

Mo Shan (Sean)

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EDUCATION

University of California, San Diego

Master of Science in Electrical and Computer Engineering, GPA 3.74/4

La Jolla, CA, USA

Sept. 2016 – Dec. 2019

National University of Singapore

Bachelor of Science in Electrical and Computer Engineering, GPA 4.84/5

Singapore

Sept. 2010 – Jun. 2014

University of Southampton

Student Exchange Program in School of Electronics and Computer Science

Southampton, United Kingdom

Dec. 2012 – Jul. 2013

RESEARCH INTERESTS

- Rich models of tightly coupled localization and environmental representation that unify multiple characteristics, such as the geometric landmarks, semantic object-level map, object surfaces, and yet scale to large environments in real-time on embedded platforms such as quadrotors
- Simultaneous localization and mapping; visual-inertial odometry
- Relevant fields: computer vision, machine learning, optimization

EXPERIENCE

Research Intern

FACEBOOK REALITY LABS

Jun. 2021 – Sept. 2021

USA

- Worked remotely on a project related to AR/VR and delivered results with a high impact
- Used modern C++, Python, PyTorch

Graduate Student Researcher

ECE, UCSD

Jun. 2018 – Jun. 2021

USA

- Designed and developed a tightly coupled, filtering based semantic VIO (OrcVIO) that produces an object-level map, with C++, Python, OpenCV, Sophus, Eigen, PyTorch
- OrcVIO is 4.8% better in object mapping accuracy compared with a single view object mapping approach, and 23.4% better in localization accuracy compared with an object SLAM approach, on the KITTI dataset

Associate Scientist

TEMASEK LABORATORIES

Jun. 2014 – Sept. 2016

Singapore

- Developed a Google Map aided visual odometry with C++, OpenCV, Dlib, which increases the localization accuracy by 96.0% compared with the baseline
- Implemented an UAV navigation approach based on a laser-stereo sensor suite with C++, OpenCV

Summer Intern

INFINEON

Jun. 2012 – Sept. 2012

Singapore

- Tested features such as a-law compression, volume control, Manchester decoding and voltage conversion
- Developed a Simulink model for touch sensing, and performed real time noise filtering

Summer Intern

INTERACTIVE DIGITAL MEDIA INSTITUTE

Jun. 2011 – Sept. 2011

Singapore

- Implemented a foreground detection algorithm based on RPCA using MATLAB, reaching more than 70% precision at recall higher than 90%, which outperforms state-of-the-art
- Designed and developed a painting classification algorithm using sparse coding with MATLAB, achieving 2.3 times better authentication accuracy than the baseline

TECHNICAL SKILLS

Languages: Python, C++ 11/14/17, MATLAB

Frameworks: ROS

Developer Tools: Vim, Git, Docker, VS Code, PyCharm

Libraries: OpenCV, Dlib, scikit-image || Eigen, Sophus || PyTorch, Tensorflow, Keras

AWARDS

Multi-Year Dean's Fellowship and Jacobs Fellowship

Sept. 2016 – Sept. 2017

UCSD

La Jolla, CA, USA

- Most prestigious fellowship offered by the ECE Department

The 3rd International UAV Innovation Grand Prix

Nov. 2015

AVIC

Zhejiang, China

- Championship of rotary wing competition with a monetary prize of 100,000 RMB
- Designed and implemented a bucket detection algorithm to guide bucket transfer for the firefighting task using a UAV, with C++, OpenCV and Dlib

PROFESSIONAL ACTIVITIES

Teaching Assistant

- ECE 276A: Sensing & Estimation in Robotics (Winter Quarter, 2021)
- Class size: 80. Duties include answering questions related to lecture notes, grading the homework and projects, and designing a project on VI SLAM.)
- For the students who provided evaluation, 75.0% says "Strongly Agree" when asked "I would recommend this Instructional Assistant to other students."

Talks

- "OrcVIO: Object residual constrained Visual-Inertial Odometry", IROS Oral Presentation, Oct. 25, 2020.
- "Geo-referenced UAV Localization", Paopao Robot Open-course, April 21, 2018.

