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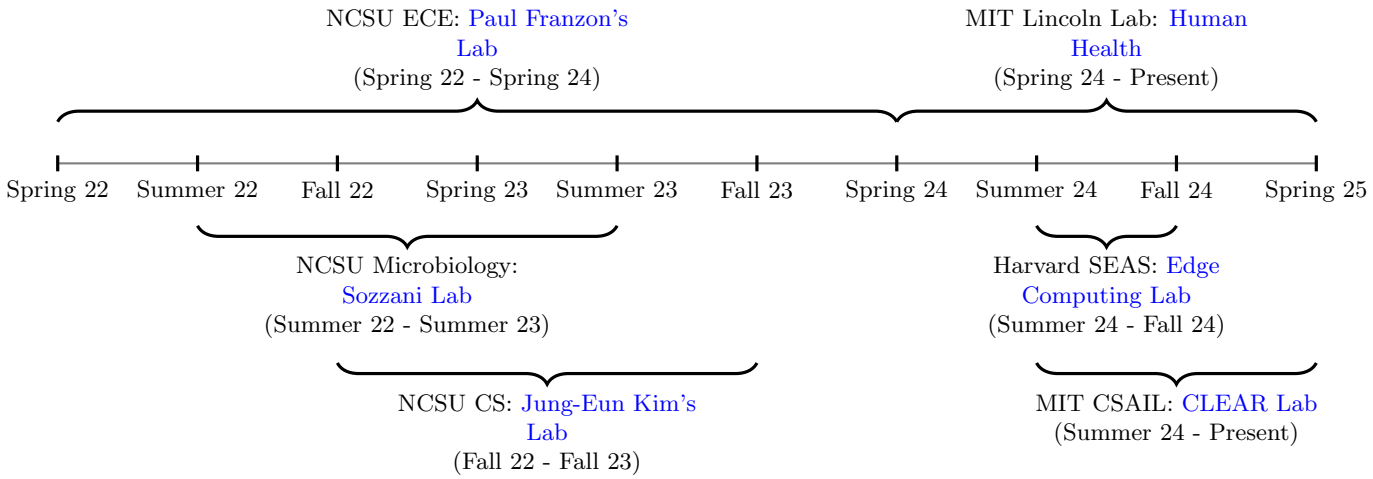
US Citizen with Secret Clearance

Research Institutions

- **Massachusetts Institute of Technology Lincoln Laboratory** — Lexington, MA
  Student Technical Staff (CO-OP) in Human Health and Performance Systems — *Feb 2024 - Ongoing*
  - Developing computer-vision algorithms for brain mapping based on 3D confocal microscopy data.
  - Investigating how to reduce energy consumption in mobile image-segmentation systems to improve the AI Guide, an emergency surgical tool.
  - Introducing meta-learning for self-supervised pre-training of tomography foundation models.
  - Estimating the intents and behaviors of health-care professionals via control theoretic and inverse reinforcement learning frameworks.
- **North Carolina State University** — Raleigh, NC
  Ph.D Student in Electrical Engineering advised by Prof. Paul Franzon — *Aug 2021 - on sabbatical as of Jan 2024*
  - Dissertation Topic: Reinforcement Learning, Graphs and Language Models for Electronic Design Automation
  - Research Interests: Neural Network {Model Calibration, Pruning, Knowledge Distillation, Unsupervised Domain Adaptation}, Language Model {Multimodality, Fine-tuning}, Diffusion Models and Graph Networks.
  - GPA: 3.87/4.00
- **The University of Texas at Austin** — Austin, TX
  Bachelor of Science in Electrical Engineering — *Aug 2016-May 2021*
  - Primary Interest: Data Science, Digital Image/Video Processing, Digital Signal Processing
  - Computational Science and Engineering Research Program
  - Terry Foundation Scholar (full tuition and housing)
  - GPA: 3.43/4.00

Collaboration Timeline



My timeline of research collaborations across multiple institutions. At NCSU, concurrently I worked in three different labs in ECE, CS, and Microbiology, balancing research, mentoring, teaching, and grant writing. Later, while working at MIT Lincoln Laboratory, I again concurrently collaborated with researchers at MIT CSAIL and Harvard SEAS.

Research Funding Contributions: $313,000

- **CISCO Research** — 08/16/2024
  $75,000 *Rapid 3DIC Thermal Modeling* — *Co-Author*
  - Proposed a diffusion model for transforming power maps into high-resolution heat maps, improving accuracy over traditional methods.
  - Co-wrote the proposal with Prof. Franzon and a labmate.
- **CAEML Research Award** — 04/28/2024
  $70,000 *Natural Language Optimization Models for PCBs and Analog ICs* — *Co-Lead Contributor*

- Developed research vision and methodology for using LLMs in multi-modal query-based optimization.
- Co-led proposal writing with Prof. Franzon; produced technical preview.

