YIHAO (Charles) CAI

Email: ycai5@wpi.edu | **LinkedIn:** linkedin.com/in/yihao-cai | **GitHub:** github.com/CharlesCai123
Mobile: +1 7743123987 | **Address:** 199 Highland St, Worcester, MA 01609

EDUCATION

Worcester Polytechnic Institute **Sep. 2021 – May. 2023**

- ***Major**: **Robotics Engineering** – **Master of Science** (GPA: 3.8/4.0)* ***Worcester, MA, USA***
- ***Relevant Course**: Robot Dynamics/Control, Human Robot Interaction, Motion Planning, Operating System, Software Security*

Nanjing University of Posts and Telecommunications **Sep. 2016 – Jun. 2020**

- ***Major**: **Telecommunications Engineering** – **Bachelor of Science** (GPA: 3.43/4.0)* ***Nanjing, Jiangsu, China***
- ***Relevant Course**: Digital Signal Processing, Signals & Systems, Automation Control Theory, Computer Networks, etc.*

WORKING EXPERIENCE

ABB Inc. (USA) **Jan. 2023 – May. 2023**

R&D Engineer, Department of Robotics & Discrete Automation | Internship ***San Jose, CA, USA***

- As an R&D engineer, I must find cutting-edge solutions in CV/ML to increase pick-and-place robot performance.
- Build a software framework on Nvidia AI SoC (Jetson AGX Orin) by setting up the GPU computing pipeline (with CUDA, PCL, OpenCV, TensorFlow) and model conversion (TF-TRT) for testing and optimizing inference result (5x faster)
- Research & explore the state-of-the-art Transformer-based DLNN model (Mask3D) in 3D semantic instance segmentation to provide alternatives for solving limitations of the current approach by establishing the high-performance training pipeline.
- Innovate a 2D-based approach for 3D point cloud data labeling and batch generation to train customized models.

Hillstone Networks Co., Ltd **May. 2021 – Aug. 2021**

Software Development Engineer, Department of Cloud Security ***Beijing, China***

- Utilize Kubernetes to organize Docker container clusters and design a security scheme following CIS Benchmarks to protect against container threats; Implement RPC frameworks (HTTP, RESTful, gRPC) to build microservice modules using Golang.
- Exposed to Linux kernel and system modules, including SELinux, AppArmor, eBPF and IPC namespace; I create application-level policies for securing interactions among Docker modules (dockerd, containerd and runc, etc.), increasing overall container security performance in business product around 15%

Whale Cloud Technology Co., Ltd **Jul. 2020 – Mar. 2021**

DevOps Engineer, Department of International & Operation Center ***Nanjing, China***

- Configure web environment by building an automation framework using Shell to deploy Java middleware (Nginx/Dubbo/Redis) on server and ensuring security by utilizing Iptables packet filter with other flow analysis tools (Tcpdump/Wireshark).
- Conduct an end-to-end product delivery by designing test cases (Functional Test) in agile software development, setting up CI/CD pipeline for blue-green deployment, and maintaining Oracle user databases by creating stored procedure statements.

PROJECT / RESEARCH EXPERIENCE

Using Reinforcement Learning to Provide More Robust Congestion Control **Sep. 2022 – Dec. 2022**

- To improve congestion control (CC) robustness in TCP layer, I design and implement a distributed RL-based framework in a virtual network environment (Mininet) and extend its interfaces for customized network topology using synthetic data (***GitHub***)
- Make a system analysis and test the final performance by comparing it with other traditional CC algorithms (TCP Cubic) in a three-by-three dumbbell network topology with different metrics (Bandwidth, Router Buffer Usage, etc.)

