Stephen Ferro

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EDUCATION

Northwestern University, Evanston, IL — Expected Graduation **Fall 2024**
Master of Science in Robotics

Purdue University, West Lafayette, IN — Graduated **May 2018**
Bachelor of Science in Mechanical Engineering
Minor in Economics and Certificate in Entrepreneurship and Innovation.

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

Obstacle Detection Using a Neural Network (in progress) — **February 2024 – Present**
- Created a convolutional neural network using PyTorch to detect obstacles in an RGBD video stream as part of a team of three.
- Collected video data with a mobile robot and created a training dataset by labelling “safe” and “unsafe” regions in the video image.

Autonomous RC Racecar Using SLAM (in progress) — **January 2024 – Present**
- Built an autonomous RC-style car from scratch to drag race and drive laps, using an Nvidia Jetson Orin Nano to control the robot.
- Created ROS 2 packages using C++ and Python to map a track through the hallways of Northwestern then autonomously raced laps.
- Created a simulation of the robot in Isaac Sim for testing new robot functionality without risking a high-speed collision.

Simultaneous Localization and Mapping (EKF SLAM) from Scratch (in progress) — **January 2024 – Present**
- Programmed an EKF SLAM algorithm 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.

Making Coffee With 7DOF Robot Arm: Botrista — **November – December 2023**
- Used ROS 2, Python, and MoveIt2 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.
- Successfully performed precise actions such as grasping the coffee ground scoop and pouring hot coffee into a cup.

Robot Navigation Using A* Algorithm — **October 2023**
- Developed a navigation model for a robot from scratch using Python and the A* algorithm to plan paths to a goal location.
- Created a motion model and PID controller to simulate the motion of the robot following the planned paths.
- Optimized performance of the algorithm using different cell sizes, different obstacles, and different start and goal locations.

Design of Back-drivable Cycloidal Actuator for Quadruped — **June 2021 – December 2022**
- Designed and manufactured a 3D printed robot actuator powered by a brushless motor with output of over 10 Nm of torque.
- With the particle filter, the robot’s position error was improved to <0.25m, compared to >2m using pure dead reckoning.

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.
- Created a MATLAB script to calculate suspension loads, then used the data to optimize suspension design, reducing weight by 15%.
- 2018 Results: 1st in Skidpad and 2nd in AutoX at Formula North and FSAE Lincoln, the team's best results to that point.

WORK EXPERIENCE

SKF USA

Product 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.
- Ensured designs met customer requirements such as stiffness and load capacity by performing raceway and bolting analysis.

Application Engineer for Industrial Market — **June 2018 – July 2022; Elgin, IL and Lansdale, PA**
- Ensure smooth operation of specialty thin section robotics bearings by performing load and torque analysis.
- Directly supported industrial market customers in all aspects of bearing system design, including bearing and seal selection, life calculations, shaft and housing tolerances, and lubrication.
- Reduced failures and improved bearing performance in applications such as pumps, gearboxes, and other rotating machinery.

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.
- Designed and implemented several test procedures, including component fatigue testing, on-vehicle testing, and flowrate tests.

RELEVANT SKILLS

Programming/Software: Python, C++, C, Git, Linux, Visual Studio, MATLAB, Unit Testing, Pytorch
Robotics: Robot Operating System (ROS/ROS 2), Computer Vision (OpenCV), Deep Learning, Neural Networks, Kalman and Particle Filters, Simultaneous Localization and Mapping (SLAM), MoveIt, Single Board Computers, Intel RealSense, LiDAR, Isaac Sim, Gazebo
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