Security Vulnerability Database for IoT

Abstract: Enter the era of Internet of Things (IoT) and wearable devices, where small embedded devices loaded with sensors collect information from its surroundings, process it and relay it to remote locations for further analysis. Albeit looking harmless, this nascent technologies raise security and privacy concerns. We pose the question of the possibility and effects of compromising such devices. Concentrating on the design flow of IoT and wearable devices, we discuss some common design practices and their implications on security and privacy. Multiple commercial smart/IoT devices will be selected as examples on how current industry practices of security as an afterthought or an add-on affect the resulting device and the potential consequences to the user's security and privacy. We then discuss design flow enhancements, through which security mechanisms can efficiently be added into a device, vastly differing from traditional practices.

About the Speaker

Biography: Yier Jin is currently an assistant professor in the EECS Department at the University of Central Florida. He received his PhD degree in Electrical Engineering in 2012 from Yale University after he got the B.S. and M.S. degrees in Electrical Engineering from Zhejiang University, China, in 2005 and 2007, respectively. His research focuses on the areas of trusted embedded systems, trusted hardware intellectual property (IP) cores and hardware-software co-protection on computer systems. He is also interested in the security analysis on Internet of Things (IoT) devices with particular emphasis on information integrity and privacy protection in the IoT era. He is the Department of Energy (DoE) Early Career Award recipient in 2016. He is the best paper award recipient of the 52nd Design Automation Conference in 2015 and the 21st Asia and South Pacific Design Automation Conference in 2016.

Refreshments will be served.

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Resistive Random Access Memory (RRAM)’s Applications for Neuro-inspired Computing and Hardware Security

Abstract: RRAM technology has made significant progresses in the past few years as a competitive candidate for the next generation non-volatile memory (NVM). In this talk, I will introduce RRAM’s new applications beyond NVM for neuro-inspired computing and hardware security. Firstly, I will show an experimental demonstration of RRAM synaptic weights for offline and online training of neural network. Secondly, I will present a simulation study of the non-ideal device effects (e.g. limited precision and variations) on the system-level learning accuracy of MNIST handwritten digits using spare coding algorithm. Furthermore, I will discuss the challenges of scaling up the synaptic crossbar array from the circuit and architecture perspective. Lastly, I will introduce how to leverage the RRAM variability as physical unclonable function (PUF) for device authentication and cryptographic key generation.

About the Speaker
Shimeng Yu received the B.S. degree in microelectronics from Peking University, Beijing, China in 2009, and the M.S. degree and Ph.D. degree in electrical engineering from Stanford University, Stanford, CA, USA in 2011, and in 2013, respectively. He is currently an assistant professor of electrical engineering and computer engineering at Arizona State University, Tempe, AZ, USA.

His research interests are emerging nano-devices and circuits with a focus on the resistive memories for different applications including monolithic 3D integration, brain-inspired neuromorphic computing, hardware security, radiation-hard electronics, etc. He has published >50 journal papers and >90 conference papers with citations >3000 and H-index 26.

Among this honors, he is a recipient of the Stanford Graduate Fellowship from 2009 to 2012, the IEEE Electron Devices Society Masters Student Fellowship in 2010, the IEEE Electron Devices Society PhD Student Fellowship in 2012, the DOD-DTRA Young Investigator Award in 2015, and the NSF CAREER Award in 2016. He did summer internship in IMEC, Belgium in 2011, and IBM TJ Watson Research Center in 2012. He held visiting faculty position in Tsinghua University in 2016, and Air Force Research Laboratory in 2016. He has been serving the Technical Committee of Nanoelectronics and Gigascale Systems, IEEE Circuits and Systems Society since 2014.

Refreshments will be served.

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Stochastic Dynamic Programming for Network Resource Allocation

Abstract: Stochastic Dynamic Programming (SDP) is a powerful tool for Markov Decision Processes and Partially Observable MDP (POMDP), etc. However, the commonly used Bellman equation and its corresponding backwards recursion algorithm suffer from prohibitive computational complexity because of the curse of dimensionality. This talk presents an application of the SDP method to wireless network resource allocation and develops a 3-layer decomposition algorithm to achieve global optimum solution with affordable complexity. Numerical results show that the SDP algorithm achieves better look-ahead planning than the greedy algorithm and other heuristic algorithms. Practical applications of the research include radio spectrum sharing, intelligent transportation systems, and underwater wireless sensor networks for structure health monitoring systems.

About the Speaker
Yahong Rosa Zheng received the Ph.D. degree Carleton University, Ottawa, ONT, Canada, in 2002. From 2003 to 2005, she was an NSERC Postdoctoral Fellow with the University of Missouri-Columbia. Since fall 2005, she has been a faculty member with the Department of Electrical and Computer Engineering, Missouri University of Science and Technology, Rolla, MO, where she is now a Professor. Her research interests include digital signal processing, wireless communications, and wireless sensor networks. She has published more than 60 journal papers and more than 100 conference papers in these areas. She served as technical program Co-Chair for the Wireless Communications Symposium (WCS) of IEEE Globecom 2012 and ICC 2014 and tutorial co-chair for Globecom 2016 and ICC 2017-2018. She serves as Associate Editor for the IEEE Transactions on Vehicular Technology. She is the recipient of an NSF CAREER award in 2009. She has been an IEEE fellow and a Distinguished Lecturer of IEEE Vehicular Technology Society since 2015.

