Missouri University of Science and Technology

Smart Living Signature Area

Missouri S&T's **Smart Living** signature area seamlessly improves quality of life by transforming home, workplace, transportation and energy infrastructures into "smart" environments.

Smart Living increases our understanding of how people and technology interact by combining sensing with physical action, social behavior analysis, data analytics, engineering, technology, communication and decision-making into a single, integrated concept.

Solar Village Living Laboratory

PoC: **Bruce McMillin**, Associate Dean,
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Nancy Stone,
Professor of Psychological Sciences
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Major Areas

- Decision Making and Governance
- Smart Grid and Transportation
- Privacy and Security
- Environment and Health

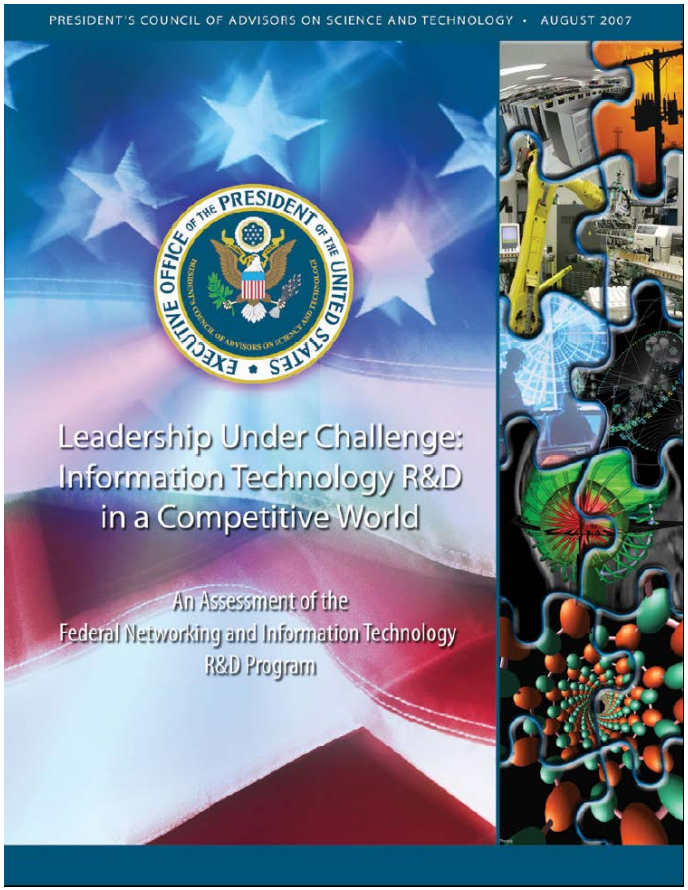
Existing Work

- Isolated Smart House Research
- SmartCitiesCouncil.com, IBM's Smarter Planet
- International Efforts
  - Smart Cities, Italy and Spain, China, Ireland

MISSOURI S&T

Missouri University of Science and Technology

Smart Living Signature Area



- Smart Living intersects two Grand Challenges:
  - *Sustainability* (President's Council of Advisors on Science and Technology - PCAST)
  - *Secure Cyber Space* (National Academies)
- Smart Living Subsumes Smart Cities and Homes
  - Smart and Connected Communities
  - Internet of things

Smart Living Signature Area

Decision Making and Governance

Smart living requires more than data and analytics. Understanding how people process, react to, and interact with information and technology will lead to a sustainable shared governance of resources.

DEPARTMENT OF ENGINEERING MANAGEMENT AND SYSTEMS ENGINEERING

Resilient Critical Infrastructure Systems

Planning Models and Tools

- Characterization of socio-critical systems interdependence
- Resiliency Risk and Uncertainty Calculation Tools.

Visualization and Data Acquisition Modeling

- Social Network Data Analytics
- Visualization and High Performance Computing Tools

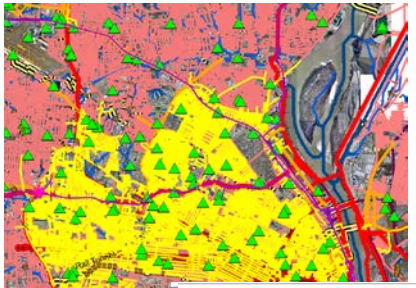
Extreme Event Restoration Prioritization Modeling

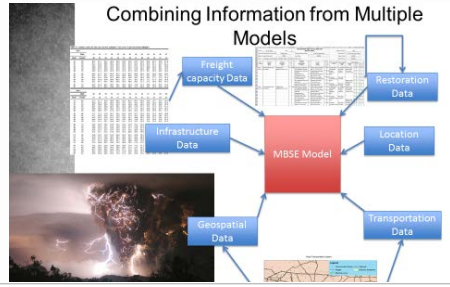
- Systems Architecture of Complex, Resilient Systems
- Resource Allocation Modeling and Tools

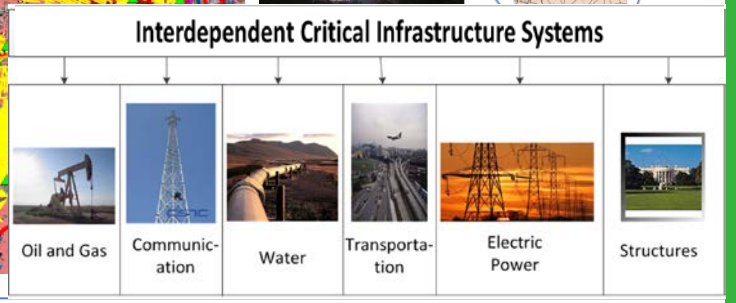
Resilience Protocols

- Decision analysis frameworks planning
- Data Analytics and Informatics Ontologies

Use Complex Adaptive Systems Theory to develop community planning tools for Smart, Resilient Systems







PoC: Suzanna Long, Ph.D. P.E.M.,
Professor and Department Head (Interim),
Engineering Management & Systems Eng.
longsuz@mst.edu;
http://emse.mst.edu/facultystafffacilities/emsefaculty/index.html

Funding

- US Department of Transportation, Federal Highway Administration, National Science Foundation, U.S. Department of Energy, U.S. Geological Survey, Missouri Department of Transportation, USACE.

Keywords

- Resilient Systems; Complex Adaptive Systems; Interdependent Critical Infrastructure Systems; Supply Chain Systems; Disaster Restoration Modeling

Recognitions

- Award: Missouri S&T Woman of the Year, 2016.
- Award: University of Missouri President's Award, 2013.
- Award: AASHTO High Value Research Project Winner, 2012.
- Fellow: ASEM.

