabilities.

Optical coherent transmitters and receivers consist of a number of high-performance optical components, such as narrow-linewidth lasers, high-speed modulators, high-speed photodetectors, polarization beam splitters and combiners, polarization rotators, and 90-degree optical hybrids. Current coherent transponders in long-haul systems use discrete but bulky optical components, driven by the performance requirement from the very challenging transmission environments. In order to address the increased density and capacity required for future optical communication, low-cost, energy-efficient, and compact coherent transceivers are required.

Photonic integrated circuits can significantly reduce the device sizes and reduce the cost by simplifying the packaging procedures by reducing component counts. In this talk, we review recent advances in coherent transmitters and receivers based on monolithic silicon photonic integrated circuits. Dense photonic integration on silicon promises small-footprint, low-power and low-cost transceivers for future coherent systems.

BIOGRAPHY:

Po Dong is currently a member of technical staff at Bell Labs, Alcatel Lucent. He is working on developing photonic integrated circuits to achieve high-bandwidth and low-power optical links. Previous to Bell Labs, he worked as a principal research engineer at Kotura Inc., where he was leading the silicon photonic effort on ultraperformance nanophotonic intrachip communications and photonic analog signal processing engines. From 2005 to 2007, he was a postdoctoral research fellow at Cornell University, Ithaca, USA. He received the Ph. D. degree in electrical engineering from McGill University, Montreal, Canada. His research areas mainly include photonic integrated circuits, nonlinear optics, and atomic coherence.

O5. Technical Session: Silicon Photonic Devices

Silicon Photonics for Optical Communications

Long Chen

Acacia Communications
1301 Route 36, Building 1, Suite 100
Hazlet, NJ 07730

ABSTRACT:

There are many reasons to expect that silicon photonics could become a platform-of-choice for optical modules used in many optical communication systems: high level of monolithic integration of many components / functionalities, small footprints, low cost and high yield production based on CMOS foundry capabilities, prospect of advanced integration with CMOS electronics, etc. Meanwhile, there are many criticisms of silicon photonics citing its drawbacks: e.g., strong polarization birefringence, large temperature sensitivity, and intolerance to nanometer-scale fabrication variations for wavelength-sensitive applications, lack of efficient modulators, and lack of efficient laser sources on silicon. In this talk, I will discuss the opportunities as well as challenges of silicon photonics in optical communications with several application examples.

BIOGRAPHY:

Long Chen currently works in Acacia Communications. He received his B. Eng. degree in Electrical Engineering from Zhejiang University, China in 2003, and his Ph.D. degree in Electrical and Computer Engineering from Cornell University in 2009. From 2009 to 2012 he worked in Alcatel-Lucent Bell Laboratories in Crawford Hill, NJ as a Member of Technical Staff. In 2012 he joined Acacia Communications. His primary focus has been on the developments of photonic integrated circuits for optical communications. He has published more than 30 journal papers, filed over a dozen US patents, and served as invited speaker and committee member for various technical conferences.

O5. Technical Session: Silicon Photonic Devices

Function-Transformable Photonics Integrated Devices for Intelligent, Flexible-grid, Multi-rate DWDM Optical Networks

Benjamin B. Dingel

Nasfine Photonics Inc., Painted Post, NY, 14870, USA.
(bbdingel@stny.rr.com)

ABSTRACT:

Photonic devices (like filters, interleavers, grating, etc) are generally considered as "one-function-one-element" devices. To form multifunction photonic devices for the emerging Intelligent and Programmable Flexible-grid, Multi-rate DWDM Optical Networks, at present, there seem to be only one approach --- *that is combining* functionally different photonics elements into one monolithic very-large-scale-integration (VLSI) circuits via CMOS-compatible Silicon Photonic Integrated Circuits (PICs). We will refer to this general approach as *Combined-and-Select (CAS)-based multifunction devices.*

Recently, we reported a new design paradigm of multifunctional photonic device that is different from conventional CAS-based multifunction devices. This new device has simple configuration that has remarkable feature *that it* can transform its inherent basic function to various functionalities ("multiple-functions-one-element") *[1]*. We refer to this new element as function-transformable (FT)-based multifunctional photonic device. This device offers simpler design, lowers chip complexity, reduces footprint, decreases overall device cost while enhancing its performances. Its compact structure makes it very suitable for monolithic PIC. This new device provides flexibility and versatility in future intelligent optical networks.

In this talk, I will discuss our novel function-transformable (FT)-based multifunctional photonic device and present its five functions namely: (1) symmetric interleaver (SI), (2) asymmetric interleaver (AI), (3) band-wavelength add-drop filter (B-ADF), (4) dual-wavelength, channel passing (CP) add-drop filter (2λ-CP-ADF), and (5) dual-wavelength, channel dropping (CD) add-drop filter (2λ-CD-ADF). This new device is a pair of direct-coupled all-pass-filter (D-APF) and cross-coupled APF (C-APF) positioned in each of the two arms of Mach-Zehnder interferometer (MZI). These five functions are realized by changing MZI's path length difference and the values of coupler's coefficients. If the APF's circumference lengths can be made variable, the new device will have wavelength or bandwidth tunable feature for all the five functions.

BIOGRAPHY:

Benjamin B. Dingel received his B.S. degree in Physics from Ateneo De Manila University, Philippines in 1980, master and doctor degrees in Applied Physics from Osaka University, Japan in 1990 and 1993, respectively. He joined NEC Central Research Laboratory as research engineer in 1993 working in optical lithography, and high power solid state laser. In 1996, he moved to Communication Research Laboratory (CRL), Japanese Ministry of Post and Telecommunication working on intelligent optical devices for optical networks, and microwave photonics. In 1999, he joined Corning Inc. as senior research scientist to continue his work on various areas of optical networks from optical equipment and subsystem, and components.

In 2003, he co-founded Nasfine Photonics, Inc., and is presently its Director of R&D. He is associate editor of SPIE's Optical Engineering since 2007, program chair of SPIE Photonics West's Optical Communications track since 2008, conference chair/co-chair of SPIE's Optical Transmission and Equipment for WDM Networking conference (2001-present), Broadband Access Communication Technologies (2006-to-present), Optical Metro Networks and Short-Haul Systems (2008-to present), and served as reviewer for NSF, IEEE, OSA and SPIE. He has 15 Patents (approved and pending) and 65 journal and conference published papers.

O5. Technical Session: Silicon Photonic Devices

An Integrated Optical Interference Cancellation System

Matthew Chang

Lightwave Communications Research Laboratory
Electrical Engineering Department, Princeton University

ABSTRACT:

We present the design and simulation results for a photonic integrated circuit (PIC) to perform in-band, broadband radio-frequency interference cancellation. The PIC subtracts known interference from a corrupted received signal by processing each signal in separate waveguides before coupling them to a single waveguide, where the interference destructively interferes. The PIC will initially be fabricated on a III-V platform to leverage an arsenal of high-speed and non-linear optical signal processing capabilities. Multipath compensation and fast electrical control are both presented as possibilities.

BIOGRAPHY:

Matthew Chang earned his B.S. degree in electrical engineering in 2011 from Penn State University. He is currently working towards his PhD degree at Princeton University in the Lightwave Communications Research Laboratory. His research interests include microwave photonics and new forms of optical signal processing using ultrafast fiber optics, nonlinear optics, and photonic integrated circuits.

Mr. Chang is a student member of the IEEE Photonics Society and the Optical Society of America (OSA). He is a Gordon Wu Fellow at Princeton University and a recipient of the National Defense Science and Engineering Graduate Fellowship (NDSEG). Outside of research he is a huge fan of basketball and football, and is an avid piano player.

O6. OFDM and Visible Light Communications
Saturday, May 10, 16:10–17:50

Session Chair:

Zhongqi Pan

Dept. of Electrical and Computer Engineering
University of Louisiana at Lafayette, LA 70504
zpan@louisiana.edu

BIOGRAPHY:

Zhongqi Pan received the B.S. and M.S. degrees from Tsinghua University, China, and the Ph.D. degree from the University of Southern California, Los Angeles, all in Electrical Engineering. He has worked as a Lecturer and Assistant Professor at Tsinghua University, and a Medical Image Processing System Engineer at 301 Hospital, Beijing. He joined the University of Louisiana (UL) at Lafayette in 2003, and currently is an Associate Professor at the Department of Electrical and Computer Engineering. He also holds BORSF Endowed Professorship in Electrical Engineering II, and BellSouth/BoRSF Endowed Professorship in Telecommunications. Dr. Pan's research is in the area of optical fiber communications, including photonic devices, wavelength-divisionmultiplexing (WDM) technologies, optical performance monitoring, coherent optical communications, and space-divisionmultiplexing (SDM) technologies. He has authored/co-authored over 120 publications on optical devices, nonlinear optics, and fiber communications systems, including 5 book chapters. He also holds 5 U. S. patents and 1 China patent. He has received the award for Excellence in Academic Advising in 2012 and Outstanding Academic Advisor Award in 2006 from UL Lafayette, and National Invention Award in China in 1998. Dr. Pan is an OSA and IEEE senior. He currently serves as a member of OSA's External Relations Advisory Committee. He also has served as Committee member and the session Chair for SPIE Photonics West, Subcommittee Co-Chair for the International Conference on Optical Communications and Networks (ICOCN), the Technical Program Committee for the IEEE International Conference on Communications Systems, the IEEE Photonics Global Conference, and the IEEE Annual Wireless & Optical Communications Conference (WOCC), and as reviewers for numerous IEEE and OSA journals.

O6. Technical Session: OFDM and Visible Light Communications

D-C ACO-OFDM and DCO-OFDM for Passive Optical Network: Performance Comparison in IM/DD Fiber Link

Max Frejus Sanya, Christelle Aupetit-Berthelemot

XLIM – UMR CNRS n°7252 – University of Limoges
123, avenue Albert-Thomas – 87060 Limoges, France
LETIA, Polytechnic School of Abomey-Calavi, Benin
frejus.sanya@ensil.unilim.fr

ABSTRACT:
We present a comparative study of Diversity-Combined Asymmetrically Clipped Optical OFDM (D-C ACO-OFDM) and DC-biased Optical OFDM (DCO-OFDM) techniques in 17Gbps intensity modulated and direct detected (IM/DD) fiber link of passive optical network (PON). From simulation results obtained with realistic components parameters, we find that D-C ACO-OFDM offers an improved demodulation than DCO-OFDM. Using 4QAM format and split ratio of 1x32, D-C ACO-OFDM is showed to reach 45.3km distance which is almost the double distance transmission of DCO-OFDM with the same modulation order. We also show at BER of 10^{-3}, that 20km transmission distance can be reached at 24Gbps 4QAM D-C ACO-OFDM data rate and then D-C ACO-OFDM is a suitable efficient cost-effective solution for GPON deployment with benefit of use of low-cost laser bandwidth in comparison with DCO-OFDM. At the same BER performance, in comparison with D-C ACO-OFDM at high bit rates transmission, DCO-OFDM promises to deliver higher throughput. The Bit Error Rate (BER) performance value is fixed to 10^{-3} (limit value when Forward Error Codes are used).

BIOGRAPHY:

Max Frejus SANYA received the engineer Degree (with first class honors) in signal processing of electrical engineering from Polytechnic School of EPAC, University of Abomey-Calavi (UAC), Benin in 2008. She received his M.S. Degree (with first class honors) in electronics and telecommunication engineering from EPAC (UAC, Benin) in 2010. He is currently working toward the Ph.D. Degree at the Department of Components, Circuits, Signals and High Frequency Systems of Xlim laboratory, University of Limoges, France in cooperation with Laboratory of Electrical Telecommunication and Computer applications (LETIA) of UAC, Benin. His research interests include signal processing and optical telecommunications, particularly, optical systems simulation, impact of components on the transmission system performances, Radio Over Fiber and optoelectronic devices characterization.

Christelle Aupetit-Berthelemot (42) received the engineer degree in telecommunication from ENSIL (Ecole Nationale Supérieure d'Ingénieurs de Limoges) in 1995. She received the M.S. degree as well as PhD degree in High Frequency and Optic Telecommunications from University of Limoges respectively in 1995 and 1998. She is currently a Professor and the co-head of Electronics and Telecommunications department at ENSIL. She has been involved in several Cooperative Projects. At the beginning she works on transistors characterization and modeling. Her current research activities concern optical telecommunication. Particularly, her interests are focused on the study of the impact of the components on the performances of an optical transmission system, integration of digital techniques of signal processing in optical communication, Radio Over Fiber, and optoelectronic devices characterization. She is specialized in optical telecommunication system simulation too. C. Aupetit-Berthelemot is co-authored of more than 100 articles in international journals or conferences.