Refreshments will be served.

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Abstract: The relentless technology scaling has led to significantly reduced noise margin and complicated functionalities. Accordingly, with demanding resource constraints, design time techniques per se are less likely to ensure power integrity. Recently several works have shed light on the possibilities of runtime noise management systems. Most of these works rely on on-chip noise sensors to accurately capture voltage emergencies. However, they all assume, either implicitly or explicitly, that the placement of the sensors is given. It remains an open problem how to optimally place a given number of noise sensors for best voltage emergency detection. A seemingly relevant problem is the temperature sensor placement, which has been well studied in literature. We then ask: is our problem a trivial extension, or does it present new challenges?

In this talk, we formally define the problem of noise sensor placement and reveal its fundamental difference from the temperature sensor placement. The problem itself is NP-hard, and we put forward an efficient algorithm to solve it. Interestingly, we are able to prove that the algorithm is optimal in the class of polynomial complexity approximations. We conclude our talk with experimental results on a set of industrial power grid designs, which show significant reduction in the miss rate of voltage emergency detections.

About the Speaker

Bio: Dr. Yiyu Shi is currently an associate professor in the Department of Computer Science and Engineering and Electrical Engineering (concurrent appointment) at the University of Notre Dame, and the director of Sustainable Computing Lab (SCL). He received his B.S. degree (with honor) in Electronic Engineering from Tsinghua University, Beijing, China in 2005, the M.S and Ph.D. degree in Electrical Engineering from the University of California, Los Angeles in 2007 and 2009 respectively. He was an assistant professor in the Electrical and Computer Engineering Department at Missouri University of Science and Technology from 2010 to 2015, where he was the site founding co-director of the NSF I/UCRC Net-Centric Software and Systems Center. His current research interests include low-power design, three-dimensional integration, hardware security and renewable energy applications. In recognition of his research, eight of his papers have been nominated for the Best Paper Award and one paper have received the Best Paper in Track, all in top conferences (DAC’05, ICCAD’07, ICCD’08, ASPDAC’09, DAC’09, ISPD’13, ICCAD’14, ISPD’15, DAC’16). He was also the recipient of IBM Invention Achievement Award in 2009, Japan Society for the Promotion of Science (JSPS) Faculty Invitation Fellowship, Humboldt Research Fellowship, IEEE St. Louis Section Outstanding Educator Award, Academy of Science (St. Louis) Innovation Award, Missouri S&T Faculty Excellence Award, NSF CAREER Award, IEEE Region 5 Outstanding Individual Achievement Award, all in 2014, and the Air Force Summer Faculty Fellowship in 2015 and 2016. He has served on the technical program committee of many international conferences including DAC, ICCAD, DATE, ISPD, ASPDAC and ICCD. He is also a member of IEEE CEDA Publicity Committee and IEEE Smart Grid R&D Committee, and an associate editor of IEEE TCAD, ACM JETC, VLSI Integration, IEEE VLSI CAS Newsletter, IEEE TCCCP Newsletter and ACM SIGDA Newsletter. He is a senior member of IEEE.

Refreshments will be served.
Sequential estimation and diffusion of information over networks

Abstract: Collaborative estimation of parameters of stochastic models in networks from observations made by individual nodes is a core topic in the field of signal and information processing over networks. In this talk, we formulate the problem of collaborative sequential estimation of unknown parameters where information in the network diffuses with time. The formulation is abstract and independent from any particular model. Our objective is to reach a generic solution that is applicable to a wide class of popular models. We adopt the Bayesian and information-theoretic paradigms so that we have at our disposal probabilistically consistent means for incorporation of the observations in the implemented estimation and for effective combination of the gained “knowledge” by the nodes in the network. The presented theory will be demonstrated by four examples. They include linear regression, Kalman filtration, logistic regression, and inference of an inhomogeneous Poisson process.

About the Speaker

Petar M. Djurić received the B.S. and M.S. degrees in electrical engineering from the University of Belgrade, Belgrade, Yugoslavia, respectively, and the Ph.D. degree in electrical engineering from the University of Rhode Island, Kingston, RI, USA. He is currently a Professor with the Department of Electrical and Computer Engineering, Stony Brook University, Stony Brook, NY, USA. His research has been in the area of signal and information processing with primary interests in the theory of signal modeling, detection, and estimation; Monte Carlo-based methods; signal and information processing over networks; machine learning, RFID and the IoT. He has been invited to lecture at many universities in the United States and overseas. Prof. Djurić was a recipient of the IEEE Signal Processing Magazine Best Paper Award in 2007 and the EURASIP Technical Achievement Award in 2012. In 2008, he was the Chair of Excellence of Universidad Carlos III de Madrid-Banco de Santander. From 2008 to 2009, he was a Distinguished Lecturer of the IEEE Signal Processing Society. He has been on numerous committees of the IEEE Signal Processing Society and of many professional conferences and workshops. He is the Editor-in-Chief of the IEEE Transactions on Signal and Information Processing over Networks and a Fellow of IEEE and EURASIP.

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Universal optimal detection of model mismatches in noise

**Abstract:** In signal processing, models are mathematical functions, whose parameters relate to physical quantities. Unfortunately, regardless of noise, real signals unavoidably deviate from their models and large deviations from models are anomalies of actual interest to detect. The issue is that very little is generally known about such deviations. In biomedical engineering, especially in intensive care, the detection of such anomalies is of utmost importance.

