

# CEWIT2015

The 12th International Conference and Expo on  
Emerging Technologies for a Smarter World

October 19-20 • Melville Marriott



## PROCEEDINGS



**Center of Excellence**  
WIRELESS AND INFORMATION TECHNOLOGY  
AT STONY BROOK UNIVERSITY



**IEEE**

CEWIT 2015 is co-sponsored by IEEE Region 1 and its Long Island section. Peer-reviewed conference papers will be submitted for inclusion in the IEEE Xplore online database and EI.

# MONDAY • OCTOBER 19

8:00 AM REGISTRATION OPEN IN MAIN LOBBY					
	TRACK A	TRACK B	TRACK C	TRACK D	
MORNING SESSION 9:00 AM - 10:15 AM	Big Data Analytics and Visualization	Health Technologies and Medical Devices	Cybersecurity	Entrepreneur's Toolkit I Funding 101	
10:15 AM - 10:45 AM BREAK: ATRIUM SHOW FLOOR AND POSTER SESSIONS					
MORNING SESSION 10:45 AM - 12:00 PM	Big Data Analytics and Visualization	Health Technologies and Medical Devices	Cybersecurity Hosted by NSI	Entrepreneur's Toolkit I Funding 101	
1:00 PM - 2:15 PM LUNCHEON, WELCOMING REMARKS, AND KEYNOTE SPEAKER					
	TRACK A	TRACK B	TRACK C	TRACK D	TRACK E
AFTERNOON SESSION 2:30 PM - 3:45 PM	Big Data Analytics and Visualization	Internet of Things	Smart Energy and Smart Urban Systems	Trends in Venture Capital and is There Another Way?	VENTure eVENT Information Tech and Communication Access for Vent-Users
3:45 PM - 4:15 PM BREAK: ATRIUM SHOW FLOOR					
AFTERNOON SESSION 4:15PM - 5:30 PM	Big Data Analytics and Visualization	Internet of Things	Smart Energy and Smart Urban Systems	Trends in Venture Capital and is There Another Way?	VENTure eVENT Information Tech and Communication Access for Vent-Users
5:30 PM - 7:00 PM ENHANCED RECEPTION AND ATRIUM SHOWFLOOR • Exhibitor and Poster Sessions					

# TUESDAY • OCTOBER 20

8:00 AM CONTINENTAL BREAKFAST AND ATRIUM SHOWFLOOR • Exhibitor and Poster Sessions						
	TRACK A	TRACK B	TRACK C	TRACK D	TUTORIALS	
MORNING SESSION 9:00 AM - 10:15 AM	Information Technology and Society	Health Technologies and Medical Devices	Emerging Technologies	Entrepreneur's Toolkit II: How Investors Think New York State Funded Resources for Entrepreneurs	NYC Data Science Academy  Session I 9:00 AM-12:00 PM Python Data Analytics  NumPy • Pandas Matplotlib • SciPy  Session II 2:00 PM-5:00 PM R Data Mining  Caret • Rpart RandomForest GBM • Boosting	
10:15 AM - 10:45 AM BREAK: ATRIUM SHOW FLOOR AND POSTER SESSIONS						
MORNING SESSION 10:45AM - 12:00 PM	Information Technology and Society	Health Technologies and Medical Devices	Emerging Technologies	Entrepreneur's Toolkit II: How Investors Think New York State Funded Resources for Entrepreneurs		
12:30 PM - 2:00 PM LUNCHEON, WELCOMING REMARKS, AND KEYNOTE SPEAKER						
2:00 PM - 5:00 PM INTERNATIONAL B2B • Networking Session						
5:00 PM CONFERENCE ADJOURNED						



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## Big Data Analytics and Visualization

### Chairs:

*Rong Zhao*

*The Center of Excellence in Wireless and Information Technology*

*Steve Greenspan*

*CA Technologies*

### Twitter Financial Community Sentiment and its Predictive Power to Market Movement

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Twitter, one of the several major social media platforms, has been identified as an influential factor for financial markets by multiple academic and professional publications in recent years. The motivation of this study hinges on the growing popularity of the use of Twitter and the increasing prevalence of its influence among the financial investment community. This paper presents empirical evidence of the existence of a financial community on Twitter in which users' interests align with financial market-related topics. We establish a methodology to identify relevant Twitter users who form the financial community, and we also present the empirical findings of network characteristics of the financial community. We observe that this financial community behaves similarly to a smallworld network, and we further identify groups of critical nodes and analyze their influence within the financial community based on several network centrality measures. Using a novel sentiment analysis algorithm, we construct a weighted sentiment measure using tweet messages from these critical nodes, and we discover that it is significantly correlated with the returns of the major financial market indices. By forming a financial community within the Twitter universe, we argue that the influential Twitter users within the financial community provide a proxy for the relationship between social sentiment and financial market movement. Hence, we conclude that the weighted sentiment constructed from these critical nodes within the financial community provides a more robust predictor of financial markets than the general social sentiment.

### Cost and Machine Learning: An Application to Feature Selection for Hidden Markov Models

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Machine learning is a collection of techniques designed to detect hidden patterns in data and use this knowledge to predict the outcome of future data. These predictions can be used to make decisions about the system, which will generate the data in the face of uncertainty. Constructing mathematical and statistical models which represent a system or process are a large component of the machine learning field. A majority of these models are learned from collected data. However, this collected data does not always represent all the

information about a system or the all the information a researcher wishes to convey to the modeling process. Therefore, many machine learning techniques are limited by the available data. One area of information that I am interested in conveying to machine learning techniques is cost, which can include the financial costs of collecting, storing, and labeling data; the computational cost of training models and predicting on future data; and the cost of misclassifying data during prediction. In this talk, I will discuss techniques for incorporating several types of cost in different machine learning algorithms. As a specific application of these ideas, the talk will focus on the problem of feature selection with respect to cost for hidden Markov models.

### RealTime LargeScale Big Data Networks Analytics and Visualization Architecture

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Complex largescale networks are massive in size of data and the information that they hold and contain. Analysis and the interactivity of a network and in particularly network that deal with largescale "Big Data" have vital importance. Visualization for large data is a crucial part of any data analysis process, especially in large data visualization of the today's emergent social network would help analyst understand and visualize how big data are being distributed along the social network. Present computing improvement have lead to big progress towards the graphical capabilities and there are many new other possible alternatives for data displays and visualization that is in current research. Big data analytics and visualization emerged as sociotechnical needs in this current century as well as will be main dominant workforces in next generation technologies. Today's social and technological operations are centered around massive data transfer. These activities are more predominant for dynamic realtime data handling and operations. Better visualization techniques will help for clear and effective understanding in any realtime dynamic systems. Existing data analytics and visualization environment lacks functional features while operating over wide range realtime dynamic systems. Considering the drawbacks of existing data visualization systems in this paper we put forward 'Large-Scale System Data Visualization' architecture i.e. XSimViz. This XSimViz framework will allow users for interactive realtime i.e. dynamic data analytics and visualization. In our proposed work we are answering one of the most important questions related to largescale network analysis: What each vertices or edge in a network? What function does it serve in the network? Many complex systems in the real world can be modeled as graphs or networks. One of the most relevant features of graphs representing real systems is community structure, or clustering. A set of mathematical equations along with the standard calculation algorithms which support us to have a better analysis of the network such as the clustering coefficient, degree distribution, adjacency matrices. This helps us to have a structured system as well as a better interactive visualization aspect along with scalable to large big data sets. More important aspect of realtime data visualization is capturing realtime clustering and degree of relationship which is most important in network such as research network, coauthorship networks. The proposed XSimViz RealTime LargeScale Big Data Networks Analytics and Visualization Architecture: Dr. Pravin Chopade model initially focuses on effective task partitioning over the Internet, but will eventually incorporate parallel processing techniques to improve the overall performance. The attributes of XSimViz components include: Dynamic partitioning of processes based on network speed, computing power, volume of data, and location of data; Able to coordinate multiple processing tasks over a network; Able to perform automatic data analysis in the areas of compression and format-

ting in preparation for transmission over a network; Able to spawn processes on multiple machines to achieve optimum performance. The XSimViz big data visualization system brings together the strengths of the current models into one package. We used XSimViz, MATLAB and AVS framework for analysis and visualization of various complex realtime networks.

## **The Data Sensorium: Multimodal Exploration of Scientific Data Sets**

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Big data is one of the defining problems of our time: we are immersed in a torrent of information from scientific discovers, news, social circles, and the devices we carry. The challenge is to distill all this abstract data into useful conclusions. The Data Sensorium was launched in 2011 to foster novel kinds of collaborations to yield new insights. Collaborations are not merely fashionable: they are critical to tackling modern scientific and engineering challenges. However collaborations are typically thought of in terms of bleeding across conventional disciplinary boundaries. While these 'nearby' interactions (e.g. between physicists and chemists) are undoubtedly valuable, the Data Sensorium instead explores how seemingly disparate disciplines such as the arts and the sciences can interact to mutual benefit.

## **Exploring the Feasibility of Heterogeneous Computing of Complex Networks for Big Data Analysis**

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We present our experience with exploring the configuration space for accelerating BFS's on large complex networks in the context of a heterogeneous GPU + CPU HPC platform. We study the feasibility of the heterogeneous computing approach by systematically studying different graph partitioning strategies while processing synthetic and realworld complex networks. To achieve this, we exploit the coreness of complex networks for load partitioning.

## **EP-SPARQL Complex Event Stream Processing System and its Applications**

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Addressing Big Data streams of events in the Web realm and development of tools for implementing streaming applications has become a very important area of research. We developed EPSPARQL, an open source system and Semantic Web language for Complex Event Processing (CEP) and stream processing based on a declarative semantics grounded in logic programming. Using the system, we developed several streaming applications in medicine, stock market applications, social networks, sensor networks, and so forth.

## **Information Technology & Society**

### **Chairs:**

*Craig Lehmann, Stony Brook University and John Vodopia, IEEE*

## **Technology Innovation Reduces Medication Errors**

*Craig Lehmann*  
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Medication nonadherence remains a major issue in our healthcare system and will continue to grow along with the aging population. More than 20 percent of hospital emergency department visits are due to medication nonadherence. Half of the 3.2 billion annual prescriptions dispensed in the United States are not taken as prescribed. Thus, costing payers anywhere from 100300 billion dollars a year. Such errors are responsible for more than 125,000 deaths per year. Medication errors are varied and can occur from a variety of scenarios; dose changes, discharge orders from hospitals, client confusion, multiple physicians' prescribing, etc. Much of these errors can be prevented with today's technology. This presentation will describe a new portable medication manager that creates a partnership between the pharmacist, patient and caregivers by reducing medication nonadherence as well as medication reconciliation. From the time clients fill their scrips, to the time they renew their medication, the medication manager guides them with voice (English or Spanish) and LCD. The medication is never removed from the original bottle. The system alerts the client when it is time to take their medication by vibrating and flashing lights on their wrist band. If the client takes the wrong medication, voice and LCD provides the following audio alert: "This is the wrong medication. Take the medication from the lit receptacle". If the patient does not take their medication, up to three family members can be notified. When the client alerts the medication manager of his/her presence, the correct medication receptacle will light up. The medication manager offers the pharmacy an opportunity to create the most accurate list possible of all medications being taken, including drug name, dosage, frequency, and route and compare that information against the physician's admission, transfer, and/or discharge orders, with the goal of providing correct medications. The medication manager has WiFi and Bluetooth technology and is portable.

## **Bringing the Most Common Health Intervention to the Digital Age Using Smart Phones**

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After the doctor prescribes, medication use is left to patients. Patient medication errors are common, and can lead to high medical care costs and other health complications. Medication errors include using a wrong medication, wrong dose, not in time or skipping doses. All of this leads to poor health outcomes to the patient and increased costs to the healthcare system. It is realized that if we could provide patients with a "pill sensor" these could be avoided, just like a GPS system can prevent a driver from getting lost. While most health parameters can be measured and tracked, medications, which are the



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most common medical and health treatment, are not digitally tractable. This is a longstanding challenge, where solutions offered so far are indirect and bulky, thus cannot provide the precision, value, ease of use and cost that can meet the expectations of users and healthcare systems. Yet, we are in a process where smartphones keep getting more sensors, communications and computing power, thus becoming more “intelligent”. Examples include speech understanding, face recognition and GPS navigation. Users learned to expect apps that provide an immediate and intelligent solution, but at the same time be inexpensive and nonintrusive. Within this context, our aim is to make the phone capable of directly “sensing” pills, using the existing camera and other sensors that are already in phones, together with proprietary computer vision algorithms and decision making logic. By directly identifying the pills and match these with the prescription – just prior of using these medications, this system is capable of preventing all patient medication errors and keep a true and validated log than can help the patient, healthcare system and pharmaceutical companies. The presentation will discuss this approach, explain why it represents a true patient empowerment technology, and show use cases where it adds additional value to patients and healthcare system alike.

## **Dynamic Authentication of Wearable Devices in Medical Applications**

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Wearable medical devices have become the trend in healthcare management. They collect patients' vital signals for diagnosis or deliver drugs or electric stimulations for treatment. The wireless communication between the wearable devices and the healthcare server has exposed the system to the possible security breaches that can undermine the privacy of patients and potentially pose life threat to patients. However, security measures to counteract those risks are not well developed in wearable devices. Thus, it is urgent to investigate current security technologies in wireless network communications and modify them for the use in wearable devices. The major obstacles of the adoption of those technologies reside in the hardware architecture of the wearable devices, which usually have limited computation resources and power to implement the security algorithms. Since most wearable devices do not have user interfaces, it is not practical to authenticate the user in a similar method used in other computing devices. Therefore the device authentication becomes the first essential step for the secured wireless communication. A well designed authentication scheme can maintain the privacy of patient data and allows physicians to have easy access to the data and the devices. We proposed a dynamic authentication scheme that utilizes the symmetric encryption key derived from the unique device parameters such as media access control address and device ID and the timestamp. The three values form 128bit binary and are permuted as the seed for the encryption key. Since the device specific data can be stored on server before the device provision, only the timestamp is transmitted to server for the key generation. Therefore, the key will not be exchanged between the device and server but generated on both sides simultaneously from the same seed value. It is further updated periodically with new timestamps to enhance its strength. The key is also served as the identification of the wearable device because the key is derived from the device specific parameters.

## **Integrated Wireless Solutions for Managing Gastrointestinal Disorders**

*Aydin Farajidavar*

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The efficient digestion of food is necessary to supply nutrients to the body. Peristalsis (the coordinated contractions of the gut) is controlled by sequences of bioelectrical waves known as slow waves. In a number of digestive disorders, abnormal slow waves occur, which leads to decreased digestion efficiency and challenging clinical conditions. In his talk, Dr. Farajidavar will describe examples of innovative wireless solutions that can be used to chronically study gastric activity, and present the preliminary results of an integrated solution for managing gastric disorders.