O6. Technical Session: OFDM and Visible Light Communications

Brightness Control in Dynamic Range Constrained Visible Light OFDM Systems

Zhenhua Yu

Georgia Institute of Technology

ABSTRACT:

Visible light communication (VLC) systems can provide illumination and communication simultaneously via light emitting diodes (LEDs). Orthogonal frequency division multiplexing (OFDM) waveforms transmitted in a VLC system will have high peak-to-average power ratios (PAPRs). Since the transmitting LED is dynamic-range limited, OFDM signal has to be scaled and biased to avoid nonlinear distortion. Brightness control is an essential feature for the illumination function. In this paper, we will analyze the performance of dynamic range constrained visible light OFDM systems with biasing adjustment and pulse width modulation (PWM) methods. We will investigate the trade-off between duty cycle and forward ratio of PWM and find the optimum forward ratio to maximize the achievable ergodic rates.

BIOGRAPHY:

Zhenhua Yu received the B.S. degree in Information Engineering and M.S. degree in Communication and Information Engineering from Shanghai Jiao Tong University, Shanghai, China, in 2007 and 2010, respectively. He has defended his PhD dissertation and will obtain the Ph.D. degree in Electrical and Computer Engineering from Georgia Institute of Technology, Atlanta, GA, in May 2014. He will join R&D center at Texas Instruments after graduation. His research interests include OFDM, visible light communications, signal processing, and optimizations.

O6. Technical Session: OFDM and Visible Light Communications

Using Delta-Sigma Modulators in Visible Light OFDM Systems

Zhenhua Yu

Georgia Institute of Technology

ABSTRACT:

Visible light communications (VLC) are motivated by the radio-frequency (RF) spectrum crunch and fast-growing solid-state lighting technology. VLC relies on white light emitting diodes (LEDs) to provide communication and illumination simultaneously. Simple two-level on-off keying (OOK) and pulse-position modulation (PPM) are supported in IEEE standard due to their compatibility with existing constant current LED drivers, but their low spectral efficiency have limited the achievable data rates of VLC. Orthogonal frequency division multiplexing (OFDM) has been applied to VLC due to its high spectral efficiency and ability to combat inter-symbol-interference (ISI). However, VLC-OFDM inherits the disadvantage of high peak-to-average power ratio (PAPR) from RF-OFDM. Besides, the continuous magnitude of OFDM signals requires complicated mixed-signal digital-to-analog converter (DAC) and modification of LED drivers. We propose the use of delta-sigma modulators in visible light OFDM systems to convert continuous magnitude OFDM symbols into LED driver signals. The proposed system has the communication theory advantages of OFDM along with the practical analog and optical advantages of simple two level driver signals. Simulation results are provided to illustrate the proposed system.

BIOGRAPHY:

Zhenhua Yu received the B.S. degree in Information Engineering and M.S. degree in Communication and Information Engineering from Shanghai Jiao Tong University, Shanghai, China, in 2007 and 2010, respectively. He has defended his PhD dissertation and will obtain the Ph.D. degree in Electrical and Computer Engineering from Georgia Institute of Technology, Atlanta, GA, in May 2014. He will join R&D center at Texas Instruments after graduation. His research interests include OFDM, visible light communications, signal processing, and optimizations.

O6. Technical Session: OFDM and Visible Light Communications

An Experiment Demonstration of A LED Driver Based on a 2nd Order Pre-emphasis Circuit for Visible Light Communications

Minglun Zhang

State Key Laboratory of Information Photonics and Optical Communications (Beijing University of Posts and Telecommunications), P.O. Box 66 (BUPT), Beijing 100876, China

ABSTRACT:

We demonstrate a proposed LED driver with a 2^{nd} order pre-emphasis circuit for visible light communications with a E/O/E bandwidth of 130MHz, and with a flatness of 0.4 dB up to 110MHz. Experiments show that BER at 300 Mbps is below 1×10^{-10} in a 2^{31}-1 NRZ OOK PRBS transmission.

BIOGRAPHY:

Minglun Zhang was born in Xi'an, China, in 1978. He received a bachelor's degree in telecommunications engineering in 2000, and a Ph. D degree in the technologies of electromagnetic field in 2005, both from Beijing University of Posts and Telecommunications. From 2005 to 2010, he was a lecturer of Beijing University of Posts and Telecommunications. In 2010, he became an associate professor. Now, his research interest is focusing on visible light communications.

O6. Technical Session: OFDM and Visible Light Communications

Optical Fibers in Human Body and Optical Communication Bionics

Anhui Liang, Leiting Hu

College of Opto-Electronic Engineering, Nanjing University of Posts and Telecommunications
liangah@njupt.edi.edu

ABSTRACT:

There are many optical fibers in human body, e.g. cones, rods on retina and collagen etc. Anhui Liang first discovered that the outer segments of foveal cones are single mode fibers in 1998, and found that the mode-field-diameters (MFDs) of outer segments of foveal cones are close to the minimum values. In this paper, we find that the MFDs of myoids of foveal cones are insensitive to their diameters and similar to those of outer fibers, and these will be good for reducing the coupling loss between myoids and outer fibers. We propose that the ellipsoids of foveal cones act as spot size converters to reduce the coupling losses between myoids and outer segments, and 1.09, 0.60 and 0.44 dB of coupling losses reduction are achieved for blue, green and red cones respectively.

We find several new golden ratio phenomena in human vision as follows: (1). The three points, which are the wavelength (496 nm) at the golden ratio point between the green and blue cones' absorption maxima, the wavelength (495 nm) at the highest color resolution, the wavelength (498 nm) at the rod's absorption maximum, are coincide or very close; (2). The most intensity sensitive wavelength of human eyes is 555 nm in photopic vision, and we found 555 nm is very close to 552 nm, which is the wavelength at the golden ratio point between the red and green cones' absorption maxima; (3). The photopic luminosity function is the weighted sum of red and green cone spectral sensitivities, where the weighting ratio of green and red cone contributions is 0.59:1 in physical experiments or 0.64:1 in psychophysical experiments. The average value of above two weightings ratios is 0.615, which is very close to the golden ratio 0.618; (4). The ratio of the cut off normalized frequency V of LP11 mode (V=2.4, i.e. the single-mode condition) to the cut off normalized frequency V of LP21 mode (about V=3.83-3.9 depending on the levels of refractive index differences) is about 0.615-0.628, which is very close to the golden ratio 0.618. (5). the refractive index at the minimum coupling loss points between the myoids and outer segments are quite close to the refractive index at the golden ratio point between myoid's refractive index (1.36) and ellipsoid's refractive index (1.39) in foveal cones (especially in green and red cones). (6). The relative blue cone's absorption coefficient at 564 nm, which is the absorption peak of a red cone, is 0.618. We shall study the deep reasons behind these very interesting Golden Ratio phenomena.

Anhui Liang first proposed the meridians in human body are optical fibers in 1992, and the theory has been proved partially by experiments. We shall discuss the progress on this subject and how to design optical components or systems by using optical communication bionics.

BIOGRAPHY:

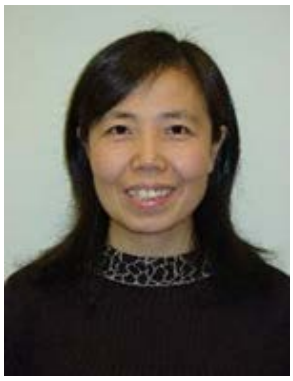
Anhui Liang is a President Specially Hired Professor, Deputy Director of University Academic Committee, Director of Optical Communication and Biophotonics Research Center, Nanjing University of Posts and Telecommunications, P.R. China. He is a China National Distinguished Expert. He is also chairman and CEO of Nanjing Qiansheng Telecommunication Technologies Ltd. He received Ph.D. from The Chinese University of Hong Kong (CUHK), where he received Young Scholars Dissertation Award of CUHK.

He held several important R&D positions in several well known companies, e.g. Chief Scientist (for System and Module), National Key Lab of Optical Communication Technology and Network, FiberHome Technologies; Chief Scientist (for Module), WTD; Tyco Submarine Systems Ltd.; Stratalight; Infinera, Futurewei etc. He research on modules, systems and devices in optical communication field, vision and optoelectronics-bionics, relationship between Chinese Medicine and optics. His inventions have been widely used in the world.

Honors and Awards: China National "Thousand Talent Program" Award recipient; Elected as a member of "Thousand Talent Program" National Representative Committee (only about 200 members in China); Jiangshu Province Creative Talent and Startup Talent Award recipient**;** Jiangshu Province Creative Team Award recipient; Hubei Province Specially Hired Expert; Wuhan 3551 Talent Program Award recipient; Nanjing 321 Talent Program Award; Elected as a famous alumni of The University of Electronic Science & Technology. He has been widely reported by many news and TV (including the most popular TV Channel , Jiangshu Satellite TV, in China).

N1. Optical Networks
Friday, May 9, 9:00–10:40

Session Chair:



Hong Zhao

Fairleigh Dickinson University

BIOGRAPHY:

Hong Zhao is an Associate Professor of Electrical and Computer Engineering at Fairleigh Dickinson University, New Jersey, US. Her primary research interests include network security, network traffic modeling, multimedia communications, cross-layer design for wireless networks, and digital signal processing. Her research results were published at IEEE prestigious journals and conferences including IEEE Transactions on Information Forensics and Security, IEEE Transactions on Broadcasting, IEE Proceedings on Communication. Dr. Zhao serves an Associate Editor of the Journal on Multidimensional Systems and Signal Processing, and Editor of the Journal of Computing and Information Technology. Professor Zhao also serves as the Chair of the IEEE North Jersey Computer Society Chapter.

Hong Zhao received the B.S., M.S., and PhD from Taiyuan University of Technology, Xian Jiaotong University, and New Jersey Institute of Technology, respectively, all in Electrical Engineering. She has served as a TPC member, technical arrangements co-chair, technical paper reviewer, and book reviewer for IEEE conferences, journal magazines and book publishers. Dr. Zhao is a Senior Member of IEEE, and Member of IEEE North Jersey Section Executive Committee.

N1. Technical Session: Optical Networks

Advances in Passive Optical Network Technologies for Broadband Access

Naresh Chand

Huawei Technologies

ABSTRACT:

Emerging bandwidth (BW) hungry applications demand energy efficient, flexible and scalable broadband optical access networks that can support residences, businesses and mobile backhauling on a common platform. This will allow operators to optimize total cost of ownership, offer more value-added services and improve their return on investment (ROI). Most of the presently deployed FTTH Passive Optical Networks are based on either GPON or EPON using TDM and their deployments will continue to dominate. There are many yet to be deployed next generation systems based on XGPON, 10GEPON, WDMPON and TWDM PON. These TDM based PON systems are relatively simple to implement, but they lack flexibility and interoperability.

Recently both copper and wireless broadband systems have adopted OFDM/FDM-based DSP links. They offer higher granularity, flexibility and dynamic rate adjustment through frequency multiplexing, spectrally efficient modulation, line codes, and channel impairment compensation. DSP addresses the limitations of TDM PON and is now considered a promising candidate for optical access networks also as evident by extensive research in this area. With DACs/ADCs costs falling, DSP based PON could find applications in realizing software defined flexible and spec

BIOGRAPHY:

Dr. Naresh Chand is Director in Optical Access research Department, Futurewei (Huawei) Technologies in Bridgewater NJ. Prior to this, he was an Engineering and Technology Fellow at BAE Systems, Wayne, NJ. where he managed advanced technology initiatives and photonics R&D for (i) fiber and free-space optical communication systems for transporting data from sensors to war fighters in air, space, ground and sea, (ii) microwave photonics and (iii) broadband data networks on avionics and other military moving platforms. Prior to joining BAE Systems in 2003, he was a Distinguished Member of technical Staff at Agere Systems where he conducted research in optical communications and networks. From 1986 through 2000, he worked at AT&T/Lucent Bell Laboratories on optical access, communication lasers and high-speed electronics technologies. During 1974-79, he worked for the Govt. of India where he was involved in development of electronics industry in India.

His education includes (1) M.Sc. (Tech) in Microwave Engineering from Birla Institute of Technology and Science, Pilani, India, (2) M.Eng. and Ph.D. in Electrical Engineering (1983) from the University of Sheffield, UK as a British Commonwealth Scholar, and (3) two years of post-doctoral research at the University of Illinois, Urbana, IL.

