

# Nathaniel Merrill

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## Education

- 2019–Present **PhD Computer Science**, *University of Delaware*, Newark, DE, GPA: 3.8.  
Advisor: Guoquan (Paul) Huang. Expected Graduation: May 2024.
- 2015–2019 **BS Computer Science**, *University of Delaware*, Newark, DE, GPA: 3.6.  
Minor: Mathematics.

## Experience

- 2019–Present **Research Assistant**, *University of Delaware*, Newark, DE.  
Collaborated with colleagues, sometimes across multiple institutions and companies, to perform research related to combining modern deep learning with classical estimation and approximation techniques for improved performance. The research effort has so far resulted in seven peer-reviewed publications with two different award nominations among them.
- Summer 2022 **Research Scientist Intern**, *Meta*, Redmond, WA.  
Improved the state of the art in deep learning-based inertial navigation, and collaborated with other interns to help with their projects.
- 2019–2020 **Teaching Assistant**, *University of Delaware*, Newark, DE.  
Assisted in teaching an undergraduate honors software engineering course. Led the laboratory portion of the course and held office hours to help students navigate difficult problems.
- 2016–2019 **Undergraduate Research Assistant**, *University of Delaware*, Newark, DE.  
Independently led a research project on deep learning-based automatic place recognition, which resulted in two peer-reviewed publications as well as open-source code. Successfully led another project with a different PI related to predicting chemical shifts and torsion angles for protein structures.
- 2016–2019 **Undergraduate Teaching Assistant**, *University of Delaware*, Newark, DE.  
Aided in the teaching of nine different undergraduate courses. Implemented a system to automatically grade coding assignments for large introductory computer science classes.
- Summer 2017 **JPSS Flight Intern**, *NASA Goddard Space Flight Center*, Greenbelt, MD.  
Developed the JPSS Evaluation Tool Suite (JETS), which was used by NASA to monitor sensor data from the family of Joint Polar Satellite System (JPSS) satellites. JETS was used to find the source of a critical anomaly that was preventing the launch of JPSS-2, and our poster won the best intern poster award.

## Publications

**Note:** † denotes equal contribution.

### Conference Papers

- [9] **N. Merrill**, P. Geneva, S. Katragadda, C. C. Chen, and G. Huang. “Fast Monocular Visual-Inertial Initialization Leveraging Learned Single-View Depth”. In: *Proc. of Robotics: Science and Systems (RSS)*. (**Best Student Paper Award finalist**). Daegu, Republic of Korea, July 2023.

- [8] X. Zuo, N. Yang, **N. Merrill**, B. Xu, and S. Leutenegger. “Incremental Dense Reconstruction from Monocular Video with Guided Sparse Feature Volume Fusion”. In: *IEEE Robotics and Automation Letters* (2023).
- [7] **N. Merrill**, Y. Guo, X. Zuo, X. Huang, S. Leutenegger, X. Peng, L. Ren, and G. Huang. “Symmetry and Uncertainty-Aware Object SLAM for 6DoF Object Pose Estimation”. In: *2022 Conference on Computer Vision and Pattern Recognition (CVPR)*. New Orleans, USA, June 2022.
- [6] **N. Merrill**<sup>†</sup>, P. Geneva<sup>†</sup>, and G. Huang. “Robust Monocular Visual-Inertial Depth Completion for Embedded Systems”. In: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. Xi’an, China, Oct. 2021.
- [5] X. Zuo<sup>†</sup>, **N. Merrill**<sup>†</sup>, W. Li, Y. Liu, M. Pollefeys, and G. Huang. “CodeVIO: Visual-Inertial Odometry with Learned Optimizable Dense Depth”. In: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. (**Robot Vision Award finalist**). Xi’an, China, Oct. 2021.
- [4] P. Geneva<sup>†</sup>, **N. Merrill**<sup>†</sup>, Y. Yang, C. Chen, W. Lee, and G. Huang. “Versatile 3D Multi-Sensor Fusion for Lightweight 2D Localization”. In: *2020 International Conference on Intelligent Robots and Systems (IROS)*. Las Vegas, USA, Oct. 2020.
- [3] K. Eickenhoff, P. Geneva, **N. Merrill**, and G. Huang. “Schmidt-EKF-based Visual-Inertial Moving Object Tracking”. In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. Paris, France, May 2020.
- [2] **N. Merrill** and G. Huang. “CALC2.0: Combining Appearance, Semantic and Geometric Information for Robust and Efficient Visual Loop Closure”. In: *2019 International Conference on Intelligent Robots and Systems (IROS)*. Macau, China, Nov. 2019.
- [1] **N. Merrill** and G. Huang. “Lightweight Unsupervised Deep Loop Closure”. In: *Proc. of Robotics: Science and Systems (RSS)*. Pittsburgh, PA, June 2018.