DEPARTMENT OF COMPUTER SCIENCE

Research Challenges in Complex, Heterogeneous and Interdependent Networks

Unmanned Aerial Vehicles (UAVs) to monitor the effects of climate change

- Enable scalable, efficient and accurate monitoring
- Combine statistical optimization with distributed algorithm design

Hybrid wireless sensor networks for homeland security

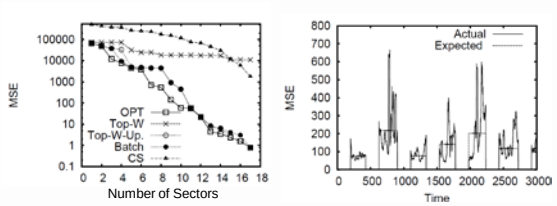
- Unified framework that exploits static, terrestrial mobile and aerial sensors
- Distributed algorithms for information awareness in critical scenarios

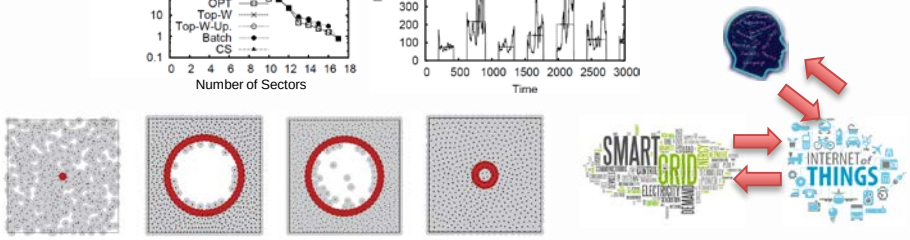
Secure Interdependent Cyber-Physical Systems (CPSs)

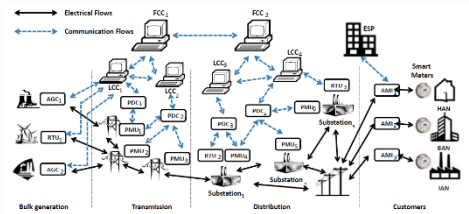
- Model infrastructure dependencies and understand implication on security
- Design algorithms for attack identification, mitigation and restoration

Integrating Social Behavioral Science in Cyber-physical system design and operation

- Exploit the Internet of Things (IoT) to learn social behavioral dimensions
- Optimize CPS operations based on learned models







Design efficient solutions for the increased heterogeneity, interdependency, and complexity of modern networks and the central role of humans

PoC: Simone Silvestri, Assistant Professor,
Department of Computer Science
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http://web.mst.edu/~silvestris/

Funding

- NSF EPSCoR funded Missouri Transect
- NSF Cyber Physical Systems
- Nato Science for Peace and Security Program
- Defense Threat Reduction Agency (DTRA)

Keywords

- Unmanned Aerial Vehicles, Cyber-Physical Systems, Wireless Sensor Networks, Security, Internet of Things, Smart Living, Smart Grid, Optimization Algorithms

Recognitions

- Several papers published on IEEE Transactions on Smart Grid, Transactions on Mobile Computing, IEEE Transactions on Wireless Communications, IEEE Transactions on Network and Service Management, IEEE ICDCS, IEEE DSN

DEPARTMENT OF PSYCHOLOGICAL SCIENCES

PsychoSocial Factors in Engineering Design

HUMAN FACTORS:

Smart Living

- Persuasive impact of wearable technologies
- Ethical and social implications of smart technology design and deployment
- Human Centered design of smart technologies

Cyber Physical Systems

- Modeling social and behavioral aspects of appliance usage in smart environments to prioritize energy management in times of energy constraint.
- Investigating perceptions of critical systems infrastructures during times of crisis across cultural and socioeconomic strata.

Assistive Technologies

- Assessing psychosocial and psychological barriers to orthopedic treatment in military populations

Psychosocial Aspects of Smart Systems Design and Application

PoC: Denise A Baker, Assistant Professor, Psychological Science,
bakerden@mst.edu
http://psych.mst.edu/facultyandstaff/facultydirectory/

Funding Recently Submitted or in Preparation

- NSF – Cyber Physical Systems: Synergy
- DOD - Peer Reviewed Orthopedic Research Program
- (PRORP)

Keywords

#HumanFactors #Psychology #AssistiveTechnology #Wearables #SmartLiving #CyberPhysicalSystems #Design

Future Projects

- Impact of ubiquitous wearable monitoring on perceptions of free will.
- Impact of design of smart systems on perceptions of personal responsibility.

DEPARTMENT OF PSYCHOLOGICAL SCIENCES

Using Technology to Improve Daily Life

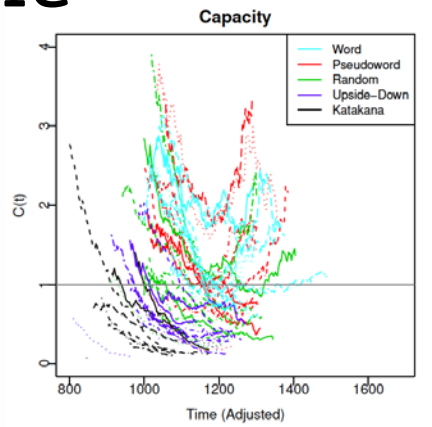
Questions of Interest

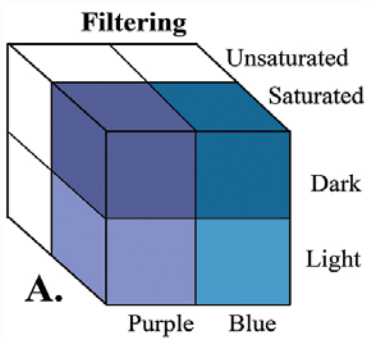
Augmented Perception: The brain is a robust processing system capable of adapting to novel information streams. What new types of information can we give it, and what are the best methods for doing so?

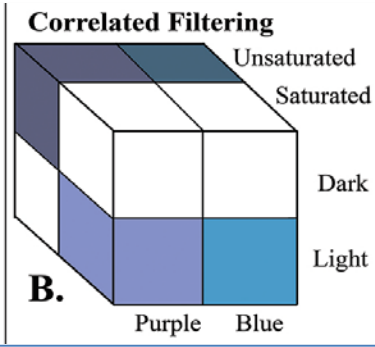
Understanding Attention: Human information processing is often limited by attentional constraints. Why can they be so different depending on the stimulus/task? Are they fundamental, or surmountable?

Maladaptive Behaviors: We often know the best course of action, but still don't do it (exercise, procrastination, etc.). How technology help us keep ourselves honest?

Cognitive Biases: Our though processes fail us in consistent and predictable ways. How can we avoid falling for the same traps again and again?







