Andrew Chio

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Research Interests

My research interests lie in addressing issues of resilience within *Cyber-Physical Human Infrastructures* such as buildings, water, and power. Broadly, I am interested in developing systems that connect theoretical foundations with practical implementations by using model-driven (physics-inspired) and data-driven (learning-enabled) methods, e.g., network science principles, simulations, and IoT data.

Education

- **Ph.D. in Computer Science** — Sep 2019 – Jun 2026 (expected)
  University of California, Irvine
  Advisor: Prof. Nalini Venkatasubramanian

- **B.S. in Computer Science, specialization in Algorithms** — Sep 2015 – Jun 2019
  University of California, Irvine
  Magna Cum Laude – Graduated in top 4% of class

Professional Experience

- **Graduate Research Assistant, Full-time**, *Los Alamos, NM (remote)* — Apr 2025 – Present
  Theoretical Division, Los Alamos National Laboratory
  - T-5 Group: Applied Mathematics and Plasma Physics
- **Ph.D. Researcher**, *Irvine, CA* — Sep 2019 – Present
  Department of Computer Science, University of California, Irvine
  - Distributed Systems Middleware Group
  - Information Systems Research Group
- **Graduate Student Internship**, *Los Alamos, NM* — Jun 2024 – Sep 2024
  Theoretical Division, Los Alamos National Laboratory
  - T-5 Group: Applied Mathematics and Plasma Physics
- **Ph.D. Visiting Research Fellow**, *Los Alamos, NM* — Apr 2022 – Apr 2024
  Theoretical Division, Los Alamos National Laboratory
  - T-5 Group: Applied Mathematics and Plasma Physics
- **Undergraduate Research Assistant**, *Irvine, CA* — Sep 2018 – Jun 2019
  Department of Computer Science, University of California, Irvine
  - Distributed Systems Middleware Group
  - Information Systems Research Group

Awards & Achievements

- **Best Poster Award** — May 2025
  ACM/IEEE 2025 CPS-IoT Week PhD Forum
  - Awarded to 5 graduate students participating in the PhD Forum

Awards & Achievements (continued)

- **NSF CPS Rising Star 2025** Mar 2025
  National Science Foundation
  - Awarded to 30 graduate students (out of 174 applicants) across the US
- **NSF-ASI Japan Fellow** May 2024
  Advanced Studies Institute, National Science Foundation
  - Awarded to 12 graduate students across the US
- **ARCS Foundation Scholar** Sep 2022 – Sep 2024
  Orange County Chapter, ARCS Foundation
  - Awarded to 10 graduate fellows from UC Irvine
- **UC National Lab In-Residence Graduate Fellowship** Apr 2022 – Apr 2024
  Los Alamos National Laboratory, University of California Research Initiatives
  - Awarded to 7 graduate fellows across all University of California campuses
- **Mark Weiser Best Paper Award** Mar 2022
  20th IEEE International Conference on Pervasive Computing and Communications (PerCom)
- **Dean's Honor Roll** Sep 2015 – Jun 2019
  University of California, Irvine
- **SURF-IoT Summer Fellowship** Jun 2018 – Aug 2018
  Undergraduate Research Opportunities Program, University of California, Irvine
  - Awarded to 10 undergraduates from UC Irvine
- **Most Startup Potential: MediPal** Nov 2016
  Med AppJam, University of California, Irvine

Publications

Journal Articles

[J-4] **Andrew Chio**, Russell Bent, Kaarthik Sundar, and Nalini Venkatasubramanian. "Beyond Steady-State: A Decoupled Approach for N-k Interdiction with Immediate Automated System Response in Electric Power Grids". In: *Review* (2025).

