

Hadi Alasti

RESEARCH ASSOCIATE ABOUT

- Purdue University Fort Wayne, Associate Professor
- Ph.D. 2009, University of North Carolina, Charlotte
- Dates of Visiting Service: 5/16/2022 - 8/05/2022
- Advisor: Dr. Lee Seversky
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SUMMER RESEARCH DESCRIPTION

- Motivation: Data-Efficient Machine Learning For Spatiotemporal Monitoring Using UAV
- Objective: Development of Classes of Data and Communication-Efficient Multiresolution Machine Learning Methods for UAV-based Spatiotemporal Monitoring (UAV-STM)
- In this research, spatiotemporal signal is reduced to its sub-domain for efficient sampling. Simple machine learning algorithms are employed to guide the UAVs capture spatial signal efficiently.

Research interests:

- ❖ *Applications of Machine Learning Efficient Smart Sensing*
- ❖ *Efficient algorithms for software defined radio applications*

Jules Chenou

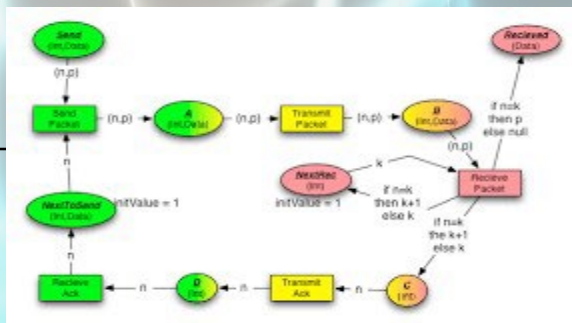
RESEARCH ASSOCIATE ABOUT

SUMMER RESEARCH DESCRIPTION

- Cybersecurity Research Scientist, Norfolk State University, Norfolk, VA
- Ph.D. 2012, Industrial and Systems Engineering, North Carolina A & T State University, Greensboro, NC
- Ph.D. 2005, Mathematics, University of Yaoundé I, Cameroon
- Dates of Fellowship: 6/01/2022 - 8/15/2022
- Advisor: Dr. Laurent Njilla, AFRL/RIGA Branch
- Contact Information: jchenou@nsu.edu

- **Motivation:** The correctness of real-time systems field-programmable gate array (FPGA) is essential to avoid unacceptable consequences.
- **Objective:** We aim to develop and present a formal verification approach using:
 - K framework
 - Colored Petri Net

To address the functional and timing correctness attributes of FPGA-based designs in safety-critical real-time applications.



```
lambda.k
module LAMBDA

syntax Val ::= Id
           | "lambda" Id "." Exp

syntax Exp ::= Val
           | Exp Exp [left]
           | "(" Exp ")" [bracket]

endmodule
```

Research interests: Machine Learning & Artificial Intelligence | Category Theory & Formal Methods | Fuzzy & Probabilistic Reasoning | Algebra Specifications | System Engineering | Petri Net.

Hobby: Traveling | Television



Zhangyu Guan

RESEARCH ASSOCIATE ABOUT



- University at Buffalo, Assistant Professor
- Ph.D. 2010, Shandong University
- Dates of Fellowship: 5/23/2022 - 8/19/2022
- Advisor: Dr. Elizabeth Serena Bentley
- Contact Information: guan@buffalo.edu

SUMMER RESEARCH DESCRIPTION

- **Motivation:** The radio resource management is becoming more and more complicated in NextG networks. On the other hand, to design and deploy network control programs the engineers need to simultaneously grapple with modeling, optimization, protocol design and the implementation of the resulting programs on software radios. This process is typically tedious and error-prone.
- **Objective:** We aim to explore a new approach based on digital twin-enabled robust learning to enhance the automation of the resource management in NextG networks.

Research interests:

Zero-Touch Theories and Algorithms: Software-defined Networking, Operating System for Wireless Networks, Digital Twin/AI/ML for/by Wireless

New Spectrum Technologies for NextG Networks: Spectrum Coexistence, mmWave/THz-band Networking, Space-Air-Ground Networks

Wireless Network Security: Protocol-Agnostic Sensing, Protocol Jamming/Anti-jamming

Testbed for Future Networks: NeXT (Digital Twin-Enabled Network Simulator), UnionLabs (Cloud-based Platform for Testbed Sharing)

