# Kaining Zhang

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## RESEARCH INTERESTS

My research interests mainly lie in stereo vision and its applications (SLAM, Structure-from-Motion, large-scale visual localization, *etc.*). Previously I have been focused on loop closure detection to improve the performance of monocular SLAM (related fields: image retrieval, place recognition, image matching, *etc.*). Currently I am working on the intersection between 3D geometry and deep learning.

## EDUCATION

**Wuhan University (WHU), Multi-Spectral Vision Processing Lab** **2019-2024 (Expected)**
*Ph.D. in Communication and Information System, supervised by Prof.* ***Jiayi Ma*** *GPA:3.83/4.00*

**Wuhan University (WHU), Electronic Information School** **2015-2019**
*B.Eng. in Electronic Information Science and Technology* *GPA:3.67/4.00*

## PUBLICATIONS

1. **Loop Closure Detection with Bidirectional Manifold Representation Consensus**
***Kaining Zhang***, *Zizhuo Li, Jiayi Ma*
IEEE Transactions on Intelligent Transportation Systems (TITS), minor revision

2. **Appearance-based Loop Closure Detection via Bidirectional Manifold Representation Consensus**
***Kaining Zhang***, *Zizhuo Li, Jiayi Ma*
IEEE International Conference on Robotics and Automation (ICRA), 2021

3. **Appearance-based Loop Closure Detection via Locality-driven Accurate Motion Field Learning**
***Kaining Zhang***, *Xingyu Jiang, Jiayi Ma*
IEEE Transactions on Intelligent Transportation Systems (TITS), 2021

4. **Motion Field Consensus with Locality Preservation: A Geometric Confirmation Strategy for Loop Closure Detection**
***Kaining Zhang***, *Xingyu Jiang, Xiaoguang Mei, Huabing Zhou, Jiayi Ma*
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021

5. **Loop Closure Detection with Reweighting NetVLAD and Local Motion and Structure Consensus**
***Kaining Zhang***, *Jiayi Ma, Junjun Jiang*
IEEE/CAA Journal of Automatica Sinica (JAS), 2022

6. **Loop Closure Detection via Locality Preserving Matching with Global Consensus**
*Jiayi Ma,* ***Kaining Zhang***, *Junjun Jiang*
IEEE/CAA Journal of Automatica Sinica (JAS), 2022

7. **Cross Fusion Net: A Fast Semantic Segmentation Network for Small-scale Semantic Information Capturing in Aerial Scenes**
*Chengli Peng,* ***Kaining Zhang***, *Yong Ma, Jiayi Ma*
IEEE Transactions on Geoscience and Remote Sensing (TGRS), 2021

# RESEARCH PROJECTS

**Deep Feature Learning with Differentiable Pose Optimization**
*Supervised by Prof.* ***Jiayi Ma*** *Ongoing*

- *Background:* Local feature detection and description is crucial in many applications such as large-scale visual localization, Structure-from-Motion, pose estimation, *etc.* Nowadays more and more deep solutions can remain competitive with or outperform their handcrafted counterparts (such as SIFT, SURF, *etc.*).
- *Expected Contribution:* Traditionally, feature detection, description, matching and pose estimation are approached in an isolated fashion. We believe that better features can be learned for the downstream tasks mentioned above if we train the feature extraction network and pose optimization jointly.

**A More Robust Geometric Verification Method for Monocular SLAM**
*Supervised by Prof.* ***Jiayi Ma***
*and Dr.* ***Ji Zhao****, who works for* ***TuSimple-Autonomous Trucking Technology, Beijing*** *Ongoing*

- *Background:* Monocular SLAM has well-known limitations in robustness and accuracy as compared to those leveraging active depth sensors (RGB-D SLAM). This performance issue is caused by the so-called scale drift in both the camera trajectory and 3D scene depth. How to deal with this drift while conducting global mapping and localization is a long-standing topic in this field.
- *Expected Contribution:* Global mapping and localization is typically achieved by bundle adjustment, and its input is a set of matches built by feature detection, description, matching, and outlier rejection. To improve the reliability of monocular SLAM systems, we attempt to propose a more robust outlier rejection method to deal with gross outliers caused by exposure changes, moving objects, *etc.*

**Learning Scene Geometry with Neural Implicit Representations for Dense Visual SLAM**
*Supervised by Prof.* ***Jiayi Ma*** *Perspective*

- *Background:* Recently, the emergence of neural implicit representations have encouraged many dense SLAM systems to be real-time capable, scalable, predictive, and robust to various challenging scenarios.
- *Expected Contribution:* The performance of dense SLAM based on neural implicit representation highly depends on the expression ability of the used scene representation. So we attempt to supervise the network with white-box computer vision models (*i.e.*, 3D geometry) to generate more powerful scene representations.

# OTHER INFORMATION

- **Languages:** Chinese(Mandarin, native), English
- **Programming Skills:** Python, C/C++, MATLAB, LaTeX
- **Operating Systems:** Windows, Linux
- **Deep Learning Framework:** PyTorch
- **Hobbies:** Tennis, Badminton

# AWARDS

- **Excellent Undergraduate Thesis of Wuhan University in 2019**
- **Recipient of Excellent Student Scholarship of Wuhan University from 2016 to 2019**