PoC: Devin Burns, Assistant Professor
Psychological Science

Background:

PhD in Cognitive Psychology and Cognitive Science from Indiana University, Bloomington

Publications:

Burns, D. M. (2016). Garner Interference is Not Solely Driven by Stimulus Uncertainty. *Psychonomic Bulletin and Review.*

Burns, D. M., Houpt, J. W., & Townsend, J. T. (2013). Functional principal components analysis of workload capacity functions. *Behavioral Research Methods, 45*, 1048-1057.

DEPARTMENT OF PSYCHOLOGICAL SCIENCES

Affective Meaning of Technology

How do the cultural affective meanings of everyday technology products, smart home products, and computer agents influence social interaction?

- altering social identity impressions
- contributing to online self-presentation
- indicating feature-based affective meaning
- fulfilling psychological needs

Examples

cars, phones, computers, shoes, watches, smart home security, smart pet products, food, drink, clothing, values, computer and human identities

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Keywords

impressions, affect, meaning, consumer products, technology, design, social interaction, human-computer interaction, culture, smart homes

Other Research Areas

public goods dilemmas, human-computer interaction, organizational attributions

Adapting to the Workforce of the Future

Research Topics

- Variance in Implicit Leadership Theories
  - Measuring cognitive schemas associated with organizational leaders across situations can help us to understand the impact of expectations and biases in the workplace.
- Social Media in the Workplace
  - Social media shapes the way people connect with each other and has a broad range of impacts on organizations.
- Games Predict Workplace Attitudes and Behaviors
  - Success in online games such as World of Warcraft rely on similar competencies to virtual leadership and teamwork in organizations.

Nathan Weidner
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Department of Psychological Science
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Phone: 573-341-7030

Funding

- Weidner, N. (2015). Influence of Age and Performance on ILTs and IFTs. University of Missouri Research Board $8,057

Keywords

- Social Media, Leadership, Implicit Theories, Video Games

Recognitions/Significant achievements

- **Weidner, N.**, O'Brien, K, & Wynne, K. (2016) Social media use: Antecedents and outcomes of sharing. In R. Landers & G. Schmidt (Eds.) *Using Social Media in Employee Selection: Theory, Practice, and Future Research.* (p. 79-101) Switzerland: Springer International Publishing
- Sirabian, M. A., **Weidner, N.**, Prewett, M. (April, 2016). Acquisition of KSAO's Through Online Games and Virtual Team Collaborations. Roundtable/Discussion Hour presented at the 26th Annual Meeting of the Society for Industrial-Organizational Psychology. Anaheim, CA.

DEPARTMENT OF BUSINESS & INFORMATION TECHNOLOGY

Data Visualization, Big Data, ERP, and Supply Chain

Data Visualization, Dashboards, and Big Data Analytics

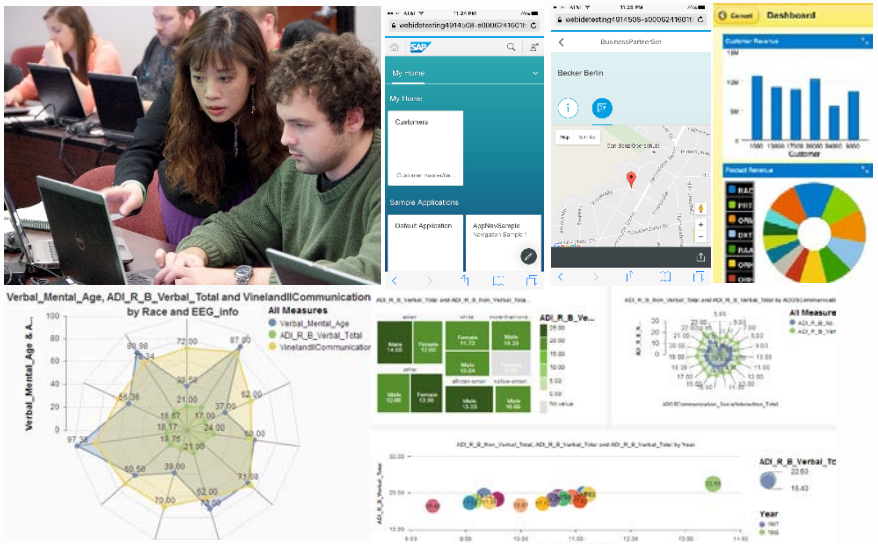
- Design & develop descriptive, predictive, and prescriptive visual analytics models utilizing high dimensional graphs, visual encoding data techniques, and human visual perception concepts
- Derive insights from visualizing both phenotype and genotype data
- Visualization software development across platforms and devices
- Streamline strategic management through dashboards & scorecard design & implementation

Enterprise Resource Planning (ERP) & Data Warehouse

- ERP systems landscaping, blueprinting, and configuration with focus in SAP ERP systems
- Design and develop adoptive in-memory data warehouse to support big data analytics, visualization, and *IoT*
- ERP user training and education

Supply Chain Design & Implementation

- Supply Chain design and implementation integrated with ERP system



Visual Analytics models utilizing in-memory data modeling for big data and supply chain applications

Faculty: Bih-Ru Lea, Associate Professor
Director, Center for Enterprise Resource Planning (ERP)
Dept. of Business & Information Technology
College of Arts, Sciences and Business
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Phone: 573-341-6436

Funding

- In-memory Data Modeling & Visualization, Autism Spectrum Disorder, Eastman, ConocoPhillips, Accenture, Avent, Union Pacific, SAP
- HANA Appliance in Research & Teaching Support, as a part of Missouri S&T Virtualization and Big Data Infrastructure Laboratory

Keywords

- Data Visualization, Dashboard, Big Data Analytics, In-memory data warehouse, Enterprise Resource Planning (ERP), Supply Chain, SAP, HANA, IBM Watson

Recognitions

- Inspirational Women Award, Leadership and Cultural Programs and Women's Programs, Missouri University of Science & Technology, 2014
- Outstanding Scholar Award, Midwest Chinese American Science & Technology Association, St. Louis, MO, 2014
- Global Learning 2010 Outstanding Teaching Commendation Award, Missouri University of Science & Technology, 2010

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CASB Research

Smart Living Signature Area

Smart Grid and Transportation

Intelligent peer-to-peer systems manage renewable energy resources, like wind and solar, backed by energy storage, including fuel cells and batteries, to provide energy to buildings.(Missouri S&T's Solar Village is a "micro" example of a smart grid in operation.) Transportation and energy systems interlink with improved urban planning to provide individualized, cost-efficient transportation.