Wireless Intelligent Networking and Security (WINGS) Lab

<http://www.acsu.buffalo.edu/~guan/>

Taeho Jung

RESEARCH ASSOCIATE ABOUT

- University of Notre Dame, Assistant Professor
- Ph.D. 2017, Illinois Institute of Technology
- Dates of Fellowship: 5/16/2022 - 7/29/2022
- Advisor: Dr. Paul Ratazzi
- Contact Information: tjung@nd.edu,
<https://sites.nd.edu/taeho-jung>

SUMMER RESEARCH DESCRIPTION

- Motivation: Various information needs to be shared for military applications, and having traceability for such sharing will enhance the security of data and systems. This is challenging when the sharing occurs in adversarial environments (e.g., tactical networks on battlefields) where insider threats may exist (e.g., compromised devices) or the network is under attack.
- Objective: The summer work will investigate the impacts of intermittent network connectivity on the traceability of the information shared among non-trustful participants, and develop solutions towards them.

Research interests: Applied Cryptography, Decentralized Ledger Technology, Data Security, Data Sharing

Hisham Kholidy

RESEARCH ASSOCIATE ABOUT

- State University of New York (SUNY) Polytechnic Institute, Assistant Professor
- Ph.D. 2012, Univ. of Pisa (joint Ph.D. program with the Univ. of Arizona).
- Dates of Fellowship: 5/9/2022 - 8/3/2022
- Advisor: Andrew Karam
- Contact Information: hisham.kholidy@sunypoly.edu, <http://people.sunypoly.edu/~kholidh/> v

SUMMER RESEARCH DESCRIPTION

- Motivation: Foster trust in decisions and actions taken by the 5G main entities toward developing a zero trust security model.
- Objective: Develop an approach to enable trustworthy deployment and management of network slices in 5G network. The proposed approach will:
 - 1) enable maintaining the security requirements for all 5G actors involved in the operation of the network slice (users, slice, and resource providers) using a smart contract approach.
 - 2) incorporate trust in brokering architecture, allowing the slice provider to securely create end-to-end network slices while outsourcing resources from different infrastructure providers;
 - 3) develop a trust architecture to manage the SLAs between the vertical/slice owner, the slice provider, and the infrastructure provider.

Research interests: Cybersecurity, Adversarial Machine learning, 5G networks, Cloud Computing, and autonomic computing.

Fanxin Kong

RESEARCH ASSOCIATE ABOUT

- Syracuse University, Assistant Professor
- Ph.D. 2017, McGill University
- Dates of Fellowship: 06/13/2022 - 08/12/2022
- Advisor: Dr. Steven Drager
- Contact Information: fkong03@syr.edu, <https://sites.google.com/site/fanxink>

SUMMER RESEARCH DESCRIPTION

- Motivation: Attacks on Cyber-Physical Systems (CPS) can cause failures or interruptions that result in quick and substantial damages. While most works focus on attack detection, a key question remains: 'what to do after detecting an attack'. A system can eventually drift to unsafe states if without response to the attack. It is essential to stop this drift and reverse the negative impact caused by the attack to the physical system.
- Objective: The objective is to propose new real-time and safe recovery techniques to enhance attack-resilience against sensor attacks in CPS.

Research interests: Cyber-Physical Systems. (i) Security: attack detection and real-time recovery. (ii) Real-time and resource management: energy-efficiency, workload scheduling, and mechanism design. (iii) Intelligent CPS: trajectory planning and task allocation.

Ji Liu

RESEARCH ASSOCIATE ABOUT

- Stony Brook University, Assistant Professor
- Ph.D. 2013, Yale University
- Dates of Fellowship: 5/25/2022 - 8/9/2022
- Advisor: Dr. Alvaro Velasquez
- Contact Information: ji.liu@stonybrook.edu, <https://sites.google.com/site/jiliucontrol>

SUMMER RESEARCH DESCRIPTION

- Motivation: In military applications, large amount of heterogeneous streaming information often needs to be collected by a team of autonomous agents which collaboratively explore a complex and dynamic environment to accomplish various types of missions and perform a multitude of operations, including control, optimization, and machine learning.
- Objective: To design distributed algorithms that are resilient in the sense that they can continue to reliably support decision making, optimization and learning in face of uncertain environmental changes, including spontaneous system malfunctions and malfunctions caused by malicious attacks on the system.

