Stephen Ferro

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EDUCATION

Northwestern University, Evanston, IL | Expected Graduation: December 2024
Master of Science in Robotics | GPA: 3.6/4.0

Purdue University, West Lafayette, IN | Graduated: May 2018
Bachelor of Science in Mechanical Engineering; Minor in Economics, Certificate in Entrepreneurship and Innovation

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WORK EXPERIENCE

SmoothAg

Robotics Software Engineering Intern — June 2024 – Present; Chicago, IL
- Created the navigation stack for the RanchRover Ackermann robot using ROS 2 Navigation 2 for outdoor autonomous navigation.
- Fused visual data from a Zed X stereo camera with GPS using an extended Kalman filter for precise waypoint navigation.
- Developed ROS 2 nodes for interfacing between Jetson Orin AGX and hardware such as the engine ECU (CAN bus) and GPS (UART).
- Integrated object detection and identification from the Zed X camera to ensure safe navigation around people and other hazards.

SKF USA

Product Design Engineer for Slewing Rings — July 2022 – August 2023; Chicago, IL
- Designed custom slewing bearings with PTC Creo for demanding applications in the wind energy and rail industries.
- Conducted raceway and bolting analyses to ensure designs met customer requirements for stiffness, torque, and capacity.

Application Engineer for Industrial Market — June 2018 – July 2022; Elgin, IL and Lansdale, PA
- Provided comprehensive support to agriculture, robotics, and other industrial customers in all aspects of bearing system design.
- Performed hands-on failure analysis to identify root causes and recommend performance-enhancing solutions.

Tenneco Automotive

Mechanical Engineering Co-Op – 5 sessions — May 2014 – August 2017; Grass Lake, MI
- Worked with four different teams at all stages of the product lifecycle: design, prototyping, testing, and warranty support.

PROJECTS (photos and more at scferro.github.io)

Robot Arm Block Sorting with Active Human Feedback — March 2024 – Present
- Created ROS 2 packages to control a Franka Emika robot arm for adaptive block sorting using any sorting method (color, shape, etc.)
- Developed a PyTorch neural network, enabling real-time learning of sorting methods through user feedback.
- Utilized MoveIt for robot control, integrating depth camera scanning for block detection, pick-up, and sorting operations.

Real Time Stereo Visual Odometry from Scratch — April 2024 – June 2024
- Engineered a real-time visual odometry algorithm for 3D stereo camera position tracking
- Evaluated algorithm performance using the KITTI dataset and conducted live testing with a RealSense stereo camera.

Quadruped Walking with Reinforcement Learning — April 2024 – June 2024
- Designed and implemented a PyTorch-based RL neural network for quadruped locomotion in the OpenAI Gym "Ant" environment.
- Created a custom reward function to optimize the robot's movement speed and smoothness after training.

Autonomous Racecar Robot Build — January 2024 – March 2024
- Built an autonomous car robot from scratch to drag race autonomously with traction control and do point-to-point races.
- Developed ROS 2 packages using C++ to map and plan racetracks through hallways using SLAM Toolbox with a 2D lidar.
- Created a simulation of the robot in Isaac Sim for testing new robot functionality before deploying on the real robot.

Simultaneous Localization and Mapping Algorithm (SLAM) from Scratch — January 2024 – March 2024
- Implemented an EKF SLAM algorithm from scratch using C++ and ROS 2 for both a real and simulated Turtlebot3 robot.
- Incorporated differential drive control of the robot, odometry, and feature classification of 2D lidar data to localize the robot.

Making Coffee With 7DOF Robot Arm — November – December 2023
- Used ROS 2, Python, and MoveIt to control a Franka Emika robot arm to brew a cup of coffee as part of a team of five.
- Used a RealSense camera and OpenCV to detect the handles of objects before picking them up.

Purdue FSAE Electric – Member and 2018 Vehicle Dynamics Team Lead — January 2016 - June 2018
- Led team of 8 students to design, manufacture, test, and tune the suspension system for an electric racecar.
- Achieved team's best results to date: 1st in Skidpad and 2nd in AutoX at Formula North and FSAE Lincoln 2018.

RELEVANT SKILLS

Programming/Software: Python, C++, C, Git, Linux, Unit Testing, Pytorch, TensorFlow, Docker, CMake, OpenCV
Robotics: Robot Operating System (ROS/ROS 2), Kalman and Particle Filters, RRT, A* Algorithm, Sensor Fusion, Reinforcement Learning, Simultaneous Localization and Mapping, SLAM Toolbox, Navigation 2, Isaac ROS, Nvidia Jetson, MoveIt, Visual Odometry, Isaac Sim
Design: CAD (SolidWorks/Creo/ProE/Fusion360/Inventor), CAM (Fusion360), FEA (SolidWorks, Creo), PCB Design (KiCAD)
Manufacturing: Manual and CNC Machining, Injection Molding, Waterjet, Laser Cutting, 3D Printing (FDM, SLA), Soldering