We established the existence of tests to optimally decide whether a mismatch between a random signal and its model is significant or not in additive and independent Gaussian noise and this, whatever the distributions of the signal samples. Such tests are universal since they perform the decision by solely assuming randomness of the signal, thus without assumptions of independence or identical distribution for the observation samples. These tests emphasize the optimality properties of energy for universal detection of model mismatches in Gaussian noise.

Application of these results to detection and physiological signal monitoring will be presented. Among several prospects opened by these results, we will discuss two of them: the first one concerns unsupervised clustering and the second one addresses models of immune systems, either natural or artificial.

**About the Speaker**

Dominique Pastor was born in Cahors, France, in 1963. He graduated from Telecom Bretagne (Brest, France) in 1986 and from the University of Rennes (France) in 1997 (Ph.D.). Between 1990 and 1998, he was an engineer at Thales Avionics where his research and development activities concerned speech processing for applications to speech recognition systems embedded in military aircraft cockpits. From 1998 to 2000, he was with Thales Nederland where his engineering activities were dedicated to the detection of radar targets in sea clutter. In September 2000, he joined Altran Technologies Nederland as a senior consultant. Since September 2002, he is with Institut Telecom, where he is currently Professor at Telecom Bretagne. His research concerns statistical signal processing and sparse transforms, with applications to physiological signal processing and biomedical engineering.

*Refreshments will be served.*
Stories from the Field:
What Happens When you Take Technology into the Wide World of Real Users

Abstract: Why do some great technology product fail, while others succeed? What tools can we rely on to move an idea from the lab to the market? Mina has led development and improvement for products ranging from small sensors to the Healthcare.gov, and will talk about techniques she uses, as well as what is always surprising to her. Translating an idea into a product - including scale deployment and usage - is a big step, and the things that cause systems to fail are frequently not the issues we perceive as "the hard stuff." Beginning life as a device engineer, Mina quickly learned that microfluidics and control systems were important, but reproducibility, design for manufacture, and, above all, user behavior had greater influence on the success of a particular design. These became the new variables that she had not considered fully as a student and researcher. These lessons continue to be important in the world of large-scale enterprise software implementations and public websites. Errors as simple as a website button which isn't debounced correctly, which seem small, can in fact cause the whole site to crash in some cases. Engineers need to ask themselves if they have designed a system so that problems can be identified easily and corrected quickly? Can machine learning be used to achieve that goal? Healthcare.gov provides one of several useful examples. The talk will examine instructive case studies, discuss challenges that arise in building and launching products, and discuss in detail some real-world solutions.

About the Speaker

Mina Hsiang currently serves as the Healthcare Lead for the US Digital Service in the White House, and as an Advisor to the US CTO on Health Data. She and her team are helping to transform government technology, bringing their combination of private and public sector expertise to challenging and high-priority projects in healthcare. She leads USDS efforts to support and transform projects including Healthcare.gov, the new quality payment rules for Medicare, and the Precision Medicine Initiative. Prior to her current role, Ms. Hsiang was the VP of Market Strategy for Optum Analytics, where she drove new product and technology strategy for a $100M data analytics business sitting at the intersection of Providers, Payers, and Pharma. In that role she was also a key player in the rescue of healthcare.gov. Prior to that she was a venture capitalist and startup launcher at General Catalyst Partners, where she sat on the board of 6 companies and helped start two, in fields from medical devices to enterprise software. She has previously been a robotics engineer building novel prosthetic arms for amputees while at Deka R&D, and has led projects in rural healthcare, water, and sanitation for the Clinton Foundation in Malawi. Ms. Hsiang holds an MEng and BS in Electrical Engineering from MIT, and an MBA from the Harvard Business School.

Refreshments will be served.

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Technology Trends to Watch in 2016
and how IBM z System is helping clients in digital world

Abstract: Over the last several years, IBM has built a comprehensive and complete analytics solution on z Systems. Clients can now take advantage of their enterprise data where the transactions originate. In today’s digital business, consumers are more informed, connected and selective than ever before. Mobile and the new app economy is fueling explosive growth in the number of users, devices, and apps changing how we work, interact and transact. During the session, plan is to highlight the trends that are happening in the Information Technology industry that is driving Systems of Engagement across the enterprise in 2016. A discussion of how IBM's Mainframes (z Systems) has been transformed into growth strategic imperatives to support Cloud, Data and Analytics, Mobile, Social and Security (CAMSS) which is helping our clients become "digital". In addition, a quick glimpse into the future of our high end designs will be presented.

About the Speakers

Bohdan's Bio: Bohdan Demczar is the z Systems Client Care Program Director, Technical Resolution Manager. He currently works with IBM's top Fortune 500 clients in addressing their critical situations and driving solutions for the platform. He has held various technical and management positions in Cache Design, Product Engineering, Quality, and Product Management / Technical Support. Bohdan serves as an Advisory Board member for the College of Engineering at SU. He is also an SU Alumni - Class of 1991 MS Computer Engineering.

Ray's Bio: Ray Newsom is the z System Hardware Subsystem Strategy Leader. He has been leading the charge in sharing IBM's z Systems strategy with our Fortune 500 clients. He has held various technical and management positions in Power Packaging & Cooling, ASIC Design, I/O Firmware and the z Systems Product Management teams.

Refreshments will be served.