Research interests: Distributed Control and Optimization, Distributed Reinforcement Learning, Epidemic and Social Networks, Network Resilience, Distributed Quantum Computing

Yan Lu

RESEARCH ASSOCIATE ABOUT

- Virginia Modeling, Analysis and Simulation Center (VMASC), Old Dominion University, Research Assistant Professor
- Ph.D. in Modeling and Simulation/Old Dominion University
- May. 30, 2022 – Aug. 19, 2022
- Advisor: Erika Ardiles-Cruz
- y2lu@odu.edu

SUMMER RESEARCH DESCRIPTION

- Title: Data Augmentation in Remote Image Processing
- Objective: Applying data augmentation by using GAN model and remote sensing imagery for building damage estimation.
- Collaborators: ARFL, ODU

Research interests: My research interest includes deep learning and artificial intelligence applications in computer vision, cyber security, robust learning system, and Generative Adversarial Networks (GANs).

Javad Mohammadi, UT Austin

RESEARCH ASSOCIATE ABOUT

- The University of Texas at Austin, Assistant Professor
- Ph.D. 2016, Carnegie Mellon University
- Dates of Fellowship: 05/30/2022 - 7/22/2022
- Advisor: Dr. Erika Ardiles-Cruz
- Contact Information: javadm@utexas.edu,
<https://javadm-utexas.github.io/Homepage/group.html>

SUMMER RESEARCH DESCRIPTION

- **Motivation:** Increasing power system resiliency in the face of disruptions through efficient grid restoration
- **Objective:**
 - Maximizing energy throughput by finding optimal adjustments for generation setting, grid topology, and line parameters.
 - Addressing the computational needs by developing **LEAP** (Learning Enhanced Agent-based Processing)
- **LEAP** is applicable for solving collaborative problems, e.g., situational awareness in normal and contingency situations across the sensing grid of the (USAF). The critical information needed for USAF's operation is multi-modal and distributed between multiple systems across the Commands, Agencies, and even Allies

Research interests:

- *Multi-agent optimization and machine learning in networked cyber-physical systems, including smart grid-interactive buildings, power grids, and electrified transportation systems*
- *Learning to Optimize the Optimization Process (LOOP)*
- *Power grid resiliency and decarbonization*

Muhammad Masud Rana

RESEARCH ASSOCIATE ABOUT

- Old Dominion University, Research Assistant Professor
- Ph.D. 2017, University of Technology, Sydney
- Dates of Fellowship: 5/09/2022 - 7/29/2022
- Advisor: Dr Ardiles-Cruz Erika
- Contact Information: mrana@odu.edu

SUMMER RESEARCH DESCRIPTION

- Motivation: A major shortcoming with prior grid modeling, collateral damage analysis and methods is that the system state estimation is done very conservatively based on insecure sensory information or is based on imperfect grid modeling or is assumed perfect communication link and low latency. In addition, the current centralized state estimation techniques are limited; e.g., they have mostly ignored cyber-attacks, collateral damage, communication link failure, and do not leverage physical laws for validation of estimation algorithms in energy management systems at control center.
- Objective: In order to design a secure energy management system, the research goal is to develop a smart grid digital twin simulator.

Research interests:

- Machine learning for complex and resilient maneuvers and behaviors
- Trustworthy AI and Perception action-communication loops
- Cyber-physical digital twin design and validation
- Cybersecurity
- Next generation secure IoT communication systems
- Next generation SCADA systems

Vladimir Nikulin

RESEARCH ASSOCIATE ABOUT

- SUNY at Binghamton, Associate Professor
- Ph.D. 2002, SUNY at Binghamton
- Dates of Fellowship: 5/2/2022 - 9/30/2022
- Advisors: Vijit Bedi and John Malowicki
- Contact Info: vnikulin@binghamton.edu (607) 321-9362

SUMMER RESEARCH DESCRIPTION

- **Motivation:** Develop quantum comm. systems that use entangled photons for secure data transfer in free-space.
- **Objective:** Research the ways to create realistic conditions of a free-space link in an experimental testbed, to develop mechanisms to control those conditions, to emulate eavesdropping attacks, and to integrate quantum instrumentation into the testbed to analyze the entangled photon states.

Research interests:

Optical/Quantum Communication. Quantum-based optical signal encryption, quantum optical circuits, acquisition and tracking for free-space links, design of electro-optical sub-systems.

Laser Technologies. Laser imaging, holographic systems, laser interferometry, optical sensors and detectors.

Systems/Controls. Analysis, modeling and characterization of dynamic systems, optimization, conventional and adaptive control systems.

