

Siming He

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Education

Master of Science in Engineering, Robotics

Philadelphia, PA

SCHOOL OF ENGINEERING AND APPLIED SCIENCE, UNIVERSITY OF PENNSYLVANIA, GPA 3.97/4.0

Aug. 2022 - May 2025

Selected Courses: Probability Theory, Advanced Linear Algebra, Convex Optimization, Principles of Deep Learning, Learning in Robotics, Machine Learning, Linear System Theory, Computer Vision, Game-theoretic Learning, Calibration and Conformal Prediction.

Bachelor of Science in Engineering, Computer Science with Math Minor

Philadelphia, PA

SCHOOL OF ENGINEERING AND APPLIED SCIENCE, UNIVERSITY OF PENNSYLVANIA, GPA 3.96/4.0

Aug. 2020 - May 2025

Selected Courses: PDE, Real Analysis, Discrete Math, Algorithms, Operating Systems, Information Theory, Algorithmic Fairness and Privacy.

Bachelor of Science in Economics, Statistics

Philadelphia, PA

WHARTON SCHOOL, UNIVERSITY OF PENNSYLVANIA, GPA 3.86/4.0, STATISTICS-GPA 4.0/4.0

Aug. 2020 - May 2025

Selected Courses: Probability, Statistical Inference, Mathematical Statistics, Bayesian Statistics, Math Foundation for RL.

Research Experience

Active Perception Researcher. Advisor: Dr. Pratik Chaudhari, Dr. Vijay Kumar

Philadelphia, PA

THE GENERAL ROBOTICS, AUTOMATION, SENSING AND PERCEPTION (GRASP) LABORATORY, UPENN

May 2021 - Current

- Developed algorithms that enable robots to autonomously decide what and how to perceive in initially unknown environments.
- **Designed active perception algorithms** to select dynamically feasible trajectories that maximize predictive information. Evaluated the effectiveness of these algorithms in **actively constructing fine-grained semantic neural radiance fields (NeRF)**.
- **Formulated a game-theoretic approach** to address the suboptimality of active perception algorithms. **Developed an online optimization algorithm** to enhance predictive information estimation, **providing theoretical guarantees** for the estimation algorithm and active perception performance. **Conducted real robot experiments** using a customized Jackal ground robot.
- First-authored two papers: one published in the American Control Conference and another under review.

Robotics Perception Researcher. Advisor: Dr. Pratik Chaudhari, Dr. Vijay Kumar

Philadelphia, PA

THE GENERAL ROBOTICS, AUTOMATION, SENSING AND PERCEPTION (GRASP) LABORATORY, UPENN

Jan. 2023 - Current

- Developed hardware, algorithms, and benchmarks for extracting ecological insights from forest image data.
- Created geometric, photometric, and semantic maps for detailed forestry studies. Designed an efficient procedure to **interconvert neural radiance fields and 3D Gaussian splatting**, leveraging the strengths of both approaches.
- **Engineered hardware and software** to enable large-scale, multimodal tree data collection. **Created a dataset** of urban and forest trees in Philadelphia using LiDAR, RGB cameras, IMU, and GPS.
- First-authored a paper presented at the Embodied AI Workshop, CVPR 2024.

Research Assistant. Advisor: Dr. Christopher Fang-Yen

Philadelphia, PA

DEPARTMENT OF BIOENGINEERING, UPENN

Sep. 2021 - Jan. 2022

- Participated in developing a robotic platform capable of conducting and analyzing experiments on C. Elegans, accelerating scientific discovery and freeing researchers from time-consuming, repetitive tasks.
- **Designed a vision algorithm to decode barcode labels** on Petri dishes, allowing the robot to record and organize experiments.
- **Created an automatic lens calibration algorithm** to ensure the cameras' focus on C. Elegans for accurate detections and operations.
- Co-authored a paper published in the National Academy of Sciences (PNAS) Nexus.

Selected Projects

Information Theory and Learning Theory

Philadelphia, PA

DIRECTED READING WITH DR. SANTOSH VENKATESH

2023 Spring

Engaged in guided reading and discussions on information theory, Vapnik-Chervonenkis theory, and probability theory. Participated in weekly problem-solving sessions and presented proofs.

Stereo Visual SLAM with Factor Graph Optimization using Symforce

Philadelphia, PA

ESE 6500 LEARNING IN ROBOTICS WITH DR. PRATIK CHAUDHARI

2023 Spring

Developed a Stereo Visual SLAM system incorporating feature-based visual odometry and backend optimization.

Conformal Risk Control in Generalist Cellular Segmentation

Philadelphia, PA

CIS 7000 UNCERTAINTY QUANTIFICATION WITH DR. AARON ROTH

2022 Fall

Collaboratively developed conformal risk control to manage false negative rates in cellular semantic segmentation tasks with two classmates.

Preventing the Transfer of Spurious Features in Transfer Learning

ESE 5460 PRINCIPLES OF DEEP LEARNING WITH DR. PRATIK CHAUDHARI

Philadelphia, PA

2022 Fall

Collaboratively identified that spurious feature transfer can be largely prevented using a transfer algorithm with task interpolation, reducing the transfer distance on the statistical manifold of neural networks.