[J-3] **Andrew Chio**, Jian Peng, and Nalini Venkatasubramanian. "STEP: Towards a Semantics-Aware Framework for Instrumenting Community-Scale Infrastructure". In: *Data Centric Engineering (DCE)* (2024). *JIF: 3.6 JCR2022.*

[J-2] **Andrew Chio**, Daokun Jiang, Peeyush Gupta, Georgios Bouloukakis, Roberto Yus, Sharad Mehrotra, and Nalini Venkatasubramanian. "SmartSPEC: A framework to generate customizable, semantics-based smart space datasets". In: *Pervasive and Mobile Computing (PMC)* (2023), p. 101809. *JIF: 4.3 JCR2023.*

[J-1] Yiming Lin, Daokun Jiang, Roberto Yus, Georgios Bouloukakis, **Andrew Chio**, Sharad Mehrotra, and Nalini Venkatasubramanian. "LOCATOR: Cleaning Wifi Connectivity Datasets for Semantic Localization". In: *Proceedings of the VLDB Endowment* 14.3 (Nov. 2020), pp. 329–341. ISSN: 2150-8097. *JIF: 2.5 JCR2022.*

Conference Proceedings

[C-6] **Andrew Chio**, Russell Bent, Kaarthik Sundar, and Nalini Venkatasubramanian. "SEQUIN: A Network Science and Physics-based Approach to Identify Sequential N-k Attacks in Electric Power Grids". In: *Proceedings of the 16th ACM/IEEE International Conference on Cyber-Physical Systems (ACM/IEEE ICCPS 2025)*. 2025.

[C-5] **Andrew Chio** and Andrey Y. Lokhov. "Physics-Based Occupancy Inference from Building Temperature Data". In: *Review*. 2025.

[C-4] **Andrew Chio**, Russell Bent, Andrey Y. Lokhov, Jian Peng, and Nalini Venkatasubramanian. "Physics-informed Pollutant Source Identification in Stormwater Systems". In: *Proceedings of the 22nd European Control Conference (ECC)*. 2024.

[C-3] Guoxi Wang, Ryan Hildebrant, **Andrew Chio**, Nalini Venkatasubramanian, and Sharad Mehrotra. "BatchIT: Intelligent and Efficient Batching for IoT Workloads at the Edge". In: *IEEE Network Operations and Management Symposium (IEEE NOMS 2024)*. 2024. *B CORE2023.*

[C-2] **Andrew Chio**, Jian Peng, and Nalini Venkatasubramanian. "STEP: Semantics-Aware Sensor Placement for Monitoring Community-Scale Infrastructure". In: *Proceedings of the 10th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (ACM BuildSys 2023)*. 2023, pp. 189–197. *A CORE2018.*

[C-1] **Andrew Chio**, Daokun Jiang, Peeyush Gupta, Roberto Yus, Georgios Bouloukakis, Sharad Mehrotra, and Nalini Venkatasubramanian. "SmartSPEC: Customizable Smart Space Datasets via Event-driven Simulations". In: *Proceedings of the 20th IEEE International Conference on Pervasive Computing and Communications (IEEE PerCom 2022)*. 2022, pp. 1–10. (**Mark Weiser Best Paper Award**), *A* CORE2021.*

Workshop Proceedings

[W-2] **Andrew Chio**, Daokun Jiang, Peeyush Gupta, Roberto Yus, Georgios Bouloukakis, Sharad Mehrotra, and Nalini Venkatasubramanian. "Artifact: SmartSPEC: Customizable Smart Space Datasets via Event-driven Simulations". In: *Proceedings of the 20th IEEE International Conference on Pervasive Computing and Communications (IEEE PerCom 2022)*. 2022, pp. 1–2.

[W-1] **Andrew Chio**, Georgios Bouloukakis, Cheng-Hsin Hsu, Sharad Mehrotra, and Nalini Venkatasubramanian. "Adaptive Mediation for Data Exchange in IoT Systems". In: *Proceedings of the 18th Workshop on Adaptive and Reflexive Middleware (ARM 2019)*. 2019, pp. 1–6.

