

Tianchen Song

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EDUCATIONAL BACKGROUND

Johns Hopkins University Master of Science in Robotics GPA: 3.8/4.0 Relevant Coursework: Machine Learning Algorithms for Sensor-based Robotics (Current teaching assistant) Augmented Reality Robot Motion Planning Robot System Programming Robot Device Kinematics Dynamics, and Control	08/2022 – 05/2024 (expected)
University of Nottingham Ningbo China BEng in Electrical and Electronic Engineering Overall GPA: 3.9/4.0 Dean’s scholarship 2020-2021 (top 10%) Relevant Coursework: Linear Algebra Calculus Electronic Processing and Communications Computer Aided Engineering Information and Systems Computer Vision, etc.	09/2018 – 07/2022





SKILLS

Programming Languages: C/C++ | Python | MATLAB | Verilog | LaTeX | C# | Swift
Frameworks & Libraries: PyTorch | TensorRT | OpenCV | Gazebo | MoveIt
Software & Tools: ROS1/2 | Linux | Git | Unity 3D | Keli MDK | STM32CubeMX | Rhino3D | LTspice | KiCad | PLECS

PROFESSIONAL EXPERIENCE

Development of an Indoor Autonomous Cruise Robotic Vehicle    <i>Final Year Project Supervisor: Dr. Liang Huang</i>	UNNC, China 11/2021 – 05/2022
<p>➤ Design, prototype and test an autonomous vehicle capable of performing indoor navigation based on UWB technology:</p> <ul style="list-style-type: none">Utilized DWM1000 UWB compliant wireless transceiver modules to enable indoor localization with a precision of 10 cm, range of 100m; Further enabled global navigation based on A* algorithm and a waypoint map;Optimized and converted the PyTorch model of collision-free space segmentation to TensorRT inference engine and deploy it on NVIDIA Jetson Xavier to accelerate the inference about 3 times faster while keeping the IoU degradation of the segmentation results less than 5%;Developed a suite of control strategies in Python to enable obstacle avoidance and speed control while heading to the target position based on free-space mask and ultrasonic sensors;Built a GUI in Swift for remote monitoring and controlling the robot through Bluetooth on an iPhone <p><i>Used: Python, Swift, C, PyTorch, TensorRT, A* algorithm, RGB-D cam, UWB module, BLE module, ultrasonic module etc.</i></p>	
Development of an On-campus Autonomous Delivery Vehicle   <i>Team Leader Supervisor: Dr. Adam Rushworth</i>	Innovation Lab, UNNC, China 12/2020 – 09/2021
<p>➤ Led the development of an RTK-GPS-guided autonomous vehicle with mechanical modification to the chassis for on-campus package delivery, with the objective of improving the collaboration and convenience for staffs and students:</p> <ul style="list-style-type: none">Led the team in the determination of the overall solution of unmanned vehicle navigation and obstacle avoidance, chassis and sensor selection and body structure design;Collected and labelled an RGB-D dataset of the campus as an augmentation of the open-sourced dataset;Trained and tested a deep learning model in PyTorch with different backbones and hyperparameters to drive real-time RGB-D camera frame segmentation to detect the collision-free space for obstacle avoidance purpose; Further deployed the model with highest IoU on NVIDIA Jetson Xavier NX board with ROS integration;Developed packages and nodes in ROS to retrieve and decode raw data from on-board sensors through UART / CAN port;Fused the GPS data, wheel odometry and IMU data using Extended Kalman Filter to obtain an optimal pose estimation; <p><i>Used: Python, PyTorch, SolidWorks, ROS, A*, IMU, Radar, RTK-GPS, RGB-D cam, NVIDIA Jetson, Linux, UART, CAN</i></p>	

COURSE PROJECTS

Alzheimer’s disease diagnosis based on MRI scans and clinical data  <ul style="list-style-type: none">Pre-processed the MRI scan data to fit the network’s input;Designed networks based on ResNet-18 by adding attention block and/or clinical data input;Trained, tested and compared the model performance between different architectures and hyperparameters and reached 83.8% accuracy and 97.7% recall on test set. <p><i>Used: Python, Pytorch, ResNet</i></p>	11/2022 – 12/2022
Mobile robot pose estimation in Gazebo <ul style="list-style-type: none">Implemented Extended Kalman Filter in C++ to estimate the location of a mobile robot based on GPS, IMU and control command on a simulated rugged terrain in Gazebo to obtain location errors smaller than 0.5m;Implemented Particle Filter in C++ to estimate the position and orientation of a mobile robot in a given map based on Lidar; <p><i>Used: C++, MATLAB, ROS, Gazebo, extended Kalman filter, particle filter, sensor fusion</i></p>	11/2022 – 12/2022
Motion Planning for a 6-joint serial link manipulator (UR5)  <ul style="list-style-type: none">Implemented hand-eye calibration algorithm in MATLAB for manipulator-camera systems and achieved 0.001m accuracy;Implemented Probability RoadMap Planning in C++ to enable the collision free operation of UR5; <p><i>Used: C++, MATLAB, ROS, RViz, forward kinematics, inverse kinematics, BFS algorithm, PRM planning algorithm</i></p>	09/2022 – 10/2022
Stereo matching using Semi-global matching algorithm  <ul style="list-style-type: none">Implemented Semi-global matching (SGM) algorithm in Python to compute the depth from a pair of rectified stereo images and compared the performance with Normalized Cross Correlation and Sum of Squared Differences methods; <p><i>Used: Python, OpenCV, semi-global stereo matching</i></p>	04/2022 – 05/2022
Design, implementation and test of an autonomous line-following robotic vehicle  <ul style="list-style-type: none">Designed the PCB of H-Bridge motor control circuit in KiCad to integrate a MOSFET driver, MOSFETs among other electronic components and peripheral equipment, followed by soldering, wire connection, and hardware test.Enabled recognition of modeled traffic light and road signs based on Haar feature-based cascade classifiers implemented in C++ using Raspberry Pi 4B and OpenCV API, with a focus on navigating through a preset route on ground while performing various dynamics maneuvers following model road signs.Implemented and parametrically optimized a digital PID controller to improve the line-tracking stability. <p><i>Used: C++, OpenCV, Linux, PID, KiCad, LTspice, various sensors & lab equipment such as oscilloscope, soldering iron etc.</i></p>	03/2020 – 06/2020