**YIHAO (Charles) CAI**

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# 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***](https://github.com/CharlesCai123/RLTCP))
* 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***](https://github.com/CharlesCai123/PhotoApp-Frontend))

[**WPI HiRO (Human-Inspired Robotics Laboratory) Lab Researcher**](#HiROLab) **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***](https://github.com/CharlesCai123/Kinova-IBVS-Control))
* 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***](https://github.com/CharlesCai123/Wearable-MultiCamera-System))

[**National University Sci & Tech Innovation Program – *SLR (Sign Language Recognition)***](#NationalCompetition) **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++**](#IntelligentHome) **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](https://www.waveshare.com/product/MQ-5-Gas-Sensor.htm), 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**](#MathematicalModel) **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**](#RobotLab) **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