Posters and Demos

[PD-2] **Andrew Chio**, Russell Bent, Kaarthik Sundar, and Nalini Venkatasubramanian. "Demo: SEQUIN: A Network Science and Physics-based Approach to Identify Sequential N-k Attacks in Electric Power Grids". In: *Proceedings of the 16th ACM/IEEE International Conference on Cyber-Physical Systems, Demo Session (ACM/IEEE ICCPS 2025)*. 2025.

[PD-1] **Andrew Chio**, Jian Peng, and Nalini Venkatasubramanian. "STEP: Semantics-Aware Sensor Placement for Monitoring Community-Scale Infrastructure". In: *ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, Posters and Demo Session (ACM BuildSys Posters and Demos 2023)*. 2023.

Other Publications and Presentations

[O-3] **Andrew Chio**. *Resilience for Large-Scale Cyber-Physical Human Infrastructures*. ACM/IEEE CPS-IoT Week PhD Forum. 2025. (**Best Poster Award**).

[O-2] **Andrew Chio**, Russell Bent, Kaarthik Sundar, and Nalini Venkatasubramanian. *Augmenting N-k Interdiction Models with Temporal Aspects for Electric Grid Networks*. 2025 Grid Science Winter School and Conference. 2025.

[O-1] **Andrew Chio**, Russell Bent, Kaarthik Sundar, and Nalini Venkatasubramanian. *SEQUIN: A Network Science and Physics-based Approach to Identify Sequential N-k Attacks in Electric Power Grids*. 2025 LANL Student Symposium. 2025.

News and Media Mentions

[N-2] Johnny Loc Nguyen. *ALOHA: Inside a UCI Mathematics Professor's Effort to Maximize Hybrid Learning*. https://www.compass.uci.edu/aloha-story/. Apr. 2024.

[N-1] Karen Phan. *Ph.D. Student Andrew Chio Named ARCS Scholar, UC National Lab In-Residence Fellow*. https://ics.uci.edu/2022/12/06/ph-d-student-andrew-chio-named-arcs-scholar-uc-national-lab-in-residence-fellow/. Dec. 2022.

Research Projects

Principle Investigator

◇ **LFRP In-Residence National Laboratory Graduate Fellows**, UCRI RGPO (L22GF4561)
Budget: $129,200.00, *(2022 – 2024)*
PIs: **Andrew Chio**, Nalini Venkatasubramanian, Russell Bent
Project Title: *Integrating Model and Data-Driven Methods in IoT-enabled Resilient Infrastructure*

- Explored different approaches for addressing issues of resilience in critical utility infrastructures (stormwater systems, electric grid networks, buildings)
- Developed a network science and optimization based approach for identifying worst-case sequential failures using a sequential N-k interdiction model
- Formulated the N-k-k' interdiction problem that considers cascading failures in the grid during and immediately after failures, which is solved through a decoupled optimization approach
- Proposed a simple, physics-based thermal dynamics model for heat transfer in buildings, which is used to derive the occupancy map of a building from coarse-grain temperature sensor observations
- Developed a physics-informed backwards inference model to quickly and efficiently reconstruct potential pollutant discharge sources and their associated flows in stormwater systems

Graduate Student Researcher

◇ **NSF-JST: Enabling Human-Centered Digital Twins for Community Resilience** NSF-JST (2420846)
Budget: $299,798, (2024-2027)
PIs: Nalini Venkatasubramanian, Sharad Mehrotra, Ronald Eguchi

- Studying resilience of power grid networks under varying types of failures (concurrent, sequential, cascading) and their impact on other critical infrastructures and communities

◇ **NSF SWADE: Smart WAter Data Exchange**, NSF S&CC (1952247)
Budget: $1,499,943.00 (2020-2025)
PIs: Nalini Venkatasubramanian, Sharad Mehrotra, Shangping Ren, David Feldman, Ronald Eguchi

- Exploring adaptive, causality-based methods for pollutant discharge anomaly detection and control
- Developed a physics-informed backwards inference model to quickly and efficiently reconstruct potential pollutant discharge sources and their associated flows
- Constructed a sensor placement decision-support tool that proposes practical deployments for sensors to balance coverage and traceability objectives in stormwater systems