## Open Source

- SUO-SLAM **Symmetry and Uncertainty-Aware Object SLAM**, *CVPR 2022*.  
[https://github.com/rpng/suo\\_slam](https://github.com/rpng/suo_slam)
- CALC **Deep Learning for Loop Closure**, *RSS 2018, IROS 2019*.  
<https://github.com/rpng/calc>  
<https://github.com/rpng/calc2.0>
- scikit-cuda **GPU Computation in Python**, *Contributed the PCA module*.  
<https://github.com/lebedov/scikit-cuda>

## Other Projects

- DCTAP **Deep Chemical shift and Torsion Angle Predictor**.  
Developed a new state-of-the-art deep learning method to predict backbone chemical shift in protein structures as well as dihedral angles from partially predicted chemical shifts.

## Awards and Honors

- 2023 **Best Student Paper Award finalist**, *Robotics: Science and Systems (RSS)*.  
*Daegu, Republic of Korea*.

- 2021 **Robot Vision Award finalist**, *IEEE International Conference on Robotics and Automation (ICRA)*. Xi'an, China.
- 2019 **AAUP-UD Award**, *University of Delaware*.
- 2017 **First Place Intern Poster Award**, *NASA Goddard Space Flight Center*.
- 2015 **UD Trustee Scholarship**, *University of Delaware*.

## Technical Skills

### Mathematics.

Deep Learning, Machine Learning, Computer Vision, Linear Approximation, Nonlinear Optimization

### Programming Languages.

Bash, C, C++, Python, Java, Matlab, ARM Assembly, R, CUDA

### Markup Languages.

LaTeX, HTML, CSS, Markdown

### Tools and Other Technologies.

MPI, OpenMP, OpenACC, Git, Microsoft Office

## Invited Talks

- [7] *Robust and Efficient VIO-Aided Deep Depth Estimation*. University of California, Los Angeles, July 2021.
- [6] *Modern Deep Learning: Tips, Tools and Tricks*. University of Delaware, Apr. 2020.
- [5] *Combining Appearance, Semantic and Geometric Information for Robust and Efficient Visual Loop Closure*. Macau, China, Nov. 2019.
- [4] *Image Classification and VAE Tutorial in Tensorflow*. University of Delaware, Apr. 2019.
- [3] *Lightweight Unsupervised Deep Loop Closure*. Carnegie Mellon University, June 2018.
- [2] *Lightweight Unsupervised Deep Loop Closure*. University of Delaware, May 2018.
- [1] *Deep Learning Tutorial in Tensorflow*. University of Delaware, Oct. 2018.

## Academic Services

### Reviewer:

- Journals TRO (IEEE Transactions on Robotics)  
IJRR (International Journal of Robotics Research)  
RAS (Robotics and Autonomous Systems)  
TNNLS (IEEE Transactions on Neural Networks and Learning Systems)
- Conferences ICRA (IEEE International Conference on Robotics and Automation)  
IROS (IEEE/RSJ International Conference on Intelligent Robots and Systems)

## Teaching

- Fall 2019 **UD CISC275 Honors: Introduction to Software Engineering**, TA.
- Spring 2019 **UD CISC181 Honors: Introduction to Computer Science II**, TA.

- Fall 2018 **UD CISC106: Introduction to Computer Science for Engineers, TA.**
- Fall 2018 **UD EGGG101: Introduction to Engineering, TA.**
- Spring 2018 **UD CISC106: Introduction to Computer Science for Engineers, TA.**
- Fall 2017 **UD MEEG211: Dynamics, TA.**
- Fall 2017 **UD EGGG101: Introduction to Engineering, TA.**
- Spring 2017 **UD MEEG112: Statics, TA.**
- Spring 2017 **UD CISC106: Introduction to Computer Science for Engineers, TA.**
- Fall 2016 **UD EGGG101: Introduction to Engineering, TA.**

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## Professional Membership

ASME

IEEE