Troi Williams, Ph.D.

AI & Robotics Engineer

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Professional Summary

Self-driven and collaborative, AI and Robotics Engineer with Ph.D.-level expertise in creating frameworks that make autonomous systems robust and safe. Experience in the full stack development and deployment of localization, perception, planning, navigation, and decision-making systems in simulation and hardware. Hands-on expert at analyzing and troubleshooting complex sensor issues and training machine learning models (PyTorch) to ensure robustness and safety in real-world conditions and within various environments. Proficient in C++, Python, and ROS.

Technical Skills, Licenses, & Certifications

AI & Machine Learning· · · · ·Machine/Deep Learning [ML/DL] (PyTorch, scikit-learn, Intel Neural Stick, wandb.ai), Generative AI (LLMs, LVMs), Computer Vision (OpenCV, CNNs), Sensor Fusion, State Estimation (Kalman & Particle Filters), FMEA, Statistical Modeling, Planning & Optimization (POMDPs, Reinforcement Learning [RL]), TensorRT

Robotics· · · · ·ROS, Navigation, Planning, Sensor Modeling, SLAM, Simulators (Gazebo, AirSim), Drones (DJI, PX4, VOXL m500, Crazyflie, Yockto, MAVROS), Ground Robots (Turtlebot), Sensors (LiDAR, Intel RealSense, GPS), Simulators (Gazebo, Unity, AirSim), Boards & microcontrollers (Arduino, Raspberry Pi)

Programming & Platform· · · · ·Linux, Python, C++, Cython, C#, CUDA, MATLAB, SQL, Bash, Java, JavaScript, Git, Docker, AWS

Licenses· · · · ·Private Pilot License w/ Instrument and Multi-Engine ratings + Complex Endorsement

Communication· · · · ·English (native), Spanish & German (elementary level), Mentoring, Grant Writing, Project Management

Professional Experiences

University of Maryland (College Park, MD) **Postdoctoral Research Fellow and Instructor** Dec. 2021 — Present

- Spearheading research in robotics and AI uncertainty, including sensor modeling, optimization, decision-making, planning, explainable AI, reinforcement learning, infrastructure inspection, and statistical modeling.
- Engineering a novel framework to systematically model how environmental factors impact AI tasks (object detection with DL) in autonomous systems using Generative AI (e.g., LLMs and VLMs), ML/DL, and data that was simulated, augmented, or real.
- Developed POMDP and RL-based planners that help robots decide when to localize, optimizing costly actions and safety by 26%.
- Engineered a sensor optimization method with ROS and Kalman Filters for a multi-robot, search-and-rescue scenario (Gazebo); improved navigation performance by at least 3.5x.
- Developed a risk-aware planner using Gaussian Processes and DL for robust control of autonomous drones in varying conditions.
- Managed 6+ cross-functional student teams to publish at premier robotics conferences and authored grant proposals for Samsung, Amazon, and NSF, securing over $200k in funding.
- Served as sole instructor for “CMSC 426: Computer Vision”, providing lectures and coding assessments with OpenCV and PyTorch.

Intel Corporation (Santa Clara, CA) **Software Development Intern** Jun. 2018 — Aug. 2018

- Developed and validated core computational operations for nGraph, a C++ deep learning compiler and pre-silicon simulator.
- Ensured functional correctness of model execution on future hardware, supporting Intel’s AI development lifecycle.

University of South Florida (Tampa, FL) **Doctoral Research and Teaching Assistant** Jan. 2016 — Dec. 2021

- Developed and patented a novel ML framework using Python and TensorFlow to dynamically predict sensor bias and noise, improving data quality and the accuracy of downstream state estimation algorithms.
- Engineered a transfer learning method to train deep learning models with limited real-world data, collecting datasets with ROS and deploying these models for real-time localization using Kalman and Particle Filters on robots.
- Developed solutions to remove computation bottlenecks; programmed Kalman Filters on GPUs for parallel, real-time execution.
- Pioneered a transfer learning methodology to train sensor models with limited data, achieving comparable performance to a fully trained model with as little as 19% of the real-world training data, significantly reducing data collection requirements.
- Authored a successful grant proposal, securing the Microsoft Research Dissertation Grant, and served as a teaching assistant for graduate-level courses including Neural Networks & Deep Learning.

Cisco (Santa Jose, CA) **Software Development Intern** Jun. 2015 — Aug. 2015

- Analyzed intelligent wireless sensor network protocols for event detection and aggregation in conversation parks.
- Produced a technical white paper that qualitatively evaluated each protocol’s effectiveness and robustness under realistic cases.

Norfolk State University (Norfolk, VA) **Graduate Research and Teaching Assistant** Aug. 2012 — Dec. 2013

- Created Tekkodu (link), a programming framework enabling intuitive control of autonomous robotic manipulators (Kodu, C++).
- Engineered fault-tolerant algorithms to mitigate perception, navigation, and manipulation issues with autonomous mobile manipulators, bridging a simulation-to-reality gap.

- Managed the robotics lab; led two winning robotics teams; developed quick fixes to address edge cases during deployment.