N1. Technical Session: Optical Networks

Hybrid Bidirectional OFDMA-PON Supporting 60/120-GHz RoF using OQPSK

Chongfu Zhang

Key Lab of Optical Fiber Sensing and Communication Networks (Ministry of Education), and School of Communication and Information Engineering, University of Electronic Science and Technology of China, Chengdu, Sichuan, 611731, China

ABSTRACT:

In this letter, we focus on a hybrid bidirectional orthogonal frequency division multiple access-passive optical network (OFDMA-PON) based on offset quadrate phase shift keying (OQPSK) to support 60 and 120-GHz RoF system. The system can support the wired/wireless applications and enable the dynamic bandwidth allocation according to subscriber's application. It is successfully achieved by using the millimeter waves (MMWs) generation and the carrier-reuse technique. In the scheme, the MMW bands used for downlink (DL) and uplink (UL) transmission are generated at the optical line terminal (OLT) by the dual-arm MZMs. Both 60 and 120 GHz MMWs are obtained for the transmission of the high bit-rate services in the source-free optical network units (ONUs), only using a single 15 GHz sinusoidal wave source. The Rayleigh backscattering (RB) effect is considered in the OQPSK-based OFDMA-PON. For DL transmission over 30-km single mode fiber (SMF), the power penalties are less than 0.8 dB and 1 dB for the OQPSK-OFDM wired data at 10-Gb/s and the OQPSK-OFDM wireless data at 5-Gb/s respectively.

BIOGRAPHY:

Chongfu Zhang is currently a full professor and Ph.D supervisor of optical communications at UESTC and selected by Program for New Century Excellent Talents in University (NCET). He received his Ph.D. degrees in Optical Engineering from the UESTC in 2009. From 2013 to 2014, he is currently working as a visiting scholar at OCLAB, University of Southern California. He has authored or co-authored over 90 journal and conference papers, and has filed over 30 patents. He has received four awards of science and technology from provinces or ministries. His current research focuses on broadband access networks, optical communications and optoelectronic devices, and optical signal processing.

N1. Technical Session: Optical Networks

Latency Analysis of the Improved Fast Handoff for MIPv6

Hamid Taghizadeh

Master Student at Middle East technical University

ABSTRACT:

Mobile IPv6 was designed to allow nodes to be reachable and maintain ongoing connections while changing their location within the topology. But MIPv6 suffers from several problems such as triangular routing, long distant and frequent registration update. FMIPv6 extension is a MIPv6 handoff enhancement that reduces the latency and stores packets delaying them instead of losing them. However IFMIPv6 is improved version of FMIPv6 and is one of the major protocols that is designed for the next generation wireless access networks and it improves FMIPv6 in terms of latency, packet loss and buffer size. In this paper, we discuss and analyze delay for IFMIPv6 and we will compare the latency between FMIPv6 and IFMIPv6. We also show that IFMIPv6 has less latency than FMIPv6.

BIOGRAPHY:

Hamid Taghizadeh was born in Urmia, Iran. He is currently an M.Sc. student in Electrical Engineering at Middle East Technical University. He got his B.S from Urmia University of Technology with honors in IT engineering. His research interests are wireless communication, antenna design and mobile networks. He is the author of some other papers and also the author of “Simulation of Communication Systems with NS-2”

N2. Internet of Things
Friday, May 9, 14:00–15:40

Session Chair:

Implementation of Randomize-then-Combine Constructed Hash Function

Xiaowen Zhang

Dept. of Computer Science
College of Staten Island, CUNY
2800 Victory Blvd, Staten Island, NY 10314

BIOGRAPHY:

Xiaowen Zhang is an assistant professor of Computer Science at the College of Staten Island (CSI) and a doctoral faculty member at the Graduate Center of the City University of New York. He has been actively engaged in research areas of information security, cryptography, RFID, biometrics, quantum computing, mobile computing, and wireless communications. Prior to joining CSI, he worked in both academia as a lecturer and industry as a software and electronic engineer. He received a PhD in Computer Science from the City University of New York in 2007, and a PhD in Electrical Engineering from Beijing Jiaotong University in 1999.

N2. Technical Session: Internet of Things

On the Role of Software Defined Networking in Mobile Networks

Colin Kahn

Alcatel-Lucent CTO

ABSTRACT:

Elastic computing and storage in data centers has ushered in a new need for highly dynamic networking that is being addressed by software defined networking (SDN). The benefits of SDN in data center networking, both within and between data centers have been firmly established. The key question that we address in this paper is what role SDN can play in the domain of wireless networking. With the ever expanding use of mobile networks for a plethora of applications through a wide variety of devices such as machine-to-machine (M2M), network operators are facing some new challenges, including accommodating large traffic volumes cost effectively, providing customized network services for new device categories and applications, and handling new shared radio access network and shared spectrum access configurations. The major principles of SDN, such as the separation of control plane and data plane, resource discovery, network abstraction, and programmability of the network by external applications are useful constructs to address the new requirements on mobile networks. We discuss at a high level how SDN and network programmability can enhance network optimization, network services, network partitioning, and Network Function Virtualization (NFV). Next, we describe the components of a Programmable Wireless Network (PWN) framework that are required to achieve the network abstraction and programmability. We then describe in detail the application of this framework to four mobile network use cases: (a) optimized traffic steering between WiFi and cellular for WiFi offloading (b) wireless transport network optimization (c) dynamic network slicing for Public Safety and (d) optimized video delivery.

BIOGRAPHY:

Colin Kahn is a member of the Corporate CTO Organization at Alcatel-Lucent. He currently supports 5G and LTE access and core network architecture initiatives, focusing on the development of new solutions that leverage Alcatel-Lucent's traditional strengths in network systems. Over the past 20 years he has worked at ALU, and Lucent Technologies and AT&T providing systems engineering, standards and customer support for IS-136 TDMA, CDMA (IS-95, 3G1X and EV-DO), GSM, UMTS and LTE. Prior to joining the AT&T wireless business unit he spent 6 years in AT&T Federal Systems conducting acoustics related research.

Prior to joining AT&T Colin conducted fusion energy research at General Atomic Corp. and Princeton University Plasma Physics Laboratory. Colin holds Electrical Engineering degrees from M.I.T and Cornell University, is a member of IEEE and has published numerous papers.

N2. Technical Session: Internet of Things

Identifying User Clicks Based on Dependency Graph

Jun Liu

Beijing University of Posts and Telecommunications, China

ABSTRACT:

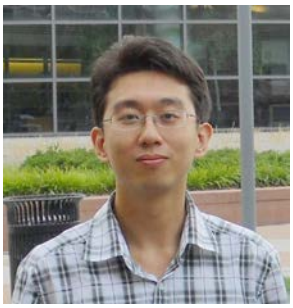
Identifying user clicks from a large number of measured HTTP requests is the fundamental task for web usage mining, which is important for web administrators and developers. Nowadays, the prevalent parallel web browsing behavior caused by multi-tab web browsers renders accurate user click identification from massive requests a great challenge. In this paper, we propose a dependency graph model to describe the complicated web browsing behavior. Based on this model, we develop two algorithms to establish the dependency graph for measured requests, and identify user clicks by comparing their probabilities of being primary requests with a self-learned threshold. We evaluate our method with a large dataset collected from a real world mobile core network. The experimental results show that our method can achieve high accurate user clicks identification.

BIOGRAPHY:

Jun Liu received his B.E and Ph.D degrees from Beijing University of Posts and Telecommunications (BUPT), China in 1998 and 2003, respectively. Currently, he is the leader of Broadband Network Monitoring R&D base in School of Information and Communication Engineering, BUPT. His research interests include network traffic monitoring and Telco big data analysis. Email: liujun@bupt.edu.cn

N2. Technical Session: Internet of Things

User Behavior based Automatical Navigation System on Android Platform



Jie Tian

New Jersey Institute of Technology

ABSTRACT:

Nowadays, navigation applications in smartphones are widely used in our daily lives. But the problem existing in using such applications is that a lot of operations between users and smartphones are needed, such as destination setting, routing options setting and zooming in/out. Potential dangers may bring to the users when they are walking on the street or especially driving. In this paper, we study providing an automatical navigation system, in which the number of users' touches is largely reduced. The navigation system can automatically predict user's future possible destinations and routes without any operation from users. The prediction is performed by analyzing both user's current position and historical tracing data. We implement the proposed system on the popular Android platform. The experimental results show that the application works effectively to provide anticipated routes and destinations for a single user.

BIOGRAPHY:

Jie Tian received his BS degree in Computer Science, Department of Computer Science from Tianjin University, Tianjin, China, in 2005, and got his MS degree in Computer Science from Department of Computer Science at Nankai University, Tianjin, China, in 2008. He is currently a Ph.D. candidate in Department of Computer Science at New Jersey Institute of Technology. His research includes wireless networks, ad hoc/sensor network and mobile computing.

N2. Technical Session: Internet of Things

ARPP: An Augmented Reality 3D Ping-Pong Game System on Android Mobile Platform

Xin Gao

New Jersey Institute of Technology

ABSTRACT:

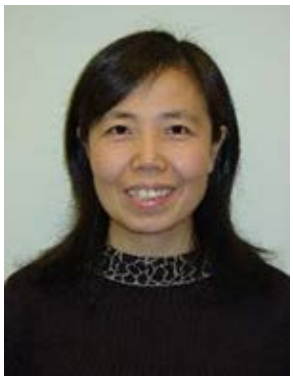
Ping-pong is a very popular physical game all over the world. People need to play it in some fixed physical locations. Based on Augmented Reality (AR) technology, we provide a more interesting and convenient way for people to play ping-pong game on smartphones. In this paper, we propose an Augmented Reality 3D Ping-Pong game system (ARPP) for two players on Android platform through Wi-Fi Direct. The game is rendered when two players aim their phones' camera at a specific marker. The players can view the virtual table tennis scenario through the screen of their smartphones. They move their phones to control paddles to play ping-pong game. The experiment results show that the proposed game system can work effectively and provide winner results on two Android mobile devices.

BIOGRAPHY:

Xin Gao is currently a second-year Ph.D. student at Department of Computer Science, New Jersey Institute of Technology, working under the supervision of Prof. Guiling Wang. Prior to her Ph.D., she received the B.E. degree in information security and LL.B. degree in civil law, both from Nankai University in China. Her general area of research is wireless networks and mobile computing with a focus on wireless sensor networks. She is a student member of IEEE.

N3. Network Analysis in Systems Biology
Friday, May 9, 16:10–17:50

Session Chair:



Hong Zhao

Fairleigh Dickinson University

BIOGRAPHY:

Hong Zhao is an Associate Professor of Electrical and Computer Engineering at Fairleigh Dickinson University, New Jersey, US. Her primary research interests include network security, network traffic modeling, multimedia communications, cross-layer design for wireless networks, and digital signal processing. Her research results were published at IEEE prestigious journals and conferences including IEEE Transactions on Information Forensics and Security, IEEE Transactions on Broadcasting, IEE Proceedings on Communication. Dr. Zhao serves an Associate Editor of the Journal on Multidimensional Systems and Signal Processing, and Editor of the Journal of Computing and Information Technology. Professor Zhao also serves as the Chair of the IEEE North Jersey Computer Society Chapter.

Hong Zhao received the B.S., M.S., and PhD from Taiyuan University of Technology, Xian Jiaotong University, and New Jersey Institute of Technology, respectively, all in Electrical Engineering. She has served as a TPC member, technical arrangements co-chair, technical paper reviewer, and book reviewer for IEEE conferences, journal magazines and book publishers. Dr. Zhao is a Senior Member of IEEE, and Member of IEEE North Jersey Section Executive Committee.

N3. Technical Session: Network Analysis in Systems Biology

Network Analysis in Systems Biology

Avi Ma'ayan, PhD

Department of Pharmacology and Systems Therapeutics
Systems Biology Center New York
Icahn School of Medicine at Mount Sinai
One Gustave L. Levy Place Box 1215
New York, NY 10029 USA

ABSTRACT:

The vision of predictive, preventive, personalized, and participatory (P4) medicine is expected to transform healthcare in the near future and this will require advances in computational sciences to properly mine diverse, complex and sizable biological and biomedical data. Transformative changes that are relevant to P4 medicine are quickly budding through large-scale projects that collect data from human cells and patients using a variety of high-content experimental methods. The combination of high-throughput genome-wide experiments with advanced computation and modeling will lead to better understanding of drug action in cells and drug induced events that perturb the human phenotype. By combining systems biology, pharmacology, genetics and genomics and computer science we should be able to better predict how drug perturbations affect the molecular networks of human cells, leading to changes in the human individual phenotype. In this talk I will discuss how over 40 different large-scale projects, databases and other resources can be integrated into a coherent map to link human and mouse phenotypes to drugs, genes, expression signatures, protein-protein interaction networks and gene-gene functional association networks. This map is helpful for assembling the puzzle pieces needed to complete understanding of the effects of drugs on the individual human phenotype at the molecular level.

