Derek W. Cheng

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Experienced robotics software engineer (5 yrs) completing Master's in Robotics at UPenn GRASP Lab. Seeking to leverage work & research experience in robotics, AI, & software to generate innovative solutions at a fast-paced technology company.

EDUCATION

University of Pennsylvania

M.S. in Robotics (Graduating in May 2024) 2022 – Present

Preprint: **D. Cheng**, F. Cladera, A. Prabhu, X. Liu, A. Zhu, P. Green, R. Ehsani, P. Chaudhari, V. Kumar. TreeScope: An Agricultural Robotics Dataset for LiDAR-Based Mapping of Trees in Forests and Orchards *Under Review* – IEEE International Conference on Robotics and Automation (ICRA) 2024. (*website*, *arXiv*, *video*)

- Lead author of first robotics dataset paper for precision agriculture addressing the counting and mapping of trees in forests and orchards by providing ground-truth diameter and semantic labels for over 1,800 trees
- Deployed state-of-the-art semantic segmentation algorithms (RangeNet, SqueezeSeg, Semantic Localization and Mapping) to enable research for diameter estimation and semantic segmentation for agricultural robots

Thesis: *Multi-Modal Deep Learning NeRFs for 3D Reconstruction of Tree Branching Factors Analysis*

- Building up deeper expertise in Robotics & Technology Development by pursuing research-focused graduate studies in Machine Learning & AI, Perception, & Advanced Robotics at UPenn GRASP Lab
- Research Assistant at Vijay Kumar Robotics Lab – Deep learning and computer vision research for the IoT4Ag project (NSF Engineering Research Center led by UPenn and Purdue) using localization & mapping (Graph SLAM), deep learning for semantic segmentation (RangeNet++), 3-D computer vision and sensor fusion (LIO and VIO) with applications in GPS-denied environments

University of Southern California

B.S. in Mechanical Engineering & Minor in Computer Science 2013 – 2017

- Software lead in capstone project – built a trajectory tracking air hockey robot, using OpenCV to capture puck motion for trajectory tracking and prediction (*video*)

WORK EXPERIENCE

OffWorld Inc. – Lead Robotics Software Engineer 2019 – 2022

- Designed industrial robots for hazardous applications in overseas underground hard-rock mining
- Coordinated with CTO to manage 10-month field testing campaign & successful deployment of first robot prototype in underground mine to conclude multi-year development cycle
- Developed an integrated master schedule with milestones and deliverables for technical testing to achieve key performance metrics (>80% equipment uptime, >200 kg/h mass excavation rates)
- Implemented algorithms for motion planning of 7-DoF robotic arm manipulation for applications in confined subterranean environment (ROS MoveIt!, OMPL, RRT Sampling)
- Filtering & stitching of point clouds to generate collision objects as part of motion planning & collision avoidance modules (PCL, 3D occupancy grid mapping approach)
- Implemented closed-loop control system to control robotic manipulator with force & power feedback while experiencing significant (~500N) reactive forces and vibrations (Linear controls, Kalman filters)
- Lead developer of ROS driver for real-time communication with Yaskawa Motoman 7-DoF robotic arms
- Integrated daily bug reports & feedback from overseas application engineers to produce prioritized task list for software team to rapidly develop mission-critical features & hotfixes with CI/CD pipeline

OnRobot (formerly Perception Robotics) – Software Engineer 2017 – 2019

- Led software design as the only software engineer for product launch of IEEE-award winning Gecko Gripper (2018 IERA Award for Robotics and Automation), leading to acquisition by OnRobot A/S
- Executed successful demos at technology trade shows *Automatica* Munich 2018 and IMTS Chicago 2018 with key partners' robot designs (Universal Robots, Kawasaki, FANUC)
- Developed embedded software drivers (C/C++) for serial communication (RS-232, CAN, UART, SPI) and Ethernet (TCP/IP, Modbus TCP) socket communication protocols on Atmel ARM-based processors
- Hands-on testing and hardware debugging of electromechanical sensors and actuators (Polyskin force & thermal sensors, ultrasonic sensors, FlexiForce, inductive & capacitive proximity sensors)

Millennium Space Systems – Software & Controls Engineer Intern 2017

- Developed C++ drivers for LEO satellite telemetry & communication (RS-422/485) on embedded Linux
- Created MATLAB/Simulink Monte Carlo simulation tool & automated analysis to evaluate power requirements, settling performance, & failure modes of satellite control algorithms

Grabit Inc. – Robotics Engineer Intern 2016

- Optimized accelerometer on ARM Cortex-M4 to minimize settling time of a Toshiba robotic arm
- Scripted tests in C to detect fiducial markers with Cognex VisionPro software

SKILLS

Robotics: ROS/ROS 2, OpenCV, Point Cloud Library, 3D Scene Reconstruction (Gaussian Splatting, NERF), LiDAR and Visual-Inertial Odometry (LIO, VIO), Bundle Adjustment (COLMAP)

Machine Learning: PyTorch, Semantic Segmentation (RangeNet, PointNet), NLP (BERT), LLM (GPT-3)

Programming Languages: C/C++, Python, Java, MATLAB, MySQL

Software: Git, influxdb, Jenkins CI/CD, Solidworks/CAD, NI LabVIEW, Cognex VisionPro

ROS Packages: MoveIt!, Gazebo, ROS-Industrial, Nav2, PCL-ROS

Perception Sensors: Ouster LiDAR, Intel RealSense, Orbecc Astra RGB-D, OVC Camera, FLIR Boson Thermal

Communications: TCP/IP, UDP, Modbus TCP, UART, SPI, I2C, CAN, RS-232, RS-422/485, USB

Embedded Platforms: ARM, AVR, PIC, Atmel, Arduino, Raspberry Pi

Robot Arms: Universal Robots (CB and E-Series), Yaskawa Motoman (7-DoF), Kawasaki (E-Series), FANUC (LR Mate and CR-Series), Toshiba (SCARA)

INTERESTS

Basketball: I co-captained my high school varsity team, and I currently play on a college intramural team and a weekend recreational league

Mentorship: I volunteer as a FIRST Robotics mentor for an inner-city public high school team, supporting weekly meetings & monthly competition events in collaboration with the Philadelphia Robotics Coalition