## **Automated Medical Diagnostic Interpretation**

*Russ Sappoff*

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*American Access Care*

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I will define an application of intelligent machines toward the automated interpretation of medical images. The imaging studies are in standard DICOM format and each imaging study has associated with it a final technical report of Diagnostic Radiologist (DR) interpretation. Rule based systems in translation are useful but limited so that an artificial neural network (ANN) solution can be combined for a more robust solution. Various activation functions for the nodes in the system can be tried with various configurations of the network (one or several hidden layers of nodes) and various feedforward and back-propagation algorithms can be employed during training. The data will first be massaged in the following manner: the input layer will be the image, for example CT scan data which is a volumetric (voxel) representation of the xray attenuation coefficients at each place in space. The computer is not limited to 'seeing' the data as a pixel by pixel greyscale slice windowed and leveled for human expert perception. The computerized analysis can supplant human limitations through feature extraction and segmentation algorithms that apply both linear discriminant analysis and calculation of the eigenvectors from the covariance matrix of the probability distribution as applied to the raw data. The output layer will be a text file template derived from the official DR report (i.e. 'normal report', 'fracture skull', 'epidural collection', etc.). It will likely be necessary to partner with an academic institution (and receive Institutional Review Board approval, stripping patient identifying information) to obtain the data necessary to train the artificial neural network. All feasible solutions should then be studied (i.e. various activation functions, configurations of the networks and algorithms employed) and analyzed so as to minimize tradeoffs and to avoid local minima in the 'Energy' function that describes the system performance. The business case will involve finding appropriate channel partners willing to purchase this software service, either through medical equipment manufacturers and/or PACS vendors willing to offer this as an addon feature or liability insurance companies that desire minimization of risk. Although the enduser DR will not be the purchaser the marketing effort needs to be directed in such a way that when the system is initially deployed it will be 'sold' as a digital assistant capable of improving efficiency and accuracy. In fact the underlying neural network should be continually modifiable by the expert human DRs in feedback training similar to today's voicerecognition software so

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that when the system provides a suggested diagnosis the DR can modify and further train the ANN. The software license will be an additional charge for each additional user or a bulk rate charge if there are enough users in an organization to justify that offering. The barriers to entry will likely be high for this technology which will represent a true paradigm shift in the way in which modern medicine is practiced. Homeland security may be interested as a digital assistant to airport screening processes. Applications may be extended into realtime diagnosis via invivo sensor technologies for personal health informatics.

## **The Rise of Mobile Health Technology: The Challenge of Securing Teleradiology**

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*CEO & Founder*

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There are many potential security risks associated with viewing, accessing, and storage of DICOM files on mobile devices. Digital Imaging and Communications in Medicine (DICOM) is the industry standard for the communication and management of medical imaging. DICOM files contain multi-dimensional image data and associated metadata (e.g., patient name, date of birth, etc.) designated as electronic protected health information (ePHI). The HIPAA (Health Insurance Portability and Accountability Act) Privacy Rule, the HIPAA Security Rule, the ARRA (American Recovery and Reinvestment Act), the Health Information Technology for Economic and Clinical Health Act (HITECH), and applicable state law mandate comprehensive administrative, physical, and technical security safeguards to protect ePHI, which includes (DICOM) medical images. Implementation of HIPAA security safeguards is difficult and often falls short. Mobile device use is proliferating among healthcare providers, along with associated risks to data confidentiality, integrity, and availability (CIA). Mobile devices and laptops are implicated in widespread data breaches of millions of patients' data. These risks arise in many ways, including: i) inherent vulnerabilities of popular mobile operating systems (e.g., iOS, Android, Windows Phone); ii) sharing of mobile devices by multiple users; iii) lost or stolen devices; iv) transmission of clinical images over public (unsecured) wireless networks; v) lack of adequate password protection; vi) failure to use recommended safety precautions to protect data on a lost device (e.g., data wiping); and vi) use of personal mobile devices while accessing or sharing e-PHI. An analysis of commonly used methods for DICOM image sharing on mobile devices elucidates areas of vulnerability and points to the need for holistic security approaches to ensure HIPAA compliance within and across clinical settings. Innovative information governance strategies and new security approaches are needed to protect against data breaches, and to aid in the collection and analysis of compliance data. Generally, it is difficult to share DICOM images across different HIPA-compliant Picture Archive and Communication Systems (PACS) and certified electronic health record (EHR) systems while it is easy to share images using nonFDA approved, personal devices on unsecured networks. Endusers in clinical settings must understand and strictly adhere to recommended mobile security precautions, and should be held to greater standards of personal accountability when they fail to do so.

## **Total Population Management Demonstration Model for Vulnerable Communities by Use of Interoperable Digital Health Solutions**

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*Co-Founder, Managing Partner*

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*Mary Jean McKeveny, RN, MS*

*Director of New Programs*

*Dominican Sisters Family Health Service*

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The Senior Total Population Assisted Telehealth Service (STATS) is an innovative new program created by Vital Care Services (VCS), Dominican Sisters Family Home Services (DSFHS), and Stony Brook University (SBU) in partnership with the Shinnecock Indian Health Services Clinic and Southampton Hospital that launched October 2015. This project is funded by the Office of National Coordinators and aims to expand healthcare access and awareness to the total population by using a technology enabled care delivery solution. The program is currently addressing the lack of access to quality healthcare by connecting a large population, starting at the community level, with access to the clinical and social aspects of care. The population can access preventative care and chronic disease management through both weekly and monthly programs designed to meet their level of need in their community setting. The STATS model differs from other models in its unique high touch, high tech program design and total population reach. A team of healthcare delivery professionals, licensed health professionals and community leaders, help participants access an array of services in one convenient location which promotes community engagement. The riskstratified alerts revolutionize total population management to provide services from wellness/prevention to acute/sub acute to chronic disease management.



## Cybersecurity

### Chairs:

*Samir Das, The Center of Excellence  
in Wireless and Information Technology (CEWIT) and  
Dave Mesecher, Northrop Grumman Corporation*

### A Digital Envelope Scheme for Document Sharing in a Private Cloud Storage

*Arturo Diaz  
Professor  
Cinvestav-Tamaulipas  
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We present a digital envelope scheme for secure document sharing in Cloud Storage Environments. Our scheme addresses the file sharing and searching in cloud storage challenges using three key ideas: This first one is the encryption of the documents to be stored in the cloud storage by combining cryptographic systems such as Symmetric Cryptography (SC), Asymmetric Cryptography (AC) and Ciphertext-Policy Attribute Based Encryption (CP-ABE). The idea is the users build control access policies (CAP) for each document based on attributes of the users included in the file sharing workflow, encrypt the documents with those CAP and send the documents to the cloud storage. The second idea is the conversion both the encrypted files and metadata based on CAP into verifiable objects (VO) by using digital signature mechanism, with which users can get access to (VO) and the owners can verify the integrity of their VOs. The third main idea is the development of a VOs management system that enables the users to build sharing workflows on the client side as well as allows the users to view the documents included into the VOs, perform annotations in them and to verify the open operations performed by the users in the VOs through a track-trace mechanism. The three main components are encapsulated in a digital envelope in which is stored the document to facilitate user access and to protect against unauthorized users.

### Ensuring Online Data Privacy and Controlling Anonymity

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In this paper we first develop models of privacy and anonymity from an examination of various categories of data and the motivations of the various persons and groups involved. We point out where specific risk-reduction tools and methods apply and where they do not. We also examine whether the desire for privacy and anonymity favors lawful or criminal activities. Then we propose methods, including legislation, which are needed to ensure that everyone's data privacy requirements might be met. We examine who benefits from anonymity and privacy and who do not, and how to take advantage of the benefits of privacy without providing undue opportunities for criminality.

### Predicting and Protecting Cross Site Request Forgery Attacks on Contemporary Web Applications

*Roshan Shaikh  
Director of Research & Development  
AiSoft, Inc.  
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This work presents the most current and comprehensive understanding of a not very well understood web vulnerability known as the Cross Site Request Forgery (CSRF) and provides specific solutions to identify and defend CSRF vulnerabilities. The immediate benefits of this work include tangible and pragmatic application framework for use by individuals, organizations and developers, either as consumers or providers of web services. This work responds directly to the challenges of keeping pace with the evolving cyber technologies and vulnerabilities that increasingly expose businesses towards privacy and identity theft specific attacks, where the traditional antivirus and anti spyware approaches fail. The urgency to come up with appropriate detection and defense mechanism against the lethal CSRF attacks is indicated due to expanding cloud based technologies, HTML5, Semantic Web, and various emerging security frameworks comprised of inchoate vestigial of "Big Data" that demand exceedingly evolved defense mechanisms. A methodical approach is used to investigate CSRF attacks and remedies are proposed by introducing a novel distinctive set of algorithms that use intelligent assumptions to detect and defend CSRF. In this work, design details of a CSRF Detection Model (CDM), implantation and experimentation results of CDM are elaborated to detect, predict and provide solutions for CSRF attacks on contemporary Web Applications and Web Services environment. Additionally, CDM based recommendations for users and providers of cyber security products and services are presented.

### Security Challenges and Data Implications by using SmartWatch Devices in the Enterprise

*Sanjeev Kumar Marimekala  
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Abstract—In the age of the Internet of Things, use of Smartwatch devices in the enterprise is evolving rapidly and many companies are exploring, adopting and researching the use of these devices in the Enterprise IT (Information Technology). The biggest challenge presented to an organization is understanding how to integrate these devices with the back end systems, building the data correlation and analytics while ensuring the security of the overall systems. The core objective of this paper is to provide a brief overview of such security challenges and data exposures to be considered. The research effort focuses on three key questions:

1. Data: how will we integrate these data streams into of physical world instrumentation with all of our existing data?
2. Security: how can pervasive sensing and analytics systems preserve and protect user security?
3. Usability: what hardware and software systems will make developing new intelligent and secure Smartwatch applications as easy as a modern web application?

This area of research is in the early stages and through this paper we attempt to bring different views on how data, security and usability is important for Enterprise IT to adopt this type of Internet of Things (IoT) device in the Enterprise.

# MONDAY • 10/19 AM • ABSTRACTS

## **SPECIAL SESSION HOSTED BY THE NATIONAL SECURITY INSTITUTE (NSI)**

*Moderated by  
Long Lu  
Assistant Professor  
Department of Computer Science  
Stony Brook University*

### **The National Security Institute (NSI) at Stony Brook University**

The NSI vision and core mission are bold: to secure our homeland by researching and developing technologies and insights for secure, trustworthy, and available communications and computing platforms. NSI's goal is to become a world leader in research, the education of professionals, security technology, business and policy, and raising awareness. NSI spans multiple disciplines and establishes public-private partnerships to develop new holistic socio-technological solutions for securing our highly-digital societies; it engages not only in research but also in the education of professionals in defense, national and cyber-security, assurance, healthcare, and policy. A comprehensive assurance education program trains not only Stony Brook students but also the broader corporate and academic community. NSI leverages the team's strengths to spawn a steady stream of successful security-centric technology startups. NSI is part of a bold new initiative, undertaken as part of the New York SUNY 2020 vision plan, to hire more than 250 faculty members at Stony Brook to expand teaching and research in emerging fields of study that cut across traditional boundaries of academic disciplines. During the next few years, NSI will recruit a total of six new faculty members whose research interests span a wide spectrum of areas, including Computing Hardware Security, Cloud Computing and Distributed Systems Security, Health Technologies Security, Security and Privacy in Online Social Networks, Big Data Security and Privacy, and Regulatory Compliance and Policy among others.

### **Increasing Privacy in a Data-Driven World**

*Roxana Geambasu  
Assistant Professor  
Department of Computer Science  
Columbia University*

The concept of personal privacy as a precious and fragile commodity worthy of protection has come under siege in today's data-driven world. Users are eager to share their data online, and mobile applications and web services aggressively collect and monetize that information. This talk describes our vision for a new, privacy-preserving world; in it, users are more aware of the privacy implications of their online actions, and systems and applications are designed from the ground up with privacy in mind. In support of this vision, we describe our research agenda to design, build, and evaluate new transparency tools that increase users' and privacy watchdogs' visibility into how personal data is being used by applications, and programming abstractions and tools that facilitate the construction of privacy-minded applications. We provide two examples of such tools and abstractions. First, we describe Sunlight, a new web transparency tool that helps privacy watchdogs track how web services use individuals' personal data to target ads, personalize content, or adjust prices. Second, we describe FairTest, a new unit testing framework for programmers that helps programmers test for unfair or discriminatory practices within their data-driven applications. Overall, our tools and abstractions aim to increase privacy by promoting a more responsible, fair, and accountable approach to user data management.

### **Investigating, Categorizing, and Mitigating Malware Download Paths**

*Roberto Perdisci  
Associate Professor  
Department of Computer Science  
University of Georgia  
Adjunct Associate Professor,  
Georgia Tech School of Computer Science*

Most modern malware download attacks occur via the browser, typically due to social engineering or drive-by downloads. In this talk, we will explore how real network users reach attack pages on the web, with the objective of improving network defenses. Specifically, I will present a study of the web paths followed by users who eventually fall victim to different types of malware downloads. I will first present a brief overview of different approaches we have developed to study malware downloads. Then, I will present a recent incident investigation system named WebWitness, which targets the following two main goals: 1) automatically trace back and label the sequence of events (e.g., visited web pages) preceding malware downloads, to highlight how users reach attack web pages; and 2) leverage these automatically labeled in-the-wild malware download paths to better understand current attack trends, and to develop more effective defenses. To evaluate its efficacy, we have deployed WebWitness on a large academic network for a period of ten months, where we collected and categorized thousands of live malicious download paths. An analysis of this labeled data allowed us to design a new defense against drive-by downloads that rely on injecting malicious content into (hacked) legitimate web pages. For example, we show that by leveraging the incident investigation information output by WebWitness we can decrease the infection rate for this type of drive-by downloads by almost six times, on average, compared to existing URL blacklisting approaches.

### **What You Scan Is Not What I Visit - Bypassing Safe Browsing Lists**

*Georgios Portokalidis  
Assistant Professor  
Department of Computer Science  
Stevens Institute of Technology*

A variety of attacks, including remote-code execution exploits, malware, and phishing, are delivered to users over the web. Users are lured to malicious websites through spam delivered over email and instant messages, and by links injected in search engines and popular benign websites. In response to such attacks, many initiatives, such as Google's Safe Browsing, are trying to make the web a safer place by scanning URLs to automatically detect and blacklist malicious pages. Such blacklists are then used to block dangerous content, take down domains hosting malware, and warn users that have clicked on suspicious links. However, they are only useful, when scanners and browsers address the web the same way. This talk presents a study that exposes differences on how browsers and scanners parse URLs. These differences leave users vulnerable to malicious web content, because the same URL leads the browser to one page, while the scanner follows the URL to scan another page. We experimentally test all major browsers and URL scanners, as well as various applications that parse URLs, and discover multiple discrepancies. In particular, we discover that pairing Firefox with the blacklist produced by Google's Safe Browsing, leaves Firefox users exposed to malicious content hosted under URLs including the backlash character. The problem is a general one and affects various applications and URL scanners. Even though, the solution is technically straightforward, it requires that multiple parties follow the same standard when parsing URLs. Currently, the standard followed by an application, seems to be unconsciously dictated by the URL parser implementation it is using, while most browsers have strayed from the URL RFC.

