Hang Liu

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Education

Xi'an University of Technology **September.2020 – June.2024**
*Major in **Robot Engineering**(Ranking:4/30)* *Xi'an, Shaanxi*

Overall Average Score: 87.2/100 **Major Average Score:** 89.1/100
Key Courses: Robot Operating System(97/100), Object-Oriented Programming for Video Processing(94/100), Microcomputer Principles and Embedded Systems(93/100), Automatic Control Theory(93/100), Robot Control(95/100)

Publication & Patent

Intelligent voice storage device based on embedded technology **November.2021**
Patent Publication Number:CN216212333U *Espacenet/CN216212333U*

Epidemicshield ROS robot control embedded system **October.2022**
Software Copyright Register Number:2023SR0324403

Epidemicshield ROS robot intelligent mapping navigation system **August.2022**
Software Copyright Register Number:2023SR0235263

Research & Project Experience

RoboMaster Robotics Competition(Organized by DJI) **2022-2023**
Xi'an University of Technology NEXT-E robot team Deputy Team Leader & Head of the Visual Team

- Designed a multi-threaded autonomous targeting system for a robot that uses OpenCV(including Contour extraction, expansion/corrosion, image filtering and other algorithms) in order to identify target objects. Simultaneously, using feature matching algorithms and Kalman filtering for multi-object matching and motion prediction across several frames at the same time. Finally, the robot was able to achieve a recognition frame rate of 80+ frames per second and a recognition accuracy of 98% within a 5-meter range for the robot.
- In charge of simulating and making control algorithms for a hybrid jumping robot with both legs and wheels based on Webots. Lagrangian dynamics modeling was used to build a state space, and the LQR algorithm was used to build a robust control method for the wheeled-legged robot.
- Create upper-level control and navigation algorithms for a robot employing the T265 camera and ORB-SLAM3 for mapping and navigation. TagSLAM was also implemented to reduce cumulative errors in the SLAM process. Created a simulation platform in GAZEBO for testing 3D laser-based navigation algorithms in challenging terrains.

National University Students' Opt-Sci-Tech Competition **2021-2022**
Undergraduate Researcher, Instructed by Prof.Jingyi Wang

- Designed a firefighting robot that uses deep learning to detect fire occurrences, autonomous robot navigation and positioning, and a two-degree-of-freedom gimbal to discharge firefighting projectiles to suppress fires.
- Developed and deployed target detection techniques within the team, utilizing the YOLOX object identification algorithm, model training with PyTorch, and deployed with OpenVINO to optimize inference speed.
- Initiated and managed the development of control software for the team's robot using the STM32 microcontroller, utilizing the FreeRTOS operating system for multi-threaded motor control to reach desired positions. The chosen algorithm employed was forward-feed PID.

China Undergraduate Mathematical Contest in Modeling **July.2022 – December.2022**
Undergraduate Researcher, Instructed by Prof.Wenyan Guo

- I aspired to use machine learning and quantitative analytic approaches to help archaeologists acquire a more rational understanding of the links between artifact chemical composition, classification, and weathering

- Used chi-square tests to determine the asymptotic significance of various chemical components on the weathering of artifacts, built a multiple linear regression model to predict the pre-weathering composition of weathered artifacts, model error less than 5%, and investigated the impact of chemical components on artifact weathering.
- Applied the Random Forest and Decision Tree algorithms to analyze the association between the chemical composition of artifacts and their respective categories, yielding an AUC of 0.94. Subsequently, used the K-means algorithm to cluster artifact data into subcategories, resulting a more rational classification system for artifacts.
- Employed Grey Relational Analysis to investigate the interaction between chemical components, resulting in the identification of compositional disparities among different categories of artifacts.

Working Experience

Jiangxi Intelligent Industry Technology Innovation Research Institute **August.2021**

Embedded Development Intern

- In charge of developing user functions for a seven-axis robotic arm. Using Python and libraries such as PyQt5, I created a real-time handwriting capability for the robotic arm's end-effector. Users can now write directly on a user interface (UI) in real time. The brush-equipped seven-axis robotic arm replicates these trajectories and conducts ink supplementing and resetting functions on a wider canvas.
- Tested the UR6-degree-of-freedom robotic arm in a simulated platform.
- Created ABB robots with the RAPID programming language, allowing ABB robotic arms to execute tasks including material handling, item flipping, and palletizing.
- Researched the robot operating system and architecture while actively contributing to the development of documentation.

Honors & Awards

- China National Scholarship 09/2023
- Third Prize in the National University Students' Opt-Sci-Tech Competition 08/2022
- Second Prize in the 22^{nd} National College Student Robotics Competition RoboMaster2023 RMUL 04/2023
- Third Prize in the 22^{nd} National College Student Robotics Competition RoboMaster2023 RMUC 06/2023
- Third Prize in the 21^{st} National College Student Robotics Competition RoboMaster2022 RMUL 11/2022
- Third Prize in the MathorCup University Mathematical Modeling Competition 06/2022
- First Prize in the National College Mechanical Innovation Competition (Shaanxi Region) 07/2022
- First Prize in the China Undergraduate Mathematical Modelling Contest (Shaanxi Region) 12/2022
- Third Prize in the National Undergraduate Electronic Design Contest (Shaanxi Region) 09/2022
- XAUT Excellent Student Scholarship 12/2022

Technical Skills

- **Programming:** C/C++, Python, OpenCV, Shell, XML, Markdown
- **Tools:** ROS/ROS2, WSL and Linux, Webots, Matlab, CubeMx, Keil, Git, AutoCAD, SolidWorks, Altium Designer

Additional Information

- Made all of my projects available as open source on GitHub. My tutorial blogs on robot vision processing have garnered over 10,000 views and more than 100 bookmarks on the CSDN website.
- XAUT New Star Cup Basketball team member from the School of Automation and Information Engineering.
- Organized multiple machine vision training sessions and embedded development workshops as a senior student, assisting many freshmen in embarking on their journey towards competitions and research opportunities.