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Power Converters for Microgrids and Sustainable Energy

Microgrid Stability Analysis

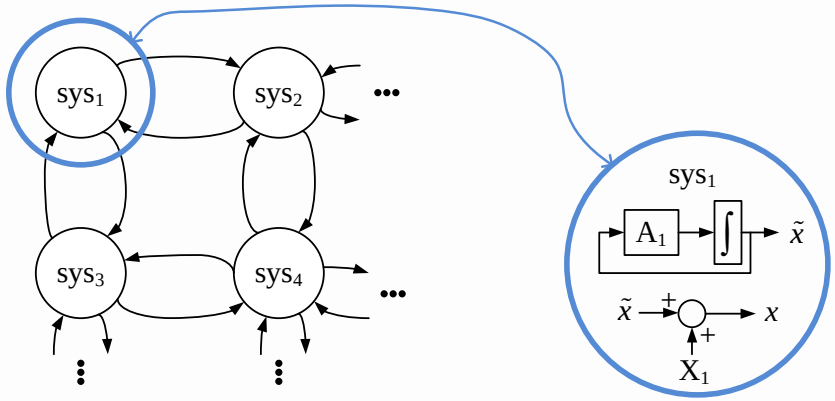
- Microgrids have limited resources, so they are fragile
- New modeling and analysis methods using stochastic hybrid systems framework

Grid-Tied Power Converters

- Intermittent sources on a weak grid or microgrid need new control methods

Cyber-Physical Systems

- How can we assure stability and security in a distributed system of power generators and consumers?



Bottom-Up Modeling of a Microgrid Using Detailed Models of Devices and Stochastic Hybrid Systems

PoC: Jonathan Kimball, Associate Professor,
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www.jonathankimball.com

Funding

- National Science Foundation, Department of Energy, NASA

Keywords

- #Invariants, #Microgrids, #Solar, #Hydrokinetics, #CyberPhysicalSecurity

Recognitions

- Award: Faculty Excellence Award, February 2015
- General chair, IEEE Applied Power Electronics Conference 2017, www.apec-conf.org

DEPARTMENT OF COMPUTER SCIENCE

Data Mining and Decision Support Systems

Urban Computing

- Smart Transportation
- Data-Driven Urban Planning
- Data-Driven Environmental Prediction and Protection
- Urban Anomaly Detection
- Urban Energy

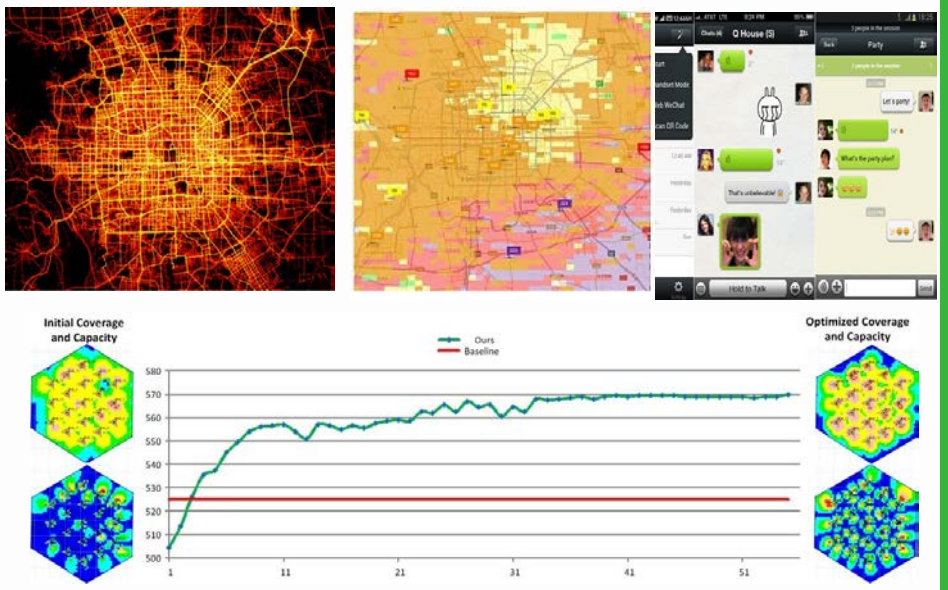
Mobile Intelligence

- Self-Optimizing Network systems (SON)
- In-App Behavior Analytics
- Analytics-Assisted App Security Enhancement

Personalization Techniques

- Mobile User Profiling
- Mobile Recommender Systems

Data Mining in Geo-Mobile Intelligence



PoC: **Yanjie Fu**, Assistant Professor
Department of Computer Science
College of Engr. and Computing
Missouri Univ. of Sci. and Tech.
Email: fuyan@mst.edu
Homepage: www.yanjiefu.com

Keywords

- #DataMining, #UrbanComputing, #MobileComputing, #RecommenderSystems, #MachineLearning, #BigData

Recognitions

- IEEE ICDM Best Paper Nomination, 2014
- Rutgers Innovation Fellowship, 2013
- Dean's Fund for Summer Research, Rutgers University, 2015
- Championship of Handwriting Recognition at IEEE WCCI, 2010

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Wireless Communications & Signal Processing

Wireless Communications with Energy Harvesting

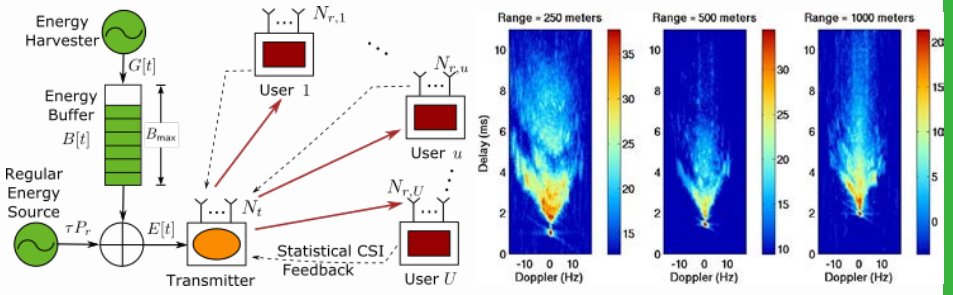
- Wireless Network Resource Allocation in Energy Harvesting Environment Using Stochastic Dynamic Programming;
- Turbo Equalization for Severe Multipath Channels.

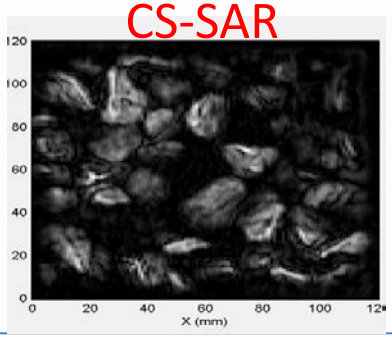
Underwater Cyber-Physical Systems (U-CPS)

- Acoustic and Magneto-Inductive Communication systems for Underwater Sensor Networks;
- Communication Systems for Underwater Drones.

