Harikrishna Kuttivelil

harikuttivelil@gmail.com | linkedin.com/in/hskutti | github.com/harikuts

Education

University of California, Santa Cruz — Santa Cruz, CA, USA
Doctor of Philosophy in Computer Engineering — *Jan. 2020 – Dec. 2026 (expected)*
Thesis: Collaborative optimization of differentiated deep learning models in networks of heterogeneous clients
Advisor: Dr. Katia Obraczka | **Affiliations**: Inter-Networking Research Group (i-NRG), Teaching & Learning Center (TLC)

University of California, Santa Cruz — Santa Cruz, CA, USA
Bachelor of Science in Computer Engineering • *Cum Laude with Honors* — *Sept. 2013 – June 2017*

Experience

University of California, Santa Cruz — Santa Cruz, CA, USA
Graduate Student Researcher — *Jan. 2020 – present*
- Conducted novel research in decentralized collaborative deep learning optimization in resource-constrained networks
- Designed and published on methods, tools, and stacks on deploying models and experiments for edge intelligence systems
- Managed teams of graduate, undergraduate, and undergraduate interns in large research projects within i-NRG
- Published academic literature, produced internal and external documentation, and procured grants and fellowships

Associate Instructor — *Sept. 2021 – Dec. 2025*
- Developed and taught undergrad course (CSE20) on Python, applying UDL and active learning to improve student experience
- Selected as the TLC Graduate Pedagogy Fellow of Computer Science to develop and disseminate novel teaching strategies
- Redesigned core graduate course (CSE200) and taught basic professional skills in research and teaching in computer science

Inria Université de Côte d'Azur — Sophia-Antipolis, France
Visiting Doctoral Student — *Oct. 2022 – Apr. 2023*
- Facilitated and advanced collaborative, interdisciplinary research initiatives between teams located in Europe and the USA
- Conducted research on novel sensor network intelligence protocols for heterogeneous device and network deployments
- Represented teams' research interests and stakes to identify opportunities to seed and grow academic partnerships

Maxar Technologies — San José, CA, USA
Associate Software Engineer — *July 2017 – Jan. 2020*
- Developed dynamic spacecraft simulator with models for temperature, solar exposure, and orbits
- Conducted digital twin experiments for multiple spacecraft in collaboration with internal and external partners
- Developed bus and networking emulations for modeling new on-board hardware for future satellite launches

Projects

NSB: Network Simulation Bridge | *Python, C++, Redis, Google Protobuf, OMNeT++, ns-3* — Dec. 2022 – present
- Created a open-source co-simulation tool to bridge applications to network simulators, enabling cross-layer modeling
- Built high-bandwidth, low-latency async socket pipelines with Protobuf MPI, using Redis to store large payloads
- Provided modular interconnects for new features, user-facing documentation, and Python and C++ API bindings
- Published proof-of-concept at ACM MSWIM 2023 and presented at IEEE ICDCS 2025 – a premier systems conference
- Awarded NSF Pathways to Enable Open Source Ecosystems (POSE) Phase I grant to fund transition to open source
- Invited to NSF Innovation Corps to grow open source ecosystem, conducted 100+ user discovery interviews

Strudel: Distributed Deep Learning Experimental Platform | *Python, PyTorch, MLX, Pandas, OMNeT++* — Aug. 2023 – Dec. 2025
- Created discrete event simulation (DES) platform for modeling distributed deep learning scenarios over networks
- Architected modular plug-and-play interfaces for various datasets, models, networks, and experimental configurations
- Validated various state-of-the-art federated learning protocols on IoT applications (e.g., image recognition, weather
- Implemented flexible ML frameworks for optimized performance in both Nvidia CUDA and Apple Silicon environments

Skills

Languages: Python, C++, Java | **Libraries:** PyTorch, MLX, TensorFlow, Pandas, NumPy, SciPy, NetworkX, MatPlotLib
Infrastructure: Git, Docker, Redis, SQL, Protobuf | **Networking:** Client-Server, P2P, Socket Programming, Simulation
ML Systems: Federated & Gossip Learning, Reinforcement Learning, Knowledge Distillation, Parameter-Efficient Fine-Tuning
Communications: Academic Writing, Workshop Facilitation, Agile Management, Open Source, Ecosystem Development
Teaching: Universal Design Language (UDL), Technical Mentorship | **Tools:** LaTeX, PowerPoint, Draw.io, Doxygen

Awards

2026 **Innovation Corps Program (NSF I-Corps)** | National Science Foundation
Designated as the team lead in an invite-only program to develop skills in product ecosystem governance, discovery, and growth; 1 of 18 teams invited from the entire USA for the Winter 2026 cohort.

