

EDWIN GOH

DATA SCIENTIST @ NASA JET PROPULSION LABORATORY (JPL)

📞 +1 (404) 834-0859 | ✉️ edwin.y.goh@jpl.nasa.gov | [in edwin217](https://www.linkedin.com/in/edwin217) | [github edwinytgoh](https://www.github.com/edwinytgoh) | U.S. Legal Permanent Resident

Personal Profile

Experienced Data Scientist with a unique blend of expertise in deep learning-based computer vision and the physical sciences. Proven track record at NASA JPL of leading cutting-edge self-supervised computer vision research for Earth science and planetary robotics to improve performance under limited (labeled) data scenarios. Passionate about leveraging machine learning to advance aerospace engineering design, validation, and manufacturing processes at GE.

Work Experience

NASA Jet Propulsion Laboratory – California Institute of Technology

Data Scientist

Pasadena, CA

Feb 2020 – Present

🚀 *Contrastive Learning for Onboard Vision-Enabled Robotics (CLOVER; Principal Investigator)*

- Won a competed proposal to investigate **self-supervised learning** for planetary science and robotic exploration
- Managed a team of 7 researchers to execute large-scale contrastive pretraining experiments on Mars imagery
- Reduced required labels by 10x and doubled inference throughput on Mars **terrain segmentation**

🌐 *Semi-supervised Learning from Images of a Changing Earth (SLICE; Technical Lead):*

- Leading a \$1M NASA-funded research program to develop **self-supervised Earth science foundation models**
- Applied masked image modeling (Masked Autoencoders; MAE) to sea surface temperature (SST) fields, attaining breakthrough 0.1°C accuracy in **reconstructing satellite SST measurements under cloud obstruction**
- Trained self-supervised models to identify oceanic eddies from Synthetic Aperture Radar (SAR) satellite images
- Presented findings to program managers from NASA HQ and NASA science stakeholders

📡 *Automated Scheduling of NASA's Deep Space Network (DSN):*

- Pioneered automated DSN communications scheduling with deep reinforcement learning (RL)
- Implemented OR-inspired RL baselines and published a benchmark dataset for satellite scheduling (SatNet)
- Developed benchmark problem set used by Microsoft collaborators for quantum annealing-based scheduling

🌑 *ShadowNav (Co-Investigator):*

- Developed a **stereo perception pipeline** for absolute rover localization on the far/dark side of the Moon
- Compared stereo and **edge-detection algorithms** and quantified their impact on localization accuracy

👛 *Business Development*

- Served 14 stakeholders across JPL, NASA and DARPA
- Published open-source code for ocean eddy detection, mars image recognition, and satellite scheduling with RL
- Co-authored 11 research grant proposals in Earth/planetary science, robotics, operations research, and ML

Ben T. Zinn Combustion Lab – Georgia Tech

Graduate Research Assistant – DOE Optimized Low-NOx Staged Combustor Development

Atlanta, GA

2016 – 2020

- Developed simulation suite in **Python and MATLAB** for preliminary **combustor design and optimization**
- Created an interactive data visualization interface for real-time analysis of terabytes of simulation data
- Elucidated key effects of non-ideal flow conditions on NOx formation and combustor design

United Parcel Service (UPS)

Data Science Co-op

Atlanta, GA

May 2019 – Nov 2019

- Developed prototype customer profiler for price optimization using regression and clustering techniques
- Formulated MILP problems to optimize UPS' last-mile delivery network in EU
- Enabled 2X speedup of a shortest-path network optimization subroutine through parallelization in the cloud

Education

Georgia Institute of Technology, Atlanta, GA

2012 – 2020

B.S., M.S., and Ph. D. in Aerospace Engineering

Skills

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|----------------------|--|
| Programming | Python (Distributed PyTorch, Scikit-learn, Ray, OpenCV, etc.), Java, C/C++ |
| Computing | Linux, shell scripting (bash, zsh), high performance computing (Slurm, PBS), ROS |
| Communication | Proficient in conveying complex AI concepts to technical and non-technical audiences |

