Fin Amin

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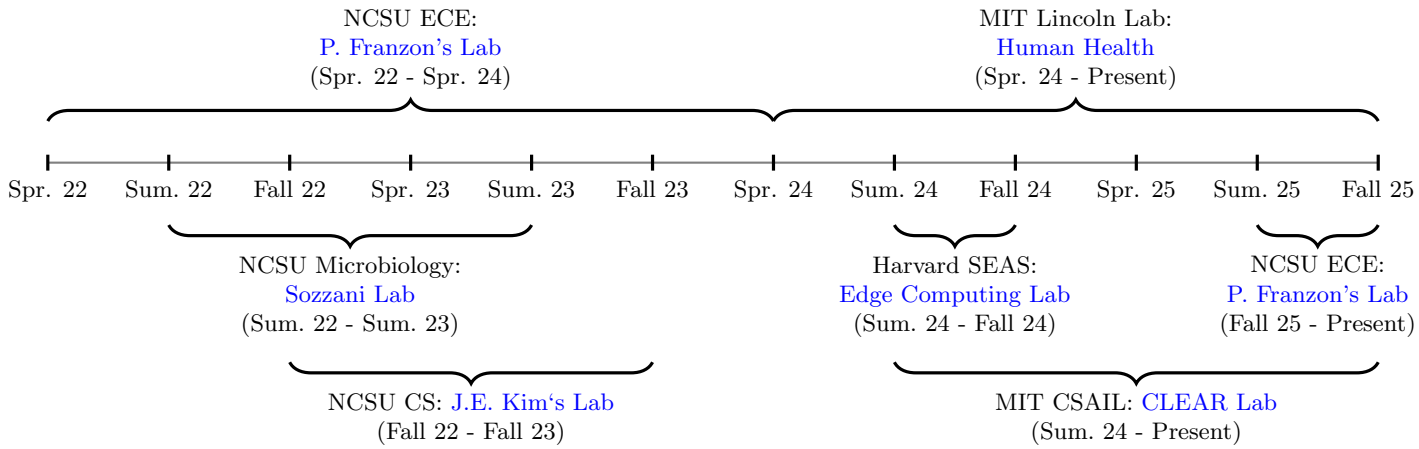
US Citizen with Secret Clearance

Research Institutions

- **Massachusetts Institute of Technology Lincoln Laboratory** — Lexington, MA
  CO-OP in Human Health and Performance Systems — *Feb 2024 - Ongoing*
  - Developing computer-vision algorithms for brain mapping, as part of the NeuroTrALE project.
  - Investigating mobile image-segmentation systems to improve the AI Guide, an emergency surgical tool.
  - Quantifying the performance of SSL strategies for tomography.
  - Introduced a trajectory smoothing algorithm that significantly improved ultrasound reconstruction performance; nominated for the laboratory-wide Best Paper of 2025 Award.
- **North Carolina State University** — Raleigh, NC
  Ph.D. Student in Electrical Engineering advised by Prof. Paul Franzon — *Aug 2021 - part-time as of Jan 2024*
  - Dissertation Topic: Resource-Aware Deep Learning for Electronic Design Automation
  - Research Interests: Reinforcement Learning, Neural Network {Model Calibration, Pruning, Knowledge Distillation, Test-Time Adaptation}, Language Model {Multimodality, Fine-tuning}, Diffusion Models and Graph Networks.
- **The University of Texas at Austin** — Austin, TX
  Bachelor of Science in Electrical Engineering — *Aug 2016-May 2021*
  - Primary Interests: Data Science, Digital Image/Video Processing, Digital Signal Processing
  - Computational Science and Engineering Research Program advised by Prof. Al. Bovik.
  - Terry Foundation Scholar (full tuition and housing)

Collaboration Timeline



My timeline of all the labs I have produced research with. At NCSU, I concurrently worked in three labs in ECE, CS, and Microbiology, balancing research, mentoring, coursework, teaching, and grant writing. While working at MIT Lincoln Laboratory, I concurrently collaborated in labs at MIT CSAIL and Harvard SEAS.

Research Funding Contributions: $313,000

- **CISCO Research** — 08/16/2024
  $75,000 *Rapid 3DIC Thermal Modeling* — *Co-Lead Contributor*
  - Proposed a diffusion model for transforming power maps into high-resolution heat maps, improving sample efficiency 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.

[0] I had significant technical contributions to these grants/fellowships. They were earned with Prof. Franzon as the PI.

- **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.
  - 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.
  - Wrote the proposal and developed a technical preview; supervised by Prof. Franzon.

In Preparation (First-Author-Level Effort)

- **A Generalist Agent for Electronic Design**
  Supervised by Prof. Franzon
  - Work involving developing a general agent for numerous EDA tasks.
- **A Motion Restoration Framework for Trackerless Freehand 3D US**
  Supervised by MIT LL
  - Work involving trajectory smoothing for freehand US. An extension of [13] for IEEE Trans. Biomedical Engineering.

Publications/Under Review

[14] **GIFT: Generalizing Intent for Flexible Test-Time Rewards**
Under review at IEEE ICRA '26. First author. Supervised by MIT CSAIL
- First work to formulate test-time reward generalization from human intent.
- Introduced a framework that infers high-level human intent from demos to generalize unseen states to training states.
- Enabled reward reuse under distribution shift without retraining by conditioning similarity on inferred intent.
- Validated on 7-DoF Jaco (simulation) and Franka Panda (real-world) robots across tabletop manipulation tasks.