Reviewer

- Journals: IEEE Transactions on Robotics (T-RO), IEEE Robotics and Automation Letters (RA-L), International Journal of Computer Vision (IJCV)
- Conferences: IEEE International Conference on Robotics and Automation (ICRA), IEEE International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Computer Vision and Pattern Recognition (CVPR)

Successful Grant Proposals

- NSF research grant. *Lyapunov-Certified Cognitive Control for Safe Autonomous Navigation in Unknown Environments*. (2017). Principal investigator: Prof. Nikolay Atanasov.
- Temasek Laboratories research grant for seed projects. *Laser-aided Stereo Vision for UAV Navigation*. (2015). Principal investigator: Mo Shan.

Membership

- IEEE Student Member

SELECTED PUBLICATIONS

Journal Articles

- **M. Shan**, V. Dhiman, Q. Feng, J. Li, N. Atanasov. "OrcVIO: Object residual constrained Visual-Inertial Odometry". (2021). arXiv:2007.15107. Submitted to IEEE Transactions on Robotics (T-RO).
- Z. Gao, **M. Shan**, Q. Li. (2015). Adaptive Sparse Representation for Analyzing Artistic Style of Paintings. ACM Journal on Computing and Cultural Heritage.
- Z. Gao, Q. Li., R. Zhai, **M. Shan**, F. Lin. (2015). Adaptive and Robust Sparse Coding for Laser Range Data Denoising and Inpainting. IEEE Transactions on Circuits and Systems for Video Technology.

Conference Proceedings

- **M. Shan**, Q. Feng, Y. Jau, N. Atanasov. (2021). "ELLIPSDF: Joint Object Pose and Shape Optimization with a Bi-level Ellipsoid and Signed Distance Function Description". In IEEE International Conference on Computer Vision (ICCV). Montreal, Canada. **25.9% acceptance rate**.
- **M. Shan**, Q. Feng, N. Atanasov. (2020). OrcVIO: Object residual constrained Visual-Inertial Odometry. In IEEE International Conference on Intelligent Robots and Systems (IROS). Las Vegas, USA. **47% acceptance rate**.
- Q. Feng, Y. Meng, **M. Shan**, N. Atanasov. (2019). Localization and Mapping using Instance-specific Mesh Models. In IEEE International Conference on Intelligent Robots and Systems (IROS). Macao, China.

- **M. Shan**, Y. Bi, H. Qin, J. Li, Z. Gao, F. Lin and B. M. Chen. (2016). A brief survey of visual odometry for micro aerial vehicles, Proceedings of the 42nd Annual Industrial Electronics Conference (IECON), Florence, Italy.
- **M. Shan**, Fei Wang, Feng Lin, Zhi Gao, Ya Z. Tang, Ben M. Chen. (2015). Google Map Aided Visual Navigation for UAVs in GPS-denied Environment. In IEEE International Conference on Robotics and Biomimetics (ROBIO). Zhuhai, China.
- Z. Gao, **M. Shan**, L. Cheong, Q. Li. (2014). Adaptive Sparse Coding for Painting Style Analysis. In Computer Vision-ACCV 2014. Springer Berlin Heidelberg.
- Z. Gao, L. Cheong, **M. Shan**. (2012). Block-sparse rpca for consistent foreground detection. In Computer Vision-ECCV 2012 (pp. 690-703). Springer Berlin Heidelberg.

Workshop Papers

- **M. Shan**. (2019). Weakly supervised keypoint detection. Southern California Robotics Symposium (SCR), Pasadena, USA.
- **M. Shan**, N. Atanasov. (2017). A spatiotemporal model with visual attention for video classification. In Robotics: Science and Systems (RSS) Workshop on Articulated Model Tracking, Cambridge, USA.
- **M. Shan**, A. Charan. (2015). Google Map Referenced UAV Navigation via Simultaneous Feature Detection and Description. Poster paper. In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Hamburg, Germany.