## Entrepreneur's Toolkit I: Funding 101

### Maintaining Your Edge in Intellectual Property

*Anthony Bennett  
Partner  
Hoffmann & Baron, LLP*



Anthony Bennett is a partner in the firm's New York Office and has experience in a broad range of matters concerning patents, trademarks, and copyrights. His practice includes rendering patent validity and non-infringement opinions, and drafting and prosecuting patent applications. Mr. Bennett also has significant experience in trademark matters which include counseling clients on brand selection, conducting trademark clearance investigations, and prosecuting trademark applications. He also has experience in appeals before the Court of Appeals for the Federal Circuit and the United States Supreme Court. Prior to earning his law degree, Mr. Bennett worked as an engineer for Grumman Aircraft Systems and Festo Corporation. Fields of technology include mechanical and electromechanical arts.

### Positioning Your Company for Fundability

*Lori Hoberman  
Founder  
Hoberman Law Group*



Lori S. Hoberman is a well-known force in the New York City venture community. As a lawyer and mentor, she advises entrepreneurs and their investors on how to build successful businesses and strategically guides them through the emerging, later stages and exits of their companies. Lori works with client companies in a range of technology industries, while counseling angel and institutional investors in their investments and in the formation of investment funds. After years of leading startup company practices at large firms such as Fish & Richardson and Chadbourne & Parke, Lori decided to become an entrepreneur. Lori sustains Mentorship of 37 Angels and chairs the NYC Chapter of the MIT Enterprise Forum. A co-founder of several companies, all of her clients followed her to the new, Hoberman Law Group. Forbes has commented that Hoberman differs from other lawyers in that -- "She not only knows people, she connects the dots between the entrepreneur and the resources needed."

### Considerations to Taking an Equity Investment

*Alon Kapen  
Partner  
Emerging Companies & Venture Capital, Farrell Fritz P.C.*



Alon Y. Kapen is a corporate attorney who focuses on representing entrepreneurs, emerging growth companies and their individual and institutional investors. He counsels entrepreneurs and emerging growth companies in the formation of business entities, structuring agreements among founders, negotiation of capital raising transactions, compliance with securities laws, structuring employee incentive arrangements and development of effective corporate governance. Alon also guides investors in the organization of private investment funds, the negotiation of various stages of equity, debt and convertible funding transactions and the planning and implementation of exit strategies.

### PANELISTS:

*Jeffrey Bass  
Founder and CEO  
Executive Strategies Group LLC*



Mr. Bass is Founder and CEO of Executive Strategies Group LLC, a recognized advisory firm specializing in strategic operations and financial consulting. He was the former Principal-In-Charge of Business Advisory Services at Margolin Winer and Evens LLP. Mr. Bass is published and widely quoted in the business press. He was an elected delegate to a White House Conference on Small Business and Chaired the New York State and Northeast Regional Committees on Capital Formation. He was also an advisor to several Federal and NYS agencies, Mr. Bass has taught at the graduate level and holds graduate degrees from CUNY and NYU

*Gary Kane  
Founder & Managing Partner  
Chimera Strategies LLC*



Gary B Kane, MBA, CFA has extensive experience both on Wall Street and on Main Street in various roles such as equity research, corporate development, business development, consulting and corporate financial planning and analysis. Mr. Kane has a Bachelor's degree in Business Administration and a Master's degree in Finance. He also is a CFA or Chartered Financial Analyst and a member of the Long Island Business News' 40 individuals under the age of 40. LIBN considers award winners to be the rising stars in the Long Island business community. Currently, Mr. Kane is the Founder & Managing Partner of Chimera Strategies LLC. [We provide strategic advisory services on 1) business sales & divestitures and 2) business acquisitions using M&ALite™ or traditional investment banking processes and procedures simplified and priced for the Lower Middle Market.]

*Neil Kaufman  
Partner & Chairman  
Abrams, Fensterman, Fensterman, Eisman, Formato, Ferrara & Wolf, LLP*



Neil M. Kaufman is a partner and chairman of the corporate department at Abrams, Fensterman, Fensterman, Eisman, Formato, Ferrara & Wolf, LLP. Mr. Kaufman represents public companies, private companies and investment firms in their corporate, securities, financing, borrowing, merger & acquisition and other legal matters. His clients range from early stage growth companies to mature public companies in a wide range of industries, including software, internet, manufacturing, distribution and services. He well known for advising clients with respect to SEC regulation, public offerings, private placements and mergers & acquisitions, as well as all types of commercial contracts. Mr. Kaufman, a frequent speaker on legal subjects, is also Chairman of the Long Island Capital Alliance (LICA); a director of Financial Executive International-Long Island Chapter (FEI); a member of the corporate advisory board of Cold Spring Harbor Laboratory (CSHL); and formerly served as Chairman of the board of directors of Vizacom Inc.; in addition to sustaining many other affiliations.



## Big Data Architecture and Visualization

### CoChairs:

*Steve Cento, Northrop Grumman Corporation  
and Ari Kaufman, The Center of Excellence in Wireless and  
Information Technology (CEWIT)*

### Streaming Data Analysis and Decision Making in Big Data Environments

*Kerstin Kleese van Dam*

*Director*

*Computation Science Initiative*

*Brookhaven National Laboratory*

*Kleese@bnl.gov*

The ability to interactively make sense of data at large volumes and faster speeds is foundational to many national mission areas in science, energy, health, national security and industry. These domains are driven by the need to assimilate and interpret ever-increasing volumes of data to accelerate scientific discovery and make critical decisions. In these domains, the speed of analysis can be as important to the final outcome as the choice of data to be collected. Brookhaven National Laboratory's (BNL) Center for Data Driven Discovery (C3D - <https://www.bnl.gov/C3D/>) with its partners is developing a new data analysis paradigm -- persistent / dynamic knowledge synthesis - in which we tightly integrate high velocity streaming analysis with human in the loop decision and sense making in one continuous process. This presentation will focus on the initial algorithm and infrastructure development research and its application to challenge in experimental science.

### Visually Studying Urban Mobility Patterns from Taxi Trajectory Data

*Ye Zhao*

*Associate Professor*

*Department of Computer Science*

*Kent State University*

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Advanced technologies in sensing and computing have created a variety of urban datasets of cities and their citizen. In particular, large amounts of taxi trajectory data are collected and utilized by transportation administrations, companies, and researchers. The data provides real situations from which real traffic flows can be extracted and city-wide transportation patterns can be discovered. Understanding and analyzing the large-scale, complex data reflecting city dynamics is of great importance to enhance both human lives and urban environments. We have developed interactive visual analytics techniques and systems to discover and analyze the hidden knowledge of massive taxi trajectory data within a city. First, we study hidden themes of taxi movement by transforming the geographic coordinates into street names. Consequently, the movement of each taxi is studied as a document consisting of the traversed street names. Urban mobility patterns and trends are identified as taxi topics (clusters) through textual topic modeling over massive taxi data. The taxi topics reflect urban mobility patterns and trends, which are displayed and analyzed through interactive visualization tools. Second, we integrate graph modeling and visual analysis to characterize the time-varying importance of different urban regions. A special graph is created to store and manifest real traffic

information recorded by taxi trajectories over city streets. Graph centralities, including Pagerank and betweenness, are computed and interactively examined to characterize the time-varying importance of different urban regions. These approaches support domain users, such as city planners and transportation researchers, in urban planning, transportation design and traffic control.

### Large Scale Analytics for Medical Applications

*Dimitris Metaxas*

*Distinguished Professor and Chair*

*Department of Computer Science*

*Rutgers University*

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Over the last 20 years, we have been developing a general, scalable, computational framework that combines principles of machine learning with sparse methods, mixed norms, dictionaries, deformable modeling methods and learning-based incorporation of domain knowledge. This framework has been used for addressing complex large scale problems in computer vision and medical image analysis. These include feature discovery for segmentation, human motion estimation and recognition of body parts, crowd analytics, cardiac MRI image reconstruction and cardiac analytics including blood flow visualization, large scale histopathological image analysis and retrieval, and ASL recognition. The success of these methods inspired the establishment of the NSF funded center on Dynamic Data Analytics ([cdda.rutgers.edu](http://cdda.rutgers.edu)) between Rutgers and Stony Brook to foster relevant research between Industry and Academia. We will conclude with open problems and future directions in this exciting area.

### Big Data Platforms for Urban Data

*Claudio Silva*

*Professor, Polytechnic School of Engineering*

*Head of Disciplines, Center for Urban Science & Progress*

*New York University*

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Today, 50% of the world's population lives in cities and the number will grow to 70% by 2050. Urban data opens up many new opportunities to improve cities and people's lives. In NYC, by integrating and analyzing data sets from multiple city agencies, the Bloomberg administration was able improve the success rate of inspections. A marked reduction in crime both in New York and Los Angeles has been in part attributed to data-driven policing. Policy changes have also been triggered by data-driven studies that, for example, showed correlations between foreclosures and increase in crime, the effects of subsidized housing on surrounding neighborhoods, and how low income households use the flexibility provided by vouchers to reach neighborhoods with high performing schools. But in each of these successes, the level of effort required to gather, integrate, analyze the relevant data, design and refine models, or develop and deploy apps, is staggering. Further as data volumes and data complexity continue to explode, these problems are only getting worse. In this talk, we will provide an overview of research in the development of new methods and systems for enabling interdisciplinary teams to better understand cities. We will also show some applications of our work.

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## Revealing Patterns in the Injured Brain

*Amitabh Varshney*

*Director, University of Maryland Institute for Advanced Computer Studies*

*Professor, Department of Computer Science*

*University of Maryland*

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I will give an overview of our collaboration with radiologists in developing new visualization tools to detect previously unseen patterns of injuries in the human brain. This allows researchers and clinicians to better identify the extent of neural injuries — whether those injuries are from trauma or other neurological disorders. This better method of visualization allows for more timely therapeutic interventions. And, these same visualization tools can gauge any improvement in someone who has suffered a brain injury. Diffusion kurtosis imaging (DKI) can reveal subtle changes in both gray and white matter. It has shown promising results in studies on changes in gray matter and mild traumatic brain injuries, where the traditional, Diffusion Tensor Imaging (DTI), is often found to be inadequate. However, the highly detailed spatio-angular fields in DKI datasets present a special challenge for visualization. Traditional techniques that use glyphs are often inadequate for expressing subtle changes in the DKI fields. My talk will outline our approach that addresses the above challenge to reveal micro-structural properties of the brain.

## Classification of Research Efforts in Big Data Analytics

*Lyublyana Turiy*

*Adjunct Professor*

*Long Island University, C. W. Post, Palmer*

*School of Library & Information Science*

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The recent explosion in Dynamic (a.k.a., “Big”) Data Analytics[1] research provides a massive amount of software capabilities, published papers, and conference proceedings that make it difficult to sift through and inter-relate it all. This paper proposes a trial classification scheme with several orthogonal dimensions of classification. These dimensions include stages of application, challenges, solution origins, specialization of technologies, purpose, ownership (business type), data processing (batch vs. streaming), and data types applied to. The full list of determined categories in each dimension is presented. The classification scheme is intentionally made to be not too complex, to help anyone entering the expanding world of big data analytics, by helping them gain a better understanding of the applicability of various tools and capabilities that are available, and how these contrast and synergize amongst each another. Additionally, this work can help with creation of educational materials, demarcation of the domain, and encourage full research coverage in big data analytics, as well as enable discovery and articulation of common principles and solutions. The research topics used in creating this classification scheme are retrieved from Scopus online database - “the largest abstract and citation database of peer-reviewed literature”[2] as well as by reviewing examples of similar classification attempts.

## Internet of Things

**Chair:**

*Susan Frank, IEEE*

## Spectral Partitioning Based Energy-Efficient Clustering Algorithm for Wireless Sensor Networks

*Songtao Guo*

*Professor*

*College of Electronic and Information Engineering*

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In wireless sensor networks, sensor nodes are usually powered by battery and thus have very limited energy resource. Therefore, saving energy to extend the lifetime of wireless sensor network becomes of much importance. Clustering has been proved as an effective method to prolong the lifetime of wireless sensor networks. Clustering algorithms usually utilize two techniques: selecting cluster heads (CHs) with more residual energy and rotating cluster heads periodically to distribute the energy consumption among nodes in each cluster. Cluster heads tend to consume more energy due to data gathering and relaying. It is reasonable to assume that cluster heads communicate with the assistance of cooperative nodes, which are also cluster members. In this paper, we first propose an analytical model to determine the optimal number of clusters in a wireless sensor network. It is of great significance because the amount of inter-cluster communications increases along with the number of clusters. On the other hand, the amount of intra-cluster communication grows significantly as the number of clusters decreases. We then propose a centralized cluster algorithm based on spectral partitioning method. We use the second eigenvector, named Fiedler vector, of the graph representation of the WSN, to determine the optimal bi-partitions of a given graph. Spectral graph partitioning is a method of partitioning a graph into two subgraphs in such a way that the subgraphs have a nearly equal number of vertices (as close to equal as possible) while minimizing the number of edges between two subgraphs. After that, we present a distributed clustering algorithm. In our algorithm, the sink node divides the sensing field into some cluster areas by using fuzzy C-means (FCM), calculates the geographic central point of each cluster area, and broadcasts the information to all sensor nodes. The sensor nodes in each cluster area then elect the node close to the center of the area as their CH. The CHs then broadcast advertisement messages to sensor nodes to invite them to join their respective clusters. Finally, we conduct extensive simulations, and the results show that the proposed algorithms outperform the previous clustering algorithms in various aspects.

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## **A New Circuit Design Framework for IoT Devices**

*Emre Salman*

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Internet of Things (IoT) is an emerging paradigm connecting global cyber network with the everyday physical realm. This paradigm enables novel applications in many areas, including transportation, healthcare, smart environment, and social relationships. It is estimated that the number of IoT devices will exceed 25 billion by 2020. This unprecedented increase brings new challenges in circuit and system level implementation of IoT devices. The contributing factor of IoT is the development and integration of advanced identification, sensing and wireless communication devices such as radio frequency identification (RFID) and wireless sensor networks (WSNs). Physical objects embedded with RFID, sensors and actuators can harvest information from the environment, communicate with each node within a WSN, and provide feedback to the virtual internet service.

As the infrastructure of IoT, these devices should satisfy key features of mobility and massive deployment. Despite lower complexity as compared to large scale ASICs and microprocessors, these devices require highly specialized design techniques that are tailored for the specific functions. A common characteristic for each of these functions is the need for higher energy efficiency.