BIOGRAPHY:

Dr. Ma'ayan is an Associate Professor in the Department of Pharmacology and Systems Therapeutics and the Director of the Computational Core of the Systems Biology Center New York (SBCNY). Dr. Ma'ayan received his PhD in Biological Sciences from Mount Sinai in 2006 and his BS and MS in Computer Science from Fairleigh Dickinson University in 1997 and 2001. The Ma'ayan Laboratory applies computational and mathematical methods to study the complexity of regulatory networks in mammalian cells. The Ma'ayan Laboratory applies graph-theory algorithms, machine-learning techniques and dynamical modeling to study how intracellular regulatory systems function as networks to control cellular processes such as differentiation, de-differentiation, apoptosis and proliferation. The Ma'ayan Laboratory also develops software systems to help experimental biologists form novel hypotheses from high-throughput data, and develop theories about the structure and function of regulatory networks in mammalian systems.

N4. Network Planning and QoS Provisioning
Saturday, May 10, 9:00–10:40

Session Chair:

Yuanqiu Luo

Futurewei (Huawei) Technologies, Huawei USA R&D Center

BIOGRAPHY:

Yuanqiu Luo is a senior staff engineer in the advanced technology department of Futurewei (Huawei) Technologies, Bridgewater, NJ. Her research interests are in the areas of broadband access networks, network modeling, and integrated optical and wireless networks. She has been heavily involved in the pioneering R&D effort of optical access networks, such as the first XG-PON1 trial, time synchronization over PON, and the first TWDM-PON prototype system. She is a coeditor of ITU-T Recommendations G.987.3, G.989.2, G.multi, and a clause editor of IEEE Standard 802.1AS. In 2011 she was honored with an IEEE Standards Award.

Yuanqiu Luo received both her Bachelor degree in electronics and information systems and her Master degree in electrical engineering from Shandong University, China. Her Ph.D. degree in electrical engineering was received from New Jersey Institute of Technology, Newark, NJ. She authors more than 40 publications and more than 10 US patents. Before joining Huawei she was with NEC Laboratories America, Princeton, NJ.

N4. Technical Session: Network Planning and QoS Provisioning

Message Passing Delay in Network Congestion Management

Hengky Susanto

Department of Computer Science
University of Massachusetts at Lowell

ABSTRACT:

Network Utility Maximization (NUM) framework has been extensively studied. Generally, existing solutions for NUM require message exchange between network and users to regulate the flow of network traffic, and information is frequently assumed to be available instantaneously and the traffic flow adjustment is accomplished immediately. However, realistically, there is delay in message exchange because time is required for the messages to reach the designated destinations and for the traffic flow adjustment in network to take effect. Consequently, without proper synchronization, transmission rate and network pricing may oscillate, resulting in the algorithm's failure to converge, even when there is a solution that converges to an optimal solution. Here, we propose a synchronization methodology to prevent the algorithm from oscillating.

BIOGRAPHY:

Hengky Susanto received the BS degree in computer science from University of Massachusetts Amherst in 1999, the MS degree in computer science from University of Massachusetts Lowell in 2004. He also did his post MS degree at Tufts University. He is currently PhD candidate in computer science at University of Massachusetts Lowell. His main interest includes wired and wireless network, network multimedia, protocol design, and network pricing. He has also received several awards including the best USENIX LISA paper award 2005, EMC Achievement award 2000, and StorageNetwork Shine Award 2002.

N4. Technical Session: Network Planning and QoS Provisioning

Network-as-a-Service in Software Defined Networks for End-to-End QoS Provisioning

Qiang Duan

Information Sciences & Technology Department
The Pennsylvania State University Abington College
Email: qduan@psu.edu

ABSTRACT:

End-to-end Quality of Service (QoS) provisioning for supporting diverse application requirements is a challenging problem in the Internet. Network-as-a-Service (NaaS) in the Software-Defined Networking (SDN) paradigm offers a promising approach to addressing this challenge. In this paper, the author first presents a framework for applying NaaS in SDN that enables network service orchestration for supporting inter-domain end-to-end QoS. Then a high-level abstraction model for network service capabilities is proposed and a technique for determining required bandwidth in network services to achieve QoS guarantee is developed. Network calculus is employed in the proposed modeling and analysis, which makes the developed techniques general and applicable to networking systems consisting of heterogeneous autonomous domains.

BIOGRAPHY:

Qiang Duan is an Assistant Professor and program director at the Pennsylvania State University Abington College. His general research interest is about data communications and computer networking. Currently his active research areas include future Internet architecture, network virtualization, Service-Oriented Architecture and Network-as-a-Service, Software Defined Network, Cloud computing, and Web services. He has published over 50 technical papers in international journals and conference proceedings and authored 5 book chapters. Dr. Duan is serving as an associate editor for a few international research journals and has served on the technical program committees for numerous conferences including GLOBECOM, ICC, ICCCN, AINA,WCNC, etc. He also serves as a reviewer for various journals including IEEE JSAC, IEEE TNSM, IEEE TPDS, ACM TAAS, Elsevier COMNET, etc. Dr. Duan received his Ph.D. degree in electrical engineering from the University of Mississippi. He holds a B.S. degree in electrical and computer engineering and a M.S. degree in telecommunications and electronic systems.

N4. Technical Session: Network Planning and QoS Provisioning

Tree-Based Energy-Efficient Data Gathering in Wireless Sensor Networks deploying Compressive Sensing

Minh Tuan Nguyen

School of Electrical and Computer Engineering
Oklahoma State University

ABSTRACT:

Compressive sensing (CS) provides a new paradigm for data collection in wireless sensor networks (WSNs). In this paper, we continue to exploit the integration between CS and tree-based data gathering in WSNs. Based on a tree formed as down-stream generations from the sink or base-station (BS), each parent node stores its children's readings and the corresponding measurement vectors through the data collecting process. All sensors send their own readings only once to their parents. The parent nodes generate measurements based on the projection matrix and then forward a certain number of measurements required to the upper nodes or the BS. The CS recovery algorithm implemented at the BS reconstructs precisely readings from all sensors. This significantly reduces a certain number of transmissions in routing. Two additional ideas are suggested related to sensor transmission range and the probability of non-zero elements in the projection matrix for the purpose of reducing power consumption for the networks.

BIOGRAPHY:

Minh Nguyen received a Bachelor degree in Electrical Engineering from Hanoi University of Communication and Transport in Vietnam in 2001 and a Masters degree also in Electrical Engineering from Military Technical Academy in Hanoi, Vietnam, in 2007. Since 2003, he has been a lecturer at Thai Nguyen University of Technology (TNUT) in Vietnam teaching courses and performing research related to optical engineering, transmission technologies, data transmission and telecom network management. In 2010 he began study for the PhD in Electrical Engineering in the School of Electrical and Computer Engineering at Oklahoma State University in Stillwater, Oklahoma USA under a scholarship from the Vietnamese Ministry of Education and Training. He is currently pursuing the PhD and working as a teaching and research associate at the School. His research focus is on signal processing, compressive sensing, and wireless sensor networks. He is an IEEE student member.

N4. Technical Session: Network Planning and QoS Provisioning

Vector Quantization based QoS Evaluation in Cognitive Radio Networks

Osama Abbas Al Tameemi

Department of Electrical Engineering and Computer Science, University of Central Florida

ABSTRACT:

In this paper, we attempt to characterize the QoS that secondary users can expect in a cognitive radio network. Using power control as a black-box, we propose a method that can help us evaluate the QoS for any given power vector based on past observations. To that end, we first define a k-dimensional QoS space where each point in that space characterizes the expected QoS. We show how the operating condition of the system maps to a point in the QoS space, the quality of which is given by the corresponding QoS index. To deal with the real-valued QoS space, we use vector quantization to partition the space into finite number of regions each of which is represented by one QoS index. We argue that any operating condition of the system can be mapped to one of the pre-computed QoS indices using a simple look-up in O(log n) time– thus avoiding any cumbersome computation for QoS evaluation. Using simulations, we illustrate how a 2-dimensional QoS space can be constructed. We choose capacity as the QoS metric and show what the expected capacity would be for a given power vector.

BIOGRAPHY:

Osama Abbas Al Tameemi (S'05) received the M.Sc. degree in Modern Communications Engineering from Al Nahrain University, Iraq, in 2008. He is currently a Ph.D. student in the Department of Electrical Engineering and Computer Science at the University of Central Florida. His research interests are connectivity and capacity of cognitive radio networks.

N4. Technical Session: Network Planning and QoS Provisioning

RCM-BR: An Efficient Rate Control Protocol for Multimedia Delivery in Wireless Internet

Sudipta Mahapatra

Associate Professor, Electronics & Electrical Communication Engineering
India Institute of Technology Kharagpur

ABSTRACT:

Next Generation Wireless Internet (NGWI) is expected to provide real-time multimedia services like voice and video delivery. It is important to develop an efficient rate control protocol for the transmission of multimedia data over the Wireless Internet. Moreover, it is desirable to develop an energy efficient protocol since wireless devices are energy constrained. In this paper an effective rate control protocol for delivering multimedia data over the wireless networks is presented. Simulation results indicate that the proposed rate control mechanism achieves a good throughput performance, smooth rate variation, minimum delay jitter and better energy efficiency. The performance test results obtained over a miniature NGWI test bed validate our proposed rate control mechanism in terms of throughput performance, rate variations, low latency and jitter.

BIOGRAPHY:

Sudipta Mahapatra graduated in Electronics and Telecommunication Engineering from Sambalpur University, Orissa, India in the year 1990. He obtained his M.Tech. and Ph.D. degrees in Computer Engineering from IIT, Kharagpur in the year 1992 and 1997 respectively.

From April 1993 to September 2002 he was working in the Computer Science and Engineering department of National Institute of Technology, Rourkela. He was in the Electronic Systems Design Group of Loughborough University, UK, as a BOYSCAST Fellow of DST, Government of India, from March 1999 to March 2000. He joined the E & ECE Department of IIT Kharagpur in Sept. 2002 where currently he is working as an Associate Professor.

His areas of research interest include: Video coding/Streaming, Optical and Wireless Networking, and Parallel and Distributed Systems.

N5. Cloud Computing
Saturday, May 10, 14:00–15:40

Session Chair:

Yuanqiu Luo

Futurewei (Huawei) Technologies, Huawei USA R&D Center

BIOGRAPHY:

Yuanqiu Luo is a senior staff engineer in the advanced technology department of Futurewei (Huawei) Technologies, Bridgewater, NJ. Her research interests are in the areas of broadband access networks, network modeling, and integrated optical and wireless networks. She has been heavily involved in the pioneering R&D effort of optical access networks, such as the first XG-PON1 trial, time synchronization over PON, and the first TWDM-PON prototype system. She is a coeditor of ITU-T Recommendations G.987.3, G.989.2, G.multi, and a clause editor of IEEE Standard 802.1AS. In 2011 she was honored with an IEEE Standards Award.

Yuanqiu Luo received both her Bachelor degree in electronics and information systems and her Master degree in electrical engineering from Shandong University, China. Her Ph.D. degree in electrical engineering was received from New Jersey Institute of Technology, Newark, NJ. She authors more than 40 publications and more than 10 US patents. Before joining Huawei she was with NEC Laboratories America, Princeton, NJ.

N5. Technical Session: Cloud Computing

A Centralized Trust Model Approach for Cloud Computing

Syed Rizvi

Department of Information Science and Technology, Penn State Altoona

ABSTRACT:
In the IT world of corporate networking, how businesses store and compute data is starting to shift from in-house servers to the cloud. However, some enterprises are still hesitant to make this leap to the cloud because of their information security and data privacy concerns. Enterprises that want to invest into this service need to feel confident that the information stored on the cloud is secure. Due to this need for confidence, trust is one of the major qualities that cloud service providers (CSPs) must build for cloud service users (CSUs). To do this, a model that all CSPs can follow must exist to establish a trust standard in the industry. If no concrete model exists, the future of cloud computing will be stagnant. This paper presents a new trust model that involves all the cloud stakeholders such as CSU, CSP, and third-party auditors. Our proposed trust model is objective since it involves third-party auditors to develop unbiased trust between the CSUs and the CSPs. Furthermore, to support the implementation of the proposed trust model, we rank CSPs according to the trust-values obtained from the trust model. The final score for each participating CSP will be determined based on the third-party assessment and the feedback received from the CSUs.