Compressive Sensing (CS) for Imaging Systems

- Image Reconstruction using advanced CS algorithms;
- Reduce Sampling Elements of Near-field SAR Imaging Systems by more than 50%.
- Reduce Artifacts for Magnetic Resonance Imaging





PoC: Y. Rosa Zheng, IEEE Fellow,
College of Engineering and Computing
Professor of Electrical & Computer Eng.
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Funding

- National Science Foundation (NSF)
- Office of Naval Research (ONR)
- Dept. of Transportation (DOT)
- Army Research Office (ARO)

Keywords

- #Underwater Wireless Communications, #Turbo Equalization; #Energy Harvesting,
- #Cyber Physical Systems, #Underwater Drones
- #Compressive Sensing, #Near-field SAR Imaging

Recognitions

- NSF Early Career Award 2009 – 2014;
- IEEE Fellow elected in 2015;
- IEEE Vehicular Technology Distinguished Lecturer (2015-2017)

Smart Living Signature Area

Privacy and Security

Intelligent systems must be resilient to security attacks while maintaining personal privacy and supporting the users' trust in the system. In Smart Living, people must adapt to the technology and the technology must adapt to the people. The result is enhanced trust and security.

DEPARTMENT OF COMPUTER SCIENCE

Secure and Smart Cyber-Physical Systems

Cyber-Physical Systems (CPS)

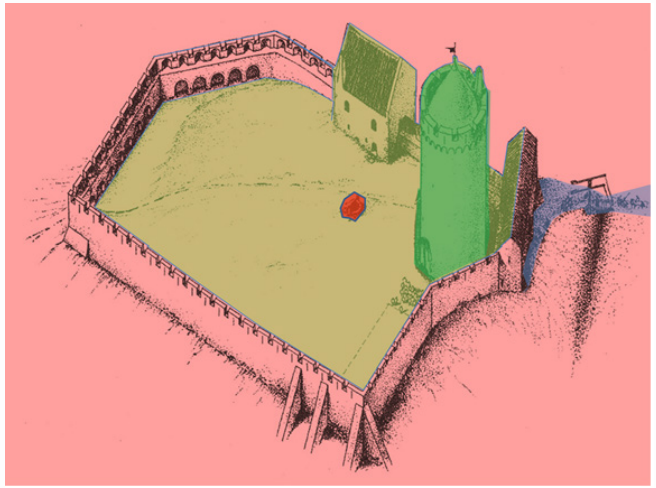
- Large complex distributed Critical Infrastructures
- Ensure correctness through distributed invariant monitoring

Security

- Mitigate cyber-physical attacks
- Determine a unified cyber-physical information flow model to determine potential attack vectors

Smart Living

- Develop Sustainable Cyber-Physical living environments
- Develop Privacy and Security for smart living environments



Security needs to move beyond the Fortress Mentality of Firewalls

PoC: **Bruce McMillin**, Associate Dean, College of Engineering and Computing
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Funding

- National Science Foundation, National Institute of Standards and Technology

Keywords

- #CyberPhysicalSecurity, #Information Assurance, #SmartLiving, #Invariants, #CriticalInfrastructure

Recognitions

- Podcast: Cybersecurity "How We Manage Stuff" http://djaghe.com, July, 19, 2016
- OpEd: Moving beyond medieval cybersecurity, St. Louis Post Dispatch, Oct 30, 2015
- IEEE Computer Society Board of Governors

DEPARTMENT OF COMPUTER SCIENCE

Security in Cloud and Sensor Cloud Environments

Risk Assessment in Sensor Cloud

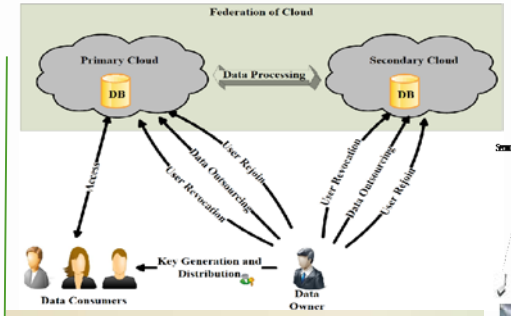
- Here provide some brief details about each
- Here provide some brief details about each

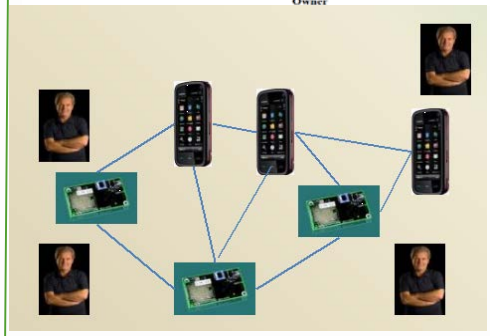
Security and Risk Assessment in Cloud Computing

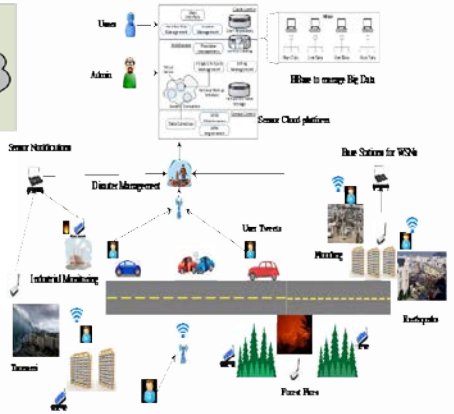
- Off-line Risk Assessment in Cloud Computing
- Data Security and Assess Control in Cloud Computing
- Combat Clouds and Edge Clouds
- Cloud-assisted Cyber Physical System

Mobile and Delay-Tolerant networks

- Situational-awareness in Delay-tolerant Networks
- Task scheduling in UAV Networks
- Ride-sharing and Transport Management for Smart City Applications
- Big Data Management







Sensor Cloud, Secure Cloud and Big Data Management

PoC: Sanjay Madria, Professor, Dept. of CS,
www.mst.edu/~cswebdb, madrias@mst.edu
Ph. 573-341-4856

Funding

- National Science Foundation (NSF)
- National Institute of Standard and Technology (NIST)
- Air Force Research Lab
- Department of Education

Keywords

- #Sensor Cloud, #Risk Assessment, # Mobile , # Cloud Security, #Delay-tolerant Networks. #Data Management

Recognitions

- Awards: IEEE SRDS Best Paper Award, 2015;
  Faculty Research Award, 2015, AFRL Fellowships
- Pub.: IEEE Transaction on Services Computing, 2016
- Service: PC Chair, Big Data and Knowledge Discovery Conf., 2016

Human Factors to Improve Privacy and Security

95% of security incidents are related to human errors (IBM 2014).