Limited energy is a significant and critical challenge for IoT devices since frequent battery replacement is not feasible. Various energy harvesting techniques have been previously proposed to alleviate this challenge. A new circuit design technique is developed in this work to significantly enhance the efficiency of existing wireless energy harvesting methods. A theoretical analysis of the proposed framework is provided. Contrary to existing methods, the rectification and regulation steps are eliminated and the harvested signal is directly used to power the IoT device in a novel fashion. In addition to higher energy efficiency, the proposed approach also reduces the form factor and therefore lowers the cost of an IoT device. The methodology is evaluated using a 45 nm CMOS technology and the benefits are demonstrated by comparing the methodology with existing techniques.

## **Reliable Sensor Networks for Medical Applications**

*Andreas Timm-Giel*

*Vice President of Research*

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Medical applications require extremely high reliability. Can wireless sensor networks already meet them? In this talk an overview on different medical applications of wireless sensor networks and body area networks are given, such as remote surveillance and home therapy scenarios. The requirements on reliability are discussed. A proposal for a fail-safe architecture is given, allowing for such applications. Finally the certification and proof of reliability in wireless networks in general is discussed. Small number of rare events make reliable results by simulation or experiments difficult to obtain. Mathematical models are required for these investigations.

## **A Robust Low-cost and Robust Sensor for Smart Particulate Sensing for PM2.5 Applications**

*Ramachandran Muralidhar*

*Research and Development Engineer*

*IBM T.J. Watson*

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Particulate pollution is one of the main components of air quality index and is particularly important in many urban areas around the globe for example in New Delhi, Beijing or Cairo. Particulate pollutants suspended in the air pose significant health hazards especially those with diameter  $< 2.5 \mu\text{m}$  (PM2.5) as they can remain suspended in air for extended periods, and can be inhaled and trapped in the respiratory system. Comprehensive air monitoring is the first step towards successful management of this issue and many cities have begun to take active steps to mitigate the pollution problem. Monitoring particulate pollution involves determining the concentration of PM2.5 particles. Traditionally, particulate pollution is measured by collecting particulate matter over a period of time in a filter and weighing the collection to obtain the pollutant concentration expressed in ( $\mu\text{g}/\text{ft}^3$ ). More recently, light-scattering-based particle counters have been proposed as an alternative as they are lower maintenance and enable continuous real-time monitoring. One approach to active pollution monitoring and forecast involves a smart network of sensors which measures and transmits data in real-time or frequent periodicity. The data accuracy from such a system depends on adequate spatial resolution in measurement, which requires a high density of sensors. To make such a system practical, these sensors should be low- cost and low-maintenance. However currently available sensors require periodic clean-up after prolonged exposure to particulate matter as this exposure also leads to concomitant undesirable deposits on sensitive sensor optical and electronic components.

In this paper, we present a low-cost and low-maintenance sensor suitable for deployment in a high density sensor network application for air particulate monitoring. The system includes a laser source and photo detector for particle detection using light scattering, a built-in solar cell and battery as power-source, and a wi-fi/GSM data transmitter that enables the sensor data to be transmitted to a central server where it can be stored and analyzed. A micro-pump enables pollution measurement with minimum exposure to particulates, thus mitigating need for frequent cleaning and interruptions and enabling real-time pollution monitoring. Component operation and duty cycle are optimized for low-power operation and weather robustness. The paper will describe the physical design and mathematical model of this particle counter and present the results of a 2- month field deployment of 5 IBM sensors and a commercially procured Dylos reference particle counter in Beijing. Cross-correlation statistics among sensors obtained from time-series confirm that the 5 IBM sensors are in good agreement with each other and correlate strongly with the commercially available Dylos sensor except when the latter gets periodically loaded with particles and requires cleaning. Auto-correlation statistics reveal characteristic time scale of particulate pollution concentration change, providing guidance to optimal frequency of data acquisition.



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## Measuring Social Networks using Proximity Sensors

*Helmut Strey*

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*Stony Brook University*

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A significant body of research demonstrates strong connections between social connectedness, stress, and health. However, to date it is unclear whether the beneficial aspects of social connectedness are due to quantity, quality, stability, or role within the network. Here we describe a Bluetooth LE proximity sensor based on the Intel Edison that allows us to track interpersonal distances as function of time while triangulating absolute position. This enables us not only to identify the duration and frequency of social contacts, but also to determine who approaches whom—a feature that is necessary in order to establish social hierarchy structures within the group.

## Object Association and Identification through RFID Cluster Collaboration

*Doug Kim and Ashley Hong*

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*Farmingdale State University*

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In this paper, we present collaborative strategies to between the distributed RFID sensor clusters address the association and identification for large area applications. The conversion process for the group associations that may arise in densely populated objects to single association is described. The basic association mechanism utilizes two homographic regions that model the RFID fluctuations. The sources of potential generation of false associations are discussed and the techniques for eliminating with sensor collaboration are presented. The problem with the information inconsistency and its temporal propagation in the large-scale is described and mechanism for detecting and correcting such inconsistency is proposed. The association performance of the proposed strategy is simulated for various parameters.

## Can Bandwidth Sharing be Truthful?

*Xiaotie Deng*

*Professor*

*Department of Computer Science*

*Shanghai Jiaotong University*

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The popular peer to peer (P2P) system has built its success on the protocols that allocate pooled resources fairly, such as in the P2P resource sharing system of BitTorrent and the crowd-sourcing mobile system of Open Garden. Equally important is the issue whether participants could take the advantage of the protocols by manipulative actions. We consider a widely studied proportional sharing (PR) protocol and discuss incentives and opportunities of a player to lie for personal gains. The main result is a proof that a player deviating from the PR protocol by reporting false broken links will not make any improvement on its utility eventually. This establishes new understanding in the studies of strategic stability of P2P or crowd resource sharing protocols for the Internet and mobile networks.

## Smart Energy and Smart Urban Systems

**Chair:**

*John Lamb*

*Pace University*

## Algorithms for Automatic Map Construction of Large Parking Structures

*Fan Ye*

*Assistant Professor*

*Electrical and Computer Engineering*

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*fan.ye@stonybrook.edu*

Due to the prevalence of digital maps, detailed navigation instructions have become standard for vehicles. However, when one drives into indoor environments, such as large underground parking lots, the world suddenly turns dark because no maps exist. There has been little effort addressing the problem. Google Indoor Maps have started to cover indoor buildings, but not specifically for large parking structures. Obtaining such maps by manual survey is effort-intensive and time-consuming. Thus we need a technical solution to reconstruct such maps in an efficient and scalable fashion. In this paper, we propose a crowdsensing based approach to reconstruct parking structure maps using data from drivers' smartphones. A driver's phone can record the inertial data as he drives through the entrance, follow certain paths and eventually parks the car. Each driver's data can be used to generate a corresponding trajectory. Given enough numbers of these trajectories, we can assemble these fragments to construct the complete map of the parking structure. We develop three algorithms of which the input are trajectory samples and the output is the map of the corresponding parking structure. The first two algorithms take trajectory samples starting from the same entrance point. They are based on different principles and have different performances: Sequential Merging Method processes one trajectory at a time and each trajectory's being processed evolves the map to some degree; Points Clustering Based Method is based on k-means clustering algorithm but has extra mechanisms to counter k-means' limits and it deals with all trajectories simultaneously instead of in some order. We also design a third algorithm — Segments Matching Based Method — which can make use of trajectory samples with arbitrary starting points. This accommodates more challenging real world cases where trajectories may start from different locations. Furthermore, we evaluate our algorithms systematically using both trajectory samples from real parking structures and a large number of simulated ones. We present the performance comparison and demonstrate their effectiveness. The experiments have shown that under the same conditions, Points Clustering Based Method, which processes all trajectories at the same time, can construct more accurate and complete maps than Sequential Merging Method, whose effect is affected by the merging order and a low-quality trajectory's being merged first will have bad influence on the following merging. Segments Matching Based Method can construct maps using shorter trajectories as input, and it is the only one among these three which applies to trajectories with arbitrary starting points. However, note that it does not work well enough when the input trajectories are too short (e.g., the number of a trajectory's segments is below 50% of the number of all segments in the parking lot) because a too short trajectory contains too little information to be matched uniquely and correctly.

## Elemental Technologies for Realizing Fully-controlled Artificial

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## **Light-type Plant Factory**

*Masashi Sugano*

*Professor*

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Plant factories are cultivation facilities that enable year-round production of vegetables and other produce by allowing precise control and monitoring of cultivation conditions and plant growth. At Osaka Prefecture University, the Research and Development Center for the Plant Factory has been established as a cutting-edge R&D base specializing in the development of a plant growth facility operated entirely under artificial light. This plant factory is the largest-scale facility of its kind among universities in Japan and can produce 5000 heads of lettuce each day. In this paper, we describe some key technologies for efficient cultivation and energy conservation that have been established in this plant factory.

## **Participatory Discovery Towards 2020**

*Sarena Maeda*

*ISI Dentsu*

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Today, we are witnessing a major paradigm shift in classic manufacturing industries. Hardware production is no longer an “end” in itself, but rather a “means” towards the creation of software platforms and human interactions that ensure sustainable lifecycles and experiences. This shift is clearly visible in the realm of urban system planning, where it is no longer sufficient to plan a city by designing the “Hardware” of the city that supplies conveniences and benefits in a linear fashion. Today’s smarter urban system should be forged through participatory planning, and should have “discovery” as its core value, expanding the sphere of encounter infinitely. Innovative technology design can play a major role in enabling sustainable, smart, urban systems. This an ambition that ISI Dentsu is actively pursuing in a series of projects set in diverse contexts. Having begun with the smart city re-development project in Osaka Japan, we are extending our expertise globally to embrace the challenge of building a “Social Campus” with Cornell Tech in New York, and our next big challenge is to incorporate sports into the participatory urban planning model for the Tokyo Olympics in 2020.

## **Review of Microcontroller Based Intelligent Traffic Light Control**

*Jing Pang*

*Associate Professor*

*Department of Electrical and Electronic Engineering,*

*California State University, Sacramento*

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The congestion of the urban traffic is becoming one of critical issues with the increasing population and automobiles in cities. Traffic jams not only causes extra delay and stress for the drivers, but also increases fuel consumption, adds transportation cost, and increases carbon dioxide air pollution. The traffic controller is one of critical factors affecting the traffic flow. The conventional traffic patterns are nonlinear and complex. As a result, the fixed traffic light controller is not optimized to reduce the traffic jam. Moreover, it does not improve response times for ambulance, fire truck, police cars and the other emergency vehicles.

As a small computer on a single integrated circuit chip, a microcontroller is self sufficient and cost effective for real time embedded system applications. Researchers have designed microcontroller based intelligent traffic light controller system, which in general consists of vehicle detection system, watch dog circuitry, and traffic light control circuitry. The traffic data can be processed by the microcontroller based on the number of the sensors activated, the difference between the major road traffic and branch road traffic, or the traffic data can be transferred by the microcontroller to the computer for processing.

Fuzzy logic based dynamic intelligent traffic light control has also been introduced by researchers. The fuzzy logic system fuzzifies the traffic data inputs into the fuzzy sets using fuzzy language variables, and also determines membership function based on previous knowledge or experience. The defuzzification can be obtained by finding out the maximum degree of membership to obtain the traffic light control variables.

In order to allow emergency mode, multiple approaches have been reported including optical based systems, sound based systems and radio controlled systems. The communication range is one of big concerns in these systems, as well as the decision time. On another hand, when the emergency vehicle is equipped with a separate wireless controller for communication with another set of base microcontroller hardware system located near the traffic light intersection, the system will have more flexibility than the wired emergency control approach to get the priority to go across the crossroad.

With the wide spread use of the cell phones, researchers have proposed to provide remote drivers with traffic status information using the microcontroller based intelligent traffic control system.

This paper is written with the endeavor to provide the readers an idea of the research that has been carried out in the intelligent traffic light field and the microcontroller based traffic light control system. The historical review of the technology and the recent development of the intelligent traffic light control system are stated in this paper. In addition, the future studies of the related work are also presented.

## **Modeling New York City’s Revolutionary Transit Signal Priority Program**

*Mark Yedlin*

*Director of Simulation Modeling Services*

*Greenman-Pedersen, Inc.*

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The New York City Department of Transportation (NYCDOT) and Metropolitan Transportation Authority (MTA) embarked on an ambitious program to improve bus service by implementing Transit Signal Priority for New York City. This new system utilizes a cost-effective, centralized, wireless approach that can ultimately provide Transit Signal Priority (TSP) to all of the MTA’s 5,700 buses operating over 2,800 miles of service routes. System performance was evaluated in 2014 for the initial implementation along a 2.2 mile stretch of the M15 Select Bus Service (SBS) route in Lower Manhattan. Work is underway to expand the system to ten other corridors in all five boroughs totaling 55 miles of roadway and 475 signalized intersections. These corridors service approximately 250,000 bus riders a day. Implementation on additional corridors is expected thereafter. The system is intended to improve overall mobility and encourage transit use by reducing bus travel time, increasing reliability and on-time performance, and improving traffic delays, speeds and air quality during peak weekday commuter hours. Essential to the success of this system is the development and application of custom sophisticated traffic simulation modeling by

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Greenman-Pedersen, Inc. (GPI) to represent algorithms of NYCDOT and MTA protocols for TSP operation in New York. TSP is a technology that enables buses to travel through a corridor more quickly, by adjusting the duration of signal phases along the route in real time to minimize delay. In-vehicle GPS devices detect an approaching bus and send a request for TSP assistance. The system can expedite bus travel by extending a current green phase, shortening a current red phase, or providing an advanced green at a specially configured near-side bus stop to allow buses to jump the queue. These adjustments are constrained by the need to maintain minimum pedestrian timing requirements and minimize adverse impacts to side street traffic. The widespread adoption of TSP throughout New York City is made possible by the city's dedicated broadband wireless infrastructure (NYCWiN) and Advanced Solid state Traffic Controllers (ASTC). Approximately, 10,000 of the city's 12,750 traffic signal controllers have already been upgraded to ASTC controllers with the rest to be converted shortly. While earlier TSP deployments required the installation of extensive (and expensive) optical or radio equipment at each traffic controller, New York's ASTC controllers and NYCWiN infrastructure eliminate the need for any infrastructure modifications to individual intersections. NYCWiN wirelessly transmits TSP instructions from the central Traffic Management Center (TMC) to each ASTC controller based on operating parameters programmed within the TMC. Thus, only in-vehicle GPS equipment is required for a bus to make TSP requests. This is an inexpensive approach to make buses more competitive and attractive. While the infrastructure exists to support wide-spread TSP implementation, appropriate operating parameters must be determined and programmed within the TMC for each corridor. These essential parameters vary by time of day and are critical to optimize bus performance while minimizing delays to other traffic. Microscopic traffic simulations and visualizations are performed to determine these parameters for each corridor as described in the presentation.