BIOGRAPHY:
Syed Rizvi is currently an Assistant Professor in the College of Information Sciences and Technology at Pennsylvania State University, Altoona. He received his doctorate in Modeling and Simulation from the University of Bridgeport in 2010. His research interests lie at the intersection of computer networking, network security and modeling and simulation. Recently, he has been working on security issues in cloud computing, cognitive radios for wireless communications, and modeling and simulation of nano-networks. He has authored and coauthored over 70 technical refereed and non-refereed papers in various conferences, international journal articles, and book chapters in research and pedagogical techniques. He is also an affiliate member of the Wireless and Mobile Communications lab at the University of Bridgeport. He is a member of IEEE Communications Society and ACM.

Jungwoo Ryoo is an associate professor of Information Sciences and Technology (IST) at the Pennsylvania State University-Altoona. Ryoo is also a graduate/affiliated faculty member of the college of IST at Penn State. He is a technical editor for the IEEE Communications Magazine and also working withIEEE and Software Engineering Institute (SEI) as a consultant. His research interests include information security and assurance, software engineering, andcomputer networking. He is the author of numerous academic articles and conducts extensive research in software security, network/cyber security, security management (particularly in the government and medical sector) and auditing (especially in cloud computing), software architectures, architecture description languages (ADLs), object-oriented software development, formal methods, and requirements engineering. Many of Ryoo's research projects have been funded by both state and federal government agencies. He received his Ph.D. in Computer Science from the University of Kansas in 2005.

Yuhong Liu is an assistant professor in the College of Information Science and Technology at Penn State Altoona. She received her Ph.D. degree from the University of Rhode Island (URI) in 2012. She received her B.S. degree in information engineering in 2004 and M.S. degree in signal processing in 2007, both from Beijing University of Posts and Telecommunications. Her primary research interests include trustworthy computing, security issues in social network and cloud computing. Her work on detecting dishonest ratings/feedbacks and malicious users in online rating systems received the best paper award at the IEEE International Conference on Social Computing. Her Ph.D. thesis has won the URI Graduate School Excellence in Doctoral Research Award 2013.

N5. Technical Session: Cloud Computing

Ensuring Data Confidentiality in Cloud Computing: An Encryption and Trust-based Solution

Yuhong Liu

Department of Information Science and Technology, Penn State Altoona

ABSTRACT:

With the rapid development of cloud computing, more users are attracted by its powerful and cost-efficient computation capability. However, whether CSPs can effectively protect CSUs' data confidentiality remains a challenging issue. In this work, we aim at ensuring data confidentiality in the cloud environment by enabling CSUs to (1) encrypt their sensitive data and perform data correctness verification from time to time, (2) evaluate the trustworthiness of CSP, and (3) determine whether to allow CSPs to perform diverse computation services according to their trust values. The proposed solution, which integrates the encryption and trust based techniques, has achieved the above design goals.

BIOGRAPHY:

Yuhong Liu is an assistant professor in the College of Information Science and Technology at Penn State Altoona. She received her Ph.D. degree from the University of Rhode Island (URI) in 2012. She received her B.S. degree in information engineering in 2004 and M.S. degree in signal processing in 2007, both from Beijing University of Posts and Telecommunications. Her primary research interests include trustworthy computing, security issues in social network and cloud computing. Her work on detecting dishonest ratings/feedbacks and malicious users in online rating systems received the best paper award at the IEEE International Conference on Social Computing (SocialCom'10, acceptance ratio =13%). Her Ph.D. thesis has won the University of Rhode Island (URI) Graduate School Excellence in Doctoral Research Award 2013.

N5. Technical Session: Cloud Computing

Cloud Computing Security, Data, And Performance Issues

Neelu Sinha

Fairleigh Dickinson University

ABSTRACT:

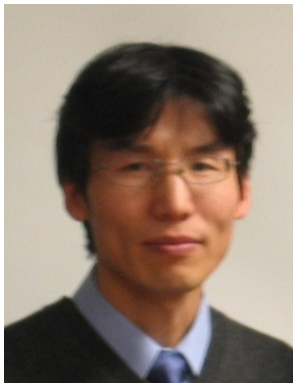
Cloud computing offers an exceptional elasticity of resources and remarkable economic advantages in the Information Technology sector. It also provides an infrastructure for processing large and complex scientific data for data mining applications. While offering compelling throughput gains, it also introduces several challenges related to security, efficient storage of data, and performance. We first present the basics and a brief history of cloud computing; followed by its benefits, architecture, implementation and applications. Finally, we provide an insight into the issues and challenges associated with cloud computing.

BIOGRAPHY:

Neelu Sinha, Associate Professor in the Department of Mathematics, Computer Science, and Physics at the College of Florham, earned her MS and Ph.D. degrees in Electrical and Computer Engineering from Iowa State University, Ames, Iowa, US. She has over 11 years of industrial experience from Control Data Corporation, Empros International, Bellcore, and Bell Laboratories (AT&T, Lucent, Alcatel-Lucent). She has also taught at the University of Minnesota and New Jersey Institute of Technology. Her current areas of research are in developing security applications on hand-held devices for Android and other platforms.

N5. Technical Session: Cloud Computing

Implementation of Randomize-then-Combine Constructed Hash Function



Xiaowen Zhang

Dept. of Computer Science
College of Staten Island, CUNY
2800 Victory Blvd, Staten Island, NY 10314

ABSTRACT:

Hash functions, such as SHA and MD families, built upon Merkle-Damgard construction suffer many attacks due to the iterative nature of block-by-block message processing. Chum and Zhang [1] proposed a new hash function construction that takes advantage of randomize-then-combine technique, which was used in the incremental hash functions, to the iterative hash function. In this paper we implement such hash construction in three ways distinguished by their corresponding padding methods. We conduct the experiment in both sequential and parallel multi-threaded programming settings. The results show that the speed of proposed hash function is no worse than the SHA-1.

BIOGRAPHY:

Xiaowen Zhang is an assistant professor of Computer Science at the College of Staten Island (CSI) and a doctoral faculty member at the Graduate Center of the City University of New York. He has been actively engaged in research areas of information security, cryptography, RFID, biometrics, quantum computing, mobile computing, and wireless communications. Prior to joining CSI, he worked in both academia as a lecturer and industry as a software and electronic engineer. He received a PhD in Computer Science from the City University of New York in 2007, and a PhD in Electrical Engineering from Beijing Jiaotong University in 1999.

N6. Network Planning and Optimization
Saturday, May 10, 16:10–17:50

Session Chair:

Jungwoo Ryoo

Penn State University

BIOGRAPHY:

Jungwoo Ryoo is an associate professor of Information Sciences and Technology (IST) at the Pennsylvania State University-Altoona. Ryoo is also a graduate/affiliated faculty member of the college of IST at Penn State. He is a technical editor for the IEEE Communications Magazine and also working with IEEE and Software Engineering Institute (SEI) as a consultant. His research interests include **information security and assurance**, **software engineering**, and **computer networking**. He is the author of numerous academic articles and conducts extensive research in software security, network/cyber security, security management (particularly in the government and medical sector) and auditing (especially in cloud computing), software architectures, architecture description languages (ADLs), object-oriented software development, formal methods, and requirements engineering. Many of Ryoo's research projects have been funded by both state and federal government agencies. He also has substantial industry experience in architecting and implementing secure, high-performance software for large-scale network management systems. He received his Ph.D. in Computer Science from the University of Kansas in 2005.

N6. Technical Session: Network Planning and Optimization

Optimizing Fast Handover in MIPv6 through Buffered Packet forwarding and Out-of-Sequence packet Reduction

Sajida Imran

Department of Information & Communication Engineering, Korea University

ABSTRACT:

For ubiquitous mobile computing, it is very important to have seamless mobility as the mobile node (MN) roams. The handover time needs to be minimized, so to reduce packet loss and latency. Fast Handover for Mobile IPv6 (FMIPV6) is an extension to the MIPv6 in order for a MN to regain its IP connectivity and enable the MN to send/receive data packets immediately following a handover. In this paper, we made an effort to address handover related issues in detail. One of the main problems associated with FMIPv6 is the out of sequence packets reception at the MN. The correspondent node considers this as congestion in the network and initiates the TCP congestion control mechanism thereby reducing its transmission window which causes performance degradation. In this paper, we addressed this problem by proposing a technique which uses two buffers at New Access Router (NAR) and uses a flag to notify both Previous Access Router (PAR) and NAR about the arrival of last packet. Also a kind of fast binding update (BU) is sent to correspondent node (CN) to notify it in earlier stage of handover to change its packet transmission path towards new access router. Simulation results reveal that our proposed technique avoided Out-of-sequence packets and triggering of TCP congestion control mechanism, thereby reducing handover delay as compared to standard FMIPv6.

BIOGRAPHY:

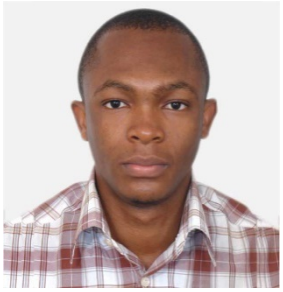
I am from Pakistan. Currently i am doing PhD from Korea University. Here I am in Internet Computing Lab under the supervision of Prof. Park, Myong-Soon. Primary focus of my research is wireless network, especially wireless sensor networks. I am also interested in handover optimization and QoS in wireless networks. Before that, I completed my Masters (MS) in Computer System Engineering from Ghulam Ishaq Khan Institute of Engineering, Pakistan in June 2010. I did my BSc in Computer System Engineering from KPK University of Engineering & Technology Peshawar, Pakistan, in 2008.

N6. Technical Session: Network Planning and Optimization

High-Resolution Hardware-based Packet Capture with Higher-Layer Pass-Through on NetFPGA Card

Yaovi E. Kwasi

New Jersey Institute of Technology



ABSTRACT:

Packet capture for measurement of several network parameters on high-speed networks requires high clock resolution and the capability of analyzing different protocol functions for behavioral functionality. Herein, we present a practical packet capture tool that timestamps packet arrivals in the data-link layer with nanosecond resolution and with the capability of forwarding packets to the application layer in real time. Our tool can be used to analyze both network performance and behavioral functionality for high-speed networks. We built this tool on a NetFPGA card and with minimum dependencies on offline data processing. Different from existing specialized packet capture cards, our card allows packets to be time-stamped at both the data-link and application layers. We present the design and evaluation of our proposed tool. We tested the accuracy of our tool and compared it to that of a commercial specialized packet capture card, and show that they are equivalent.

BIOGRAPHY:

Yaovi Kwasi received his BS degree in computer engineering in 2011 from Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. In 2013, he received his MS degree in computer engineering from the department of Electrical and Computer Engineering at the New Jersey Institute of Technology. He is a member of the IEEE COMSOC and computer society. His research interests include high speed network analysis, and network measurement tools development. He is currently a software engineer at RDE systems LLC.

N6. Technical Session: Network Planning and Optimization

Information-Centric Networks: Categorizations, Challenges and Classifications

Naveed Bin Rais

CoreNet Research Group, M.A. Jinnah University, Islamabad, Pakistan

ABSTRACT:

Information-Centric Networking (ICN) emerges as a promising approach for content dissemination and retrieval with a number of advantages including efficient content delivery, better bandwidth utilization and improved mobility support. In past few years, several ICN architectures have been proposed offering different set of features and characteristics, which makes it difficult to choose a particular architecture, given some network conditions and characteristics at hand. These characteristics include IP compatibility, and choice of naming structures etc. Besides, there is a little focus on a number of challenging areas including congestion control, availability, sporadic behavior, multi-source multi-destination and security etc. Moreover, it is not clear how ICN approaches behave with different emerging network environments such as user-centric networking, object-centric networking, Software-Defined networking and Cloud Computing. In this paper, we target all these issues together. First, we attempt to categorize different ICN architectures based on some common characteristics. Second, we identify a number of research challenges in the ICN domain and provide suggestions on mapping them to different ICN approaches. At the end, we bisect ICN approaches based on their characteristics and classify them on the basis of usability which helps a user choose a particular ICN approach given network requirements at hand.

