# 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 Engineering Intern**                                        **June 2024 – Present; Chicago, IL**
- Created the RanchRover navigation stack 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 with robot hardware such as the engine ECU (CAN bus) and sensors like GPS (UART).
- Integrated object detection and identification from the Zed 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 distinct teams at all stages of the product lifecycle: design, prototyping, testing, and warranty support.

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## 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.

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## 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