Objectives

- Identify human security breaches to improve privacy and security training, and assess the effectiveness of training
- Improve computer interface design to mitigate privacy and security breaches experienced by users
- Understand user privacy preferences in varying contexts

Approaches for Evaluation

- Lab and field experiments
- Case studies
- Surveys

Theoretical Perspectives

- Privacy calculus theory – intention to disclose info is based on trade-offs between expected risks and benefits, giving rise to the personalization-privacy paradox
- Social response theory – a user engages in self-disclosure of personal info if s/he is the recipient of a similar disclosure from another person, organization or even computer, thus following the norm of reciprocity
- Protection motivation theory – intention to protect oneself from security threats depends on perceived severity of the threat, perceived probability of occurrence of the threat, efficacy of preventive behavior, and individual's perceived ability (or self-efficacy)

Personnel/Investigator/Point of Contact

Fiona Nah, Professor of Business and Information Technology
nahf@mst.edu, 573-341-6996

Major Milestones

- Experiment to assess effectiveness of security training
- Experiment to evaluate computer interface design in behavioral information security
- Survey to assess user privacy preferences in varying contexts in mobile commerce

Current and Future Work

- EAGER funding by NSF
- Privacy by design
- Management of privacy and security practices in the Smart Living context
- Issues in user privacy and security in Smart Living

Reference

- IBM Corporation: IBM Security Services 2014 Cyber Security Intelligence Index. IBM Global Technology Services, Somers, New York

DEPARTMENT OF COMPUTER SCIENCE

Evolutionary Computing & Hyper-Heuristics

Automated Design of Algorithms

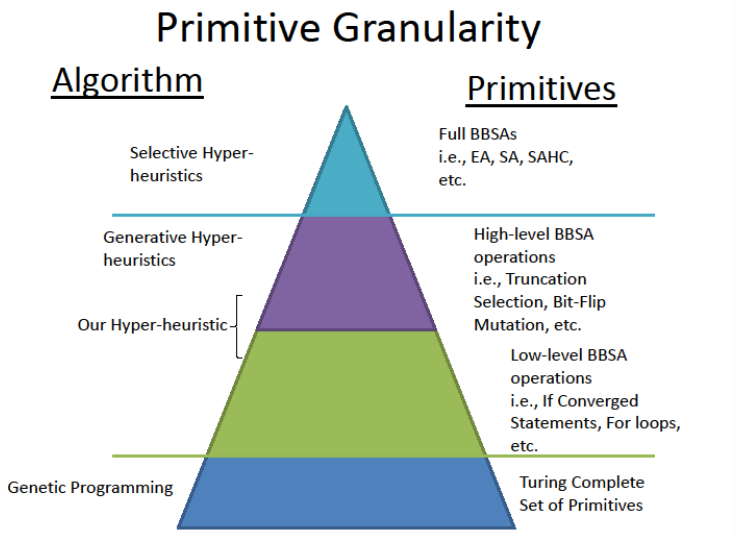
- Create highly customized solutions for repeated solving of instances of the same problem class, where high a priori computational cost is effectively amortized
- Create tools to assist practitioners with automating the design of algorithms for custom applications

Coevolutionary Computational Game Theory

- Approximate Nash Equilibria with Coevolution to support real-world game theoretic problems
- Automate the identification of adversarial threats
- Automate the mitigation of identified threats

Cyber Security

- Create Hyper-Heuristics to automate the design of SAT Solvers for program understanding
- Coevolve attackers & defenders for enterprise computer networks



Daniel's Pyramid Classification of Hyper-heuristics Ranked by their Primitive Granularity

PoC: Daniel R. Tauritz, Associate Chair,
Department of Computer Science
Associate Professor of Computer Science
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Recent Funding

- Los Alamos National Laboratory
- Sandia National Laboratories
- National Security Agency

Keywords

- #EvolutionaryComputing, #ComputationalIntelligence, #HyperHeuristics, #AutomatedDesignOfAlgorithms, #CyberSecurity, #ComputationalGameTheory, #CriticalInfrastructureProtection, #ArtificialIntelligence

Recognitions

- Senior Member, ACM & IEEE
- S&T Faculty Service Award: 2014
- S&T Outstanding Teaching Award: 2007, 2008, and 2011

Dependability for Intelligent Infrastructure

Examples of Dependability Attributes Studied

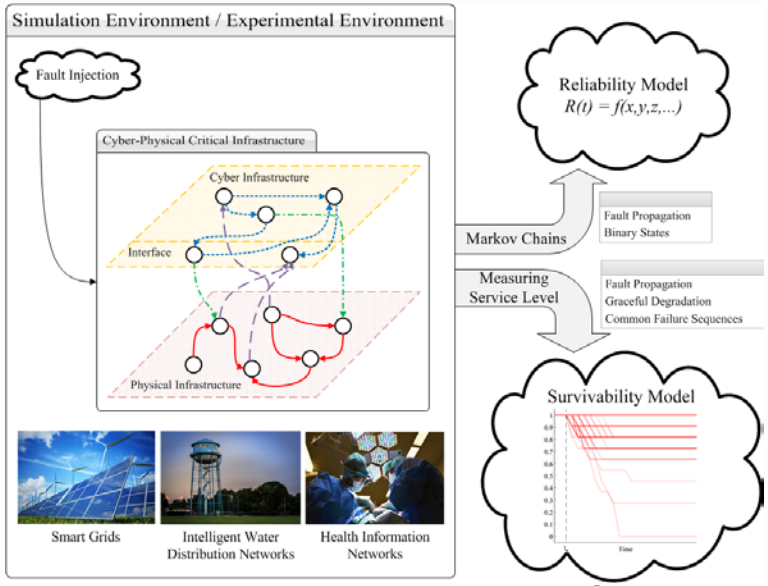
- Reliability: Probability of system remaining functional
- Availability: Percentage uptime
- Survivability: Functionality maintained after failure
- Resilience: Ability to bounce back from failure

Examples of Systems Analyzed

- Smart grids, intelligent water distribution, networks autonomous vehicle systems, collaborative robots

Examples of Tools and Techniques Developed

- Stochastic models of dependability attributes for critical infrastructure systems
- Simulation environments that capture both the physical infrastructure and the intelligent control
- Analysis of failure propagation



Does "intelligence" make critical infrastructure systems more dependable?