BIOGRAPHY:

Rao Naveed Bin Rais received his M.S. and Ph.D. degrees in Computer Engineering from INRIA/University of Nice, Sophia Antipolis, France in 2007 and 2011 respectively. Before that, he received his B.E. in Computer Systems from National University of Sciences and Technology (NUST), Pakistan in 2002. He is currently working as Assistant Professor in the Electronic Engineering Department at M.A. Jinnah University, Islamabad Pakistan. He has 5+ years of teaching, 7+ years of research and 4+ years of industrial experience. His current research interests include future internet architecture, network protocol design for heterogeneous networks and mobile ad-hoc networks (MANETs), information-centric and software-defined networking approaches.

N6. Technical Session: Network Planning and Optimization

Next Generation Hybrid Wireless-Optical Access with TWDM-PON

Yuanqiu Luo

Futurewei Technologies, Huawei USA R&D Center

ABSTRACT:

This paper reviews the latest progress in ITU-T standards on high-speed access networks. We focus on the employment of the time and wavelength division multiplexed passive optical network (TWDM-PON) for the next generation wireline and wireless broadband services. Several applications with TWDM-PON are proposed. We investigate the proposal by developing a prototype system to test the physical layer capability and network service provisioning. Test results demonstrate salient features of employing TWDM-PON to provide broadband access for residential, business, wireless backhaul and fronthaul.

BIOGRAPHY:

Yuanqiu Luo is a senior staff engineer in the advanced technology department of Futurewei (Huawei) Technologies, Bridgewater, NJ. Her research interests are in the areas of broadband access networks, network modeling, and integrated optical and wireless networks. She has been heavily involved in the pioneering R&D effort of optical access networks, such as the first XG-PON1 trial, time synchronization over PON, and the first TWDM-PON prototype system. She is a coeditor of ITU-T Recommendations G.987.3, G.989.2, G.multi, and a clause editor of IEEE Standard 802.1AS. In 2011 she was honored with an IEEE Standards Award.

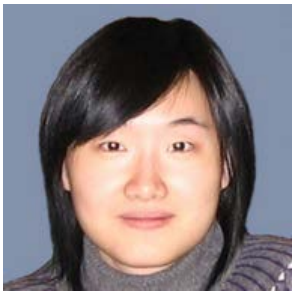
Yuanqiu Luo received both her Bachelor degree in electronics and information systems and her Master degree in electrical engineering from Shandong University, China. Her Ph.D. degree in electrical engineering was received from New Jersey Institute of Technology, Newark, NJ. She authors more than 40 publications and more than 10 US patents. Before joining Huawei she was with NEC Laboratories America, Princeton, NJ.

B2. Visual Analytics
Friday, May 9, 14:00–15:40

Session Chair:

Wendy Wang

Stevens Institute of Technology



BIOGRAPHY:

Dr. Wendy Hui Wang is an assistant professor in the Computer Science Department, Stevens Institute of Technology, New Jersey. She received her PhD degree in computer science from University of British Columbia, Vancouver, Canada. Her research interests include data management, data mining, database security, and data privacy.

B2. Technical Session: Visual Analytics

Bigger data and bigger models for visual recognition and social media

Liangliang Cao

Multimedia Group, IBM Watson Research Center
http://researcher.watson.ibm.com/researcher/view.php?person=us-liangliang.cao

ABSTRACT:

In the past decade, the field of visual recognition has experienced a number of significant changes. The size of the datasets collected by vision researchers has grown substantially. For example, the ImageNet LSVRC dataset in 2010 is 150 times bigger than the Caltech101 dataset in 2003. On the other hand, the visual recognition models also become dramatically bigger. The-state-of-the-art deep CNN models have 1000 times more parameters than the tradition bag of words model in the early 2000s. In this talk, I plan to give a personal overview of these evolvements in visual recognition, and show how models and data reinforce each other's growth. I would like to share our experiences of winning the First Place in ImageNet Large Scale Visual Recognition Challenge 2010 as well as the First Place in ImageCLEF medical image recognition 2012&2013 and examine the influence of scalable techniques in these visual recognition problems. A few our recent demos of visual recognition, text recognition and social media mining will be shown during the talk together with discussions of future research.

BIOGRAPHY:

Liangliang Cao is a research staff member in IBM T.J. Waston Research Center. He also holds an adjunct faculty position at the Columbia University in the City of New York. His work has received three times the IBM Research Division Award (individual award) as well as one Outstanding Technical Accomplishment (group award). He is now leading the efforts of building big data learning toolkit for IBM Multimedia group. Before joining IBM, he did summer interns at Kodak, Microsoft, and NEC Research Labs and received his Ph.D. from University of Illinois at Urbana-Champaign. He received the best paper award from the International Workshop on Big Data Mining, 2012 He was listed as an IBM Emerging Leader in Multimedia and Signal Processing in 2010 and Facebook Fellowship Finalist in 2010. He was a general chair of Greater New York Area Multimedia and Vision Meeting from 2012 to 2013. He was also a founding chair of ACM workshop on Geo-Multimedia. He was an area chair of ACM Multimedia 2012 and WACV 2014.

B2. Technical Session: Visual Analytics

Video Event Detection

By Temporal Sequence Modeling

Quanfu Fan

Exploratory Computer Vision Group, IBM T. J. Watson Research Center

ABSTRACT:

Video event detection plays a central role in many applications such as surveillance, topic discovery and content retrieval. I will talk about an approach we recently developed for video event detection based on temporal sequence modeling. Exploiting temporal information has lain at the core of many approaches for action and activity recognition. Our approach addresses several limitations of event modeling in previous work including long-range temporal dependencies between events, null events (i.e. background clutter) and temporal segmentation. I will show the efficacy of our approach on a challenging surveillance dataset.

BIOGRAPHY:

Dr. Quanfu Fan is a Research Staff Member in the Exploratory Computer Vision group, IBM T. J. Watson Research Center. He joined IBM in 2008 after receiving his Ph.D. degree in Computer Science from the University of Arizona. His research interests cover multiple aspects of computer vision, including image and video understanding, human activity recognition and video analytics. Dr. Fan is a member of the core R&D team of the award-winning IBM surveillance offering and his contributions to video analytics have earned him multiple IBM Research awards. From 2008 to 2010, he led a project on retail fraud detection for loss prevention in retail. The vision system developed by him and his colleagues was live demonstrated at NRF 2010 (the world's largest trade show in retail). Dr. Fan has over 30 publications in peer-reviewed conference/workshop proceedings and journals, including leading ones such as ICCV, CVPR, IJCV and KDD. He is the author (or co-author) of over 30 issued or pending patents.

Prior to joining IBM, Dr. Fan worked in the domain of image and video understanding. His dissertation focused on improving the indexing, browsing, and quality of educational videos, and has led to a system SLIC (Semantically Linked Instructional Content), which offers semantically enhanced and visually improved instructional content to users.

B2. Technical Session: Visual Analytics

Web-scale mobile content search

Zhu Liu

AT&T Labs Research

ABSTRACT:

With unprecedented growth in the volume of multimedia content available and the desire to locate it quickly, new applications demand robust and efficient underlying content search algorithms that perform well in web scale. This talk reviews the recent progress in the related areas, and presents a mobile content search system built at AT&T Labs. The system is composed of audio- and visual-based video copy detection sub-modules, and a late fusion scheme is adopted for combining the copy detection results from both modalities to achieve more robust and accurate results. This system was evaluated in TRECVID copy detection tasks and applied in consumer applications aiding personal library management and product search. A mobile search app will also be demonstrated in the talk.

BIOGRAPHY:

Dr. Zhu Liu is a Principle Member of Technical Staff at AT&T Labs – Research. He received the B.S. and M.S. degrees in Electronic Engineering from Tsinghua University, Beijing, China, in 1994 and 1996, respectively, and the Ph.D. degree in Electrical Engineering from Polytechnic Institute of New York University, Brooklyn, NY, in 2001. His research interests include content-based multimedia indexing and retrieval, audio/image/video signal processing, large-scale multimedia database, computer vision and machine learning. He authored and co-authored 1 book, 7 book chapters, 12 journal/magazine papers, and more than 50 conference/workshop papers. He also holds 41 issued US patents. Dr. Zhu Liu was an associated editor for IEEE Trans. on Multimedia from 2008 to 2012, and he is on the editorial board of IEEE Signal Processing Letters and the Peer-to-peer Networking and Applications Journal. He has been on organizing committee for many IEEE conferences. Dr. Liu is a senior member of IEEE and a member of ACM.

B2. Technical Session: Visual Analytics

Computer Vision based Assistive Technology for Visually Impaired People

YingLi Tian, PhD

Media Lab, Department of Electrical Engineering
The City College, City University of New York
160 Convent Avenue New York, NY 10031
ytian@ccny.cuny.edu

ABSTRACT:

In this talk, I will introduce the computer vision-based assistive technology for visually impaired people. Based on statistics from the American Foundation for the Blind and the National Health Interview Survey, there were, as of 1994-1995, approximately 275,000 people in the US with bare light perception or less. While a small percentage of the 1.3 million people who qualify as legally blind, this is the population who are most in need of vision substitution systems, since many other people with low vision can accomplish visual tasks with magnification and other aids. Recent technology developments in computer vision, digital cameras, and portable computers make it possible to assist these individuals by developing camera-based products that combine computer vision technology with other existing products. I will describe several prototype systems including the indoor navigation system, text extraction, etc. In order to find different rooms (e.g. an office, a lab, or a bathroom) and other building amenities (e.g. an exit or an elevator), we incorporate object detection with text and signage recognition. The object type, location, and text can be displayed as speech for blind users.

BIOGRAPHY:

Dr. YingLi Tian is a professor in the Department of Electrical Engineering at the City College of New York since 2008. She received her PhD from the Department of Electronic Engineering at the Chinese University of Hong Kong. After she held an associate professor position in National Laboratory of Pattern Recognition at the Chinese Academy of Sciences, Beijing, China, Dr. Tian joined the Robotics Institute in Carnegie Mellon University as a postdoctoral fellow. She focused on automatic facial expression analysis. From 2001 to 2008, Dr. Tian was a research staff member at IBM T. J. Watson Research Center. She focused on moving object detection, tracking, and event and activity analysis. She was one of the inventors of the IBM Smart Surveillance Solutions (SSS) product and was leading the video analytics team. She received several IBM Invention Achievement Awards and the IBM Outstanding Innovation Achievement Award due to her contributions to IBM SSS. Her research experience includes video surveillance, event and activity analysis, scene understanding, facial expression recognition, and assistive technology. Dr. Tian has published more than 150 papers in journals and conferences and has filed about 30 patents. She is a senior member of IEEE.

B3. Data Mining Methods and Applications
Friday, May 9, 16:10–17:50

Session Chair:

Zhu Liu

AT&T Labs Research

BIOGRAPHY:

Dr. Zhu Liu is a Principle Member of Technical Staff at AT&T Labs – Research. He received the B.S. and M.S. degrees in Electronic Engineering from Tsinghua University, Beijing, China, in 1994 and 1996, respectively, and the Ph.D. degree in Electrical Engineering from Polytechnic Institute of New York University, Brooklyn, NY, in 2001. His research interests include content-based multimedia indexing and retrieval, audio/image/video signal processing, large-scale multimedia database, computer vision and machine learning. He authored and co-authored 1 book, 7 book chapters, 12 journal/magazine papers, and more than 50 conference/workshop papers. He also holds 41 issued US patents. Dr. Zhu Liu was an associated editor for IEEE Trans. on Multimedia from 2008 to 2012, and he is on the editorial board of IEEE Signal Processing Letters and the Peer-to-peer Networking and Applications Journal. He has been on organizing committee for many IEEE conferences. Dr. Liu is a senior member of IEEE and a member of ACM.

B3. Technical Session: Data Mining Methods and Applications

A Cognitive Hierarchical Framework for Evaluating Emergency Response Activities

Presenter: Dr. Mark Rahmes

Co-authors: Rick Pemble, Kevin Fox, John Delay

Harris Corporation,
Government Communications Systems
Melbourne, Florida 32904

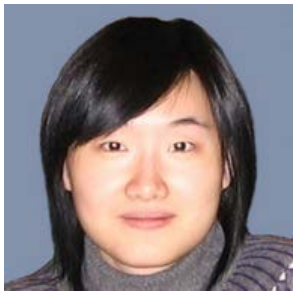
ABSTRACT:

We describe a system model for determining decision making strategies based upon the ability to perform data mining and pattern discovery utilizing open source information to prepare for specific events or situations from multiple information sources. Within this paper, we discuss the development of a method for determining actionable information. We have integrated open source information linking to human sentiment and manipulated other user selectable interlinking relative probabilities for events based upon current knowledge. Probabilistic predictions are critical in practice on many decision making applications because optimizing the user experience requires being able to compute the expected utilities of mutually exclusive pieces of content. Hierarchy game theory for decision making is valuable where two or more agents seek their own goals, possibilities of conflicts, competition and cooperation. The quality of the knowledge extracted from the information available is restricted by complexity of the model. Hierarchy game theory framework enables complex modeling of data in probabilistic modeling. However, applicability to big data is complicated by the difficulties of inference in complex probabilistic models, and by computational constraints. We focus on applying probabilistic models to evaluating emergency response activities. We specifically evaluate adversarial competition to help decide and plan how much to give in our emergency response example to capture the position of highest donor nation using mixed probabilities from game theory. Our contribution in this paper is to combine linear programming, hierarchical game theory with uncertainty modeling as a tool in order to plan for activities based on open source intelligence.