Mohammad *Ashiqur* Rahman

RESEARCH ASSOCIATE ABOUT

- Florida International University, Assistant Professor
- Ph.D. 2015, University of North Carolina at Charlotte
- Dates of Fellowship: 06/06/2022 - 08/05/2022
- Advisor: Dr. Laurent Njilla
- Contact Information: marahman@fiu.edu,
<https://rahman.eng.fiu.edu/>

SUMMER RESEARCH DESCRIPTION

- Motivation:
 - Impact-aware threat analytics are crucial for attack-resiliency assessment in IoT/CPS systems.
 - Formal analytics are useful to find potential attacks and related impacts.
 - ML-based control techniques are increasingly used in modern IoT/CPSs, which often lack exact mathematical representations of control logics like typical physics-based controllers.
- Objective: Develop AI-assisted analytics to identify potential attacks and impact in ML-based IoT systems.

Research interests: My primary research interest covers a wide area of computer networks and communications, within both cyber and cyber-physical systems (CPS)/ Internet of Things (IoT).

My research focus includes computer and information security analysis, control loop security analysis, risk assessment and security design, resiliency analysis and hardening, and secure and dependable resource allocation.

In my research, I primarily apply formal methods, artificial intelligence, and game theory.

Lixin Shen

RESEARCH ASSOCIATE ABOUT

- Academic Institution, Position: Syracuse University, Professor of Mathematics
- Degree(s)/Institution(s): Ph.D., Sun Yat-sen University
- Dates of Fellowship: 5/9/2022 - 8/9/2022
- Advisor: Dr. Erin Tripp
- Contact Information: lshen03@syr.edu

SUMMER RESEARCH DESCRIPTION

- Title: A Class of Nonsmooth Nonconvex Optimization Problems
- Objective: To develop theory and algorithms for nonsmooth, nonconvex optimization problems regularized by group sparsity promoting functions from various applications in imaging sciences and signal processing. The developed algorithms will be efficient and robust to find stationary points of problems.

Research interests: Optimization, Applied and Computational Harmonic Analysis, Image Processing

Jeremy Rosenbaum

- Undergraduate Student at Syracuse University
 - Rising Senior
 - Internship Dates: 6/6/22 – 8/5/22
 - Advisors: Dr. Lixin Shen and Dr. Erin Tripp
 - Contact Information: jrosenba@syr.edu
-

- Research Interests/Topics
 - ANNs (MLP)
 - Gradient Descent Methods
 - Non-Convex Optimization
 - Combinatorics

Jiafeng Xie

RESEARCH ASSOCIATE ABOUT

- Villanova University, Assistant Professor
- Ph.D. 2014, University at Pittsburgh
- Dates of Fellowship: 4/4/2022 - 6/24/2022
- Advisor: Dr. H. Shelton Jacinto
- Contact Information: jiafeng.xie@villanova.edu, <https://www.ece.villanova.edu/~jxie02/>

SUMMER RESEARCH DESCRIPTION

- Motivation: Binary Ring-Learning-with-Errors (BRLWE)-based post-quantum cryptography (PQC) is a promising candidate for ultra-lightweight PQC. Its efficient implementation on hardware platforms, however, has not been well covered in the literature.
- Objective: This project aims to deliver a fast hardware accelerator for the BRLWE-based PQC primitive, covering algorithmic derivation, architectural design, and final implementation.

Research interests:

- Cryptographic engineering: post-quantum cryptography accelerator design, implementation and security analysis
- Fault attack and detection: novel algorithm-to-architecture fault attack and detection methodologies for pre-/post-quantum cryptographic processor
- Hardware security: hardware IP protection and hardware security primitives for resource-constrained systems
- Computer arithmetic & digital design: VLSI digital signal processing and neural network systems design

Chengtao Xu

RESEARCH ASSOCIATE ABOUT

- Embry-Riddle Aeronautical University (Daytona Beach, Florida)
- Ph.D. Candidate in Department of Electrical Engineering and Computer Science
- Dates of Fellowship: 5/9/2022 - 7/27/2022
- Advisor: Doug Smith, AFRL/RIGC
- Contact Information: xuc3@my.erau.edu

SUMMER RESEARCH DESCRIPTION

- Motivation: To perform multi-user detection via blind signal separation in MIMO wireless receivers operating in highly dynamic channels, we are forced to adopt short data blocks to maintain quasi-stationarity within each block. However, short blocks results in deterioration of signal detection performance. Therefore, performance enhancement is needed. This research shows it's potentials on enhancing digital cancellation process on realizing MIMO Full Duplex System.
- Objective: To achieve signal detection performance enhancement, we study the technique of artificial data injection by linear interpolation to increase the effective data block size of blind signal separation. Important issues concerning practical application of this technique will be studied, such as the effects of source signals' modulation schemes, number of source transmissions, level of thermal noise, the type and amount of the artificial data injected, and the computational complexity resulted from the data injection operation.

