Mo Shan (Sean)

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Education

University of California, San Diego — La Jolla, CA, USA
Candidate of Philosophy in ECE, GPA 3.74/4 — *Dec. 2019 – Dec. 2021*

University of California, San Diego — La Jolla, CA, USA
Master of Science in Electrical and Computer Engineering, GPA 3.74/4 — *Sept. 2016 – Dec. 2019*

National University of Singapore — Singapore
Bachelor of Science in Electrical and Computer Engineering, GPA 4.84/5 — *Sept. 2010 – Jun. 2014*

University of Southampton — Southampton, United Kingdom
Student Exchange Program in School of Electronics and Computer Science — *Dec. 2012 – Jul. 2013*

Experience

Graduate Student Researcher — Sept. 2021 – Dec. 2021
ECE, UCSD — *USA*

- Implemented OrcVIO-Lite, OrcVIO-Stereo, for distributed SLAM and map alignment using C++, ROS
- Performed evaluation in Unity simulator and real robots using RealSense D435i, D455, on NVIDIA's Jetson AGX Xavier, Jackal

Research Intern — Jun. 2021 – Sept. 2021
Facebook Reality Labs — *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 — Jun. 2018 – Jun. 2021
ECE, UCSD — *USA*

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

Associate Scientist — Jun. 2014 – Sept. 2016
Temasek Laboratories — *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 — Jun. 2012 – Sept. 2012
Infineon — *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 — Jun. 2011 – Sept. 2011
Interactive Digital Media Institute — *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++ 11/14/17/20, MATLAB
Frameworks: ROS
Developer Tools: Vim, Git, Docker, VS Code, PyCharm
Libraries: OpenCV, Open3D || Eigen, Sophus || PyTorch

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

- *ELLIPSDF: Joint Object Pose and Shape Optimization with a Bi-level Ellipsoid and Signed Distance Function Description*, ICCV Poster Presentation, Oct. 11, 2021.
- *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.

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.