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Command and Control of Proactive Defense

Abstract: This talk will introduce the Command and Control of Proactive Defense (C2PD) program. The goal of this program is to provide a Command and Control capability that orchestrates the dynamic employment of multiple Moving Target Defense (MTD) components, configurations, and services across the enterprise to assure mission success. Cyber agility techniques called moving target defenses offer a capability to assure the network and Air Force missions. By providing mobility to static network and computing resources within the enterprise, we create uncertainty for the attacker and can outmaneuver attacks to critical cyber infrastructure. However, without a command and control structure to plan, assess, and execute a coordinated defense, we may expose a larger attack surface to the network and increase the risk of cyber fratricide. C2PD has four main technical challenges enabling decision making capability targeted at orchestrating the dynamic employment of multiple moving-target defense components, configurations and services across the enterprise. The four challenges are: (1) Optimize static, dynamic, and MTDs based on mission priority, (2) De-conflict resource contention among competing MTDs and the missions they are protecting, (3) Measure effectiveness of deployed defenses on services and network, and (4) Reconstitute consistent state services. Open issues and challenges requiring further research will be presented.

About the Speaker

David Last received a Bachelor's in Electrical and Computer Engineering from Auburn University, Alabama in 2006. He received his Doctorate in Electrical and Computer Engineering from Auburn University, Alabama in 2013. Since 2013, he has been employed at the Air Force Research Laboratory in Rome, NY, where he has been a technical advisor on the Command and Control of Proactive Defense (C2PD) program. He has been involved in the technical development and technical administration for this program. He also performs his own research to address different aspects of the C2PD program. His current research interests include cyber security, attack surface measurement as a security metric, and zero-day vulnerability forecasting.

Refreshments will be served.

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Towards Spectrum Efficiency and Energy Efficiency in Next Generation Wireless Networks

Abstract: Recent surge of various new applications and rapid growth of mobile traffic are stressing the mobile and wireless network infrastructure. The fast wireless data volume growth and dramatic expansion of network infrastructures will also inevitably trigger tremendous escalation of energy consumption in wireless networks. The wireless network research should meet the challenges raised by the demands from the growth of both wireless traffic volume and energy consumption. At the same time, ever increasing video penetration will undoubtedly have a significant impact on the energy and bandwidth consumption of future wireless infrastructure, greatly challenging their ability to deliver the users’ expected Quality-of-Service (QoS) and Quality-of-Experience (QoE). This talk will present an ultra-dense, highly heterogeneous 5G wireless communication system with coexistence of overlay and underlay deployments. Under such a 5G system framework, we will identify key technical challenges and propose new solutions to address spectrum efficiency, energy efficiency and QoE issues in the next generation wireless networks.

About the Speaker

Rose Qingyang Hu [S’95, M’98, SM’06] (rosehu@ieee.org) received a B.S. degree from University of Science and Technology of China, a M.S. degree from New York University, and a Ph.D. degree from the University of Kansas. From January 2002 to June 2004 she was an assistant professor with the Department of Electrical and Computer Engineering at Mississippi State University. She also has more than 10 years of R&D experience with Nortel, Blackberry and Intel as a technical manager, a senior wireless system architect, and a senior research scientist. Currently she is an associate professor with the Department of Electrical and Computer Engineering at Utah State University. Her current research interests include next-generation wireless communications, wireless network design and optimization, green radios, multimedia QoS/QoE, communication and information security, wireless system modeling and performance analysis. She has published extensively and holds numerous patents in her research areas. She is currently serving on the editorial boards for IEEE Wireless Communications Magazine, IEEE Internet of Things Journal, IEEE Communications Surveys & Tutorials. She has also been a 7-time guest editor for IEEE Communications Magazine, IEEE Wireless Communications Magazine, and IEEE Network Magazine. Prof. Hu is IEEE Communications Society Distinguished Lecturer class 2015-2016 and is the recipient of the Best Paper Awards of IEEE Globecom 2012 and IEEE ICC 2015. She is a senior member of IEEE and a member of Phi Kappa Phi and Epsilon Pi Epsilon Honor Societies.

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Finding Meaningful Communities in Complex Networks
Using Vertex Permanence

Abstract: Community detection, or finding groups of tightly connected vertices, is a widely studied problem in network analysis. However, many community detection algorithms focus on finding the best possible community and therefore can end up finding communities even in grid-like networks that do not have any community.

I will talk about our recent work on developing a vertex-based community score called permanence that can quantify whether the network indeed has communities and find strong communities when they occur. I will show how permanence can be applied to non-overlapping and overlapping communities and is also useful in measuring the effect of noise in disrupting the communities.

About the Speaker
Sanjukta Bhowmick is an Associate Professor in the Computer Science department at the University of Nebraska at Omaha. She obtained her Ph.D. from the Pennsylvania State University, and her postdoc at Columbia University and Argonne National Lab. Her current research is on complex network analysis, with a focus on developing scalable algorithms for large-scale networks and studying how perturbations in networks affect the analysis results. Her work has been supported by NSF, AFSOR and INBRE (NIH).

