Girish Krishnan

gikrishnan@ucsd.edu girish-krishnan.github.io github.com/Girish-Krishnan

EDUCATION

University of California, San Diego **Graduation: December 2025**

Master of Science in Electrical and Computer Engineering (Specialization in Intelligent Systems, Robotics, and Controls)

- *Relevant Coursework:* Stochastic Dynamical Systems, Convex Optimization, Robot Learning, Statistical Learning, Sensing and Estimation, Deep Learning, Visual Learning, Planning and Learning in Robotics, Robot Manipulation and Control
- GPA: 4.00/4.00

University of California, San Diego **Graduation: March 2025**

Bachelor of Science with a Triple Major: Electrical Engineering (Specialization in Machine Learning and Controls), Mathematics-Computer Science, and Physics (Specialization in Computational Physics)

- *Relevant Coursework:* Optimization, Machine Learning, Computer Vision, Robotics
- GPA: 3.924/4.00

RESEARCH EXPERIENCE

Existential Robotics Lab, UCSD **October 2022 – Present**

Research Assistant — Advisor: Prof. Nikolay Atanasov

- **Python Robotics:**
  - Developed a 3D simulation environment using **PyBullet** to test mapping, localization, and control algorithms, including Occupancy Grid Mapping (OGM), Particle Filters, A*, Rapidly-exploring Random Trees (RRT), and PID control.
  - Designed interactive **Google Colab Jupyter notebooks** with explanations and code to make robotics algorithms accessible to learners.
  - Presented this work at the UCSD Undergraduate Research Conference (Spring 2024) and the GEAR Summer Research Showcase (2023, 2024).
  - Mentored two undergraduate students during Summer 2024, guiding them through implementing foundational robotics algorithms.
- **Reinforcement Learning for Autonomous Navigation:**
  - Designed and trained reinforcement learning (RL) policies for an **F1TENTH robot car** to autonomously navigate environments with unknown obstacles.
  - Re-implemented and modularized the entire RL codebase, leveraging **PyTorch**, **TensorRT**, **MuJoCo**, and **Stable-Baselines3** for improved scalability and clarity.
  - Developed a **ROS** node to deploy the trained RL policy on real-world robots, utilizing **ONNX** for efficient inference on **Jetson TX2**.
  - Experimenting with graph-based feature extractors for point clouds and extending RL methods to multi-DOF robots, such as a Husky robot with a KUKA arm.
- **Robot Manipulation (with KETI):**
  - Integrated **Octomap** with **ORB SLAM3** to create a 3D map of obstacles in dynamic environments using live camera feeds from **Intel RealSense**.

- Modified ROS2 packages to adapt them for live data processing and added support for camera pose representation in quaternion format.
- Enabled obstacle-avoidance capabilities for robotic arms in collaborative environments, enhancing real-world deployment readiness.

Video Processing Lab, UCSD **June 2022 – Present**

Research Assistant — Advisor: Prof. Truong Nguyen

- Built a scalable 3D reconstruction system from scratch, generating point clouds of human subjects using **Intel RealSense D415 cameras**.
- Designed and implemented multi-camera calibration mechanisms using **ChArUco boards**, extending stereocalibration methods to four cameras and refining alignment through bundle adjustment.
- Enhanced model quality by applying advanced noise reduction techniques, smoothing filters, and parameter tuning, ensuring high fidelity of the generated 3D meshes.
- Extended the system to capture **3D video**, enabling time-series analysis of human motion in noisy environments.
- Contributed to open-vocabulary 3D segmentation validation by creating a low-fidelity dataset used by Ph.D. students to test segmentation models under real-world conditions.
- Presented at major conferences and forums, including the Undergraduate Summer Research Conference (2022) and the **CWC Beyond 5G Forum** (Fall 2022).
- Co-authored a paper accepted at **3DV 2025**, detailing the 3D reconstruction system and dataset.

Turakhia Lab, UCSD **April 2023 – August 2023**

Research Assistant — Advisor: Prof. Yatish Turakhia

- Contributed to the **Wastewater-based Epidemiology (WBE)** project by analyzing SARS-CoV-2 RNA sequences from wastewater samples to identify viral strains.
- Implemented local alignment algorithms for RNA reads to reference genome mapping, improving genomic region identification accuracy.
- Optimized **C++** tools for genome alignment, significantly reducing runtime and improving computational efficiency.
- Developed a **decoder-only transformer model** in **PyTorch**, trained on a mutation-annotated tree (MAT), to predict future viral mutations.
- Presented findings at the UCSD Undergraduate Summer Research Conference (2023), highlighting novel approaches to genomic mutation prediction.

