

Andrew Kwolek

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Education

Northwestern University | Evanston, IL
M.S. in Robotics

August 2025 (Expected)

University of Michigan – Ann Arbor | Ann Arbor, MI
B.S.E in Mechanical Engineering and Computer Science, Cum Laude

April 2022

Technical Skills

Robotics: ROS/ROS 2 | SLAM | Perception | OpenCV | Mechatronics | PID Control | Forward/Inverse Kinematics | Gazebo | Kalman Filtering | Sensor Fusion | Unity
Software: C++ | Python | Linux | Git | Docker | C | C# | REST | gRPC | CI/CD | Unit Testing | UDP | SQL | Dynatrace | Jenkins | SQL | Java | Golang | TCP/IP | CAN
Machine Learning: PyTorch | CNN | Clustering | Reinforcement Learning | Sci-Kit Learn | Pandas | Data Augmentation | Signal Processing | Bayesian Inference
Mechanical: SolidWorks | 3D Printing | Motor Selection | Rapid Prototyping | Simulink

Work Experience

Deloitte | Seattle, WA

July 2022 – August 2024

Software Engineer | Cloud Engineering Group

- Led development and conducted code reviews for deployment automation tools leveraged by 20+ teams at TikTok. Reduced deployment times by ~90%
- Maintained end-to-end architecture of microservices in Golang dealing with user accounts, paid content, and creator monetization
- Managed full scale cloud service migration involving multiple teams from US and China for data query service leveraged by hundreds of internal users

General Atomics ASI | Poway, CA

June 2021 – August 2021

Software Engineering Intern | Drone Flight Controls Team

- Developed Python integration test scripts for six autonomous flight control patterns used on ground control station and onboard aircraft
- Merged Python code into production repository using SVN version control software for use in full system CI/CD test suite
- Designed class diagrams, logged test cases and procedures, and devised 28 system requirements for automated unit testing and integration testing framework

Sarcos Robotics (now Palladyne AI) | Salt Lake City, UT

July 2020 – October 2020

Robotics Intern | Controls Team

- Optimized Force Balancing and Payload Estimation software in C++ for Guardian XO robotic exoskeleton to produce fluid movement and reduce user stress
- Wrote new technical documentation for 16 exoskeleton link test procedures used to verify joint limits, position and torque control, and encoder readings
- Designed link components, parts, and test fixtures in SolidWorks. Manufactured and assembled parts for use in exoskeleton performance and testing

University of Michigan Neurobionics Lab | Ann Arbor, MI

May 2019 – February 2020

Research Assistant | Variable-Stiffness Prosthetic Ankle

- Designed and prototyped three robotic subsystems for a variable stiffness prosthetic ankle device using SolidWorks and 3D printing
- Developed 3 unique CAM profiles with varying angle-stiffness curves and rapid-prototyped designs for better visualization
- Led experiments with live test subjects wearing prosthetic. Operated Vicon motion capture to analyze gait with adjustable parameters based on user feedback

Projects

Visual SLAM in Dynamic Environments

April 2025 - Present

- Designed high performance low latency visual SLAM system in C++ with ROS2 and RealSense RGB-D camera for use in dynamically changing environments
- Integrated ORB feature detection and BF feature matching algorithms with RANSAC PnP from OpenCV for feature matching and real-time pose estimation
- Implemented Ceres solver for non-linear optimization of local bundle adjustment and map optimization using DBow2 for scene recognition and loop closure
- Collaborated with robotics faculty to research novel solutions for identifying dynamic scene objects through semantic classification using machine learning

SLAM with Underwater ROV

January 2025 – June 2025

- Developed multithreaded hardware abstraction layer in Python for Simultaneous Localization & Mapping (SLAM) and deployed robot underwater
- Built Docker webservice to run onboard Raspberry Pi in parallel with middleware. REST API built on uvicorn for communication between frontend and backend
- Used CFAR and adaptive filtering for noise reduction then deployed clustering for object detection. Converted data into costmaps for robust map generation
- Implemented monocular visual odometry in Python from optical flow using OpenCV and CLAHE feature detection algorithm for additional localization
- Leveraged C++ multithreading and memory management to fuse camera and IMU data from processing pipeline with ORB-SLAM3 for higher performance

Robot Hand Design Project

January 2025 – May 2025

- Built a robot hand with wrist, dexterous finger, and power grasp finger as part of cross-functional project with mechanical, electrical, and software teams
- Led software design for hand sensing and PID control using Teensy 4.0 MCU programmed in C++ enabling low-level joint FOC and high-level control
- Fused motor and joint encoders, current sensors, and load cells with kinematic model for state estimation and precise control across fingers and wrist
- Designed mechanical components in OnShape for compact design and custom motor driver board with GaN FETs for high switching speed
- Developed CAN driver for high speed and reliable communication between MCUs with simple request/response architecture for error handling and feedback

Image Classification with CNN

November 2024 – December 2024

- Implemented multi-layer Convolutional Neural Network (CNN) on a team using PyTorch for image classification of 20,000 hand-drawn sketches into 250 classes
- Performed data augmentation on training data and utilized batch normalization and dropout for better generalization and reduced overfitting
- Used 3 convolutional layers to achieve 57% validation accuracy and compared results to K-Nearest Neighbors with cosine similarity distance metric in Python