Refreshments will be served.
Guidance, Navigation and Control for Maneuverable Unmanned Vehicles

Abstract: Unmanned vehicles are finding use in diverse applications like security, agriculture and aquaculture, inspection of civilian infrastructure, space and underwater exploration, wildlife tracking and conservation, package delivery and remote sensing. A critical aspect of reliable operations of unmanned vehicles is that of safe autonomous guidance, navigation and control in the presence of other vehicles. This is also an issue that has been recently highlighted by reported near-collisions between UAVs and manned aircraft, or drones causing injuries to people on the ground. This talk advances some ideas based on robust onboard guidance, navigation and collision-avoidance control schemes for UAVs that can increase their reliability, while taking into account hardware constraints like constraints on power and sensor/actuator/processor hardware, uncertainties in sensor noise, and underactuation in several common types of UAVs. It also outlines a plan for indoor laboratory verification of these approaches at Syracuse University, for autonomous sense-and-avoid by fusing information from exteroceptive and inertial sensors.

About the Speaker

Amit Sanyal obtained the B.Tech. degree in Aerospace Engineering from the Indian Institute of Technology, Kanpur, in 1999. He obtained the Distinguished Graduate Student Masters Research Award for his MS thesis in Aerospace Engineering from Texas A&M University in 2001. He received his MS in Mathematics and Ph.D. in Aerospace Engineering from the University of Michigan in 2004, where he was awarded the Engineering Academic Scholar Certificate. Between 2004 and 2006, he was a Post-doctoral Research Associate in the Mechanical and Aerospace Engineering department at Arizona State University. From 2007 to spring 2010, he was Assistant Professor in Mechanical Engineering at the University of Hawaii. Between fall 2010 and spring 2015, he was a faculty in Mechanical and Aerospace Engineering at New Mexico State University. He is now Associate Professor in Mechanical and Aerospace Engineering at Syracuse University. He applies geometric mechanics, nonlinear and geometric control, and variational integration of Lagrangian/Hamiltonian systems, to dynamics modeling, guidance, navigation, and control of unmanned and autonomous systems. He is a senior member of AIAA and IEEE, and a member of ASME.

Refreshments will be served.

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Distributed Robust Nonparametric Sequential Spectrum Sensing under Electromagnetic Interference and Fading

Abstract: A nonparametric distributed sequential algorithm for quick detection of spectral holes in a Cognitive Radio set up is proposed. Two or more local nodes make decisions and inform the fusion centre (FC) over a reporting multiple access channel, which then makes the final decision. The local nodes use energy detection and the FC uses mean detection in the presence of fading, heavy-tailed electromagnetic interference (EMI) and outliers. The statistics of the primary signal, channel gain or the EMI is not known. Different nonparametric sequential algorithms are compared to choose appropriate algorithms to be used at the local nodes and the FC. Modification of a recently developed random walk test is selected for the local nodes for energy detection as well as at the fusion centre for mean detection. It is shown via simulations and analysis that the nonparametric distributed algorithm developed performs well in the presence of fading and EMI and is robust to outliers. The algorithm is iterative in nature making the computation and storage requirements minimal.

About the Speaker

Vinod Sharma completed his Phd in ECE from CMU in 1984. After spending time at Northeastern University and UCLA, he joined Indian Institute of Science, Bangalore in 1988 where currently he is a professor in the ECE department. He was chairman of the department from 2006 to 2011. His research interests are in wireless communication, information theory and detection-estimation.

Refreshments will be served.
Role of information technology in healthcare delivery in Nepal-Existing landscape, opportunities and challenges

Abstract: Despite the increasing number of hospitals and health care centers across the country, there is a huge disparity in access to quality health care in Nepal, be it in cities or in villages. After an overview of the current landscape of health care in Nepal, we will focus on the potential of information technology to improve access to care and share Pratham Health’s experience in addressing the problem of access to specialist care.

About the Speaker

Dr. Adarsha Bajracharya is a hospitalist physician and the associate director of inpatient informatics at Cambridge Health Alliance in Boston, MA. He serves as a physician lead for the implementation of electronic health record system in the inpatient setting, and for the development of telemedicine and mobile health programs. He is also a faculty member in the division of Clinical Informatics at Beth Israel Deaconess Medical Center and an instructor in medicine at Harvard Medical School. He obtained his medical degree from Manipal College of Medical Sciences in Nepal and completed his residency training in internal medicine from Steward Carney Hospital in Boston, MA. He recently completed his fellowship training in biomedical informatics focusing on clinical informatics from Harvard Medical School in Boston, MA.

Dr Bajracharya’s clinical and research interests include examining the role of information technology to improve patient engagement, use of patient portals, and telemedicine. He has developed applications for patients to provide their medical history and health care proxy information through patient portals integrated with their electronic health record, which are used by patients at Beth Israel Deaconess Medical Center. He is also a co-founder of PrathamHealth, a telemedicine service company that provides patients in Nepal with access to specialist care by connecting Nepalese physicians with international specialist physicians.

Refreshments will be served.

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Learning with Algebraically Structured Subspaces

Abstract: Low dimensional subspace models have had a huge impact on statistical signal processing theory and methods. In this talk we will revisit these subspace models and endow them with algebraic structures that allow group-invariance (submodule) and multilinear (tensor product) properties present in data to be captured in a natural and tractable way. This perspective leads to a number of new classes of subspace models such as the low-rank submodule, the union of submodules and the union of multilinear subspaces. We will discuss how these new algebraically-structured subspace models can be used to solve a number of multidimensional data processing problems such as data completion, clustering, outlier detection, and denoising in an effective and unified way. Time permitting, we will also highlight some related research directions and recent results.