◇ **Privacy Cognizant IoT Environment for the Brandeis Program**, DARPA (FA8750-16-2-0021)
Budget: $5.2M (2015-2021)
PIs: Sharad Mehrotra, Alfred Kobsa, Nalini Venkatasubramanian

- Developed realistic simulations of human trajectories in a navy ship for mission-critical and daily operation use cases, as part of the Trident Warrior exercise in 2019 and 2020
- Proposed a mediation-based architecture for supporting heterogeneous communications and protocols in IoT systems

Research Prototypes

◇ **SEQUIN**: An analysis toolkit for exploring worst-case sequential attacks on power grids
More info: https://github.com/andrewgchio/SEQUIN

Research Prototypes (continued)

- **STEP**: A dashboard for sensor placement, that leverages insights from structural, behavioral, and semantic aspects of a stormwater infrastructure for suitable deployments
  More info: `https://github.com/andrewgchio/STEP`
- **SmartSPEC**: A smart space simulator and data generator that creates customizable smart space datasets using semantic models of spaces, people, events and sensors
  More info: `https://github.com/andrewgchio/SmartSPEC`

Teaching Experience

- **Graduate Teaching Assistant** Sep 2019 – Jun 2021
  Department of Computer Science, University of California, Irvine
  - ICS 46: Data Structures Implementation and Analysis (*Fall '19*)
  - ICS 33: Intermediate Programming (*Winter '20*, *Fall '20*, *Winter '21*, *Spring '21*)
  - CS 143A: Principles of Operating Systems (*Spring '20*)
- **Undergraduate CLAP Learning Assistant** Sep 2018 – Jun 2019
  Department of Mathematics, University of California, Irvine
  - Math 1B: Pre-Calculus II (*Fall '18*, *Winter '19*)
  - Math 2B: Single-Variable Calculus II (*Spring '19*)
- **Undergraduate CLAP Learning Assistant** Sep 2017 – Jun 2019
  Department of Physics and Astronomy, University of California, Irvine
  - Physics 7LC: Classical Physics Lab (*Fall '17*, *Winter '18*, *Spring '18*, *Fall '18*, *Winter '19*, *Spring '19*)
- **Undergraduate Reader** Sep 2017 – Dec 2018
  Department of Computer Science, University of California, Irvine
  - ICS 46: Data Structure Implementation and Analysis (*Fall '17*, *Winter '18*, *Fall '17*)

Mentoring

- **IoT-SITY Graduate Student Mentor**
  - Miguel A Melo Ochoa, *San Diego State University*, 2024
  - Anton Dimitriev, *Washington University in St. Louis*, 2023 (Co-mentor: Ryan Hildebrant)
  - Christina Youn, *University of Notre Dame*, 2020 (Co-mentor: Praveen Venkateswaran)
- **Undergraduate Researchers**
  - Max Peng, *University of California, Santa Barbara*, 2025
  - Rohit De, *University of California, Irvine*, 2025
  - Nhat Matthew Phan, *University of California, Irvine*, 2025

Professional Service

- **Technical Program Committee Member**
  - IEEE International Conference on Pervasive Computing and Communications (PerCom): 2023
- **Artifact Evaluation Committee Member**
  - IEEE International Conference on Software Architecture (ICSA): 2024
- **Invited External Reviewer**
  - ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS): 2025
  - ACM/IFIP International Middleware Conference (Middleware): 2024, 2025
  - ACM International Conference on Distributed and Event-based Systems (DEBS): 2025
  - Journal of Ambient Intelligence and Smart Environments (JAISE): 2023

Skills

- **Programming**: C/C++, Python, Julia, Java, Bash, x86 Assembly, MIPS Assembly, LaTeX
- **Tools**: Vim, Anaconda, Jupyter Notebooks, Docker, Grafana, AWS, GNS3, Linux, Windows, Raspberry Pi

References

Available on Request