- **Qualcomm Innovation Fellowship** 05/03/2023
  $100,000 *Reinforcement Learning for 3D Floorplanning in EDA* *Lead Contributor*
  - Proposed and defended novel RL approaches for floorplanning over three rounds of evaluation.
  - Co-led proposal with a labmate; supervised by Prof. Franzon and Prof. Xiaorui Liu.
- **CAEML Research Award** 04/11/2023
  $68,000 *Siamese-Graph Neural Networks for Circuit Graph Isomorphism Detection* *Lead Contributor*
  - Developed core SGNN architecture and research methodology.
  - First author on the proposal; supervised by Prof. Franzon.

In Preparation (First-Author-Level Effort)

- **Motivation-Guided Feature Generalization for Inverse Reinforcement Learning**
  Supervised by Prof. Bobu of MIT CSAIL's CLEAR Lab
  - Work involving language and human robot interaction.
- `[REDACTED]`
  Supervised by MIT LL
  - Work involving meta learning and estimation theory.

Publications/Under Review/Under Revision

- **The Over-Certainty Phenomenon**
  Under review at ICML '25. First author. Supervised by Prof. Jung-Eun Kim
  - Introduced a novel unsupervised domain adaptation algorithm (UDA) which improves calibration.
  - Identified key issues in state-of-the-art UDA algorithms which harm model calibration.
  - Retained comparable accuracy to SOTA.
- **Just Go With The (Optical) Flow!**
  Under review at IEEE EMBC '25. First author. Supervised by MIT LL
  - Developed an optical flow-based approach to enhance axon centerline detection and tracing in 3D microscopy data.
  - Demonstrated that interpreting volumetric imaging data as sequential frames improves spatial feature extraction for neuron structure identification.
- **A Domain-Specific Q&A Dataset for Computer Architecture**
  Published in IEEE CAL. Contributing author. Supervised by Harvard Edge Computing Lab
  - Developed a Q&A dataset for benchmarking LLMs in computer architecture.
  - Assessed LLMs, identifying gaps in systems topics like memory and interconnects.
  - Proposed a roadmap to enhance LM reasoning and design capabilities.
- **Topology-Aware Deep Supervision for Axon Centerline Detection**
  To appear at IEEE ISBI '25. Co-first author. Supervised by MIT LL, MBF Bioscience, and Univ. Central Florida
  - Addressed the issue of limited annotations for axon centerline detection data in brain mapping.
  - Improved performance over baseline despite using only 66% of the annotations.
  - Maintained performance for fully-annotated setting.
- **Mobile-Optimized Real-Time Vessel Segmentation for Ultra-Sound Guided Surgery**
  Published in IEEE HPEC '24. Second author. Supervised by MIT LL
  - Investigated various pruning/quantization techniques for real-time image segmentation of human vessels.
  - Contributed to writing a custom application for evaluating performance on a mobile AI system.
  - Motivated the processing of tomographic segmentation algorithms from a discrete computer to a mobile AI system in the next generation of AI Guide.
- **Large Reasoning Models for 3D Floorplanning in EDA**
  Under revision. First author. Supervised by Qualcomm Fellowship and Prof. Franzon
  - Developed an architecture that integrates sequence-to-sequence reinforcement learning algorithms, enhancing the model's ability to reason over large discrete action spaces.
  - Achieved notable improvements in sample efficiency by incorporating non-expert trajectories.
  - Evaluated the model against the SOTA ML approach, demonstrating superior performance in reducing wirelength and reasoning over multiple objectives.
- **Can Low-Rank Knowledge Distillation be Useful for Microelectronic Reasoning?**
  Published in IEEE/ACM LAD '24. Co-first author. Supervised by Prof. Franzon

- Introduced a novel LLM adaptation technique, low-rank knowledge distillation (LoRA-KD).
- Evaluated Llama-2-7B's performance as a microelectronics Q&A expert, focusing on its reasoning and problem-solving abilities.
- Released an evaluation benchmark to support future research.