About the Speaker

Shuchin Aeron is an assistant professor in the ECE department at Tufts University. He received his Ph.D. in ECE from Boston University in 2009. From 2009 to 2011 he was a post-doctoral research fellow at Schlumberger-Doll Research (SDR), Cambridge, MA where he worked on signal processing solution products for borehole acoustics. He has several patents in acoustic signal processing and his proposed workflows are currently implemented in SDR’s logging while drilling tools. He is the recipient of the 2009 best doctoral dissertation award from both the college of engineering and the ECE department at BU. He received the Center of Information and Systems Engineering (CISE) award from Boston University in 2006 and a Schlumberger-Doll Research grant in 2007. He is currently a senior member of the IEEE. His research interests are in statistical signal processing, information theory, and optimal sampling and recovery.

Refreshments will be served.

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The "Many Faces" of Biometrics

Abstract: Biometrics is the science of recognizing individuals based on their physical and behavioral attributes such as face, fingerprints, iris, gait, voice, etc. A number of applications, ranging from border control systems to smartphone access, are utilizing biometrics in order to recognize individuals. For example, smartphones are being equipped with fingerprint sensors for user authentication.

- One, it refers to the fact that an operational biometric system has to address "many different facets" ranging from robust pattern recognition to provable data security/privacy in diverse unconstrained scenarios.

- Second, in the context of face recognition, it refers to the problem of matching “different types of face images” (known as heterogeneous face recognition) such as images collected (a) using different sensors (thermal, visible, near-infrared), or (b) before and after the application of facial cosmetics.

In this talk, we will first discuss the range of research activities being conducted in the biometrics community, and then present some of our work on heterogeneous face recognition; cross-modality matching of face and iris; and privacy enhancement using visual cryptography and mixing schemes.

Biography: Arun Ross is an Associate Professor in the Department of Computer Science and Engineering at Michigan State University and the Director of the i-PRoBe Lab. From 2003 to 2012, he was a faculty member at West Virginia University. He also served as the Assistant Site Director of the NSF Center for Identification Technology and Research (CITeR) between 2010 and 2012.

Arun received the B.E. (Hons.) degree in Computer Science from the Birla Institute of Technology and Science, Pilani, India, and the M.S. and Ph.D. degrees in Computer Science and Engineering from Michigan State University.

He is the coauthor of the textbook “Introduction to Biometrics” and the monograph “Handbook of Multibiometrics,” and the co-editor of “Handbook of Biometrics”. He is a recipient of the IAPR JK Aggarwal Prize, the IAPR Young Biometrics Investigator Award (YBIA), the NSF CAREER Award, and was an invited speaker at the Frontiers of Science Symposium organized by the National Academy of Sciences in November 2006. He is also a recipient of the 2005 Biennial Pattern Recognition Journal Best Paper Award and the Five Year Highly Cited BTAS 2009 Paper Award.

Arun served as a panelist at a counter-terrorism event that was organized by the United Nations Counter-Terrorism Committee (CTC) at the UN Headquarters in May 2013. He was an Associate Editor of IEEE Transactions on Information Forensics and Security (2009 – 2013), and IEEE Transactions on Image Processing (2008 – 2013). He currently serves as Senior Associate Editor of IEEE Transactions on Image Processing, Area Editor of the Computer Vision and Image Understanding Journal, Associate Editor of the Image and Vision Computing Journal, and Chair of the IAPR TC4 on Biometrics.

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An Adaptive Multi-factor Authentication (A-MFA) Methodology

Abstract: Multi-factor Authentication (MFA) is the current trend to identify authorized users (in multiple ways) through an authentication process via passwords, security token, biometrics, cognitive behavior metric, software/hardware sensors, etc. Existing MFA systems typically use static policies for selecting authentication factors and do not consider dynamic aspects of operating environment. We are developing an authentication framework for adaptive selection of multiple modalities at different operating environments so to make authentication strategy unpredictable to the hackers. This methodology, called adaptive multi-factor authentication (A-MFA) will incorporate a novel approach of calculating trustworthy values of different authentication factors within different environmental settings. The objectives of this project are to develop (i) a trust-based adaptive, robust and scalable software-hardware framework in selecting authentication modalities for continuous and triggered authentication, (ii) optimal algorithms to determine the security parameters of each authentication modality/factor. Accordingly, a subset of authentication factors will be determined (at triggering events) on the fly thereby leaving no exploitable a priori pattern or clue for adversaries. Our empirical results reflect that such a methodology of adaptive authentication can provide legitimacy to user transactions with an added layer of access protection that will not rely on a fixed set of authentication modalities. Robustness of the system will be maintained through designing the framework so that if any modality data get compromised, the system will still perform flawlessly using other non-compromised modalities. Scalability will be guaranteed by adding new and/or improved modalities with existing set of modalities and generating the operating/configuration parameters for the added modality.

Bio: Dipankar Dasgupta is a Professor of Computer Science at the University of Memphis. His research interests are in the area of scientific computing, design, and development of intelligent cyber security solutions inspired by biological processes. He is one of the founding fathers of the field of artificial immune systems. He has written many books. His latest book, “Immunological Computation”, is a graduate level textbook, and was published by CRC press in 2009. His new textbook on Advances in User Authentication will be published by Springer-Verlag, 2016.