Honors & Awards

2024	Class of 1971 Robert J. Holtz Fund Grant — \$1,000 , Penn Center for Undergraduate Research & Fellowships	Philadelphia, PA
2024	ETH Robotics Student Fellowship — CHF 4,000 , ETH RobotX	Zürich, Switzerland
2024	Honorable Mention, CRA Outstanding Undergraduate Researcher Award , Computing Research Association	Philadelphia, PA
2023	Vagelos Undergraduate Research Grant — \$500 , Penn Center for Undergraduate Research & Fellowships	Philadelphia, PA
2023	Wharton Summer Program for Undergraduate Research — \$6,000 , Wharton School	Philadelphia, PA
2022	Wharton Summer Program for Undergraduate Research — \$6,000 , Wharton School	Philadelphia, PA
2021	Penn Research Mentoring Program — \$4,500 , Penn Center for Undergraduate Research & Fellowships	Philadelphia, PA

Publications

- [5] **He, S.**, Osman, Z. & Chaudhari, P. *From NeRFs to Gaussian Splats, and Back*. Embodied AI Workshop, CVPR 2024
- [4] **He, S.**, Tao, Y., Spasojevic, I., Kumar, V. & Chaudhari, P. *An Active Perception Game for Robust Autonomous Exploration*. arXiv preprint arXiv:2404.00769 (2024)
- [3] **He, S.**, Hsu, C. D., Ong, D., Shao, Y. S. & Chaudhari, P. *Active Perception Using Neural Radiance Fields* in Proc. of American Control Conference (ACC) (2024)
- [2] Li, Z., Fouad, D.A., Bowlin, D.P., Fan, Y., **He, S.**, Chang, M., Du, A., Teng, C., Kassouni, A., Ji, H., Raizen, M.D., & Fang-Yen, C. *A robotic system for automated genetic manipulation and analysis of *Caenorhabditis elegans** in Proc. of the National Academy of Sciences (PNAS) Nexus (2023)
- [1] Lv, Q., Ding, M., Liu, Q., Chen, Y., Feng, W., **He, S.**, Zhou, C., Jiang, J., Dong, Y., & Tang, J.. *Are we really making much progress? revisiting, benchmarking and refining heterogeneous graph neural networks* in Proc. of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD) (2021)

Presentations

2024	Robust Active Perception: A Game-theoretic Perspective , Northeast Systems and Control Workshop (Poster)	Philadelphia, PA
2024	Active Perception using Neural Radiance Fields , Penn Undergraduate Spring Research Symposium (Oral)	Philadelphia, PA
2024	Active Perception and Robot Exploration , GRASP Lab tours to Sawiris Scholars (Oral)	Philadelphia, PA
2023	Active Simultaneous Localization and Mapping in Unstructured Environment with a Quadrotor , Penn Undergraduate Spring Research Symposium (Poster)	Philadelphia, PA
2021	Control, Learning, and Perception for an Intelligent Robot , Penn Undergraduate Fall Research Expo (Poster)	Philadelphia, PA

Teaching & Community Involvement

Course Development Assistant

UNIVERSITY OF PENNSYLVANIA

Philadelphia, PA

Mar. 2024 - Current

- Assisted in developing the course 'Mathematical Foundations for Machine Learning' for Penn Engineering Online. Designed the syllabus and organized weekly content and homework problems.

Teaching Assistant

UNIVERSITY OF PENNSYLVANIA

Philadelphia, PA

Sep. 2022 - Current

- Teaching assistant for graduate-level courses including CIS 5200 Machine Learning (Dr. Lyle Ungar), ESE 5460 Principles of Deep Learning (Dr. Pratik Chaudhari), ESE 6050 Convex Optimization (Dr. Nikolai Matni), and ESE 5300 Probability Theory (Dr. Santosh Venkatesh).
- Developed 51 pages of recitation materials on machine learning with detailed examples. Conducted 14 recitations for 40 students. Held weekly office hours to help students overcome understanding and implementation challenges.

Peer Research Advisor

CENTER FOR UNDERGRADUATE RESEARCH & FELLOWSHIPS, UNIVERSITY OF PENNSYLVANIA

Philadelphia, PA

Sep. 2022 - Current

- Advised undergraduate researchers on research opportunities, faculty mentors, and grants.
- Mentored 30 first- and second-year students interested in computer science, robotics, and statistics research.
- Compiled weekly research seminar lists to keep mentees informed about topics in their areas of interest.
- Designed and conducted annual Python Programming for Research Workshops to introduce Python and common Python packages to researchers from various fields, including biology, architecture, and psychology.

Robotics Education for Underrepresented Students

Philadelphia, PA

THE GRASP LAB, UNIVERSITY OF PENNSYLVANIA

Sep. 2023 - Current

- Taught robotics to over 90 K-12 students in total in Philadelphia public schools who identify as being underrepresented in STEM fields.
- Presented and demonstrated my robotics research to 30 seventh-grade students.
- Taught Arduino basics to 30 tenth-grade students.
- Taught 30 high school students about mapping and planning in robotics.

Resident Advisor of a First-year Students' Dorm

Philadelphia, PA

COLLEGE HOUSES & ACADEMIC SERVICES, UNIVERSITY OF PENNSYLVANIA

Aug. 2023 - May 2024

- Advised residents on various aspects of academic and residential life, supporting them through the challenges of first-year college life.
- Hosted lunch and dinner sessions with faculty members, facilitating conversations on academic, research, and cultural topics. Organized information sessions to connect residents with research resources on campus.
- Recipient of the **Excellence in Academic & Intellectual Life Award**.

Founder

St. Catharines, Ontario

RYKERT AFTER SCHOOL SCIENCE PROGRAM

Sep. 2018 - May 2020

- Organized a program to engage underprivileged middle school students in science experiments, providing access to laboratory environments beyond their regular experiences.
- Led the development of engaging experiments, including building electric wheels, constructing water rockets, and observing specimens under microscopes.