Photo App Development (Full-stack) **May. 2022 – Aug. 2022**

- Design and create App UI layout using Flutter including interaction with SaaS platform Firebase, response/request by RESTful API, and widget status management through Riverpod; Also, I build an architecture for Flutter Automation Testing (Frontend)
- For backend side, I set up an environment for auto-configuring PostgreSQL database and also establish a benchmark test framework to estimate database RLS (Row-Level-Security) feature performance (***GitHub***)

WPI HiRO (Human-Inspired Robotics Laboratory) Lab Researcher **Aug. 2021 – Sept. 2022**

- I create an IBVS (Image-based Visual Servoing) scheme with two 6-Dof Kinova arms model by combination of Unity3D and ROS for shared autonomous teleoperation which uses Oculus VR headset for remote scenario telepresence (***GitHub***)
- Development of physical wearable system with RealSense Cameras (sensing), HTC VIVE Trackers (body data) and VR Headset (gaze data + presence) in Unity3D using C#. Design user study and analyze data for research on active telepresence (***GitHub***)

National University Sci & Tech Innovation Program – *SLR (Sign Language Recognition)* **Sept. 2018 – Jan. 2020**

- Data Extraction of sign language features from a batch of video frames captured by KinectV2 (using C++) plus image-processing algorithms from OpenCV (Edge Detection, Threshold Segmentation, Image Filtering) for performance optimization.
- Implementation of Neural Networks (C3D, LSTM, R(2+1)D, etc.) to train model and model parameters tuning on server

An Intelligent Housekeeper System Design Based on Physical Raspberry Pi using C++ **Dec. 2018 – May. 2019**

- Build a master controlling system from scratch by deploying wires on bread board with GPIO pins Including single module implementation (Laser and Temp sensor, MQ-5 Gas Sensor, ADC etc.) and module communication (using SPI, I2C, UART)
- Program analog sensors using C++ and design a user-friendly GUI with Qt Creator in Raspberry Pi (Broadcom BCM2835)

Summer Mathematical Modelling Competition Activity **Jun. 2018 – Sept. 2018**

- Master common mathematical models and algorithms like regression model, correlation analysis and grey prediction, etc.
- Responsible for creating mathematical models applied to daily life and improve the parameters (MATLAB)

University Automation Science Laboratory Robotics Research Project **Jan. 2017 – Dec. 2018**

- Design robot URDF model (using Solidworks) for simulation and integrate tools/algorithms into the physical robotic platforms (TurtleBot, DOBOT Arm, etc.) to perform some basic tasks (Navigation, Locomotion, Grasping, etc.)
- Build a framework for robot hand-eye coordination system using Halcon and MATLAB, plus implementation of it for object detection and grasping without collision using motion planning algorithms from MoveIt library.

EXTRA-CURRICULAR ACTIVITIES

- Member of Cyber Security and Rho Beta Epsilon Club in WPI **2021 - Present**
- Founder Member of University Piobot Robotics Club in NJUPT **2017 - 2019**

Team Leader of Robotics Arm Team, organizing instruction lessons and participating in national robotics competitions and projects

HONORS / AWARDS

- Candidate of Tau Beta Pi Honor Society (WPI Massachusetts Alpha Chapter) **2022**
- ML Paper published on IWPR 2020 **(DOI:** http://dx.doi.org/10.1117/12.2574424**)** **2020**
- First Prize in 2018 National Artificial Intelligence Internet Innovation Competition **2018**
- Third Prize in National University Mathematics Modelling Competition **2018**
- Third Prize in 2018 China National Service Robot Competition **2018**
- First Prize in Provincial University Advanced Mathematics Contest **2017**
- Faculty Honors: Faculty Academic Excellence Scholarship, Civilian Award **2016 – 2017**

SKILLS

- **Programming Languages:**
  - C/C++, Python, MATLAB, C#, Shell/Tcl, Golang, Dart, Assembly**,** HTML5/CSS, JavaScript, PL/SQL, VHDL/Verilog
- **AI & Robotics Framework:**
  - ROS, Gazebo/RViz, SLAM, OpenCV/Open3D, Point Clout Library, MoveIt, scikit-learn, TensorFlow/PyTorch/RLlib, Keras/Caffe, CUDA/cuDNN/TensorRT, OpenGL
- **Tools/Platforms:**
  - **Software:** MS Office, OmniGraffle, Unity3D, Blender, Wireshark, Mininet, SolidWorks, AutoCAD, IDA Pro
  - **IDE:** Vim/Emacs, RoboWare Studio, Android Studio, VSCode, Eclipse, CLion, PyCharm, Qt Creator, MASM
  - **DevOps/Web:** CMake, Docker, Kubernetes, Oracle Database, Flutter, .Net Framework, Git and SVN