ZEFENG YE

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RESEARCH INTERESTS

My work focuses on autonomous information collection using visual and lidar sensors equipped on the robots for localization and mapping, environmental monitoring, and security and surveillance. I also focus on scene understanding problems that perceive geometry and semantic information to improve the autonomy of robots. The relevant fields of my interesting research are **Visual/LiDAR SLAM, Multi-sensor fusion, Semantic mapping, 3D modeling, Robotics, Computer Vision, and Autonomous Vehicles**.

EDUCATION

Colorado State University, USA August 2015 - June 2018
M.S. in Electrical Engineering
Overall GPA: 3.61/4.0

Zhejiang University City College, China August 2011 - June 2015
B.S. in Information & Electrical Engineering
Overall GPA: 3.43/4.0

WORK EXPERIENCE

The Chinese University of Hong Kong December 2020 - Present
- ***Shenzhen Innovation and Technology Research Institute (Futian)*** *Shenzhen, China*
Research Assistant

- Maintained and developed the automatic interior painting robot.
- Deployed SLAM system based on multi-sensor fusion (wheel-encoders, kinematics, IMU, 3D LiDAR).
- Designed whole-body motion planning framework for mobile manipulator robots.
- Developed Gazebo simulation environments and verifying algorithms.

Harbin Institute of Technology (Shenzhen) December 2018 - December 2020
- ***Department of Mechanical Engineering and Automation*** *Shenzhen, China*
Research Assistant

- Maintained and developed the automatic interior finishing robot.
- Designed wall defects-based semantic SLAM system with multi-sensor fusion (wheel-encoders, kinematics, IMU, 2D LiDAR, Stereo Camera) for mobile manipulator robots.
- Developed Gazebo simulation environments and verifying algorithms.

RESEARCH EXPERIENCE

Low-Drift RGB-D SLAM with Room Reconstruction Using Scene Understanding
May 2021 - Present

- Developed an architecture for online, incremental room reconstruction which combines an accurate RGB-D SLAM and room layout understanding.

- Proposed an efficient scene understanding method to detect wireframes and layout planes of building from RGB-D image, even if there are occlusions in the scene.
- Treated the wireframes and layout planes as global features and integrated them with points-based SLAM to improve the accuracy and robustness.
- Conducted experiments on a public ICL-NUIM dataset, our algorithm achieves lower drift (1-2 cm), and it also builds a geometrically meaningful map.
- The video material on YouTube: https://youtu.be/57E03vVi8_c

Development of an Automatic Robot for Interior Wall Painting December 2020 - Present

- Developed a full-coverage wall painting framework for the automatic interior painting robot, which ables automatic perception in the construction site through 3D LiDAR and performs full-coverage painting planning with minimum length of the execution trajectory.
- Designed a modeling algorithm to establish the relationship between the 3D building models and painting coverage by the spray gun's sector field.
- Conducted experiments on a realistic interior painting robot to validate the performance of the developed framework (painting path reduced: 56.2%, painting efficiency: $40 sec/m^2$).
- The video material on YouTube: https://youtu.be/QkSO2NRF3Wo

A Wall Defects Based Semantic SLAM System for Autonomous Interior Finishing Robot
December 2018 - December 2020

- Proposed a global accuracy and wall defects-based semantic SLAM system for automatic interior finishing robot.
- Improved the accuracy and robustness of localization by leveraging a tightly-coupled state estimator with multi-sensors fusion.
- Involved object-level semantic mapping to achieve centimeter-level wall defects positioning.
- Conducted experiments on realistic interior finishing robot, and the results of repetitive pointing the wall defects by the end-effector's center showed the reliability and efficiency of our proposed SLAM system (2-3 cm error).
- The video material on YouTube: https://youtu.be/wcEjymOD_18

Real-time Obstacle Avoidance for 6-DoF Manipulators 2017 - 2018

- Conducted research on real-time obstacle avoidance algorithm for 6-DoF manipulators.
- The DLS inverse kinematics algorithm is used to solve the singularity problem. Moreover, the DLS algorithm is improved through SVD analysis: improve real-time performance.

PUBLICATIONS

- **Zefeng Ye**, Xin Jiang, Yunhui Liu. Low-Drift RGB-D SLAM with Room Reconstruction Using Scene Understanding. *In 2021 IEEE International Conference on Robotics and Biomimetics (ROBIO)* (Accepted)
- **Zefeng Ye**, Changheng Sun, Xin Jiang, Yexi Chen, Honghai Zhang, Yun-hui Liu. A Wall Defects Based Semantic SLAM System for Autonomous Interior Finishing Robot. *(Under Review)*
- Yang Zhou, **Zefeng Ye**, Linzhu Yue, Linhai Gui, Xin Jiang, Xiang Li, Peng Li, Yun-hui Liu. Development of an Automatic Robot for Interior Wall Painting. *(Under Review)*

PROFESSIONAL SKILLS

Programming	C, C++, Python, Matlab, Javascript.
Tools	ROS, Gazebo, PCL, OpenCV, Pytorch, Eigen, MoveIt, G2O, GTSAM, Ceres.
SLAM	State estimation, Multi-sensor fusion, Visual-inertial odometry (VIO), Visual SLAM, LiDAR SLAM, Semantic mapping.
Planning/Control	Motion planning, Navigation, Mobile manipulator, Kinematics and Dynamics of manipulator,
Learning	Machine Learning, Deep Learning.

AWARDS

- 2017 Spring & Fall Scholarship, Colorado State University.
- Provincial Third prize in The 9th National College Student Smart Car Competition, China.