Naigui Xiao

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Education

M.S. **Harbin Engineering University(211)**, *Harbin, China*
Major: *Naval Architecture and Ocean Engineering* *2019 - 2022*
Final Grade: *3.5/5.0 (Top 30%)*
Specialisms: *Mainly focus on underwater robot navigation and control in underwater robot lab.*
Thesis title: *Research on Positioning Method of Underwater Robot Based on Multi-sensor Data Fusion*
Detail: *In this paper, a ROV localization method is proposed, which integrates multiple sensors such as camera, sonar and IMU through nonlinear optimization method to adapt to the special underwater environment.*

B.Eng. **Nanjing University of Aeronautics and Astronautics(211)**, *Nanjing, China*
Major: *Automation* *2015 - 2019*
Final grade: *3.1/5.0 (Top 45%)*
Specialisms: *automatic control theory; Embedded System development; Signal processing; Visual SLAM*
Thesis title: *The Research and Implementation of SLAM System Based on Binocular Vision*

Experience

Engineer of LiDAR Algorithm and Application *FEB 2022 - NOW*
Fulltime in Innovusion Co. *Suzhou, China*

- **LiDAR-based localization algorithm:** Develop multi-sensor fusion LiDAR localization algorithm based on optimization and Kalman filter for autonomous driving and road end applications.
- **LiDAR-IMU calibration:** Develop LiDAR-IMU calibration algorithm based on hand-eye calibration method.
- **low cost GPS and IMU fusion localization method:** Develop GPS-IMU fusion localization algorithm using ESKF(second version is implemented with the IKFoM lib). GPS measurement come from cell phones using websocket.
- **Large-scale environment mapping:** Build large-scale pointcloud map of highway.
- **3D Pointcloud Classification:** Develop 3D Pointcloud Classification network run on CPU using ncnn.

ROV localization using SBS(Short Baseline Sonar) *JUN 2021 - AUG 2021*
Internship in Feimabin (Qingdao) Intelligent Technology Co., Ltd. *Qingdao, China*

- Responsible for the design of the positioning scheme of the ship cleaning robot, and code implementation.

ROV sea trial for coral protection in Sourth China Sea *MAR 2021 - MAY 2021*
Harbin Engineering University underwater robot lab *Sourth China Sea, China*

- In charge of the ROV control system design and to maintain and test. This experiment was designed to test the effect of using ROV to clean up acanthaster planci flooding in shallow waters, which feeds mainly on coral.

Pratical project of bionic UAV *SEP 2017 - JAN 2018*
Internship in Shenzhen DAMODA Intelligent Control Technology Company *Nanjing, China*

- Use Solidworks to design bionic butterfly ornithopteric aircraft. Write control program, make and test the prototype.

Human gesture recognition and 3D modeling *JUL 2018 - OCT 2018*
A campus science and innovation project *Nanjing, China*

- Using STM32 and six-axis inertial sensors make a wearable glove, which could colect the movement of human hand. Based on these information, Unity3D was used to build 3D models for visualization.

Motion-sensing game design based on FPGA *APR 2018 - JUN 2018*
A campus FPGA Design Competition *Nanjing, China*

- A Flappy Bird like game using FPGA, sound transducer was used to control character's movement.

Internship in AVIC Jiangxi Hongdu Aviation Industry Group Company *JUL 2017 - AUG 2017*
AVIC Jiangxi Hongdu Aviation Industry Group Company *Nanchang, China*

Skills

Skills: Robotics Related

My interest in robotics throughout my studies, and my knowledge of the field, has led me to develop skills in the following areas:

SLAM and mulit-sensor fusion: start with visual SLAM; and then explored the fusion of vision, sonar and IMU on underwater robot for application in underwater scenes(in my master's studies); also have experience in LiDAR odometry, LiDAR-IMU odometry and GPS-IMU fusion for autonomous driving(at work).

LiDAR data processing and application: handling LiDAR data in various methods, including registration, motion compentation, cluster, etc.

Design and execution of prototype experiments: over two years experience working cooperatively in ROV laboratory; self-motivated and tough enough to endure poor experimental environment.

Multi-platform development: develop on ROS and Baidu APOLLO.

Control theory: systematically studied in university, and used in many projects.

Design and modeling of robot structure: in development of bionic aircraft, CAD and Solidworks was used to design the prototype.

PCB design and embedded circuit programming: using STM32 series chips to develop control program in ROV and other project; also have FPGA development experience.

Design and modeling of robot structure: in development of bionic aircraft, CAD and Solidworks was used to design the prototype.

Skills: Computer and Programming

During years of study, work and practice, the following computing abilities have been developed:

C/C++ for development: is my primary programming language, familiar with tools and utilities available in C++(CMake, Bazel, etc.)

Python for data processing: use python as an efficient tool for processing data and previewing new ideas; in a period of time, tried to use neural network for pointcloud classification.

Use MATLAB to process data: used for control system simulation in some projects during undergraduate years.

Use git to manage projects and collaborate with others: proficient in git management of project code with team.

Skills: Reading and Communication

Keep reading papers: this is where I get new knowledge and keep up with trends.

Collaborate and communicate with people from different backgrounds: shared workspace, materials, and knowledge.

Language competence: proficient in English for communication, presentation and reading.

Open Source Projects

MobileGPS2PC	Transmit mobile phone GPS to server in Baidu APOLLO module using websocket.
GIOODOM	GPS IMU Fusion via ESKF on ROS.
LIGO	A robust odometry that fused LiDAR, IMU and GPS, which can still work when different sensors join and exit.
LiDAR-IMU Calibration	LiDAR to IMU calibration using hand-eye method.
LiDAR-IMU Extrinsic refine	GPS Refine extrinsic of LiDAR to IMU.
Highway mapping	Build LiDAR pointcloud map through RTK and IMU measurements.

Grants and Awards

2x academic scholarships in HEU

1x academic scholarship in NUAA

Third prize of Aircraft Design Competition

Second Prize in Anlu Cup FPGA Competition

Outstanding Student Certificate of Visual SLAM Course of Deep Blue Institute(Online course)

Outstanding Student Certificate of Multi-sensor Fuison Course of Deep Blue Institute(Online course)

3x Runner-up of the Intercollegiate Cup Football Competition in 15/16, 16/17 and 17/18 academic year:(

Academic Interests

Robotics Related

1. **Real-time and Large-scale SLAM**. I find that there is a great demand in real application scenarios.

2. **SLAM in Dynamic Environments**. I have encountered such a problem at work, we came up with a redundant solution, but I didn't like it.

3. **Map reuse and update in dynamic environment**. The sparsity of the point cloud map makes it difficult to reuse the maps established by the point cloud map. Novel map representation methods can bring new blood to SLAM.

4. **Deep Learning for SLAM**. Since deep learning techniques have shown great potential in various tasks. How will he applied in SLAM is exciting.

5. **Semantic related**. It is important for robots or autonomous systems to have a richer understanding of environment.

6. **Collaborative SLAM**. Multiple robots or UAVs working together to build a shared map of the environment is a promising approach to solve the localization problem in large-scale environments.

7. **State estimation method for multi-sensor fusion**. SLAM problem is essentially a state estimation problem. Fast and accurate back-end optimization methods are still a challenging subject.

8. **event-based SLAM**.As an emerging sensor, how the sparsity and asynchrony of event cameras will be applied to perception and positioning remains to be explored.

AR/VR/MR

1. Use sensor fusion and SLAM to improve this new method for human and computer interaction.

2. Any novel research and applications.

Other Interests

Hobbies: football, cycling, reading, play electric guitar, movie

Figure 1: pic of myself :)