MINZHAO ZHU

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EDUCATION

Beijing Institute of Technology *(Project 985/211/Double-First Class)* Sept. 2017 - Jun. 2020
Master of Engineering (Control Science and Engineering)
GPA: 86.5/100 **Rank:1/147**

Beijing Institute of Technology *(Project 985/211/Double-First Class)* Sept. 2013 - Jun. 2017
Bachelor of Engineering (School of Automation)
GPA: 92.8/100 **Rank:3/172**

PUBLICATION

Papers:

[1] Mengyin Fu, **Minzhao Zhu**, et al. "LiDAR-based Vehicle Localization on the Satellite Image via a Neural Network". (Under Review)

[2] Ting Zhang, **Minzhao Zhu**. "GPS-assisted Aerial Image Stitching Based on Optimization Algorithm", IEEE 38th Chinese Control Conference. (Accepted)

Patents:

● Yi Yang, **Minzhao Zhu**, et al. A localization method based on 3D point cloud and satellite image matching. 201910204082.4 (submitted)

● Yi Yang, **Minzhao Zhu**, et al. Automatic mouse & keyboard switching method based on face orientation recognition. 201810612137.0 (Substantive Examination)

● Yi Yang, **Minzhao Zhu**, et al. Autonomous navigation and automatic charging method for bank hall environment. 201710477997.3 (Substantive Examination)

PROJECTS

LiDAR-based Vehicle Localization based on Satellite Image Matching Oct. 2018 – Present

● Postgraduate Research

● Proposed a localization method that uses satellite image as the prior information to achieve localization in GNSS-denied area. A neural network is proposed to compare the LiDAR grid-map with the satellite image patch in the Bird's Eye View (BEV). The network first extracts the spatial-discriminative feature maps of the grid-map and the satellite image respectively, then a classification network is used to compare the feature maps and outputs the probability of correspondence. Then based on the outputs, a particle filter is used to obtain the probability distribution of the vehicle's pose. The average position error on several KITTI sequence is 2.5 m. Compared with other methods, our method is more robust in some challenging scenarios such as the occluded or shadowed area on the satellite image.

● Recent work is a LiDAR SLAM framework based on LeGO-LOAM. Our approach performs road

intersection detection at each timestamp. If the vehicle is near the intersection, then the LiDAR grid-map and satellite image patch are fed to a neural network, which directly outputs the pose correction bias. The bias is added as a prior factor to the factor graph to perform pose optimization.

UAV-UGV Collaborative Target Searching Project Jun. 2018 – Sep. 2018

- Competition Project.
- The UAV searches and tracks the moving target (a vehicle) in an unknown area and send the position of the target to the UGV continuously.
- Designed the hardware and software architecture of the UAV-UGV collaborative system.
- Designed an aerial image stitching algorithm.
- Designed a target detection algorithm based on YOLO v3 network and Kalman filter.

Intelligent Mouse and Keyboard Switcher Aug. 2017 – May. 2018

- The project is designed to make it easy for users to operate multiple computers with a single mouse and keyboard. Face orientation recognition algorithm is used to find which computer the user desires to use. Then the device automatically switches the mouse & keyboard signals to that computer.
- Designed a face orientation recognition neural network. The network consists of MTCNN and a VGG-16 network with 3 outputs which represent different orientations. About 30,000 images are collected to train the network. The classification accuracy is 98.3%.

Hongqi-H7 Self-driving Car Sep. 2017 – Nov. 2017

- Competition Project
- Designed a lane detection algorithm. SegNet is used to segment the ground region. Then the image with the ground mask is transformed into bird's-eye view by Inverse Perspective Mapping (IPM). Hough transform is used to detect the lane. Then the feature maps of the image patches on the lane candidate regions are fed to a classification network to obtain the type of the lane. The algorithm can run at a frequency of 5Hz on the computer with NVIDIA GTX 1070.

BankBot (A mobile robot for bank reception service) Mar. 2017 – Sep. 2017

- A product developed in cooperation with a private company
- Designed a localization algorithm which can be used for docking with the auto-charge station. The algorithm uses 2D-laser SLAM and visual-based charge station detection to localize the robot. Up until now, the robot has been deployed into service at 35 banks for 2 years.

Research on Air-Ground Collaborative Perception Mar. 2017 – Jun. 2017

- Undergraduate Research
- Proposed a method for complementing the blind spot of the UGV. The LiDAR point cloud is divided into 720 sectors. The blind areas are detected in each sector. Then the UAV uses ORB-SLAM to construct the map of the blind areas. The AprilTags is used to calculate the transformation between the map constructed by the UAV and UGV.

HONORS AND AWARDS

2018, 2016,2015	National Scholarship	**Top 2% in BIT**
2018	Unmanned System Challenge (Air-Ground Collaboration Competition)	**National First Prize**
2018	the 46th International Exhibition of Inventions of Geneva	**Gold Award**
2017	2017 China Smart Car Future Challenge Competition	**National First Prize**
2017	the 15th Challenge Cup National Undergraduate Extracurricular Academic Science and Technology Contest	**National First Prize**
2017	the 45th International Exhibition of Inventions of Geneva	**Gold Award**
2017	Excellent undergraduate thesis of Beijing Institute of Technology	**Top 5% in BIT**

EXPERIENCE

Sep. 2018 - Present	Peer tutor of one of the first-year undergraduate classes in BIT
Mar. 2019 - Jun. 2019	Teaching assistant in "Digital Electronic Technology Course" in BIT
Sep. 2018 - Jan. 2019	Teaching assistant in "Analog Electronic Technology Course" in BIT
May. 2018	Assistant referee in the 17th China University Robot Contest (ROBOCON)
Oct. 2017 - May. 2018	Tutor of a project in China Adolescents Technology Innovation Contest

MISCELLANEOUS

- **Programming languages:** C/C++, Python
- **Tools:** ROS, Caffe, PyTorch, OpenCV, PCL
- **Skills:** Understand the mainstream methods of image classification, target recognition, and semantic segmentation; understand the mainstream SLAM method.