PoC: Sahra Sedigh Sarvestani,
Associate Professor of Electrical and Computer Engineering and Computer Science (courtesy)
sedighs@mst.edu, http://web.mst.edu/~sedighs

Keywords

- #Dependability, #CriticalInfrastructure, #StochasticModeling, #Cyber-PhysicalSystems, #Simulation, #FailureAnalysis

Funding

- US Department of Education, US Department of Transportation, Department of Homeland Security, Private Industry

Recognitions

- Best Paper, International Symposium on Resilient Cyber Systems, August 2016
- Two papers cited in the NSF Science of Security Index as Significant Research in Cyber Security., 2015

Smart Living Signature Area

Environment and Health

Current advances in remote monitoring and treatment for populations (i.e., Smart Health) and in significantly improved agriculture through targeted application of fertilizer and pesticides (i.e,, Smart Food) illustrate how biological systems inform Smart Living. Understanding and using Big Data related to climate change and a growing industrial base ties Smart Living to environmental sustainability. And new smart materials can turn buildings into “living laboratories” that, through advanced analytics, provide feedback to inform users as well as to adapt to human behavior.

Phytoforensics and Engineered Natural Systems

Phytoforensics

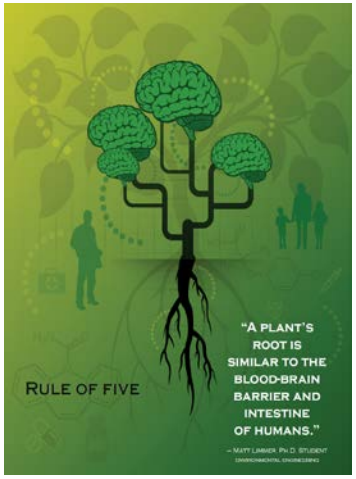
- Plants act as biosentinels, collecting pollutants from surroundings as a measure of exposure.
- Advanced analytic methods can measure pollutant levels in various plant tissues.
- Remote sensing techniques from unmanned aerial vehicles (UAVs) for detecting plant stress

Phytoremediation and green infrastructure

- Plants mitigate potential exposure for fugitive pollutants, through uptake and increased degradation
- Green infrastructure reconnects the urban water cycle to benefit stormwater water and ecosystem services

Plant uptake and food safety

- Uptake of pollutants is controlled by chemical properties of pollutants



New relationships plant uptake related to mammalian membrane permeability

Missouri S&T greenroof research facility integrated with Building energy

Greenhouse work on plant impacts on explosives, solvents, metals and fuels

PoC: Joel G. Burken, PhD, PE, BCEE
Curators' Distinguished Professor and Chair
Civil, Architectural & Environmental Engineering
Burken@mst.edu

Funding

- National Science Foundation, US Geological Corporate and Industrial Partners, Department of Defense, National Institute of

Keywords

- #Phytoforensics, #Phytoremediation, #FoodSafety, #GreenInfrastructure, #Exposure

Recognitions

- President and Fellow of the Association of Environmental Engineering and Science Professors (AEESP)
- Board Certified Environmental Engineer (BCEE)
- Rudolph Hering Medal ASCE
- Appointed Curators Distinguished Professor

DEPARTMENT OF CIVIL, ARCHITECTURAL AND ENVIRONMENTAL ENGINEERING

Engineering indoor air quality

Chemical transport from air to clothes and through skin

- Clothing enhances dose for many indoor chemicals

Indoor chemistry

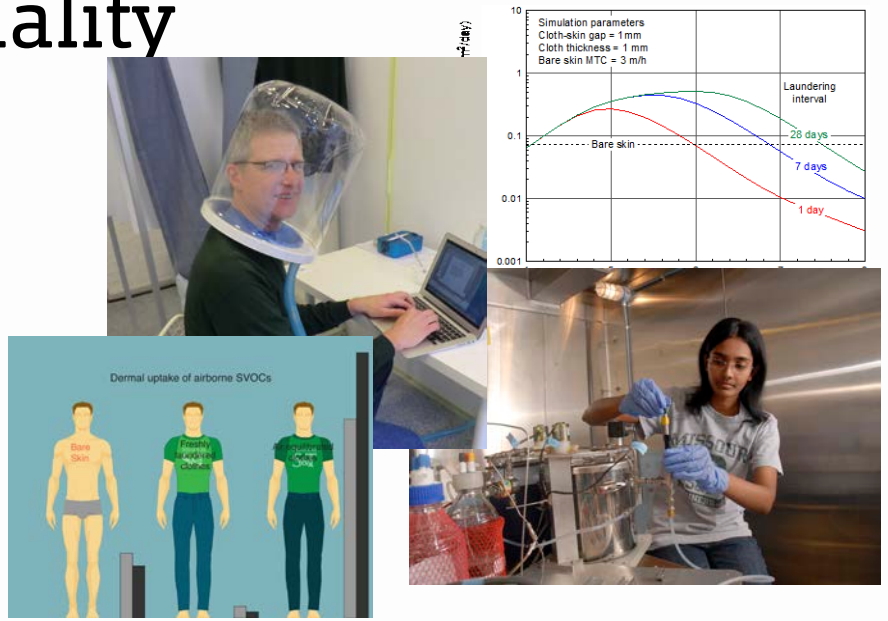
- Surfaces are reservoirs for pollutants
- Surfaces promote reactions that remove some pollutants and create new ones

Aerosols and indoor exposure to SVOCs

- Small particles transport low semi-volatile organic compounds like plasticizers and pesticides from surfaces to people

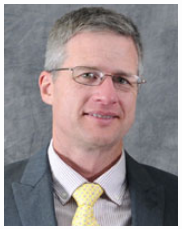
Indoor air pollution control

- Technology development: passive, zero-energy control of indoor pollutants



Indoor air chemistry and physics in the service of understanding and improving human health

PoC: Glenn Morrison, PhD, PE
Professor of Civil, Architectural and Environmental Engineering
gcm@mst.edu



Funding

- National Science Foundation, US Environmental Protection Agency, California Air Resources Board, Alfred P. Sloan Foundation, National Institute for Standards and Testing

Keywords

- #IAQ, #indoorair, indoor chemistry, #SVOCs, #exposure

Recognitions

- President and Fellow of the International Society of Indoor Air Quality and Climate
- Otto Mønsted Professorship, Technical University of Denmark
- Wilhelm Klauditz Fellowship, Fraunhofer Institute, Braunschweig, Germany

DEPARTMENT OF COMPUTER SCIENCE

Smart Living: The Next Frontier

Smart Environments and Cyber-Physical-Social Systems

- **(Smart Healthcare)** Monitoring activities of daily living through sensors, wearable, and smart chair for wellness management and early detection of cognitive impairment.
- **(Smart Grid)** Characterizing complex dependency between communication networks and electrical grid to optimize energy consumption and control cascade failures.
- **(Disaster Response)** Establishing post-disaster communication network infrastructures.