Dr. Dasgupta, served as a program co-chair at the National Cyber Leap Year Summit organized at the request of the White House Office of Science and Technology Directorate (2009). Some of his groundbreaking works, like digital immunity, negative authentication, and cloud insurance model, was covered by Computer World Magazine and other News media. Prof. Dasgupta is an Advisory Board member of Geospatial Data Center (GDC), Massachusetts Institute of Technology since 2010.

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Low-Complexity Scheduling Policies for Achieving Throughput and Delay Optimality in Multi-channel (OFDM) Downlink Systems

Abstract: The dramatic increases in demands from multimedia applications have put an enormous strain on the current cellular system infrastructure. This has resulted in significant research and development efforts on 4G/5G multi-channel wireless cellular systems (e.g., LTE and WiMax) that target new ways to achieve higher data rates, lower latencies, and a much better user experience. Further, in these multi-channel systems, such as OFDM, the time intervals in which the scheduling decisions need to be made, is typically on the order of a few milliseconds. On the other hand, there are hundreds of orthogonal channels that need to be allocated to hundreds of users. Hence, many decisions have to be made within a short scheduling cycle, which means that it is critical that scheduling policies must have low complexity. Thus, a major challenge in the development of next generation wireless networks is to design scheduling policies that can simultaneously provide high throughput, low delay, and low complexity. In this talk, I will present a unifying framework for designing low-complexity scheduling policies in the downlink of multi-channel (e.g., OFDM-based) wireless networks that can provide optimal performance in terms of both throughput and delay. We first develop new easy-to-verify sufficient conditions for rate-function delay-optimality in the many-channel many-user asymptotic regime, and for throughput-optimality in general (non-asymptotic) settings. The sufficient conditions enable us to prove rate-function delay-optimality for a class of Oldest Packets First (OPF) policies and throughput optimality for a large class of Maximum Weight in the Fluid limit (MWF) policies. By intelligently combining policies from the classes of OPF policies and MWF policies, we design hybrid policies that have a low complexity of $O(n^{2.5} \log n)$, and are yet both throughput and rate-function delay optimal. We further develop simpler greedy policies that are throughput-optimal and are near delay-optimal. The efficacy of our schemes and comparisons with the state-of-the-art are also illustrated through simulations.

Bio: Ness Shroff received his Ph.D. degree in Electrical Engineering from Columbia University in 1994. He joined Purdue university immediately thereafter as an Assistant Professor in the school of ECE. At Purdue, he became Full Professor of ECE in 2003 and director of CWSA in 2004, a university-wide center on wireless systems and applications. In July 2007, he joined The Ohio State University, where he holds the Ohio Eminent Scholar endowed chair in Networking and Communications, in the departments of ECE and CSE. From 2009-2012, he served as a Guest Chaired professor of Wireless Communications at Tsinghua University, Beijing, China, and currently holds an honorary Guest professor at Shanghai Jiaotong University in China and Indian Institute of Technology Bombay. His research interests span the areas of communication, social, and cyberphysical networks. He is especially interested in fundamental problems in the design, control, performance, pricing, and security of these networks. Dr. Shroff is an editor at large for the IEEE/ACM Trans. on Networking and senior editor of the IEEE Trans. on Control of Networked Systems. He also serves on the editorial board of the IEEE Network Magazine, and the Networking Science journal. He has chaired various conferences and workshops, and co-organized two workshops for the NSF to chart the future of communication networks. Dr. Shroff is a Fellow of the IEEE and an NSF CAREER awardee. His work has received numerous best paper awards for his research, e.g., at IEEE INFOCOM 2008, IEEE INFOCOM 2006, Journal of Communication and Networking 2005, and Computer Networks 2003 (his papers also received runner-up awards at IEEE INFOCOM 2005 and IEEE INFOCOM 2013), and also student best paper awards (from all papers whose first author is a student) at IEEE WiOPT 2013, IEEE WiOPT 2012, and IEEE IWQoS 2006. Dr. Shroff is listed as a highly cited researcher from Thomson Reuters ISI and also in Thomson Reuters Book on The World’s Most Influential Scientific Minds in 2014. In 2014, he received the IEEE INFOCOM achievement award for seminal contributions to scheduling and resource allocation in wireless networks.

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Evolution of the IP-over-Optical Core Network

Abstract: Software Defined Network (SDN) and Network Functions Virtualization (NFV) have been proposed and leading disruptive technologies to reshape the networking industry landscape. SDN is an architectural framework for creating intelligent networks that are programmable, application aware, and more open. SDN allows the network to transform into a more effective business enabler, enables applications to request and manipulate services provided by the network and allows the network to expose network state back to the applications. Network Functions Virtualization (NFV) was recently proposed to improve the flexibility of network service provisioning and reduce the time to market of new services. By leveraging virtualization technologies and commercial off-the-shelf programmable hardware, NFV decouples the software implementation of network functions from the underlying hardware. In this talk, I will give a brief overview of AT&T's vision of SDN and NFV, including its requirements and architectural framework. I will start with ideas of how carrier’s network should evolve with emerging packet and transport technologies. This talk also will give brief descriptions of EdgePlex, a flexible and reliable provider edge platform that decomposes and virtualizes the functions performed by a traditional edge router; and CORD, an architecture for the Telco Central Office with SDN, NFV, Cloud and commodity hardware to build cost effective, agile networks that significantly lower cost and enable rapid service creation.