PUBLICATIONS

- Keito Suzuki, Bang Du, **Girish Krishnan**, Kunyao Chen, Runfa Li, Truong Nguyen. *"Open-Vocabulary Semantic Part Segmentation of 3D Human."* Accepted at **International Conference on 3D Vision (3DV)**, 2025.
  - Research presented a novel approach to semantic segmentation of 3D human models using open-vocabulary techniques, outperforming traditional methods on in-the-wild datasets.
  - Paper link will be provided upon public availability.

INDUSTRY EXPERIENCE

AI/ML and Robotics Engineer at Argon Robotics **2024 – Present**

Argon Robotics, a startup focused on building fully autonomous welding robots for the construction industry.

- Developed 3D reconstruction algorithms to generate high-precision models of welding objects, minimizing noise and improving mesh quality.
- Designed deep learning models to accurately detect welding seams using convolutional neural networks (CNNs) and advanced feature extraction methods.
- Integrated **ROS2**, **MoveIt2**, and Xarm libraries to program and control the robot manipulator for precise movement during welding tasks.
- Created and optimized control algorithms to ensure smooth and accurate robotic arm movement along complex seam paths.
- Collaborated in iterative testing and debugging processes to bridge gaps between simulation and real-world deployment, significantly reducing error rates.

Software Engineering Lead at Innovative Marine Technology Lab **2023 – Present**

Leading software development for underwater robotics at Scripps Institution of Oceanography under Dr. Grant Deane and Dr. Dale Stokes.

- Designed and implemented hardware control systems, including circuits for aerosol particle counters and underwater devices.
- Developed software pipelines for underwater cameras and sensors, ensuring robust data acquisition in challenging marine environments.
- Programmed Raspberry Pi systems to interface with and control sensors, actuators, and other devices on autonomous underwater robots.
- Built a full-stack web application for real-time data visualization and a GUI for controlling robot sensors and devices, improving usability for researchers.
- Created computer vision algorithms to detect and analyze underwater phenomena such as bubble formations, enhancing research insights.

Applied AI/ML Software Engineering Internship at Brain Corp **Summer 2024**

Contributed to AI-powered robotics for retail automation at a San Diego-based robotics company.

- Trained deep learning models on Google Vertex AI to detect out-of-stock items on grocery store shelves, achieving high detection accuracy.
- Collected, annotated, and managed a custom dataset using **Darvin V7** and **BigQuery**, addressing challenges posed by limited pre-existing data.
- Optimized model performance through hyperparameter tuning and advanced image augmentation techniques, ensuring robust inference in real-world settings.
- Deployed the trained models into production systems, improving operational efficiency in inventory management workflows.
- Collaborated cross-functionally to integrate the AI solution into Brain Corp's existing product pipeline, ensuring seamless adoption and scalability.

AI/ML and Computer Vision Engineer at NeuronFlo **2023 – 2024**

Developed real-time AI solutions for personal protective equipment (PPE) compliance monitoring in industrial settings.

- Trained object detection models using **PyTorch** to identify various PPE, such as helmets, vests, and gloves, achieving high detection accuracy.
- Deployed these models on **NVIDIA Jetson Nano** for real-time inference in industrial environments, ensuring on-site compliance monitoring.
- Designed downstream processing pipelines to analyze detection results and generate actionable alerts for non-compliance events.

- Optimized model inference for low-power devices, ensuring consistent performance in real-time applications.
- Delivered a scalable AI pipeline that increased worker safety by providing accurate and timely alerts.

TEACHING EXPERIENCE

Machine Learning Courses, Cognitive Science Department, UCSD **Fall 2023 – Winter 2025**

- **COGS 118A: Supervised Machine Learning Algorithms**
  - Taught machine learning fundamentals including regression, support vector machines, decision trees, random forests, and neural networks.
  - Assisted students in implementing algorithms using Python libraries such as NumPy, Pandas, and Scikit-learn for solving real-world problems.
  - Guided 150+ students on debugging and optimizing code for programming assignments, and mentored project teams for their final presentations.
- **COGS 118B: Unsupervised Machine Learning Algorithms**
  - Covered advanced topics including dimensionality reduction (PCA, t-SNE, UMAP), clustering (K-means, DBSCAN, spectral clustering), and Gaussian Mixture Models.
  - Designed hands-on programming assignments, enabling students to experiment with unsupervised techniques on datasets of their choice.
  - Supported students in developing independent unsupervised learning projects, incorporating concepts such as autoencoders and Expectation-Maximization.
- **COGS 188: AI Algorithms and Reinforcement Learning**
  - Focused on core AI and RL algorithms, including A*, dynamic programming, Monte Carlo methods, Q-Learning, SARSA, and eligibility traces.
  - Designed innovative assignments for students to implement RL agents and understand theoretical foundations of Markov Decision Processes.
  - Evaluated students' projects involving real-world applications of reinforcement learning and AI search algorithms.