## **The Outlook of Applying "Internet of Things" to the Energy Sector by Text-mining\**

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Internet of things will be used in many different aspects of the energy supply sector including managing efficiency enhancement, new added value creation, and regulation responding. Currently, every area of energy is promoting the use of Internet of things: The power sector has been building the infrastructure for Internet of things through the deployment of smart meters. The city gas sector has been using sensor networks in the pipeline operation and the integrity assessment and is also disseminating smart meters for city gas. The oil and natural gas sector has been trying to increase productivity by real time monitoring the state of oil fields with the use of sensors and telemetry. The taking advantage of Internet of things in the energy sector is expected to create new business models by varying the conventional energy business practices. Even though there is a general consensus about the potential of using the Internet of things in the field of energy, yet there is lacking of a comprehensive outline for the prospects. This study explores key-words related to Internet of things business in the energy sector by text mining of web news which are searched in Google, and analyzes the relations between the key-words. By examining both currently emerging key-words and the key-words with high possibility of spreading, separated are the key-words whose long term signal is expected to be getting stronger while the current signal is weak. In addition, the network centrality and the association of the key-words are looked to by network analysis. This study will contribute to the enhancement of insight of stakeholders by

providing the impact of Internet of things, the next generation of information and communication technology, on the energy sector comprehensively in the perspective of trends.

## **A Data-driven Approach to Soil Moisture Collection and Prediction**

*Zhihao Hong*  
*Research Assistant*  
*Department of Electrical and Computer Engineering*  
*University of Illinois at Urbana-Champaign*  
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Agriculture has been one of the most under-investigated areas in technology, and the development of Precision Agriculture (PA) is still in its early stages. This paper proposes a data-driven methodology on building PA solutions for collection and data modeling systems. Soil moisture, a key factor in the crop growth cycle, is selected as an example to demonstrate the effectiveness of our data-driven approach. On the collection side, a reactive wireless sensor node is developed that aims to capture the dynamics of soil moisture using MicaZ mote and VH400 soil moisture sensor. The prototyped device is tested on field soil to demonstrate its functionality and the responsiveness of the sensors. On the data analysis side, a unique, site-specific soil moisture prediction framework is built on top of models generated by the machine learning techniques SVM (support vector machine) and RVM (relevance vector machine). The framework predicts soil moisture  $n$  days ahead based on the same soil and environmental attributes that can be collected by our sensor node. Due to the large data size required by the machine learning algorithms, our framework is evaluated under the ICN dataset, not field collected sensor data. It achieves low error rates (15%) and high correlations (95%) between predicted values and actual values across 9 different sites when forecasting soil moisture about 2 weeks ahead. Also, it is shown that the prediction outputs can remain accurate over a long period of time (one year) when models are corrected by reliable data from other sources every 45 days.



## Trends in Venture Capital and is There Another Way?

*Moderated by  
Michael Faltischek  
Senior Partner  
Ruskin Moscou Faltischek, P.C.*



Michael Faltischek is a senior partner at Ruskin Moscou Faltischek, P.C. He has played a key role in the success and growth of the firm since graduating from law school at the top of his class. He served as Managing Partner from 1982 until 2006, leading the firm from its roots as a small local firm to its current prominence as a major regional firm with more than 60 professionals and 130 staff members. Mr. Faltischek has been frequently recognized as one of the leading members of the legal profession by Long Island Business News in its annual Who's Who in Law and was a recipient of its Leadership in Law Award. Mr. Faltischek is a founding member and currently serves as Chairman of the Long Island Angel Network.

### PANELISTS

*David Calone  
CEO  
Jove Equity Partners LLC*



David L. Calone is the CEO of Jove Equity Partners LLC, a venture capital firm that helps build technology companies in the internet, software, digital media, energy, real estate, transportation and health care industries. He serves as a director of eight privately-held companies located throughout the country and is a co-inventor on fifteen issued U.S. patents. He helped organize the recently formed bipartisan Congressional Caucus on Innovation and Entrepreneurship in the U.S. House of Representatives through which he has been a leading advocate for federal policies that promote the creation and development of start-ups and other small businesses. He is the co-founder of the newly launched Long Island Emerging Technologies Fund which creates and provides seed funding for early stage technology companies on Long Island. Since 2008, Mr. Calone has served as the Chairman of the Suffolk County Planning Commission where his efforts were recognized with a National Association of Counties' 2012 National Achievement Award. He is also on the board of directors of Accelerate Long Island, the Long Island Angel Network, United Way of Long Island and the Community Development Corporation of Long Island. Previously, Mr. Calone served as a federal prosecutor at the U.S. Department of Justice where he received the national "Attorney General's Award" for prosecuting terrorism and international crime, and as a Special Assistant Attorney General in the NY State Attorney General's Office where he prosecuted health care fraud and helped negotiate the largest Medicaid settlement in state history. He is an honors graduate of Harvard Law School and has an economics degree from Princeton University where he was named a USA Today College Academic All-American

*Andrew Hazen  
Co-Founder and CEO  
Angel Dough Ventures*



Andrew is a successful entrepreneur with 20+ years experience in Domain Name Investing & Development, Search Engine Optimization (SEO), Paid Search (PPC), eMail Marketing, Social Media Marketing and Custom Bobbleheads (yes, bobbleheads!). In both 2007 & 2008 the company he founded was listed on the INC List of Fastest Growing Companies in the US. Thereafter Andrew sold the business in 2007 to private investors and again in 2011 to a public company. In 2012, Andrew founded Angel Dough Ventures ([www.AngelDough.com](http://www.AngelDough.com)), which is a startup accelerator for new business ideas and opportunities that are identified, internally developed, and launch new products & services. Angel Dough Ventures presently has a dozen Portfolio companies including AllBobbleheads.com (the world's largest custom bobblehead retailer), BagelOfTheMonth.com (largest online retailer of NY bagels), eGifter, LaunchPad, BSafe Electrix, 4 Hour Protection & more.

*Lori Hoberman  
Hoberman Law Group  
(See page 11)*

*Chaired by  
Frank Chau  
Founder  
F. Chau & Associates, LLC*



Frank Chau, Founder, F. Chau & Associates, LLC Frank Chau is the founding member of F. Chau & Associates, LLC, an intellectual property law firm founded in 1998 and recognized by Intellectual Asset Management and Ocean Tomo in 2013 as the No. 1 New York law firm in securing the highest quality patents in consumer electronics for its clients. Mr. Chau is a graduate of NYU – Polytechnic University with a Master degree in Electrical Engineering and holds a Juris Doctorate from Seton Hall University. Mr. Chau has for each of the past five years achieved AV Preeminent, the Highest Possible Martindale-Hubbell® Peer Review Rating. He advises Fortune Global 100 companies and large and small local business clients in complex patent litigations, licenses, opinions, and patent and trademark procurement. His practice concentrates in software-based technologies, electronics, semiconductors, and telecommunications. Mr. Chau is a member of the New York and New Jersey Bars, and is registered to practice before the U.S. Patent & Trademark Office. Mr. Chau has served as Special Advisor to CEWIT since 2010.

**Succeeding Without Venture Capital  
Entrepreneurship Success Story**  
*Brian McAuliff  
Founder and Principal Designer  
Bri-Tech, Inc.*



Brian McAuliff is the founder and principal designer of Bri-Tech, a Bohemia technology specialty company that provides electronics system design, installation and consulting services to hi-end commercial, and residential property owners. These services include: Building Automation, Audio Video Systems, Multi-room Audio, Security and Fire Alarm systems, Access Control, Remote

Surveillance. Expertise includes hardware and software development. Bri-Tech's integrated approach to system design and high level customization capability has won favor with some of the tristate areas leading firms and statement property owners. He also founded Smart Power, a design build electrical contracting firm specializing in health care, manufacturing, high-end corporate/residential projects. The firm's employee 45 people in have 4 offices in the tristate area. Brian has spoken on technology for many trade organizations, specialty groups and most recently at 2015 Islip Ignite event. The firm's are in their 24th year.

## **Role and Elements of a License, a Technology Business Man's Perspective**

*Lawrence Weber*

*Business Development Manager and Entrepreneur in Residence*

*Center for Advanced Technology in Diagnostic Tools and Sensor Systems (Sensor CAT);*

*Center of Excellence in Wireless and Information Technology (CEWIT), Stony Brook University*



Lawrence Weber provides a portal to collaborative R&D opportunities at SBU, and to associated resources and programs. Business Development Manager and Entrepreneur in Residence, he serves companies with a New York address in these dual capacities with both the Center of Excellence in Wireless and Information Technology (CEWIT), and the Center for Advanced Technology in Diagnostic Tools and Sensor Systems (Sensor CAT), each sponsored by NYSTAR. His outreach includes companies at all stages. For start-up companies and inventors, he provides an entrepreneurial resource in strategic and funding matters. An award winning scientific researcher early in his career, Weber's background is also punctuated by his Ph.D. in physical chemistry, and new product launches in the chemical process, electric power generation, and wireless devices industries, together with goals accomplished in worldwide technical business development in Fortune 1000 and multiple start-up company settings.

## **Employer Perspective on Immigration Issues**

*Frank Fountain*

*Rothbell & Fountain Lawyers*



As a lawyer for more than 20 years, Mr. Fountain has served as a prosecutor, defense attorney, and counsel in complex investigations and litigation, including at the White House as the Chief Counsel to the President's Foreign Intelligence Advisory Board and also to the President's Intelligence Oversight Board. At the U.S. Senate, he served as Senior Counsel to the Permanent Subcommittee on Investigations. He also served as the first Chief of Prosecutions for the international criminal court established to prosecute international crimes in Sierra Leone. Most recently Mr. Fountain has been in private practice with a concentration in immigration and international law. Mr. Fountain has practiced in 25 countries.

## **VENTure eVENT Information Technology and Communication Access for Vent-Users**

Smart Devices connect us to the world. So much is available at our fingertips. This is especially important for Vent-users, whose lives rely on the interface of complex equipment, requiring specialized supplies, maintenance and adjustment. Many Vent-users rarely get outside their home -- which may be in the community or in a residential institution. A vent-user's home is their daily world. How can we use technology to make that world as comfortable as possible? Technology can connect Vent-users to friends, family, health providers outside the home. Many vent-users have speech/communication challenges. How can technology assist with that? Technology can provide essential information in times of emergency. How can we better insure that vent-users can communicate in all the ways necessary to them?

### **VENTure Think Tank**

*Brooke Ellison*

*VENTure Co-Director and Lead Researcher*

*VENTure Think Tank*

*Assistant Professor*

*School of Health Technology and Management*

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VENTure is a newly-founded think tank, established in November 2012, designed to meet the unmet needs of individuals who are dependent on ventilators. This organization was founded as a result of many of the profound, even life-threatening, challenges that ventilator-users in the Northeast experienced as a result of the devastation caused by Hurricane Sandy. While the goals of VENTure far exceed this isolated issue, the circumstances that were generated as a result of the shortcomings following Hurricane Sandy brought to light just how socially pervasive these challenges are, and how ill-equipped society often can be in meeting the needs of some of its most vulnerable citizens.

VENTure is a nonpartisan, nonprofit think tank generating ideas and solutions to address challenges faced uniquely by people dependent on ventilators. We are a multidisciplinary group of experts and advocates, from such domains as respiratory therapy, physical therapy, occupational therapy, health policy, nursing, disability studies, private business and many ventilator-dependent people themselves, with experience well suited for devising strategies to help improve daily life for people dependent on ventilators. VENTure is an ongoing effort that advises proactively to meet the concerns of the ventilator-dependent community, and responds reactively to address the changing political and social environments.

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## **Telehealth and Online Advocacy Networks: New Healthcare Alternatives For the Disabled**

*Dan Lorence  
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As recent health reform initiatives created under the US Affordable Care Act continue to restrict options for health care, purchasers of insurance are often left with few plan choices, especially in underserved and rural areas. While insurance options are likely to remain limited, technology-based solutions are available which can help provide alternatives to traditional healthcare options. One class of resources, often summarized under the general concept of “telehealth”, combines telecommunications and medical technology applications (telemedicine), with information solutions, methods, and models of making relevant health information accessible to providers and consumers (informatics). Though promising, telehealth initiatives at both the state and federal level continue to challenge persons with disabilities seeking health insurance and/or alternative healthcare support. Online resources are emerging to address this problem. The health reform, or “Affordable Care” Act now requires non-grandfathered group health plans and health insurance companies to provide consumers with an effective internal claims, appeals and external review process for members to challenge an insurance claim denial, also known as an adverse benefit determination (ABD). This requirement includes notice to members of available appeals processes, along with an opportunity to review their file and present evidence. If your health plan denies payment for a treatment that you believe should be covered, you have the right to challenge that decision and appeal it.

Such appeals can be made by individual consumers, or through healthcare-specific online advocacy networks. Such “networked” advocacy has grown dramatically as the internet, wireless communications, and connected environments have enhanced collective action at many levels.

The special use of such evidence-based advocacy networking involves the collective or group filing of challenges to insurance denials, for a specific procedure, disease, or treatment. This is often advertised as legal services by law firms, but is actually designed to be accessible to the average healthcare consumer, or their advocates or representatives.

These virtual communities have been shown to have an exponential growth effect from the specialization of advocacy activities. The development of such “niche” networks, in conjunction with widely-available informatics resources, has allowed events of seemingly local significance to be scaled to global significance.

When applied to health insurance appeals, advocacy networks can take advantage of a broad definition of adverse benefit determination to include a rescission of coverage, generally defined as a cancellation or discontinuance of coverage that has a retroactive effect. Additionally, new conflict of interest criteria are also in place to guarantee the independence of the decision-maker.

## **The Speech-Language Pathologists’ Role in Assistive Technology for Communication**

*Craig Beale  
Speech-Language Pathologist  
Stony Brook University  
Craig.Beale@stonybrookmedicine.edu*

As a Speech-Language Pathologist I am dedicated to the pursuit of functional communication for all persons. My professional and personal ethos is that communication is a human right. Unfortunately, expressing one’s ideas using a mutually understood language or writing system is not automatic for some people especially when his or her health is compromised. Luckily, technology has offered us with other modalities to enable persons with communication disorders the opportunity to engage with others and their environment. As a Speech-Language Pathologist, I am trained to assess how a client’s present and projected cognitive, language, and sensory skills will impact his or her functional use of an augmentative and alternative communication system. Once an evaluation is completed, my recommendations are made, and a device is funded then secured, I work individually with the client to customize the device and train the functional use for everyday communication situations. The world of augmentative and alternative communication encompasses all ways of communicating without spoken words. From writing, to pointing to pictures, to selecting sounds, words, or phrases on a computer screen to generate speech, augmentative and alternative communication devices allow creative solutions to complicated problems. Additionally, Speech Generating Devices have the ability to provide solutions to problems that people without communicative disorders take for granted. Things like social media, writing an email, using a telephone, sending a text message or even changing the channel on the television. Tobii Dynavox provides a variety of solutions for individuals with alternative access needs. Many of the devices that are available come with infrared control capabilities, imbedded applications for Eye gaze accessible Facebook pages, skypeing, emailing and more. As technology changes every year, the abilities and features of high-tech communication devices also expands. Casey Pomerantz, a Speech-Language Pathologist and Augmentative and Alternative Communication device consultant with Tobii Dynavox, will share some of the available technologies currently available on the marketplace for persons with communication disorders. Our focus will be on what we can offer today to assist people with complex communication needs while also stimulating a discussion on what can be improved and most beneficial for our users in the future.