NASA-Johnson Space Center (Houston, TX) **Software Development Intern** Aug. 2011 — Dec. 2011
- Integrated legacy C++ guidance code into the flight software for the Morpheus vertical test bed, a prototype planetary lander.
- Authored a best-practices guide for the software package to streamline team onboarding and improve development efficiency.

Air Force Research Laboratory (Fairborn, OH) **Software Development Intern** Jun. 2010 — Aug. 2010
- Developed a point-to-point navigation tool (C#) with GPS and head tracking sensors for training solidiers in the real world.
- Supported the development of a real-time multi-user combat simulation environment.

Education

Doctorate of Philosophy (Ph.D.) in Computer Science and Engineering, *University of South Florida* Aug. 2015 — Dec. 2021
Master of Science (M.Sc.) in Computer Science, *Norfolk State University* Jan. 2012 — Jun. 2014
Bachelor of Science (B.Sc.) in Computer Science, *University of the Virgin Islands* Aug. 2007 — May 2011

Projects

1. "Flow Rider: Adaptive Drone Control Using Vision, Wind Maps, and Energy-Efficient Paths", *In Progress*.
   - A drone-based tool that uses cameras to estimate wind flow-fields and plan more energy-efficient and safer flight paths.
2. "Online, Context-Aware Semantic Mapping via LLMs", *In Progress*.
   - A tool that helps robots quantify the utility of environmental objects for long-term localization under changing conditions.
3. "Contextual Neural Moving Horizon Estimation for Robust Quadrotor Control in Varying Conditions", ICRA 2026 (Paper link).
   - A Bayesian optimizer that actively context switches among neural network estimators for robust control in turbulent winds.
4. "The SET Perceptual Factors Framework: Towards Assured Perception for Autonomous Systems", PTAS 2025 (Paper link).
   - A systematic AI-driven method for modeling and predicting why a robot's perception might fail.
5. "When to Localize? A Risk-Constrained Reinforcement Learning Approach", 2025 (Paper link).
   - An RL method that balances determining where a robot is versus continuing a mission-critical task.
6. "Where Am I Now? Dynamically Finding Optimal Sensor States to Minimize Localization Uncertainty for a Perception-Denied Rover", MRS 2023 (Paper link).
   - A sensor uncertainty optimizer that guides a "viewer" drone to the optimal position for helping a "blind" rover find its way.
7. "GATSBI: An Online GTSP-Based Algorithm for Targeted Surface Bridge Inspection", 2023 (Paper link).
   - An autonomous drone inspector that builds a 3D map and finds cracks in bridges on the fly using a YOLO detection model.
8. "Learning State-Dependent Sensor Measurement Models with Limited Sensor Measurements", 2021 (Paper link).
   - A two-stage process for learning sensor models using large synthetic datasets and small numbers of real data.
9. "Learning State-Dependent Sensor Measurement Models for Localization", 2019 (Paper link).
   - A probabilistic, deep learning model that predicts bias and noise in sensor measurements for any given situation.

Awards & Patents

The Presidential Postdoctoral Fellowship, *University of Maryland* Apr. 2024 — Present
The PROMISE Academy Fellowship, *University of Maryland* Apr. 2024 — May 2025
CRA Computing Innovation Fellowship (CIFellow), *University of Maryland* Sept. 2021 — Apr. 2024
RSS Pioneer, *Robotics: Science and Systems Conference* Jul. 2021
Learning State-Dependent Sensor Measurement Models for Localization, *U.S. Patent (link)* Feb. 2020
Dissertation Grant, *Microsoft Research* Aug. 2019 — Jul. 2020
Invitation to the 2nd Round–Combating Zika and Future Threats Grand Challenge, *USAID* Jul. 2016
Ph.D. Fellowships, *Florida Education Fund ● Alfred P. Sloan Foundation ● National GEM Consortium* During Aug. 2015 — Dec. 2021
2nd Place, *2014 ARTSI Robotics Competition (Tapia Conference)* Feb. 2014
Winner, *2013 ARTSI Robotics Competition* Mar. 2013

Leadership Activities

Reviewer, *IEEE (ICRA, IROS, SSRR, Transactions-ASE) ● IFRR (ISER, ISRR) ● ACM (SAC)* 2019–2025
Doctoral Mentoring Program, *University of Maryland* Feb. 2024 — May 2024
Pioneers Workshop Program Committee, *The Robotics: Science and Systems Conference* Nov. 2022 — Jun. 2023
Range Sensing Session Chair, *The IEEE International Conference on Intelligent Robots and Systems* Sept. 2021
Resource and Event Coordinator, *University of South Florida* Aug. 2020 — May 2021
USF Graduate School Recruiter, *The National Society of Black Engineers' 43rd Annual Convention* Nov. 2017

Professional Organizations

Black in Robotics Sept. 2020 — Present
Institute of Electrical and Electronics Engineers (IEEE) ● IEEE Robotics and Automation Society (RAS) Jun. 2019 — Present
Black in Artificial Intelligence Jun. 2019 — Present
National Society of Black Engineers Mar. 2017 — Mar. 2018