Research interests:

MIMO Full Duplex System, Space Electro-optic Communication, CubeSat Swarm and Constellation, Statistical Signal Processing, Mm-wave Phase Array, Cognitive Radio.

Approved for Public Release; Distribution Unlimited: Case # AFRL-2022-2922



Tianyu Yang

RESEARCH ASSOCIATE ABOUT

- Embry-Riddle Aeronautical University (Daytona Beach, Florida), Professor of Electrical and Computer Engineering
- Ph.D. in Electrical Engineering, 2004, University of Central Florida, Orlando, Florida
- Dates of Fellowship: 5/2/2022 - 7/27/2022
- Advisor: Doug Smith, AFRL/RIGC
- Contact Information: yang482@erau.edu.

SUMMER RESEARCH DESCRIPTION

- Motivation: To perform multi-user detection via blind signal separation in MIMO wireless receivers operating in highly dynamic channels, we are forced to adopt short data blocks to maintain quasi-stationarity within each block. However, short blocks results in deterioration of signal detection performance. Therefore, performance enhancement is needed.
- Objective: To achieve signal detection performance enhancement, we investigate the technique of artificial data injection by linear interpolation to increase the effective data block size. Important issues concerning practical application of this technique will be studied , such as the effects of source signals' modulation schemes, number of source transmissions, level of thermal noise, the amount of artificial data injected, and the choice of the block size.

Research interests:

Statistical Signal Processing, Wireless Communications, Machine Learning, Distributed Control of Multi-agent Systems.

Yu Zhou

RESEARCH ASSOCIATE ABOUT

- SUNY Polytechnic Institute, Associate Professor
- Ph.D. 2004, The Johns Hopkins University
- Dates of Fellowship: 5/30/2022 - 8/05/2022
- Advisor: Dr. Jessica Dorismond
- Contact Information: zhouy2@sunypoly.edu

SUMMER RESEARCH DESCRIPTION

- Motivation: In a drone-truck combined ground mission, a swarm of UAVs provides surveillance coverage to guide the navigation of a ground vehicle, which vastly extends the sensing capability of the ground vehicle and largely improves the efficiency and safety of the mission.
- Objective: to explore an effective optimization algorithm for forming an optimal UAV swarm coverage around a ground vehicle from the perspective of energy efficiency subject to the constraints in UAV positioning, communication, and coverage.

Research interests:

1) Multi-robot collaboration, 2) robotic manipulation and manufacturing, 3) mobile robot navigation, 4) machine learning, 5) signal processing, 6) image processing.

Shaofeng Zou

RESEARCH ASSOCIATE ABOUT

- University at Buffalo, Assistant Professor
- Ph.D. 2016, Syracuse University
- Dates of Fellowship: 5/23/2022 - 8/12/2022
- Advisor: Dr. Alvaro Velasquez
- Contact Information: szou3@buffalo.edu, <http://www.acsu.buffalo.edu/~szou3/>

SUMMER RESEARCH DESCRIPTION

- Motivation: Recent empirical success of reinforcement learning (RL) in benchmark tasks has significantly boosted the interest in RL. However, most current RL approaches suffer from significant performance degradation when deployed in real world due to potential model deviation between training and test environments. Such model deviation may be caused by 1) modeling error between simulation and real world; 2) unexpected perturbation/attack to the system; and 3) system non-stationarity. Both modeling errors and model deviation between training and test environments can be viewed as external disturbances enforced on the system by an adversary, whose goal is to deteriorate the overall reward.
- Objective: The goal is to design reinforcement learning approaches that are provably robust to model deviations under various RL problem settings, e.g., non-Markovian reward, multi-chain MDP, multi-agent RL.

Research interests: My research interests include reinforcement learning, statistical signal processing, machine learning and information theory, e.g., design and analysis of sample-efficient and robust RL algorithms, quickest change detection, nonparametric anomaly/fault detection, and information theoretic security and privacy.