## **Developing an Individual Communication Strategy as a Ventilator User: Chelsea R. King’s Experience**

*Chelsea King*

Chelsea R. King is participating in the second annual eVENT at the CEWIT2015 meeting in order to share her experiences with communication technologies, successes she has had and barriers that still exist. She will discuss what has worked for her, and what has not, and ways that assistive and information technology experts can work together with vent-users to improve communication technologies for this group.

Chelsea is diagnosed with Spinal Muscular Atrophy, Type 1. She has overall low muscle tone and severe weakness and needs maximum support to hold up her head and trunk. She wears a body jacket that is integrated with a chin and occipital support. Her vision is limited as she has no head control, she can only see objects within her range, in front of her and part of her field of vision is occluded by her chin support. She also has significant visual perceptual deficits. Chelsea has ligament laxity in her upper extremities. Chelsea does not



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have a gag reflex and cannot swallow so she requires frequent suctioning of her mouth and tracheal tube. She has a nurse with her at all times.

Chelsea has been on a ventilator since she was six months old, and as so has relied on assistive communication for most of her life. She will discuss her high and low tech communication strategies, from the use of her eyebrows to indicate “yes” and “no” to complex technologies, such as a Dynavox, which allows her to type and then render her text audible. Dynavox allows her to communicate conversationally, to present before an audience, and to write. She also uses communication technology called Soundbeam to make music. Chelsea comes from a family of Gospel singers. She wanted to participate in the Jazz ensemble. So a pre-recording of drums was done on a Big Mac switch and Chelsea hit the switch every time the drums had to be played. The movement activated Sound Beam was also used to harness the movement in her eyebrows and fingers.

## **Use of Technology to Improve Quality of Life In Vented Patients**

*Jennifer Noronha*  
*Occupational Therapist*  
*Henry Viscardi School*  
*jenvaz111@gmail.com*

I have worked as an Occupational therapist at the Henry Viscardi School for 22 years and have had the opportunity to work with many students that are vented. We strive to lead them towards independence, to overcome their limitations and become productive members of society. The more severe the disability, the more challenging it is and the more creative we have to get, and think outside the box. Technology has opened a whole new vista of opportunities to meet this challenge. We use high and low tech technology and adaptations to give these students control back so that they can lead a fuller and satisfying life. One of the students I worked with for 10 years was Chelsea.

Initially, being nonverbal, Chelsea communicated raising her eyebrows to say yes and by knitting her eyebrows to say no. Using myofascial release and intensive ranging, she gained some active ROM in her fingers which was harnessed using a proximity switch to activate the Dynavox using single switch scanning, the Victor Reader, the Sound beam, CD recorders. She participated in the Jazz ensemble using a pre-recording of drums on a Big Mac switch. The movement activated Sound Beam was also used to harness the movement in her eyebrows and fingers.

Technology allows Chelsea to do community service, create her own music, to change her own TV channels. It allows her to correspond with family members that live in other states. She even sent me in Email when I was presenting at a conference in Italy. From using a yes/ no signal with her eyebrows to sending a message half way around the world is amazing progress.

Using the Victor Reader and rigging it up to her proximity switch she read to the elementary class. She participated in the morning announcements, “Pledge of Allegiance” and was in charge of reciting the “Girl Scout Pledge” I created an art adaptation with the assistance of my nephew using remote control cars to assist her to participate in Art and she was able to create her first Art masterpiece! The story of her achievements was published in the 2012 Federal Outlook for exceptional children for members of the Congress to influence funding. Using technology she now has a voice in DC to advocate for herself and others. I nominated her for the prestigious “Yes I Can Award.” in the category of Technology. and she won the award presented by the Council of Exceptional Children. We advocated on her behalf with NYC to give her the IMAX Eye gaze system and she has soared to unbelievable levels. She was elected prom queen twice, has had great relationships, gone on dates and has a full social

life. Chelsea has been a role model and encouraged another student with the same disability to use the Eye Gaze system. This student uses the IMAX system in class and enjoys switch activated games on the computer using multiple points of access. With the advent of the Ipad and the accessibility options that come with it, we have been able to use the blue tooth switch adapter, a micro-light switch and scanning to enable her to access the Ipad and all its features of music, email, facetime, and games like her peers. We continue in our mission to find ways to use technology to Improve Quality Of Life in our vented and severely limited students and welcome any suggestions of new untapped technology methods that might be useful.

## **Use of Interoperable Telehealth Technology to Customize Clinical and Social Care Workflow Driven Use Cases**

*Pramod Gaur*  
*Adjunct Professor*  
*Seidenberg School of Computer Science and Information Systems*  
*Pace University*  
*pgaur@pace.edu*

Innovations in medical devices and information & communication technologies have led demonstration of the most synchronous and asynchronous telehealth solutions and use cases. Both federal and state government programs have supported many pilot studies that show high potential for success in sustaining disease specific care management use cases. However, these disease/condition specific telehealth solutions are not interoperable with other e-health solutions. Thus, these pilot studies are unable to produce scalable and sustainable, patient centric care coordination models ranging from wellness and prevention to acute and post-acute care for total population health management.

Recent advances in consumer electronics and big data analytics have allowed a transition to an interoperable telehealth platform solution that can be customized for each individual patient's unique social and clinical needs. For example, a disabled person who is dependent on a ventilator requires unique social and clinical workflow and their care requires data interoperability between caregiver, case manager, family members and other key stakeholders. A blueprint was developed to map total workflow of a ventilator dependent person and interoperable technology components were identified to build a customized telehealth solution. Importance of key stakeholder's engagement and incorporating their needs in designing a state-of-the-art telehealth solution will be presented.

## **Round Table Discussion**

*Moderated By*  
*Pamela Block*  
*VENTure Co-Director, Lead Researcher*  
*VENTure Think Tank*  
*Associate Dean for Research,*  
*School of Health Technology & Management*  
*Stony Brook University*  
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*Vent-users, Family Members,*  
*Clinical, Technology, and Research Specialists*

## Information Technology and Society

### Chairs:

*Debra Dwyer and David Ecker, Stony Brook University*

### Identity Crisis in Teens: Role of Technology Addiction

*Debra Dwyer*

*Visiting Associate Professor*

*Department of Technology and Society*

*Stony Brook University*

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Is there a risk associated with too much of a good thing? The literature on Internet addiction, cell phone addiction, pathological Internet use, and problematic Internet use is growing rapidly. Much of the literature focuses on the existence and magnitude of technology addiction (Ogletree et al, 2014; Davenport et al, 2014; Saryska et al, 20014; Park et al; 2013; Salehan & Negahban, 2013; Walsh et al, 2008; Young, 1998). Another developing literature examines the implications of technology addiction (TA) for various outcomes. As a rule, this strand of the literature has tended to focus on one facet of technology in isolation, measuring TA in terms of either Internet addiction (Saryska et al, 2014 for example), cell phone addiction (Walsh et al, 2008; Lepp et al, 2014) or social networking (Davenport et al, 2014; Salehan Nehahban, 2013). Not all of the literature predicts negative effects on mental wellbeing. Magsamen-Conrad et al (2014) hypothesize that for one type of users, namely self-concealers, technology use enhances online social capital and improves relationships and outcomes. Building on these findings, we will contribute to this literature by applying factor analysis to two large, nationally representative datasets: the 2012 supplement to the Current Population Survey (CPS) Internet Use Supplement and Educational Supplement and the Jan 2-5, 2014 Pew Research Center Omnibus Internet Survey. In the CPS data for teens and young adults, we identify three mutually exclusive varieties of technology use, each of which corresponds to subsets of users of both the Internet and cell phones. In the Pew data, with respondents from all age groups, we identify four types of users. Our examination of the attributes of respondents exhibiting these technology usage patterns, and of how the attributes load onto the underlying indicators, lends support to our interpretation of the factors. We use multivariate analysis to uncover attributes of the types. We hypothesize that the usage types may correspond to heterogeneity in the impact of technology use on user outcomes. In further research, we will examine the impact of usage type on educational outcomes as indicated by GPA as well as on mental health outcomes, including anxiety and narcissistic personality disorder.

### Convergence: A Transformative Approach to Advanced Research at the Intersection of the Life, Physical and Engineering Sciences

*Melvin Greer*

*Senior Fellow and Chief Strategist*

*Lockheed Martin*

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Convergence — an integration of the knowledge, tools, and ways of thinking from the life and health sciences; physical, mathematical, and computational sciences; the engineering disciplines; the social and behavioral sciences; and the humanities to form a comprehensive framework for tackling scientific and societal challenges that exist at the interfaces of multiple fields — is a movement gaining traction in universities across the country. Industry sees the approach as critical to educating the 2020 workforce it needs to deliver the advanced technological products and services that will otherwise go uncommercialized without the enhanced workforce capabilities for which Convergence offers the blueprint.

### Understanding Transformation in Cyber-Human Systems

*Stephanie White*

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*Computer Science and Management Engineering*

*Long Island University*

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Richard Ormerod in the book *Multimethodology* which was edited by John Mingers, wrote "Transformation to be achieved - should include intangibles learning, ownership, and commitment as well as tangible outcomes such as strategy, options, and recommendations." When we build a system, the goal is to create a transformation which changes activity and thus people and their environment. The change may occur to an organization, a mission, society, or culture. During the mid to late 90(s), the primary interest was in business systems and embedded systems, but today systems such as the internet google, facebook, and twitter are changing how we shop, what we know, and how we interact with others and society at large. Transformations can have small or large effects. The effects can be planned or emerge and surprise us. Emergent effects can be good or bad. Transformations relate to variables and states, and states depend on a set of variables. To be more formal, we say there is an initial state and specific events cause a sequence of actions and also change the system state. In the systems that people control, state transition or transformation is deterministic. This means that there can only be a single way in which the system changes - that there aren't two possible outcomes. We call systems non-deterministic when we cannot predict that a specific outcome will occur. Systems that are embedded in physical systems should be deterministic as we wish to control the physical system.

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Systems that are embedded in an organization or society can affect that society in many different ways. The effects on the larger system are not deterministic as the larger systems involves people and we cannot predict what people will do. Man-made systems used to be controlled by the designer, for example a payroll system. Today, no-one knows what the eventual effects of our systems will be. Who imagined that because of twitter, thousands of people would show up in a city square to express their displeasure with their government? Modeling and simulation can help us understand the effects of transformation, but only if we can identify, relate, and detail relevant aspects. Today, our system models are incomplete. They omit intangible as well as some tangible perspectives, and they do not relate these perspectives to each other and to the system itself. Also, current methods are insufficient for decomposition of complex systems, as methods decompose state or event but not both. This presentation will discuss aspects of transformation and decomposition that are missing in today's system models.

## **IBM Research: STEM and Green IT**

*John Lamb  
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IBM Research  
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Most students know about Information Technology (IT) through the use of their PCs, laptops, iPads, smart phones, and all the social media used with those devices. Thus energy efficient IT (or Green IT), is an area that should grab their interest. Most schools in the U.S. use IT as a tool with their instruction. The student will need to understand the basics on data centers since data centers house the servers that students access when they use Google, Facebook, or any of the many Internet applications used by all users, young and old. This paper provides an overview on how Green IT is an excellent topic for STEM (Science, Technology, Engineering, and Mathematics). An important aspect of the STEM project would be data centers. Data centers are found in nearly every sector of the economy including financial services, media, high-tech, universities, and government institutions. Dramatic server growth at data centers is indicated by well known web services such as Google, Amazon, and eBay. Estimates indicate that Google maintains over 450,000 servers, arranged in racks located in clusters in cities around the world. Google has major data centers in California, Virginia, Georgia, Ireland, and new facilities in Oregon and Belgium. In 2009 Google opened one of its first sites in the upper Midwest in Council Bluffs, Iowa, close to abundant wind power resources for fulfilling green energy objectives and proximate to fiber optic communications links. There are also thousands of servers for Amazon.com and eBay. It is estimated that the Second Life Internet-based virtual world launched in 2003 has over 9,000 servers. Even with these large numbers of current servers, IBM Consulting estimates that in the next decade server shipments will grow by six times and data storage by an amazing 69-fold. Green energy efficient data centers will help us reduce greenhouse gases – which in turn will help reduce global warming. The ongoing UN and White House sessions on climate change emphasize the environmental importance of green projects. Although the extent of the Global Warming danger may continue to be open to debate, implementing Green Data Centers presents a significant opportunity for all of us to help reduce greenhouse gasses. This paper will bring in case studies based on the authors' experiences with energy efficient computing and experiences discussing Green IT with STEM students.

## **Managing Remote Operations Teams**

*Michael Ohayon  
Operations Manager  
Webair Internet Development, Inc.  
michael.ohayon@webair.com*

Advances in technology and ubiquitous connectivity worldwide have made the utilization of a dispersed workforce more common. Whether that remote team is located across the street, city, state or country, management styles and approaches will have to be adjusted to accommodate this imminent, new dynamic. Corporate leadership will need to motivate and manage these virtual teams very differently than on-site personnel, whether they are hired internally or outsourced to a third-party support company.

This session will focus on the unique challenges of managing remote teams. It will focus on real life examples from case studies demonstrating what works - and what doesn't – within these virtualized environments. It will also cover proper training and integration of these teams into the corporate structure, and the most effective ways to introduce these teams to your customer base. Furthermore, it will discuss proper vetting of external, third-party teams should these functions be outsourced.

## **Ideas and Innovation at Stony Brook**

*David Ecker  
Director  
Research Technologies  
Stony Brook University  
david.ecker@stonybrook.edu*

The SBU Innovation Lab has been open over a semester, we have already begun to see some great ideas developed. Hear about the ideas that have been coming out of the Innovation Lab and hear about the future programs we are offering. Which is changing the way Innovation is approached on campus.

## **Security Issues Surrounding the Use of Open Source Software by Online Students**

*Jose Rene Tubilleja  
Long Island University*

This study investigates the security issues related to the use of open source software by students in online education. Research studies and common wisdom contend that open source software, by having being developed and continuously updated by numerous experts, is more secure and less prone to hacking attacks. Using a systematic three-step approach, this study surveyed journals and conference proceeding articles that deal with the security of using open source software in online education. The open source software most commonly used by online students are identified and the articles on the security of using them are categorized. It is discovered that not very many articles are dedicated to purely online education, but conclusions can be drawn from them that answer this study's research questions. The studies that are investigated report that open source software are indeed more secure and more quickly patched than their proprietary counterpart. Online students are also found to be not any more vulnerable than their onsite counterparts. The studies surveyed, however, indicate that the institutions and educators are the ones who should pay particular attention to their use of open-source software in their online education activities.