Computer Science Courses, UCSD **Spring 2022 – Summer 2024**

- **CSE 95: Tutor Apprenticeship in Computer Science and Engineering**
  - Mentored first-time tutors in effective pedagogy, grading methodologies, and fostering inclusive classroom environments.
  - Facilitated interactive discussions on best tutoring practices and provided feedback on reflective assignments.
- **CSE 175: Entrepreneurship for Engineers**
  - Guided students in developing tech startup ideas, performing market research, and creating viable business models.
  - Supported team projects by providing feedback on business plans, funding strategies, and pitch decks.
- **CSE 190: AI/ML for Music and Audio**
  - Taught signal processing techniques, music theory, and neural network-based algorithms for genre classification and music generation.
  - Recreated TensorFlow-based programming assignments to ensure compatibility with modern platforms like Google Colab.

Electrical and Computer Engineering Courses, UCSD **Spring 2022 – Winter 2024**

- **ECE 16: Rapid Hardware and Software Design**
  - Guided students in building IoT devices using ESP32 microcontrollers, interfacing with sensors, and implementing Bluetooth communication.
  - Supported final projects where students designed and presented innovative hardware-software prototypes.
- **ECE 25: Introduction to Digital Design**
  - Led lab sessions on Boolean algebra, finite state machines, and Verilog programming for designing digital circuits on Basys3 boards.
  - Helped students develop a fully functional calculator as part of their final lab project.
- **ECE 140A-B: The Art of Product Engineering**
  - Mentored students in product development and entrepreneurship, including full-stack web development and IoT integration using Raspberry Pis.
  - Supported senior capstone projects, guiding teams from concept to functional prototypes.
- **ECE 198: Directed Group Study, HKN Outreach**
  - Supervised student-led outreach programs, teaching electrical engineering and computer science to high school students.
  - Developed engaging lessons on digital logic design, Arduino programming, and signal processing.

Mathematics Courses, UCSD **Spring 2024 – Fall 2024**

- **MATH 31CH: Honors Vector Calculus**
  - Assisted in teaching advanced calculus topics including exterior derivatives, Stoke's theorem, and change of variables.
  - Provided detailed feedback on students' proof-based assignments to develop their mathematical rigor.
- **MATH 109: Mathematical Reasoning**
  - Supported students in mastering proof techniques such as induction, contradiction, and set theory.
  - Evaluated and guided projects involving complex reasoning in applied mathematics.
- **MATH 168A: Random Walks on Graphs**
  - Taught specialized topics on graph theory, including hitting times, cover times, and their application to electrical networks.
  - Provided detailed explanations and feedback to help students navigate the intersection of applied mathematics and computer science.

Physics Courses, UCSD **Spring 2024**

- **PHYS 1CL: Waves and Optics Laboratory**
  - Guided students through laboratory experiments on oscillations, optics, and quantum mechanics.
  - Provided constructive feedback on lab reports to help students improve their scientific writing and understanding of physical principles.

SELECTED PROJECTS

Visual-Inertial SLAM for Robotics Localization **ECE 276A, Winter 2024**

- Developed a robust Visual-Inertial Simultaneous Localization and Mapping (VI-SLAM) system in Python, integrating data from stereo cameras and an Inertial Measurement Unit (IMU).

- Designed and implemented an Extended Kalman Filter (EKF) to fuse kinematic motion predictions with visual observations, estimating both robot trajectory and environmental landmark positions.
- Enhanced computational efficiency by downsampling features and utilizing sparse matrix operations, ensuring real-time localization and mapping capabilities.
- Validated the system on multiple driving datasets, demonstrating precise trajectory mapping and accurate landmark identification.
- Fine-tuned noise parameters to improve numerical stability, ensuring robustness in recursive EKF calculations and improved performance compared to IMU-only systems.

FutureGAN for Human Motion Prediction **ECE 285, Spring 2024**

- Designed and implemented a simplified version of FutureGAN, a generative adversarial network (GAN) for video prediction, to predict future human movements for athletic training.
- Adapted GAN architecture, including generator and discriminator networks, for motion prediction tasks, leveraging optical flow estimation.
- Trained the model on the HMDB Human Activity Dataset, focusing on fencing sequences, to predict future frames based on a single input frame.
- Evaluated model performance using Frechet Inception Distance (FID) and Inception Scores, achieving realistic future frames while preserving general motion patterns.
- Identified and addressed challenges such as blurriness and limited dataset resolution, refining generated video sequences for enhanced realism.