2025 **Pathways to Enable Open-Source Ecosystems (NSF POSE) Phase I** | National Science Foundation
Open-Sourcing the Network Simulation Bridge for Networked Applications Development – PI: Dr. Katia Obraczka
Applied as the primary author and won $300000+ award for the development of the open-source ecosystem for the NSB (Network Simulation Bridge) tool; 1 of 44 projects selected from the entire USA in 2025.

2024 **COR Large Grants Program (CLGP)** | Committee-on-Research (COR) at UC Santa Cruz
Towards AI Democratization Through Decentralized Edge Intelligence – PI: Dr. Katia Obraczka
Applied as the primary author and won the maximum award of $12000 for research AI/ML democratization and decentralized algorithms for edge intelligence; 1 of 32 projects selected from UC Santa Cruz in the 2024-2026 period.

2022 **TLC Graduate Pedagogy Fellowship** | Teaching & Learning Center (TLC) at UC Santa Cruz
Selected to research novel teaching methods, disseminate knowledge within Computer Science & Engineering (CSE) department, and redesign a core course for CSE graduate students; 1 of 25 selected across all disciplines at UC Santa Cruz.

2020 **Best Teaching Assistant Award** | Computer Science Department & Engineering (CSE) at UC Santa Cruz
Recognized for transitioning the Intro. to Computer Networks (CSE150) course and lab experiences to an online synchronous format due to the COVID-19 pandemic; singly selected from the department during the 2019-2020 academic year.

2019 **Apogee Award** | Maxar Technologies
Recognized for improving dynamic spacecraft simulation with smarter temperature modeling and hardware bus emulation.

Publications

2025 **Chisme: Fully Decentralized Differentiated Deep Learning for IoT Intelligence**
preprint – *Harikrishna Kuttivelil, Katia Obraczka* – arXiv
Novel gossip learning method for joint model training differentiated for clients' underlying data distributions.

2025 **Network Simulation Bridge: Bridging Distributed Applications with Network Simulation Platforms**
tutorial – *Harikrishna Kuttivelil, Katia Obraczka* – IEEE ICDCS 2025 | Workshops
Public release of re-factored network co-simulation framework (NSB) and demonstration of high-bandwidth message relays.

2024 **Modeling, Simulating, and Evaluating Complex End-to-End Edge Intelligence Systems**
book chapter – *Harikrishna Kuttivelil, Katia Obraczka* – Springer
Taxonomy and guide to test-driven design and development of edge intelligence systems, part of the *IoT Edge Intelligence* book.

2023 **Network Simulation Bridge: Bridging Applications to Network Simulators**
paper – *Harikrishna Kuttivelil, Shesha Sreenivasamurthy, Lakshmi Krishnaswamy et al.* – ACM MSWIM 2023 | Q2SWinet
Proof-of-concept for NSB, a client-server framework for API-accessible MPI-based network co-simulation.

2021 **Community-Structured Decentralized Learning for Resilient Edge Intelligence**
workshop – *Harikrishna Kuttivelil, Katia Obraczka* – ACM SOSP 2021 | ResilientFL
Preliminary work exploring the potential of fully decentralized federated learning within metadata-oriented communities.

Course Development

2023–25 **Research & Teaching in Computer Science & Engineering** *(Graduate Course)*
Full Course Redesign & Course Instruction – CSE200 – University of California, Santa Cruz
Mandatory core course on developing basic research and teaching skills. Redesigned to be more engaging and multi-modal via curated activities, provided pathways for research involvement, and uplifted teaching as a community practice. Introduced peer-led modality of instruction to foster community and exchanges of knowledge and experience within CSE.

2025 **Internet-of-Things** *(Undergraduate Senior Project Course & Lab)*
Initial Course Design & Lab Design – CSE157/L – University of California, Santa Cruz
Advanced course on sensor interfacing, computer networking, and data processing. Contributed to application-based curriculum, designed scaffolded projects that culminated in a final miniature smart greenhouse project.

2021 **Introduction to Programming in Python** *(Undergraduate Lower-Division Course)*
Course Material Redesign & Course Instruction – CSE20 – University of California, Santa Cruz
Beginner course on teaching programming basics via Python. Redeveloped materials and activities for online engagement, exposed students to the full programming stack from terminal to IDE, and designed assignments to encourage student agency.