BIOGRAPHY:

Mark has 22 years of experience at Harris Corporation as an Electrical/Computer Engineer and Senior Research Scientist. He earned his BSEE from The Citadel, MSEE from Duke University and PhD in Operations Research from Florida Tech. Mark is a retired U.S. Navy Reserve Captain and served 22 years as a Commanding Officer, Engineering Duty Officer and Surface Warfare Officer. He currently has 40 patents granted. Mark has published 35 IEEE, ASPRS, ILMF, and SPIE conference papers. At Harris Corporation, Mark serves in the capacity of a Principal Investigator and Chief Software Engineer on various programs while advancing image processing research and development. Mark is a member of Tau Beta Pi and Phi Kappa Phi National Honor Societies.

B3. Technical Session: Data Mining Methods and Applications



Verifiable Outsourcing of Big Data Mining Computations

Wendy Wang

Department of Computer Science
Stevens Institute of Technology
Hoboken, NJ, 07030

ABSTRACT:

Spurred by developments such as Big data and Cloud computing, there has been considerable recent interest in the data-mining-as-a-service (DMaS) paradigm. In this paradigm, a client lacking in expertise or computational resources outsources her mining needs to a third party service provider (e.g., the Cloud). In this paradigm, however, the client no longer has direct control over either the outsourced data or the computations. An economically-motivated DMaS provider can be incentivized to skip some of the computations to conserve resources and return cheap (and incorrect) answer. Furthermore, a compromised DMaS provider may modify the result intentionally. Given the fact that many data mining applications (e.g., fraud detection and business intelligence) are so important, there is a crucial need for techniques that enable the client of weak computational power to verify whether the service provider returned correct result of the outsourced data mining computations.

In this talk, we will present our work on verifiable outsourcing of data mining computations. We will present some of our result verification techniques for various data mining computations, including frequent itemset mining and k-means clustering.

BIOGRAPHY:

Dr. Wendy Hui Wang is an assistant professor in the Computer Science Department, Stevens Institute of Technology, New Jersey. She received her PhD degree in computer science from University of British Columbia, Vancouver, Canada. Her research interests include data management, data mining, database security, and data privacy.

B3. Technical Session: Data Mining Methods and Applications

A case study for social media application

Jin Xu

Behaviormatrix

ABSTRACT:

Big data is a quite hot topic recently, one of most popular topics in big data is social media research. How to find interested data from Facebook, Tweets or other sources? How to build metrics for special application? (Such as building the similarity links, graph structure, and recommendation engine.) They are open questions both in industry and academia. The case study in this presentation would give some details about social media application in business problem.

BIOGRAPHY:

Jin Xu received Phd degree in Computer Engineering (Major in Data mining) from Stevens Institute of Technology. He has spent one year in Operations and Information Management Department (Wharton School of the University of Pennsylvania) doing the Postdoctoral research on recommendation system and Big social media graph identification. Currently, he is a data scientist in Behaviormatix, building online classification system for identification the authors in social media, and Leading the research in emotion analysis for Chinese social media. He has more than 5 years research experience in applying Machine Learning on large-scale data analysis and recommendation system. He has more than 10 algorithms/publications of peer-reviewed conferences and journals.

B3. Technical Session: Data Mining Methods and Applications

Detecting Asset Pricing Bubbles: From Small Data to Big Data Approaches

Haobo Lai

New Jersey Institute of Technology

ABSTRACT:

This presentation givens a survey about the current status of two main schools of research concerning the asset pricing bubbles as one of the major social phenomena confronting scientists and economists alike over the years. After the literature survey, an attempt is made to compare the state of art about the two ways of thinking, econometrics and econophysics. Furthermore, the possible synergy between the two disciplines is explored from a view of big data, with the caveat that any economic problem comes with an extra layer of complexity from interacting human calculations in decision-making.

BIOGRAPHY:

Haobo Lai received the B.S. in the Department of Information and Control Engineering from Xi'an Jiatotong University of Xi'an, China in 1993 and M.S. of Systems Engineering from Xi'an Jiatotong University in 1996 and M.S. of Electrical Engineering from New Jersey Institute of Technology of Newark, NJ in 2004. Currently, he is pursuing his Ph. D. degree in New Jersey Institute of Technology. From 1990s, Haobo has significant industry experience in decision support systems, research and development of wireless communication systems, and quantitative analysis for fixed income asset trading and sales. His main research interests are quantitative research of asset pricing bubbles, market microstructure, risk management, robust statistics, explorative data analysis, and statistical modeling and instrumentation of wireless communication systems. His recent research activities include the data centric approach of financial bubbles and digital predistorter designs for amplifier nonlinearity in wireless physical layer.

B5. Network Service Quality and Security
Saturday, May 10, 14:00–15:40

Session Chair:

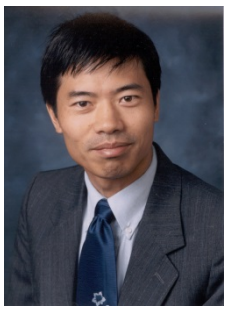
Rong Duan

AT&T Labs

BIOGRAPHY:

Rong Duan, Principle Member of Technical Staff at AT&T Labs, New Jersey, USA. She received her Ph.D. in Computer Engineering from Stevens Institute of Technology. Rong has extensive experience in data mining, statistical learning and business intelligence for various business applications. Her main research areas include statistical learning theory and methods, Spatial-Temporal data modelling, Cause-effect modelling, data integration and quality assessment on big data. Rong served as Secretary/Treasurer, Vice Chair and Chair for the Data Mining Section of INFORMS (Institute of Operations Research and Management Sciences) in 2006-2008, 2008-2009, 2009-2010 respectively. She was the Data Mining cluster co-chair for INFORMS Annual Conference in 2008 and INFORMS International Beijing in 2012. Rong also served as a program co-chair for the First and Second International Symposium on System Informatics and Engineering in 2010 and 2012.

B5. Technical Session: Network Service Quality and Security



Predicting Web Service QoS via Matrix-factorization-based Collaborative Filtering under Non-negativity Constraint

Xin Luo[1], MengChu Zhou[2], Fellow, IEEE, YunNi Xia1, Member, IEEE, and QingSheng Zhu1, Member, IEEE

[1.] Chongqing University
[2.] New Jersey Institute of Technology

ABSTRACT:

Matrix-factorization based collaborative filtering is an efficient approach to the problem of user-side quality-of-service (QoS) prediction. In this work, we focus on building a matrix-factorization-based collaborative filtering model for QoS prediction under a non-negativity constraint. The motivation is that since QoS data such as response time, cost and throughput, are all positive, a non-negative model can better demonstrate their characteristics. By investigating a non-negative training process relying on each involved feature, we invent a non-negative latent factor model to deal with the sparse QoS matrix subject to the non-negativity constraint. We subsequently introduce Tikhonov regularization into it to obtain the regularized non-negative latent factor model. Their efficiency is proven by the experimental results on a large industrial dataset.

BIOGRAPHY:

MengChu Zhou received his B.S. degree in Control Engineering from Nanjing University of Science and Technology, Nanjing, China in 1983, M.S. degree in Automatic Control from Beijing Institute of Technology, Beijing, China in 1986, and Ph. D. degree in Computer and Systems Engineering from Rensselaer Polytechnic Institute, Troy, NY in 1990. He joined New Jersey Institute of Technology (NJIT), Newark, NJ in 1990, and is now a Distinguished Professor of Electrical and Computer Engineering. He is presently a Professor of Tongji University, Shanghai, China. His research interests are in Petri nets, sensor networks, web services, big data, semiconductor manufacturing, transportation and energy systems. He has over 500 publications including 11 books, 250+ journal papers (majority in IEEE Transactions), and 22 book-chapters. He is the founding Editor of IEEE Press Book Series on Systems Science and Engineering, and Associate Editor of IEEE Transactions on Systems, Man and Cybernetics: Systems, IEEE Transactions on Industrial Informatics, and IEEE Transactions on Intelligent Transportation Systems. Web of Sciences/Thomson Reuters ranked Prof. Zhou as the top one of 2012 most highly cited scholars in the field of engineering globally. He is a life member of Chinese Association for Science and Technology-USA and served as its President in 1999. He is a Fellow of IEEE, IFAC and AAAS.

B5. Technical Session: Network Service Quality and Security

Estimation of Missing Measurements in Computer Networks: Matrix Completion vs. Compressed Sensing

Dr. Ziqian (Cecilia) Dong

Department of Electrical and Computer Engineering
New York Institute of Technology
New York, NY 10023

ABSTRACT:

The performance of communication networks largely depends on the instantaneous or the long-term statistical measurements of network parameters, such as packet-loss rate and end-to-end delay. In computer networks, an important network parameter is the end-to-end delay (often measured in terms of round trip time (RTT)) between different network nodes. The RTTs, in turn, are used to support different network engineering tasks such as traffic engineering, capacity planning, and support for quality-of-service (QoS). However, RTT measurements are not always successful due to security measures of the intermediate network nodes. This talk discusses two methods to estimate the missing round trip time (RTT) measurements in computer networks by using doubly nonnegative (DN) matrix completion method and compressed sensing. The major contributions of this research are the following: i) an iterative DN matrix completion method that minimizes the mean square estimation error; ii) mathematical conditions for the convergence of the algorithm; iii) systematic and detailed experimental comparison of DN matrix completion and compressed sensing for estimating missing RTT estimation in computer networks. To our best knowledge, this study is the first work that compares the pros and cons of compressed sensing and DN matrix completion for RTT estimation using actual Internet measurement data. Results indicate that compressed sensing provides better estimation in networks with random sporadic missing values while DN matrix completion is more suitable for estimation in networks, where blocks of measurements are missing. Our proposed DN matrix completion method is one of the first approaches to matrix completion that minimizes the estimation error.

BIOGRAPHY:

Ziqian (Cecilia) Dong is an Assistant Professor in the Department of Electrical and Computer Engineering at New York Institute of Technology. She received her B.S. degree in Electrical Engineering from Beijing University of Aeronautics and Astronautics, Beijing, China, M.S. in Electrical Engineering and Ph.D. in Electrical Engineering from New Jersey Institute of Technology, Newark, NJ. She received the Hashimoto Prize for the best Ph.D. dissertation in Electrical Engineering, NJIT. She is the recipient of 2006 and 2007 Hashimoto Fellowship for outstanding scholarship and recipient of the New Jersey Inventors Hall of Fame Graduate Student Award for her inventions in network switches. Her research interests include architecture design and analysis of practical buffered crossbar packet switches, network security and forensics, wireless sensor networks, social networks and assistive medical devices. She was associated with Networking Research Laboratory at New Jersey Institute of Technology and MySYNC Laboratory at Stevens Institute of Technology for her postdoctoral research. Her research has been funded by the National Science Foundation, Motorola Solutions, NCIIA and NYIT. She is the principal investigator for the NYIT Research Experience for Undergraduates program funded by the US National Science Foundation to engage undergraduates in mobile device and network security research. She is a member of IEEE Communications Society, IEEE Women in Engineering, ACM, and American Society for Engineering Education. She has served as a technical committee member in the IEEE HPSR, IEEE Sarnoff, IEEE Greencom, IEEE ICNSC, and a panelist for the U.S. National Science Foundation.