- **Optimal Brain Dissection**
  Published in IEEE BIP '23. First author. Supervised by Sozzani Lab and USDA
  - Won Best Paper award.
  - Introduced a technique for feature-importance determination that exploits pruning algorithms.
  - Outperformed the *de facto* gene regulatory network with respect to explaining gene expressions.
- **DepthGraphNet**
  Published in IEEE/ACM MLCAD '23. First author. Supervised by Prof. Franzon
  - Investigated the use of siamese-graph neural networks for circuit graph isomorphism (CGI) detection.
  - Empirically demonstrated logarithmic run-time complexity with respect to graph size.
  - Outperformed all other classical and neural methods in CGI detection accuracy.
- **Network Inference Approach for Phosphoproteomics**
  Published in Springer MIMB vol. 2690. Second author. Supervised by Sozzani Lab
  - Described methods to statistically analyze label-free phosphoproteomic data and infer post-transcriptional regulatory networks over time.
  - Used the Bayesian Dirichlet Equivalent Uniform to inference underlying latent causal relationships between variables.

In Preparation (Contributer-Level Effort or Supervision)

- **Is This Worth Asking?**
  Supervised by Prof. Bobu of MIT CLEAR Lab
  - Work involving understanding human effort answering questions.
- **Large Language Optimization Model for Electronic Design**
  Supervised by Prof. Franzon
  - Work involving the design of a multi-modal agent which interfaces with optimization algorithms.
- **Diffusion Models for Rapid 3DIC Thermal Modeling**
  Supervised by Prof. Franzon
  - Work involving the design of a conditional diffusion model which estimates the thermal properties of 3DICs.

Research Talks and Clinics

- MLCAD talk on *Large Reasoning Models for 3D Hard Macro Placement.* 09/11/2024
- Qualcomm Innovation Fellowship invited talk on *Large Reasoning Models for 3D Floorplanning.* 07/30/2024
- LLM-Aided Design talk on *Low-Rank Knowledge Distillation for LLMs.* 06/29/2024
- MIT-LL clinic on *Axon centerline detection using 3D-UNets.* 05/18/2024
- BioInspired Processing talk on *Optimal Brain Dissection.* 11/29/2023
- MLCAD talk on *Siamese-Graph Neural Networks for Circuit Graph Isomorphism Detection.* 09/12/2023

Professional Service

- Mentor to four Ph.D students.
- Reviewer for Neurips Workshop on Foundation Models for Science (FM4Science 2024).
- Contributor to *Machine Learning Systems: Principles and Practices of Engineering Artificially Intelligent Systems*, the textbook used for Harvard's CS249R (a course on TinyML).
- Contributor to Tensorflow Probability, SciKit Learn, and Deep Robust python libraries.
- Director of NC State Community Affairs for ECE Graduate Students Association (2021-2022).
- Organized NC State ECE Research Symposium January 28, 2022.
- Organized NC State TEDx Talk with Analog Devices, March 7, 2022.
- Member of UT Austin IEEE Robotics and Automation Society.
- Each year, incoming ECE Ph.D. students at NCSU watch a video titled *How to Succeed Doing a Ph.D in ECE.* The presentation includes me as an example of a Ph.D. student navigating the program successfully.
- Director of Student Affairs for UT Austin Planet Longhorn (International Students Org) (2020-2021).

Teaching

- **ECE 220 Analytical Foundations of ECE** — Raleigh, NC
  Teaching Assistant for North Carolina State University — *Aug 2022 - May 2023*
  - Taught a sophomore-level course on circuit theory, control, differential equations and communication systems.
  - Supervised weekly labs which introduced students to MATLAB.
  - Graded homework and exams.
  - Gave career advice to aspiring engineers.
- **ECE 301 Linear Systems and Signals** — Raleigh, NC
  Teaching Assistant for North Carolina State University — *Aug 2021 - May 2022*
  - Taught a junior level course on linear systems and signals.
  - Wrote exams and lead recitation twice a week.
  - Taught students introductory machine learning in MATLAB.
  - Graded homework and exams.
  - Received outstanding feedback from my students.
- **Signal Processing and Data Science Tutor** — Austin, TX
  Varsity Tutors — *Feb 2021 - July 2021*
  - Tutored undergraduates in data science, linear systems and signals
  - Taught introductory classes in Java and Python
  - 4.9/5.0 stars (top 10% of all tutors on platform)

Technical Skills

- Very experienced with PyTorch and TensorFlow.
- Daily usage of Python. Skilled with Java.
- Seasoned with libraries such as OpenCV, PIL, sci-kit-image, Gym and PyBullet.
- Skilled at digital {tomography, image, video, voxel} processing. Strong background in applied reinforcement learning, pattern recognition, detection/estimation theory, Bayesian optimization and large scale self-supervised learning.
- Growing experience in stochastic geometry, algebraic topology and inverse RL.