Bio: Weiyi (Max) Zhang is a Senior Inventive Scientist of the Network Service Quality Management Department at AT&T Labs Research, Middletown, NJ. Before joining the AT&T Labs, he was an Assistant Professor at the Computer Science Department, North Dakota State University. His research interests include routing, scheduling, and cross-layer design in computer networks, survivable design and quality-of-service provisioning of communication networks. He has more than 80 refereed papers published in his research areas. He received AT&T Labs Research Excellence Award in 2013, Best Paper Award in 2007 from IEEE GLOBECOM'2007, and Best Paper Award in 2014 from IEEE ICC'2014.

Refreshments will be served.
Dr. Qi Cheng, Associate Professor
School of Electrical and Computer Engineering
Oklahoma State University

Wednesday, September 30, 2015
4-201 Center for Science and Technology – 1:00 PM

Distributed Dynamic Event Region Detection and Tracking

Abstract: Large-scale sensor networks are expected to play an important role in modern cyber-physical systems. They can monitor phenomena of interest at close range with high spatial and temporal resolutions. Among these, detection/estimation of spatially varying processes or fields is considered as one of the critical problems in sensor network applications. Rapid, accurate and reliable detection of such spatially distributed phenomena evolving over time will facilitate better prediction of their future course, enabling formulation of early control, mitigation, and evacuation actions. This talk focuses on the acute issue of how to efficiently process the large amount of collected sensing data for improved detection accuracy and timeliness of decision making. Part one focuses on the distributed algorithms proposed for event region detection and tracking by utilizing the spatiotemporal correlation information to predict the event region evolution. Part two focuses on reconstructing critical dynamic event regions at a control center in bandwidth-limited wireless sensor networks.

Speaker Bio: Qi Cheng received the B.E. degree from Shanghai Jiao Tong University, Shanghai, China, in 1999 and the M.S. and Ph.D. degrees from Syracuse University, Syracuse, NY, USA, in 2003 and 2006, respectively, all in electrical engineering. Dr. Cheng joined Oklahoma State University in 2006 and currently is an associate professor with the School of Electrical and Computer Engineering. Her research interests include distributed detection and estimation, distributed change/fault/anomaly detection, statistical learning theory, communications and information theory and their applications to distributed sensor networks. Dr. Cheng is a Senior Member of IEEE and Member of Women in Engineering ProActive Network (WEPAN). She served as an Editor for the IEEE Communications Letters 2011-2014. Dr. Cheng received a Research Associateship award at the Air Force Research Laboratory (AFRL) from the National Research Council (NRC) of the National Academies in 2015.
Scene Understanding for Real Time Processing Over Streaming Video

Abstract: With heightened security concerns across the globe and the increasing need to monitor, preserve and protect infrastructure and public spaces to ensure proper operation, quality assurance and safety, numerous video cameras have been deployed. Accordingly, they also need to be monitored effectively and efficiently. However, leveraging human operators to constantly monitor all the video streams is not scalable or cost effective. Humans can become subjective, fatigued, even exhibit bias and it is difficult to maintain high levels of vigilance when capturing, searching and recognizing events that occur infrequently or in isolation.

These limitations are addressed in the Live Video Database Management System (LVDBMS), a framework for managing and fusing live motion imagery data. It enables rapid development of video surveillance software much like traditional database applications are developed today. Such developed video stream processing applications and ad hoc queries are able to "reuse" advanced image processing techniques that have been developed. This results in lower software development and maintenance costs. Its intrinsic privacy framework facilitates a formalized approach to the specification and enforcement of verifiable privacy policies. This is an important step towards enabling a general privacy certification for video surveillance systems by leveraging a standardized privacy specification language.

Speaker Bio: Alex J. Aved received the BA degree in Computer Science and Mathematics in 1999 from Anderson University in Anderson, Indiana, an MS degree in Computer Science from Ball State University, Muncie, Indiana and PhD in Computer Science in 2013 from the University of Central Florida, Orlando, Florida. Alex’s research interests include multimedia databases, stream processing, dynamic mathematical models that operate in real time and mobile computing.

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Dr. Zhenliang Zhang  
Senior Engineer in Qualcomm Corporate R&D  
Adjunct Professor at Columbia University  

Wednesday, September 16, 2015  
4-201 Center for Science and Technology – 1:00 PM  

Decision making in large networks  

Abstract: Have you ever shopped online? Do you read other people's reviews before buying something? Over the past few decades, people get connected within social network more than ever in history. We see, we hear, and we learn from other people around us. There is no doubt that learning and influence from others helps us to make smarter decisions. However, have you ever thought about how learning might actually harm? When what you learn is bad or even malicious information, will you still be available to dust off rumor and make the right decision? Same concerns occur in engineering networks (e.g., wireless sensor networks and smart grids), which are informationally decentralized, comprise many nodes carrying disparate information, and are subject to constraints on computation, power, and communication. A central question here is whether we can aggregate the disparate information to jointly make a smart decision. In today’s talk, I will discuss the fundamental limits of decision making in several network structures.  

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Speaker Bio: Zhenliang Zhang is currently a senior engineer in Qualcomm Corporate R&D. He is also an adjunct professor in Columbia University. He got the Ph.D. degree in Aug. 2013 from Department of Electrical and Computer Engineering, Colorado State University, where he also held a M.S. degree in Physics. Prior to that, he received the B.S. degree from Special Class for Gifted Young, University of Science and Technology of China, in 2008. Zhenliang Zhang's research interests span the areas of optimization, statistical signal processing, and network science.  

Refreshments will be served.  

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