Carson Sobolewski

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Education

Bachelor of Science in Computer Engineering — Spring 2025
University of Florida — *Current GPA: 4.0/4.0*

Research Experience

Explainable Counterfeit Part Detection Using DiffLogic Networks | *Dr. Domenic Forte*

- Providing transparent, rule-based image classification based on the structure of a variational autoencoder (VAE)'s latent space using differential logic gate (DiffLogic) networks
- Creating a classifier for counterfeit parts that is provably reliable and trustworthy

Autonomous Localized Friction Estimation for Small-scale Race Cars | *Dr. Ivan Ruchkin*

- Leveraging simultaneous localization and mapping (SLAM) and raceline optimization algorithms to push a RoboRacer autonomous race car to its limits and compute localized friction estimates
- Designed an algorithm for detecting loss of traction based on discrepancies between IMU and odometry data

Distribution-Free Out-of-Distribution Correction for Image-based Control | *Dr. Ivan Ruchkin*

- Led a project on increasing the reliability of image-based controllers by automatically repairing distribution shifts and image corruption using CycleGAN models, which is under review at IROS 2025
- Supported by grant funding from the UF Center for Undergraduate Research's AI Scholars Program

Uncertainty Quantification for Detection Transformers (DETRs) | *Dr. Navid Azizan*

- Examined the underlying mechanisms behind object predictions in DETR models
- Proposed OCE, an object-level calibration error for evaluating DETR performance while simultaneously calibrating for optimal separation of positive and negative predictions
- Extensively contributed to both the ideation and implementation of this co-first-author work, which is under review at TPAMI 2025

Pipeline for Automated PCB Reverse Engineering | *Dr. Domenic Forte*

- Designed a Python pipeline for the creation of PCB design files from images of physical boards obtained through X-ray computed tomography (CT) scans
- Supported by grant funding from the UF Center for Undergraduate Research's University Scholars Program
- Set the primary research direction of this project, working largely independently on a first-author work published at ISQED 2025

Calibrated Safety Chances for Image-based Autonomy | *Dr. Ivan Ruchkin*

- Created robust evaluators for determining the safety of an autonomous vehicle in top-down images, removing unnecessary information, and combating distribution shift caused by hallucinations in forecasted images from a VAE
- Converted existing CNN controllers from TensorFlow to PyTorch, adapting them to fit our existing codebase
- Assisted with the writing, review, and submission of a second-author paper to L4DC 2024

Awards

Ralph Sias Scholarship in ECE | *Scholarship* — Spring 2025

- Awarded $1500 for being a top junior/senior student in the ECE department

ECE Undergraduate Research Excellence Award | *Recognition* — Spring 2024

- Recognized as the top undergraduate researcher in the Electrical and Computer Engineering (ECE) department, comprised of nearly 600 undergraduate students

AI Scholars Program | *Research Funding* — Fall 2024

- Awarded $1750 in grant funding to research generalizable image repair for vision-based control

University Scholars Program | *Research Funding* — Fall 2023

- Awarded $1750 in grant funding to research automated PCB design reconstruction from X-ray CT scans

Wentworth Honors Study Abroad Scholarship | *Scholarship* — Summer 2023

- Awarded $1500 in funding to study abroad in Kyoto, Japan during summer 2023

Helen E. Khouri Memorial Scholarship | *Scholarship* Fall 2022, Fall 2023

- Awarded a $1250 academic scholarship two years in a row for being a top student in the ECE department

University Honors Program | *Recognition* Fall 2021

- Admitted to the UF University Honors Program, recognizing top incoming undergraduate students

Benacquisto Scholarship | *Scholarship* Fall 2021

- Awarded a full-ride academic scholarship as a result of being named a National Merit Scholar

National Merit Scholar | *Recognition* Fall 2021

- Recognized for scoring in the 99th percentile of students taking the PSAT

Bright Futures Scholarship | *Scholarship* Fall 2021

- Awarded full tuition to attend Florida public universities based on grades, test scores, and community service

Publications

C. Sobolewski, Z. Mao, K. Vejre, and I. Ruchkin, "Generalizable Image Repair for Robust Visual Autonomous Racing," **Under review** at *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2025. Preprint: https://arxiv.org/abs/2503.05911.

Y. Park*, **C. Sobolewski***, and N. Azizan, "Identifying Reliable Predictions in Detection Transformers," **Under review** at *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2025. Preprint: https://arxiv.org/abs/2412.01782.

C. Sobolewski, D. Koblah, and D. Forte, "A Framework for PCB Design File Reconstruction from X-ray CT Annotations," *26th International Symposium on Quality Electronic Design*, 2025.

Z. Mao, **C. Sobolewski**, and I. Ruchkin, "How Safe Am I Given What I See? Calibrated Prediction of Safety Chances for Image-Controlled Autonomy," *Proceedings of the 6th Annual Learning for Dynamics & Control Conference*, PMLR 242:1370-1387, 2024.

Presentations

2024 Warren B. Nelms Annual IoT Conference | *Demonstration* Fall 2024

- Won **best demonstration** out of 26 demonstrations, explaining the functionality of the TEA Lab's F1/10th cars that operate with a SLAM-based pure pursuit controller

2024 MIT Summer Research Program Poster Session | *Poster Presentation* Summer 2024

- Presented my work on uncertainty quantification for Detection Transformers (DETRs) to other MIT Summer Research Program students and MIT faculty/staff

2024 Spring Undergraduate Research Symposium | *Poster Presentation* Spring 2024

- Presented my University Scholars Program work on PCB design file reconstruction

ECE Department External Advisory Board | *Demonstration* Spring 2024

- Demonstrated the functionality of the TEA Lab's F1/10th cars, including both a follow-the-gap controller and a SLAM-based pure pursuit controller

Teaching

Assistant Instructor/Mentor | *Reliable and Safe Autonomous Racing* Spring 2024

- Led a team of first-year students to build F1/10th autonomous race cars and design control algorithms for them

Undergraduate Peer Instructor | *Microprocessor Applications* Spring 2023

- Assisted with teaching 90 students the characteristics and capabilities of microprocessors in assembly and C

Extracurricular Activities

Treasurer | *Eta Kappa Nu (HKN) Epsilon Sigma* Summer 2024 - Present

- Serve on the executive board of the IEEE's honor society, managing finances and creating fundraising opportunities

Peer Advisor and Ambassador | *UF Center for Undergraduate Research* Fall 2023 - Present

- Guide undergraduate students on how to find research opportunities and interact with faculty

Resident Assistant | *UF Department of Housing and Residence Life* Fall 2022 - Present

- Mentoring first-year undergraduate students on acclimating to campus life and fostering community development

Industry Chair | *Eta Kappa Nu (HKN) Epsilon Sigma* Spring 2024

- Interacted with various companies in electrical and computer engineering to plan info sessions and events