Wireless Sensor Networks

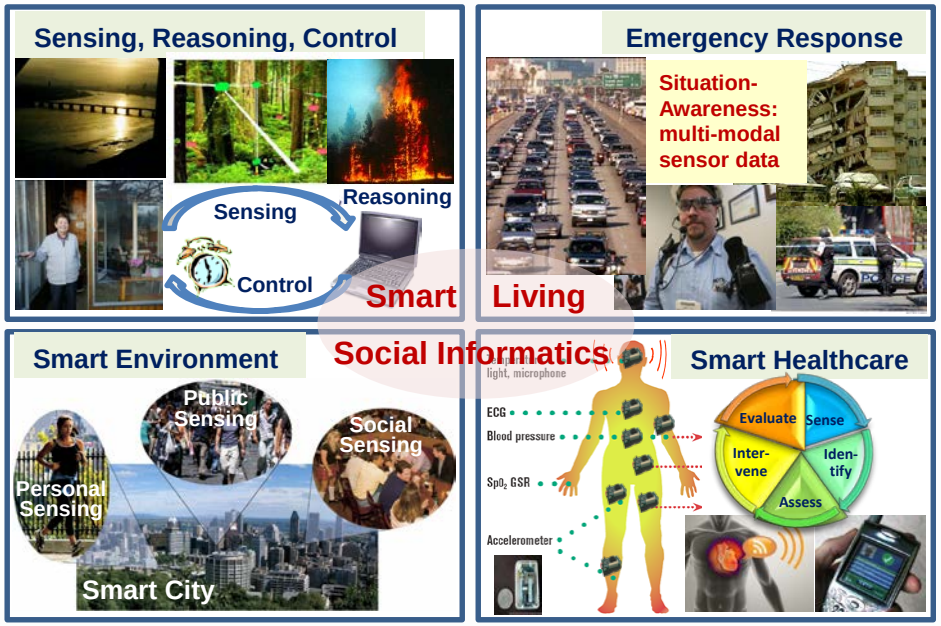
- Design energy-efficient architectures, algorithms and protocols for multi-modal sensory data collection, fusion, coverage, and routing with novel applications.

Cyber-Physical Security

- Provide high information assurance, security, reliability, and trustworthiness in cyber-physical systems with human in the loop in the wake of attacks.

Mobile and Pervasive Computing

- Develop context/situation aware models in ubiquitous computing systems in the presence of uncertainty due to mobility, topology dynamics, and resource availability.



PoC: **Sajal K. Das**, Professor and Chai
Department of Computer Scienc
Daniel St. Clair Endowed Chair
sdas@mst.edu
http://web.mst.edu/~sdas

Funding

- National Science Foundation
- Air Force Office of Scientific Research
- Department of Justice
- NASA, Google, Nokia, Nortel Networks, VentureWell

Keywords

- #Smart Living, #Cyber-Physical Systems, #Wireless Sensor Networks, #Pervasive Computing, #Big Data, #Cloud Computing, # Cyber-Security, #Social Informatics

Recognitions

- IEEE Fellow, 2015.
- IEEE Computer Society Technical Achievement Award, 2009.
- Dean's Award of Excellence in Mentoring Doctoral Students, 2011.
- Ten Best Paper Awards in IEEE and ACM Conferences.
- IEEE Engineer of the Year Award, 2007.
- Editor-in-Chief, Pervasive and Mobile Computing journal, 2005 -- present.

MISSOURI S&T

CEC Research

Source: Transverter.com, Bosch

DEPARTMENT OF CHEMISTRY

Bioanalytical, Biomedical, and Environmental Analysis

Single Cell Analyzer

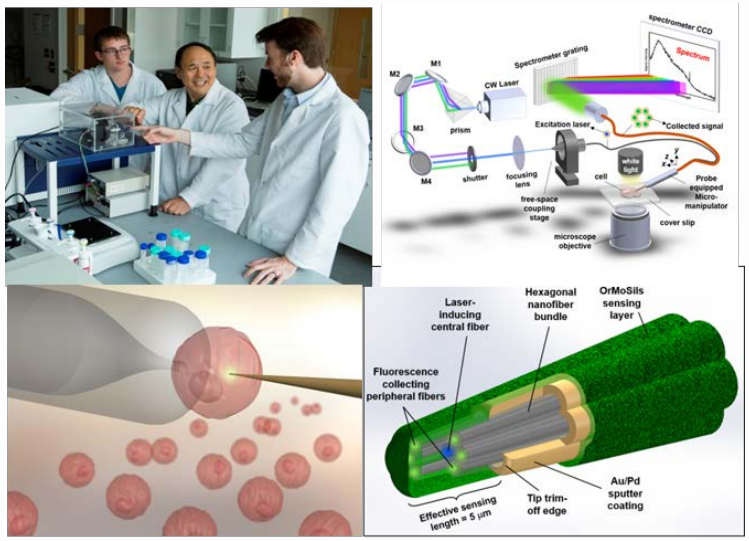
- Single cell pH probing when cells are exposing external conditions
- Single cell temperature probing when cells are exposing external conditions
- Single cell analyzer instrument development (patent pending)

Early Cancer Screening Using Urinary Biomarkers

- P-scan Technology development and commercialization (patented)
- Method development for different panels of cancer biomarkers
- Correlation study of cancer biomarkers levels with cancer stages
- Concentration normalization of Urinary biomarkers
- Specificity, sensitivity, and accuracy of urinary biomarkers for cancer diagnosis

Emerging Environmental Contaminants

- Assessment and removal of emerging environmental contaminants
- Cytotoxicity study of nanomaterials



A P-scan technique and single cell pH analyzer have been invented for biomedical researches.

PoC: Yinfa Ma, Associate Dean,
Curators' Distinguished Teaching
Professor of Chemistry and
College of Arts, Sciences and Business
Email: yinfa@mst.edu;
Phone: 573-341-6220

Funding

- National Institute of Health, Missouri Department of Natural Resources, REPSEA (DoE)

Keywords

- Bioanalysis; environmental analysis; biomedical; instrumental analysis; biomarkers; cancer screening

Recognitions

- President's University Citizenship Award for Mentoring, University of Missouri System
- Yinfa Ma, Stephen Gibbons, "P-Scan technology for early cancer screening". United States Patent, December 8, 2015, patent number: 9,207,205.
- Qingbo Yang, Hanzheng Wang, Sisi Chen, Xinwei Lan, Hai Xiao, Honglan Shi, Yinfa Ma, "A Novel Fiber-Optic Based Nano-Probe Using Hexagonal 6 -in-1 Fiber Configuration for Intracellular Single-Cell pH Measurement", Analytical Chemistry, 2015, 87: 7171−7179.

Missouri University of Science and Technology

Smart Living Signature Area

PoC: **Bruce McMillin**, Associate Dean,
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Nancy Stone,
Professor of Psychological Sciences
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