B5. Technical Session: Network Service Quality and Security

A Study of LTE Network Performance based on Data Analytics and Statistical Modeling

Sangqing Hu[1], Ye Ouyang[2], Yu-dong Yao[1], M. Hosein Fallah[1], and Wenyuan Lu[1]

[1.] Stevens Institute of Technology
[2.] Verizon Wireless

ABSTRACT:

Various simulation based approaches are developed to study wireless network performance and capacity traditionally. However, these simulation based approaches has its own limitations in supervised and unsupervised learning. Since big data techniques become more available, using big data techniques to understood the huge amount of the LTE network measurements and diagnosis data, evaluate and predict the LTE network capacity and performance becomes a very promising approach. This paper investigates the LTE network performance from the aspect of data analytics and statistical modeling. In this paper, we develop a methodology of data analytics and modeling to evaluate LTE network performance based on traffic measurements and service growth trends. A relational algorithm is developed to obtain the relationship between LTE network resources and LTE KPIs and a forecasting algorithm is developed to trend the network resource consumptions based on traffic and service growth. The numerical results show a high accuracy, robustness, and reliability of the proposed methodology.

BIOGRAPHY:

Dr. Ye Ouyang is a Distinguished Member of Technical Staff-Mobile Network Analytics, Verizon Wirelesss. His research interest is in big data analytics and quantitative modeling for wireless networks, with a focus on 2G/3G/4G LTE network performance, network capacity, traffic patterns, user behaviors, and network service quality etc. by leveraging data analytics, network simulation, statistical modeling, machine learning, and data mining techniques. He holds a Bachelor of Engineering from Southeast University in China, a Master of Science from Tufts University in Massachusetts USA, and a Doctor of Philosophy from Stevens Institute of Technology in New Jersey USA. Dr. Ouyang authored 20+ academic papers, 3 book chapters, and 6 US Patents.

B5. Technical Session: Network Service Quality and Security

A Hidden Markov Model Detection of Malicious Android Applications at Runtime

Mo Ghorbanzadeh

Hume Center for National Security, Virginia Tech, Arlington, VA 22203

ABSTRACT:

A hidden Markov process-based approach is leveraged to detect potentially malicious Android applications at run-time based on analyzing their Intents passing through the binder. Real world applications are emulated, their Intents are parsed, and, after appropriate discretization of the Intent action fields, they train the hidden Markov models for recognizing anomalous and benign Android application behaviors. The inferred stochastic processes can probabilistically estimate whether an application is performing a malicious or benign action as it is running on the device. Such a decision is realized through the maximum likelihood estimation. The results show that the method is capable of detecting malicious Android applications as they run on the platform.

BIOGRAPHY:

Mo Ghorbanzadeh is a Ph.D. student at the Hume Center for National Security at Virginia Tech. He has M.S. and B.S. degrees from the Southern Illinois University Edwardsville and Azad University of Arak, respectively.

B6. Data Sensing and Modeling
Saturday, May 10, 16:10–17:50

Session Chair:

Ye Ouyang

Verizon Wireless

BIOGRAPHY:

Dr. Ye Ouyang is a Distinguished Member of Technical Staff-Mobile Network Analytics, Verizon Wirelesss. His research interest is in big data analytics and quantitative modeling for wireless networks, with a focus on 2G/3G/4G LTE network performance, network capacity, traffic patterns, user behaviors, and network service quality etc. by leveraging data analytics, network simulation, statistical modeling, machine learning, and data mining techniques. He holds a Bachelor of Engineering from Southeast University in China, a Master of Science from Tufts University in Massachusetts USA, and a Doctor of Philosophy from Stevens Institute of Technology in New Jersey USA. Dr. Ouyang authored 20+ academic papers, 3 book chapters, and 6 US Patents.

B6. Technical Session: Data Sensing and Modeling

Adjusted KNN Model in Estimating User Density in Small Areas with Poor Signal Strength

Rong Duan and Guangqin Ma

AT&T Labs
Middletown, NJ

ABSTRACT:

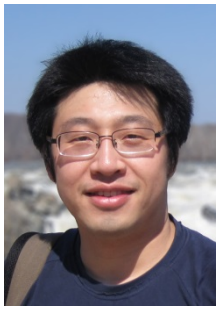
Localized user density estimation is fundamental in many fields such as urban planning, traffic engineering, disease control, location based marketing and telecomm capacity planning. Modern mobility technologies provide the capability for measuring the localized user density dynamically and precisely. However, this is only limited to the areas that have good signal strength. It is a challenge to accurately estimate user density for areas with poor signal strength. However, user density can be estimated from other big data collected by telecommunication providers from different sources. This paper is a case study leveraging big data for developing a business solution. Exploratory Data Analysis (EDA) is applied to quantify the good signal vs bad signal, and a group of important variables that are highly related to user density are selected. An adjusted K-Nearest-Neighbor is applied to infer bad coverage user densities from the good coverage areas. Instead of predefining the K, different percentile measurements are provided to increase the robustness in business decision.

BIOGRAPHY:

Rong Duan, Principle Member of Technical Staff at AT&T Labs, New Jersey, USA. She received her Ph.D. in Computer Engineering from Stevens Institute of Technology. Rong has extensive experience in data mining, statistical learning and business intelligence for various business applications. Her main research areas include statistical learning theory and methods, Spatial-Temporal data modelling, Cause-effect modelling, data integration and quality assessment on big data. Rong served as Secretary/Treasurer, Vice Chair and Chair for the Data Mining Section of INFORMS (Institute of Operations Research and Management Sciences) in 2006-2008, 2008-2009, 2009-2010 respectively. She was the Data Mining cluster co-chair for INFORMS Annual Conference in 2008 and INFORMS International Beijing in 2012. Rong also served as a program co-chair for the First and Second International Symposium on System Informatics and Engineering in 2010 and 2012.

Guangqin Ma, Director of Research-Applied Data Mining at AT&T Labs, New Jersey, USA. Since 2010, he has been responsible for localized mobility demand traffic forecasting for mobility network capacity planning. He manages a group of data scientists on data mining research and applications related to telecommunications. He received his PhD in Statistics from the University of Rochester. His research interests include Big Data Analytics, Spatial Temporal Forecasting and Modeling, Churn Predictive, and Technology Comparison.

B6. Technical Session: Data Sensing and Modeling



Tracking Human Queues

Using Single-Point Signal Monitoring

Yan Wang

ECE Department of Stevens Institute of Technology

ABSTRACT:

We investigate using smartphone WiFi signals to track human queues, which are common in many business areas such as retail stores, airports, and theme parks. Real-time monitoring of such queues would enable a wealth of new applications, such as bottleneck analysis, shift assignments, and dynamic workflow scheduling. We take a minimum infrastructure approach and thus utilize a single monitor placed close to the service area along with transmitting phones. Our strategy extracts unique features embedded in signal traces to infer the critical time points when a person reaches the head of the queue and finishes service, and from these inferences we derive a person's waiting and service times. We develop two approaches in our system, one is directly feature-driven and the second uses a simple Bayesian network. Extensive experiments conducted both in the laboratory as well as in two public facilities demonstrate that our system is robust to real-world environments. We show that in spite of noisy signal readings, our methods can measure important time periods in the queue (e.g., service and waiting times) to within a 10 second resolution.

BIOGRAPHY:

Yan Wang is working towards his doctoral degree at DAISY lab in the Dept. of ECE at Stevens Institute of Technology, under the guidance of Prof. Yingying Chen, and collaborates with Profs. Marco Gruteser and Richard P. Martin at Rutgers University. His research interest lies in mobile computing, smartphone apps and privacy, cyber security, internet of things, and wireless networks. He has won the student research competition (SRC) Award at ACM MobiCom 2013. The research work "Tracking Human Queues Using Single-Point Signal Monitoring" has been accepted as the full paper of ACM MobiSys 2014.

B6. Technical Session: Data Sensing and Modeling

Smartphone Based User Verification Leveraging Gait Recognition for Mobile Healthcare Systems

Yanzhi Ren

Stevens Institute of Technology

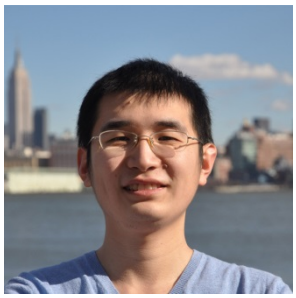
ABSTRACT:

The rapid deployment of sensing technology in smartphones and the explosion of their usage in people's daily lives provide users with the ability to collectively sense the world. This leads to a growing trend of mobile healthcare systems utilizing sensing data collected from smartphones with/without additional external sensors to analyze and understand people's physical and mental states. However, such healthcare systems are vulnerable to user spoofing attacks, in which an adversary distributes his registered device to other users such that data collected from these users can be claimed as his own to obtain more healthcare benefits and undermine the successful operation of mobile healthcare systems. Existing mitigation approaches either only rely on a secret PIN number (which cannot deal with colluded attacks) or require an explicit user action for verification. In this paper, we propose a user verification scheme leveraging unique gait patterns derived from acceleration readings in mobile healthcare systems to detect possible user spoofing attacks. Our framework exploits the readily available accelerometers embedded within smartphones for user verification. Specifically, our user spoofing attack mitigation scheme (which consists of three components, namely Step Cycle Identification, Step Cycle Interpolation, and Similarity Score Computation) is used to extract gait patterns from run-time accelerometer measurements to perform robust user verification under various walking speeds. Our experiments using 322 smartphone-based traces over a period of 6 months confirm that our scheme is highly effective for detecting user spoofing attacks. This strongly indicates the feasibility of using smartphone based low grade accelerometer to conduct gait recognition and facilitate effective user verification without active user cooperation.

BIOGRAPHY:

Yanzhi Ren is currently working toward a Ph.D. degree in the Electrical and Computer Engineering Department at Stevens Institute of Technology. He is under the supervision of Prof. Yingying Chen at DAISY Lab. He received his B.S. and M.S. degrees from the University of Electronic Science and Technology of China. His research interests include the areas of mobile social networks, wireless security and mobile cloud computing. The research work " Smartphone Based User Verification Leveraging Gait Recognition for Mobile Healthcare Systems" has been published in IEEE SECON 2013.

B6. Technical Session: Data Sensing and Modeling



Activation Analysis on fMRI time series using Stochastic Context-free Model

Xingzhong Xu

Stevens Institute of Technology

ABSTRACT:

In this paper, a novel statistical model, stochastic context-free models (SCFMs), has been introduced to model and analyze the voxel activation in fMRI time series. SCFMs characterize a dynamic system where Blood-oxygen-level dependent (BOLD) responses are assumed generated through the hidden activity of voxels. Typically such activities are determined by pre-designed paradigm experiments. Classical hidden Markov models (HMMs) in fMRI made strong Markov assumptions on states behaviors. Whereas, in SCFMs, we use more powerful context-free grammar to model the paradigm design as well as the voxel states. We present the methodologies of evaluation, inference, and decoding based on SCFMs, and the likelihood ratio test for voxel activation detection. Experimental results on both HMMs and SCFMs show that the later models not only better capture the completeness of the target patterns, but also encapsulate more hierarchical information in its tree structural.

BIOGRAPHY:

Xingzhong Xu received his B.S. degree in electrical engineering from Beijing Jiaotong University, Beijing, China, in 2009. Later in 2012, he received the M.E. degree from Stevens Institute of Technology, Hoboken, New Jersey. Currently, he is a Ph.D candidate in electrical engineering at Stevens Institute of Technology, Hoboken, New Jersey. His research interests include machine learning and signal processing.

Benefits of Membership

Join the IEEE Photonics Society

Stay on the cutting edge of photonics

- Discounted conference registration at leading international Photonics technical conferences
- Free online access to Photonics Society Journals—PTL, JQE, JSTQE, JLT, and The Journal of Photovoltaics
- Open access publishing member discount: 15% discount for Photonics Society members
- Free print subscription to the Photonics Society's bi-monthly newsletter
- Free online access to all Photonics Society-sponsored conference proceedings

Network with other photonics professionals

- Access the Photonics Society's online membership directory
- Engage with more than 100,000 photonics professionals and 400,000 IEEE members in 160 countries
- Join one of more than 80 local chapters worldwide

Enhance your education/professional development

- Receive special student rates for membership, conferences and journals
- Become eligible for the Photonics Graduate Student Fellowship
- Participate in IEEE's GOLD program (Graduates Of the Last Decade)

Advance your professional success with the prestige of IEEE membership

- Become eligible for prestigious industry awards/recognition programs
- Explore opportunities for participation on program committees and editorial boards
- Receive superior financial benefits and services with IEEE membership, including credit cards, insurance, travel and financial planning

Get Connected, Stay Informed:

PhotonicsSociety.org

@IEEEPhotonics

Facebook.com/PhotonicsSociety

PhotonicsConferences.org

PhotonicsJournal.org

IEEE photonics SOCIETY

Transforming science into technology™

445 Hoes Lane
Piscataway, NJ 08855
+1-732-981-0060
PhotonicsSociety@ieee.org
www.photonicssociety.org

IEEE