[13] **Boosting Framework for Trackerless Freehand 3D US Reconstruction Estimators**
Under review at IEEE ICASSP '26. First author. Supervised by MIT LL
- Introduced a boosting-based correction framework for trackerless freehand 3D ultrasound reconstruction.
- Learned residual updates in Lie algebra, $\mathfrak{se}(3)$, to correct systematic drift and jitter in pose estimations.
- Demonstrated significant improvements over oracle variants of prior art.

[12] **Just Go With The (Optical) Flow!**
Published in IEEE EMBC '25. First author. Supervised by MIT LL, MBF Bioscience, and Univ. Central Florida
- Invited for an oral presentation.
- Developed an optical flow-based approach to enhance axon centerline detection and tracing in 3D microscopy data.
- Demonstrated that interpreting volumetric imaging data as videos extracts directional features for neuron structure identification.

[11] **Topology-Preserving Deep Supervision for Axon Centerline Detection**
Published in 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.

[10] **Mobile-Optimized Real-Time Vessel Detection for Ultra-Sound Guided Surgery**
Published in IEEE HPEC '24. Second author. Supervised by MIT LL
- Implemented tomographic vessel detection algorithms on a smartphone platform.
- Adapted methods for deployment in the next-generation AI Guide mobile system.
- Explored pruning and quantization techniques for real-time segmentation.
- Developed a custom mobile app to benchmark performance.

[9] **The Over-Certainty Phenomenon**
Published in TMLR (Aug. '25). First author. Supervised by Prof. J.E. Kim
- Identified a trend in the design of test-time adaptation algorithms (TTA) which harms model calibration.
- Introduced a novel TTA algorithm which improves calibration while maintaining accuracy uplifts.

[8] **Addressing Large Action Spaces in 3D Floorplanning via Spatial Generalization**
Under review at IEEE/ACM ISQED '26. First author. Supervised by Qualcomm Fellowship and Prof. Franzon
- Investigated continuous action representations in RL for 3D floorplanning to improve scalability and spatial generalization.
- Developed a decision-transformer-based model that reasons over continuous placements and discretizes only at inference.

- Demonstrated that spatial inductive biases enable learning from non-expert and random trajectories.

[7] **A Domain-Specific Q&A Dataset for Computer Architecture**
Published in IEEE CAL. Contributing author. Supervised by Harvard Edge Computing Lab
- Selected for HPCA Best of IEEE Computer Arch. Letters Session.
- Developed a Q&A dataset for benchmarking LMs in computer architecture.
- Proposed a road map to enhance LM reasoning and design capabilities.

[6] **Language-Model Interfaces for SerDes Design Optimization**
To appear at IEEE ECTC '26. Contributing author. Supervised by Prof. Franzon and Hewlett Packard Enterprise
- Developed an LM-guided design-space exploration workflow for SerDes equalization parameters, integrating circuit simulation outputs into an automated optimization loop.
- Explored frameworks for interfacing LM agents with optimization tools.

[5] **A Conditional Diffusion Framework for Sample-Efficient Thermal Modeling in 3DICs**
Published in IEEE EPEPS '25. Second author. Supervised by Prof. Franzon. Funded by Cisco
- Invited for an oral presentation.
- Proposed HeatDiffUNet, a conditional diffusion model for static temperature prediction from power maps.
- Demonstrated sample-efficient thermal modeling.

[4] **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).
- Released an evaluation microelectronics Q&A benchmark to support future research.

[3] **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.

[2] **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.

[1] **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 and cognitive load.
- **Actor-Critic Frameworks for Analog Design**
Supervised by Prof. Franzon
  - Work involving the design of agentic feedback loops that interface with optimization.

Invited 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
- Qualcomm Innovation Fellowship invited talk on *Challenges in Using RL for 3D Placement.* 05/29/2024
- MIT-LL clinic on *Axon Centerline Detection Using Large Spatial Models.* 05/18/2024
- BioInspired Processing Best Paper Award talk on *Optimal Brain Dissection.* 11/29/2023
- CAEML seminar on *Siamese-Graph Neural Networks for Circuit Graph Isomorphism Detection.* 05/12/2023

Professional Service

- Reviewer for IEEE International Conference on Robotics and Automation (ICRA '26), IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP '26), IEEE Software Journal (special edition '26), IEEE Body Sensor Networks (BSN '25), and NeurIPS Workshop on Foundation Models for Science (FM4Science '24).
- Mentor to two Ph.D students.
- Contributor to Tensorflow Probability, SciKit Learn, and Deep Robust Python libraries. Contributor to *Machine Learning Systems*, the textbook used for Harvard's CS249R (a course on TinyML)
- 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 (2018-2021).
- 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 led recitation twice a week; taught 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 ML libraries such as OpenCV, PIL, sci-kit-learn, and Gym. Experienced with HPCs (SLURM)
- Experience with robotics and physics simulation libraries such as PyBullet and Polymetis.
- Skilled at digital {tomography, image, video, voxel} processing. Strong background in applied reinforcement learning, pattern recognition, detection/estimation theory, Bayesian optimization, control theory and large-scale SSL.
- Growing experience in causality (Pearl), Lie algebra, convex optimization, online learning, statistical learning theory, complex analysis, finite-element techniques, inverse RL and spectral graph theory.