Autonomous Navigation for F1TENTH Racecar **IEEE IV Symposium, Spring 2023**

- Led the design and deployment of a deep learning-based navigation system for the F1TENTH autonomous racing competition, earning the **Most Innovative Award**.
- Developed a Convolutional Neural Network (CNN) to predict steering and throttle commands based on RGBD input data from the racecar's depth camera.
- Optimized real-time performance for deployment on **NVIDIA Jetson Nano** using **ROS2**, achieving smooth and reliable navigation.
- Competed at the IEEE Intelligent Vehicles Symposium 2023, securing 4th place among predominantly Ph.D.-led teams.
- Engaged with robotics researchers at the symposium, fostering connections that deepened my interest in intelligent vehicle research.

Quadcopter Flight Control and PCB Design **CSE 176E, Fall 2023**

- Designed a 4-layer PCB for a quadcopter drone using Autodesk EAGLE, minimizing noise and interference to ensure stable power distribution.
- Integrated the PCB with an Atmega128RFA1 microcontroller, developing embedded software in C/C++ to control motor speeds using PID control for stable flight.
- Implemented secure RF communication between the drone and its remote, ensuring reliable and safe operation.
- Enhanced orientation estimation by fusing gyroscope and accelerometer data, stabilizing flight and mitigating measurement drift.
- Successfully tested and refined the quadcopter's performance, demonstrating smooth and precise control in various flight conditions.

STUDENT ORGANIZATION INVOLVEMENT

Eta Kappa Nu (HKN), UCSD **Winter 2022 – Spring 2023**

Outreach Chair

- Designed and taught hands-on lessons in **electrical engineering** and **computer science** for K-12 students, introducing topics such as Arduino programming, Bluetooth communication, and digital signal processing.
- Organized an upper-division undergraduate course (**ECE 198**) to prepare UCSD students for designing and delivering K-12 outreach lessons. Topics included lesson planning, teaching techniques, and educational engagement strategies.
- Coordinated visits to local San Diego schools, arranged transportation logistics, and ensured high levels of engagement during outreach activities.
- Impacted over 150 K-12 students by fostering curiosity and enthusiasm for engineering through accessible and interactive lessons.

IEEE @ UCSD **Fall 2022 – Present**

Technical Chair (2022 – 2023); Mentor, Signal Processing Cup Team (2024 – Present)

- As **Technical Chair**, conducted workshops on **computer vision** and **deep learning**, teaching over 30 UCSD students the fundamentals of **OpenCV** and neural networks, with a focus on practical implementations.
- Mentored the IEEE Signal Processing Cup Team, guiding them in applying **deep learning** techniques for detecting Deepfakes in the **Video and Image Processing Cup at IEEE ICASSP 2025**.
  - Provided foundational understanding of deep neural networks and state-of-the-art models such as **Wavelet-CLIP** and **Inception-v3**.
  - Implemented and optimized an Inception-v3 model achieving **95.5% accuracy** on validation datasets; collaborated with the team to further refine performance.

Yonder Deep, UCSD **Fall 2022 – Spring 2023**

Software Team Lead

- Led the software team in building autonomous underwater robots designed for deployment in Arctic oceanographic research.
- Developed Python-based software for robotics applications, integrating **embedded systems** and hardware to ensure efficient and reliable robot operation.
- Designed and implemented control algorithms for underwater navigation, leveraging expertise in **robotics**, **sensor integration**, and **system optimization**.

SCHOLARSHIPS AND AWARDS

- **Apple Pathways Scholars Award (2024)**: $15,000/year merit-based scholarship awarded to underrepresented engineering students for academic excellence and leadership potential.
- **UCSD ECE Best Tutor Award (2022)**: Recognized for excellence in teaching and impactful contributions as an instructional assistant across over 20 courses.
- **Most Innovative Award, IEEE F1TENTH Competition (2023)**: Acknowledged for designing a creative, deep learning-based navigation solution for an autonomous racecar.

MEMBERSHIPS

- **Eta Kappa Nu (HKN)**, UCSD Chapter (2022–Present): Held roles including Outreach Chair, contributing to hands-on engineering education for K-12 students.

- **IEEE Member** (2022–Present): Technical Chair for IEEE @ UCSD, leading workshops on computer vision, deep learning, and robotics.

TECHNICAL SKILLS

- **Programming Languages:** Python, C++, Java, SQL
- **AI/ML Frameworks:** PyTorch, TensorFlow, Scikit-learn
- **Robotics Tools:** ROS, MoveIt2, TensorRT, MuJoCo
- **Cloud and DevOps:** Docker, Kubernetes, Git, ONNX

URLS

- Personal Website: https://girish-krishnan.github.io/
- GitHub: https://github.com/Girish-Krishnan
- Publications: Links to conference papers will be provided upon public availability.