## Health Technologies and Medical Devices

### Chairs:

Donald Harrington, Stony Brook University  
and Victory Levy, E Physicians Office, Inc.

### Challenges for Healthcare Data Analytics in the EHR Era

Janos Hajagos

Chief of Data Analytics and Research Assistant Professor

Department of Biomedical Informatics

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In the past 10 years there has been the widespread deployment of electronic health records across most health care organizations. The promise of analyzing large volumes of clinical data is appealing to researchers and stakeholders. However, there are significant challenges in utilizing data collected in these systems for improving the quality of care and for gaining insights into the progression of human diseases. The challenges include, but are not limited to, a patient's record is often incomplete, loss of information occurs across multiple clinical information systems, and critical information is often found only in narrative texts or scanned images. Emerging informatics strategies for handling data analysis in the EHR era will be explored.

### Practical Applications and Pitfalls Of 'Big Data' For Decision Support In Medical Imaging and Informatics

Eliot Siegel

Professor and Vice Chair of Research Information Systems

Department of Diagnostic Radiology and Nuclear Medicine

University of Maryland

### Converting Visions into Reality in a Mobile Era

Oren Fuerst

Chairman and Founder

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The face of medicine is changing rapidly with the availability of real-time consumer information, a flood of health information from a plethora of sources and a wealth of data obtained from dedicated sensors and the mobile phone's built in sensors. A shift toward rapid and agile development had changed the landscape of computer sciences. In this lecture, we shall highlight how personal medical stories can become visions and how these visions can be converted into products in a rapid and agile fashion. Two cases in point are Eco Fusion, a digital therapeutics company dealing with stress, focus, nutrition and exercise, and Medivizor, the first truly personalized health care information service.

### Customized EHR Analytics Systems: Clinicians Using Bayesian Probabilistic Algorithms to Create Actionable Applications

Victor Levy

Founder and CEO

E Physicians Office, Inc.

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Clinicians have been reluctant to embrace electronic medical records and, by association, data analytics systems. To facilitate clinician buy-in, recent forums have asserted that innovative technology should accommodate clinic workflows, rather than forcing physicians and staff to adapt to a fixed template and structure. Clinicians, who are now seen as a key driver in IT development, need systems that can deliver customized solutions regarding the diagnosis, treatment and monitoring of acute and chronic disease. Accordingly, an IT informatics tool needs to be adroit enough to accommodate different institutions, each with unique patient populations and clinical processes, and be locally conceived and assembled at a user-client interface. Prior predictive tools have included ER evaluation of chest pain, esophageal cancer surveillance, and clinic appointment noncompliance. Such informatics solutions have at their core Bayesian probabilistic properties that derive their functionality from the weighted contributions of multiple independent variables to a dependent variable, all specifically selected by clinicians and extracted from an EHR database. The result is a unique matrix which functions as a multinomial multivariate logistic regression. The validity of any resultant tool so created—regardless of the subject matter—and its functionality, is related to the sample sizes of the extracted data sets, containing the answer categories of the dependent and independent variables. An algorithm is created, and its predictive power tested against a separate test group of data sets; probability thresholds for decision making can be auto-generated by maximizing predictive value. Integrated EHR systems contain the “big data” which largely nullify the alpha and beta errors inherent in more traditional medical research techniques. For the present application, a previously used data base, composed of demographic, clinical and administrative fields selected from CPRS/Vista (EHR) records of patients from several outpatient clinics at the Stratton VA Medical Center in Albany, New York, is again utilized. Over 10,000 data sets were entered into the EHR in real-time during clinic visits, and extracted for inclusion. The objective of the present study was to identify those patients who may be at risk for serious psychiatric illness and may benefit from more frequent periodic assessment. To accomplish this objective, certain fields of the data set were extracted, while other fields, previously utilized, which were not relevant to the application under study, were excluded. The automated Bayesian system can facilitate aggregation of data sets from different clinics, or even locales. New data sets may be added in real-time, and resultant changes in the weighted contribution of any specific variable monitored, for true machine learning. Any EHR-driven big data analytics system must possess the adaptive functionality to effectively address the challenges of multiple disparate clinical and logistical situations, thus impacting service and outcome in a wide variety of health care scenarios.

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## **Hospital Based Solution to Achieve Higher Airborne Pathogen Killing Ratios**

*Louis Gagliano*

*Senior Advisor*

*Pathogen Technologies Corporation*

*ljgags@aol.com*

There are 1.7 million (1) Hospital Acquired Infections (HAI) cases per year in the US. These HAI infections result in 100,000(1) deaths per year, and the annual cost to the U.S. healthcare system is estimated between \$30-40 billion. Pathogen Technologies Corporation (PTC) has a proprietary product technology utilizing ultra violet (UV) germicidal lamps in combination with our unique design producing high levels of UV energy. PTC technology simply holds each UV light reflection longer, so an increased “energy-plasma” is achieved and utilized to kill pathogens during airflow exposure. Science has long documented that UV germicidal light at high levels of concentration kills living organisms that are exposed close to this energy source. In early 2014, PTC engaged in a development project with Stony Brook University (SBU). SBU has a large development lab and a multi-discipline University Hospital. The first step in the PTC and SBU collaboration was to validate our mobile unit's ability to kill airborne pathogens. PTC engaged a principal investigator (PI), Dr. George T. Tortora, SBU's Emeritus Professor of Clinical Laboratory Sciences, School of Health Technology and Management, and former Head of Clinical Microbiology University Medical Center. Dr. Tortora conducted tests using active pathogen agents. The results provided a basis for ongoing efforts to engage SBU in the final chamber design, a HVAC product, to be installed in the ductwork of air handling systems and test this product with active pathogen agents. PTC has completed the design of a product that would be installed into a hospital's HVAC system. Earlier this year we completed a grant application under the Federal Government's SBIR program with the review body being the NIH Infectious Disease group. The funds from this grant would be used to build and test the PTC HVAC product at SBU using the same PI as the initial testing of our mobile unit. PTC development steps strongly support the efforts and findings to date that our products will improve the killing ratios of airborne pathogens in hospitals resulting in improved patient care and reduced impacts of HAI, lowering death rates and the negative cost consequences.

## **Wearable Sensors Corresponding to Various Applications in Healthcare Field**

*Koji Miyamoto*

*General Manager*

*Digital Health Business Development Department*

*Toshiba Corporation*

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Wearable sensors can not only just transfer data, gathered by using sensors, to cloud databases but also they can independently make complex data and signal processing and analysis, which reduces data transfer load to Smartphone, PC, system and database. Toshiba has positioned wearable sensors, which are a component of the so-called Internet of Things (IoT), as key devices in a broad range of healthcare fields including preventive medicine, diagnosis and treatment, prognosis and nursing care, and health promotion. The main point is the holistic integration of data analysis techniques and links to healthcare providers. This presentation will explain “Dementia research” in Japan as an example.

## **Neuro-diagnostic Brain Checklist Development for Learning on Dynamic Cognitive Development of Abstractions**

*Alex Hyungkyu Kwon*

*Kyungsung University*

*alexhkwon@gmail.com*

This study explores the neuro-diagnostic brain checklist development on the neurological dynamic cycles of the brain development of abstractions. Neurological cycles of the brain development of abstractions from right hemisphere to left hemisphere through the development of abstract systems transferred to brain learning questionnaires categorized in cyclic variation of the distance as hypothesized and the spurt hypothesis was applied for abstract systems with low and high support in abstract systems. In conclusion, the rhythmic coherence and EEG oscillations are considered in the brain learning index development of all levels of abstractions. The categorized questionnaires are consistently assigned to the hemispheric formation that occurs in cycles toward abstract systems.

This is to develop the neurological dynamic brain checklist for learning by the various brain learning factors in cognitive processes of abstractions. The tasks are based on the four learning biomarkers of attention, emotion, memory, and adaptation. Dynamic brain learning models shows the organized and interrelated changes that take place during brain growth, cognitive development, and learning (Fischer, 2008). Neurological brain learning cycles are theorized to adapt existing brain structure and function matched with new neurophysiological activities to learn the targeted knowledge. Flexible brain learning index exists over multiple brainwave scales as performance of a brain rhythm change in various patterns. EEG brainwave and coherence values are matched with each question in the various learning condition. The brain learning checklist showed the neurological dynamic structure and function by identifying dynamic changes of brain modularity of Fisher's dynamic learning theory which shows the complex network of interactions, convergent and divergent paths, nested cycles, stabilities and instabilities, progressions and regressions, clusters of discontinuities and stable levels of performance (Fischer, 2008). It represents the relationships between neurological brain activities and cycles of cognitive performance which becomes most visible with optimal functioning of the cognitive system when the effective supports a student's performance. A series of continuities and discontinuities in optimal cognitive growth matched with an abstract level scale are developed by the structured questionnaires.

Neurological changes of brain by the development of abstractions are assumed to occur in parallel with the answers on the questionnaires of the brain learning checklists. The neurological framework of the dynamic brain learning checklists for interpreting complex patterns of the development of abstractions. Neurologically proved brain learning checklists provides a useful ruler to track the individual learning patterns and the specific learning level decision. Learning checklists of the brain are generated to map with the specific area and strengths of the brain hemisphere, brain lobes, and 19 different brain locations.

## Emerging Technologies

### Chairs:

*Sangjin Hong and Yuanyuan Yang, The Center of Excellence in Wireless and Information Technology (CEWIT)*

### **GRT v1.1: A Novel SDR Platform for Full-Duplex WiFi**

*Tao Wang*

*Principal Investigator*

*Center for Energy-Efficient Computing and Applications*

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As wireless networking is increasingly popular, the radio spectrum has become over-crowded. Both user demand and scarce spectrum resource call for more efficient wireless technologies, which can achieve higher efficiency of spectrum utilization. To this end, full-duplex wireless communication holds great promise since it theoretically doubles the spectrum efficiency of its half-duplex counterpart. In the WiFi network context, researchers need suitable platforms to explore full-duplex WiFi. In essence, full-duplex WiFi platforms need to meet two basic design requirements: flexibility and real-time processing. Specifically, flexible platforms help researchers to prototype and assess different algorithms at fast pace and low cost, while real-time platforms ensure high throughput and low latency in processing. In recent years, researchers have built several platforms for full-duplex wireless communications[3-7]. Unfortunately, none of such platforms, no matter whether it is based on software or relies on hardware, can meet both requirements simultaneously. In this paper, we propose GRT v1.1, a novel softwaredefined radio (SDR) platform for full-duplex WiFi that achieves both goals. GRT can meet the strict timing requirement of 802.11a/g protocols, work in the 20MHz bandwidth, and can respond to a received frame in 16us (i.e., within SIFS, which is the fine time granularity stipulated for 802.11 a/g[2]). Moreover, GRT adopts a flexible module structure, upon which a full 802.11a/g physical (PHY) layer module library is offered. Consequently, researchers can easily add, delete, or modify any module, and connect these modules at will. This makes the platform flexible enough to enable researchers to design and refine full-duplex WiFi, while meeting the real-time requirement concurrently. We have completed the implementation of the GRT platform, and prototyped a full-duplex WiFi instance on it. The prototype supports 20MHz bandwidth operation, and offers various modulation/demodulation schemes, including BPSK, QPSK, 16QAM, and 64QAM, for standard 802.11a/g frames in the full-duplex mode. Our system further delivers throughput up to 92.45Mbps, about 1.7 times compared with the half-duplex 802.11a/g standards.

### **Fast Pipelined Storage for High-Performance Energy-Efficient Computing with Superconductor Technology**

*Mikhail Dorojevets and Zuoting Chen*

*Associate Professor, Research Assistant*

*Department of Electrical and Computer Engineering*

*Stony Brook University*

New superconductor single flux quantum (SFQ) technology, such as Reciprocal Quantum Logic (RQL), is currently considered one of the promising candidates for high-performance energy-efficient computing. This paper presents our work on the design and detailed energy efficiency analysis of three types of 32- and 64-bit RQL multi-ported pipelined local storage structures (13 total), namely 1) random access memory (RAM) and register files, 2) direct-mapped write-

through and write-back caches, and 3) first-in-first-out (FIFO) buffers. Our layout-aware cell-level design process uses a VHDL RQL cell library developed at the Ultra High Speed Computing Laboratory at Stony Brook University (SBU). The SBU VHDL RQL cell library specifies the dynamic and standby energy consumption, gate delays, a number of Josephson junctions (JJs) per cell, and approximate sizes of individual cells based on the parameters of the 248 nm 100  $\mu\text{A}/\mu\text{m}^2$  10 Nb metal layer SFQ fabrication process currently under development at the MIT Lincoln Laboratory. Gate and wire delays as well as clock skew are taken into account during digital circuit simulation done with Mentor Graphics CAD tools. After completing a physical chip layout, the circuit models need to be updated and re-simulated to include the effects of parasitic inductances and actual wire lengths on signal propagation delays. To meet both performance and energy efficiency targets, the RQL storage structures were designed with RQL non-destructive read-out single-bit storage cells. We chose a relatively moderate clock frequency of 8.5 GHz for all storage units to keep their read latencies in the range of 1-3 cycles. The most complex design in terms of JJs is a triple-ported 4 Kbit 64x64-bit register file with 253,918 JJs and its read access latency of 338 ps. The highest energy consumption in terms of energy/operation/bit ( $\sim 9.5$  aJ at 4.2 K) is for a write hit in a 2 Kbit 32-bit wide write-back cache. The average energy consumption of the RQL storage designs varies from  $\sim 1.6$  aJ/operation/bit for a small 4x32-bit FIFO to 7.3 aJ/operation/bit for the 2 Kbit write-back cache at 4.2 K. Given the cryocooler efficiency of 0.1%, this means the energy consumption of  $\sim 1.6$ -7.3 fJ/operation/bit at room temperature. The physical implementation of the RQL storage units will become feasible upon the development of the target MIT fabrication process and CAD tools for VLSI RQL chip design in 2015-2016.

### **Booting up 1,000 Virtual Machines in 2 Minutes**

*Yiming Zhang*

*Associate Professor*

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Internet-based virtual computing environment (iVCE) [3] has been proposed to combine data centers and other kinds of computing resources on the Internet to provide efficient and economical services. Virtual machines (VMs) have been widely used in iVCE to isolate different users/jobs and ensure trustworthiness, but traditionally VMs require a long period of time for booting, which cannot meet the requirement of iVCE's large-scale and highly-dynamic applications. To address this problem, in this paper we design and implement VirtMan, a fast booting system for a large number of virtual machines in iVCE. VirtMan utilizes the iSCSI protocol to remotely mount to the source image in a scalable hierarchy, and leverages the homogeneity of a set of VMs to transfer only necessary image data at runtime. We have implemented VirtMan both as a standalone system and for OpenStack. In our 100-server testbed, VirtMan boot up 1,000 VMs (with a 15GB image of Windows server 2008) on 100 physical servers in less than 120 seconds, which is 3 orders of magnitude lower than current public clouds.



## Cloud-based User-customized Smart Mobile Interface Interworking Technology for Smart Space/Smart Works

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With the development of the Internet environment, users can connect to the Internet anytime, anywhere. In addition, due to the smart mobile devices, people are able to easily access information what they want. Furthermore, the existing Internet environment has been extended to the Internet of Things (IoT). The IoT connects various physical entities. These entities have communication capability and deploy the observed information to various service areas such as building management, energy-saving systems, surveillance services, and smart homes. In this presentation, we will introduce next-generation dynamic mobile interface interworking technology for smart space/smart works. Through a simple sign-in process, the user-customized interface can be controlled by synced/stored on the cloud and ready to be apply on other compatible devices of the same user in anytime, anywhere. We will provide all of functionality to provide user-driven services in this presentation. Also, we will provide E-textile oriented smart wearable device platform technology in order to control and integrate of IoTs for the next generation Technology.

## Countermeasure of NFC Relay Attack with Jamming

SungTaek Oh, Taekyun Doo, TaeHyung Go, Manpyo Hong

Ajou University

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Near Field Communication (NFC) is a short-range contactless technology allowing smart phones to act primarily as either a reader or a token. NFC on mobile phones presents new opportunities and threats. NFC provides convenient and easier payment service. However, it is vulnerable to relay attacks. Constantly coming out, the relay attack-related vulnerable reports. Relay attack is simple to implement and principles. If the future commercialization of NFC service, abuse of concern is high. In this paper, utilized the network jamming for the purpose of blocking the communication between the attackers. By applying the difference between the bandwidth of wireless channel used by attackers and NFC communication. We propose countermeasure of NFC relay attack.

## Review of One Time for Multicast Authentication in Smart Grid

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One-time signatures are known to be one of the most promising solution for time-critical multicast authentication in environments with resource-constrained devices such as smart grid. There have been several solutions for multicast applications and TV-OTS has been known to be the most efficient scheme so far. However, there still exists several challenges for the solutions to be deployed in practice. We review existing one-time signatures for multicast authentication and address the practicality issues such as key management and storage cost.

## Entrepreneur's Toolkit II: How Investors Think. New York State Funded Resources for Entrepreneurs

### Forming Your Exit Strategy

Gavin Grusd

Partner

Business Law Group

Silverman Acampora LLP



Companies and business owners in almost every industry turn to Gavin for advice in nearly every aspect of their businesses. He regularly assists clients with business formation and structure, and provides sound advice regarding the relationship of business owners in operating, shareholder and partnership agreements. When financing is sought, Gavin shepherds new and established companies through the often complicated worlds of angel financing, private equity, venture capital, loan transactions, and private and public offerings. When a merger or acquisition is in order, he routinely represents either side of a strategic and financial acquisition or sale. Gavin also represents public companies in all aspects of securities regulation, compliance, and reporting matters. His business acumen and experience enables him to effectively guide clients through the most complex commercial, licensing, e-commerce, technology development, distribution, and manufacturing contracts and transactions in a way that the business aspects of a deal are not lost to the lawyers.

### Crowdfunding: How Kickstarter Investors Make Their Decisions

Richard Chan

Assistant Professor

College of Business

Stony Brook University



Richard Chan is an assistant professor in the College of Business of Stony Brook University. He serves on the editorial board of the Journal of Management and the advisory board of franchisegrade.com. His research focuses on entrepreneurial finance, especially factors shaping screening evaluation and new venture investment decisions. His work has appeared in the Journal of Business Venturing and Academy of Management Best Paper Proceedings and has been mentioned by Wall Street Journal, Inc., and other media outlets.

# TUESDAY • 10/20 PM • ABSTRACTS

## **New York Excelsior Growth Fund**

*Steven Cohen  
President*

*New York Excelsior Growth Fund*



Steven Cohen is President of Excelsior Growth Fund (EGF), leading its creative lending products and business advisory services. Prior to joining Excelsior Growth Fund, Mr. Cohen was Executive Vice President and deputy commissioner at Empire State Development (ESD), where he led the Department of Small Business Services and Community Economic Development. Under his leadership, the agency launched new access to capital and business advisory programs totaling over \$200 million, leveraging \$1 billion in private investment. Mr. Cohen also served as senior vice president for Seedco Financial Services where he worked in executive management and economic development, as well as loan portfolio management. He founded and ran a music production company in San Francisco. Steve has a bachelor's degree from UC Berkeley and a master's in public administration from Harvard's Kennedy School.

## **Overview of NY State Venture Capital Programs**

*Brian Keil*

*Managing Director*

*New York State Innovation Venture Capital Fund  
Empire State Development*



Brian Keil is the Managing Director for the New York State Innovation Venture Capital Fund, a \$100 million venture capital fund sponsored by the State of New York. The fund is focused on generating economic growth across NY State through its investments in innovative, technology-based companies. Prior to joining the fund, Brian was VP of Strategy & Corporate Development at Arbitron (now Nielsen Audio) and a Managing Director at the Peacock Fund, the venture capital arm of NBC Universal. Before joining the Peacock Fund, Brian worked at GE Capital and Bain & Co. Brian is active in the New York City venture community acting as a volunteer mentor and coach for start-up companies. Brian's expertise as a venture capital specialist has helped numerous companies achieve the financial backing they need to become successful. Brian holds an MBA in Finance from The Wharton School and a BS in Industrial Engineering from The University of Southern California. Brian is a Chartered Financial Analyst.

## **Communicating Science to Investors and Others**

*Howard Schneider*

*Founding Dean, School of Journalism  
Stony Brook University*

*Co-Chair, Alan Alda Center for Communicating Science*



Howard Schneider is the Founding Dean of the School of Journalism. He spearheaded the team that developed the proposal for SUNY's first, and still only, journalism school in 2006. For more than 35 years, Schneider was a reporter and editor at Newsday. For more than 18 of those years, he was managing editor and then editor. Under his tenure, the newspaper won eight Pulitzer Prizes. Newsday was also among the first newspapers in the country to create news websites. At Stony Brook, Schneider helped develop the nation's first course in News Literacy, which is designed to teach students across all disciplines how to become more discerning news consumers. A version of the course has subsequently spread to universities across the country and overseas. He is Executive Director of the school's Center for News Literacy. He also collaborated with the actor, writer and science advocate Alan Alda to launch what is now the school's Alan Alda Center for Communicating Science. The Center trains current and future scientists to communicate more effectively with the public.

## **Working with Stony Brook University's Technology Transfer Office and IP Environment**

*Peter Donnelly*

*Director, Technology Licensing and Industry Relations  
Stony Brook University*



At SUNY Stony Brook, Peter is Director of Technology Commercialization and broadly responsible for the identification, development, and commercialization of promising early stage technologies. Prior to joining Stony Brook, he held similar roles at Argonne National Laboratory and the University of Iowa, where he was also adjunct MBA faculty in innovation. Earlier, Peter led the innovation and product development consulting practice for Accenture in China. As an entrepreneur, he was CEO of an early-stage biotech firm that raised venture capital and grants totaling \$20 million and which he successfully sold. Peter was also a co-founder and COO of a thin film startup company that raised \$30 million in venture capital and reached \$10M in revenue. In addition, the founders of over 50 startups have engaged him as a consultant. Peter gained early professional development with Intel and The Boston Consulting Group. He has an MS in Biotechnology and MBA from the Johns Hopkins University.

## Big Data and Data Science Tutorial Workshops

### Session I: Python Data Analytics Workshop

Before a data scientist can dive headfirst into drawing heavy insights from their studies, they must take a step back and evaluate the structure of their data. From manipulation to organization, the basic structure of one's data can dictate how to proceed before moving into higher-level statistical learning techniques. In this course we cover a bunch of Python packages that focus on various topics of exploratory data analyses: data manipulation, scientific computing, descriptive statistics, and plotting.

- NumPy (for scientific computing in Python)
- SciPy (for scientific computing in Python)
- Matplotlib (for creating 2D plots in Python)
- Pandas (for data manipulation in Python)

### Session II: R Machine Learning Workshop

In a world where data seems to be generated faster than our data scientists can analyze, how can we wrangle such multitude of information? Often, the most complicated analyses depend not on the amount of data, but the quality of the data. In this course we cover statistical and machine learning topics surrounding the curse of dimensionality and methods of how to begin fighting the battle of big data with dimension reduction techniques.

- The Curse of Dimensionality
- Principal Components Analysis
- Ridge Regression
- Lasso Regression


### About the Instructor

Christopher Peter Makris is a NYCDSA instructor and machine learning specialist. With years of problem solving experience in statistics, logic, and discrete mathematics, CPM has developed the types of skills necessary to isolate a problem and construct a solution. CPM holds a Master of Statistical Practice from Carnegie Mellon University, and has a thirst for seeing success come to fruition with the New York City Data Science Academy.

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## KEYNOTES

MONDAY, OCTOBER 19

### Digital Health – Where is Value Created and Who Will Pay?

*Harry L. Leider, MD, MBA, FACPE*  
*Chief Medical Officer & Group Vice President*  
*Walgreen Company*

From a technological standpoint, innovation in the mHealth space is driving an explosion of new wearables, remote devices, sensors, and health apps. This innovation is exciting, but in the long run; consumers, payers, and providers will only adopt and pay for mHealth technologies that either improve health, prevent disease, or provide more convenient solutions to challenging health problems. Based on 25 years of experience as a physician executive in medical groups, health plans, population health companies and the nation's largest pharmacy retailer, Dr. Leider will share his perspectives on the future of mHealth.

TUESDAY, OCTOBER 20

### IoT: Hype or Reality?

### Outlook for Schools, Hospitals, Stores, Offices and Beyond

*Girish Rishi*  
*Executive Vice President*  
*North America Installation & Services and Tyco Retail Solutions*  
*Tyco International*



# POSTERS

## Poster Session Chair

*Samir Das*

*The Center of Excellence in Wireless and  
Information Technology (CEWIT)*

## Poster Judges

*Steve Cento, Northrop Grumman Corporation*

*Andreas Timm-Giel, Hamburg University of Technology*

*Joe Marino, Zortag*

1. *Fatemehalsadat Almodaresi T. S.*  
*Stony Brook University*  
**Friendship and Educational Progress: Role of Personality**
2. *Mohammad Ruhul Amin*  
*Stony Brook University*
3. *Maryam Bahojb Imani*  
*Stony Brook University*  
**A Novel Adaptive Learning Path Construction: ACO-Map**
4. *Reza Basseda*  
*Stony Brook University*  
**Planning With Concurrent Transaction Logic**
5. *Cheng Chang*  
*Stony Brook University*  
**sRSA: High Speed RSA on the Intel MIC Architecture**
6. *Ayon Chakraborty*  
*Stony Brook University*  
**Network-Side Positioning of Cellular Band Devices with Minimal Effort**
7. *Ayon Chakraborty*  
*Stony Brook University*  
**Spectrum Sensing on Commodity Mobile Platforms: Motivation, Feasibility and Performance Evaluation**
8. *Chen Chen*  
*Stony Brook University*  
**Plausible deniability for Flash**
9. *Jose Cordova-Garcia*  
*Stony Brook University*  
**Networking-Induced Failures in Smart Grids**
10. *Richard Darienzo*  
*Stony Brook University*  
**Gold Nanoparticles in Cancer Imaging**
11. *Konstantin Dmitriev*  
*Stony Brook University*  
**Diseased Pancreas Segmentation**
12. *Jun Duan*  
*Stony Brook University*  
**Cost Efficient VN Embedding in Fat-tree Data Centers**
13. *Moussa Ehsan*  
*Stony Brook University*  
**Speedster: On Ridding Hadoop of Stragglers**
14. *Pramod Ganapathi*  
*Stony Brook University*  
**A Framework to Discover Rescursive Waterfront DP Algorithms**
15. *Pramod Ganapathi*  
*Stony Brook University*  
**A Cache-Efficient Cache-Oblivious Parallel Viterbi Algorithm**
16. *Pramod Ganapathi*  
*Stony Brook University*  
**Automatic Discovery of Divide-and-Conquer**
17. *Tiantian Gao*  
*Stony Brook University*  
**Controlled Natural Languages and Their Extensions for Defeasible Reasoning**
18. *Jong-Ui Hong and Yoo-Joo Choi*  
*Korean German Institute of Technology*  
**Adaptive Multiview Image Generation for Autostereoscopic Display using Lenticular Lens**
19. *Hyunjae Kim*  
*Korea Energy Economics Institute*  
**Reviewing influences of ICT in Energy through Causal Maps**
20. *Zhenhua Li*  
*Stony Brook University*  
**ABCCC: An Advanced Cube Based Network for Data Centers**
21. *Ji Li*  
*Stony Brook University*  
**Mobility Assisted Data Gathering with Solar Irradiance Awareness in Heterogeneous Energy Replenishable Wireless Sensor Networks**

# POSTERS

22. *Kin Sum Liu*  
*Stony Brook University*  
**iLo: Infrared Device-Free Indoor Localization**
23. *Mahdin Mahboob*  
*Stony Brook University*  
**AC-Stop: Acoustic Sensor Detection of Vehicle Stoppage at Traffic Stop-Signs**
24. *Mohammad Mahdi Javanmard*  
*Stony Brook University*  
**Space-Parallelism Tradeoff under Cache Optimality**
25. *Najmeh Miramirkhani*  
*Stony Brook University*  
**AS-Connectivity**
26. *Koosha Mirhosseini*  
*Stony Brook University*  
**Crowdsourcing Virtual Colonoscopy**
27. *Saad Nadeem*  
*Stony Brook University*  
**Registration of Volumetric Prostate Scans using Curvature Flow**
28. *Chetan Naik*  
*Stony Brook University*  
**Semantic Role Labeling for Process Recognition Questions**
29. *Javad Nejati*  
*Stony Brook University*  
**Modeling Web Page Load Time**
30. *Ji Hwan Park*  
*Stony Brook University*  
**Exploration of Multivariate Geographical Data**
31. *Jihoon Ryu*  
*Stony Brook University*  
**RIBBN: Research Infrastructure for Backscatter-Based Networks**
32. *Michael Salerno*  
*Stony Brook University*  
**An Overview of Key Issues on Green Computing**
33. *Qi Sun*  
*Stony Brook University*  
**Virtual Colonoscopy in Cross-Platform VR Environment**
34. *Mahsa Torkaman*  
*Stony Brook University*  
**AS-Connectivity**
35. *Cong Wang*  
*Stony Brook University*  
**Improve Charging Capability for Wireless Rechargeable Sensor Networks using Resonant Repeaters**
36. *Jie Zhao*  
*Stony Brook University*  
**Cooperative Sequential Compressed Spectrum Sensing over Wide Spectrum Band Dynamic Programming (DP)**

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