Professional Service/Activities

- American Institute of Aeronautics and Astronautics (AIAA), senior member
- Elected [AIAA Intelligent Systems Technical Committee \(ISTC\) member](#)
- Intelligent Systems Technical Discipline Lead (TDL) for the AIAA ASCEND 2024 Conference

Book Chapters

- [B1] **Goh, E.**, Didier, A., Wang, J. (2023) Deep Learning for Ocean Mesoscale Eddy Detection. Artificial Intelligence in Earth Science: Best Practices and Fundamental Challenges.

Journal Publications

- [J1] Vincent, G., Ward, I., Moore, C., Chen, J., Pak, K., Yepremyan, A., Wilson, B., **Goh, E.** (2023). CLOVER: Contrastive Learning for Onboard Vision-Enabled Robotics. AIAA Journal of Spacecraft and Rockets.
- [J2] **Goh, E.**, Yepremyan, A., Wilson, B., Wang, J. (Under Review). MAESSTRO: Masked Autoencoders for Sea Surface Temperature Reconstruction under Occlusion. Ocean Science.
- [J3] Guillaume, A., **Goh, E.**, Johnston, M.D., Wilson, B.D., Ramanan, A., Tibble, F., Lackey, B. (2022). Deep Space Network Scheduling using Quantum Annealing. IEEE Transactions on Quantum Engineering, 3, 1-13
- [J4] Claudet, T., Alimo, R., **Goh, E.**, Johnston, M.D., Madani, R., Wilson, B. (2022). Δ -MILP: Deep Space Network Scheduling via Mixed-Integer Linear Programming. IEEE access, 10, 41330-41340.
- [J5] **Goh, E.**, Li, J., Kim, N.Y., Lieuwen, T. and Seitzman, J. (2021). Finite-rate entrainment effects on nitrogen oxide (NOx) emissions in staged combustors. Combustion and Flame, 230, 111-434.
- [J6] **Goh, E.**, Sirignano, M., Li, J., Nair, V., Emerson, B., Lieuwen, T. and Seitzman, J. (2019). Prediction of minimum achievable NOx levels for fuel-staged combustors. Combustion and Flame, 200, 276-285.

Conference Publications

- [C1] **Goh, E.**, Ward, I.R., Vincent, G.M., Pak, K., Chen, J. (2023). Self-Supervised Distillation for Computer Vision Onboard Planetary Robots. 2023 IEEE Aerospace Conference. IEEE.
- [C2] Vincent, G.M., **Goh, E.**, Pak, K., Wilson, B., Wang, J., Holt, B. (2023). Unsupervised SAR Images for Submesoscale Oceanic Eddy Detection. IEEE IGARSS.
- [C3] **Goh, E.**, Yepremyan, A., Wilson, B., Wang, J. (2023). Reconstruction of Sea Surface Temperature Under Clouds Using Masked Autoencoders. IEEE IGARSS.
- [C4] Ward, I.R., Moore, C., Pak, K., Chen, J., **Goh, E.** (2022). Improving Contrastive Learning on Visually Homogeneous Mars Rover Images. European Conference on Computer Vision (ECCV) Workshop on AI4Space.
- [C5] Vincent, G.M., Yepremyan, A., Chen, J., **Goh, E.** (2022). Mixed-domain Training Improves Multi-Mission Terrain Segmentation. European Conference on Computer Vision (ECCV) Workshop on AI4Space.
- [C6] **Goh, E.**, Chen, J., Wilson, B. (2022). Mars Terrain Segmentation with Less Labels. 2022 IEEE Aerospace Conference. IEEE.
- [C7] **Goh, E.**, Venkataram, H.S., Hoffmann, M., Johnston, M. and Wilson, B. (2021). Scheduling the NASA Deep Space Network with Deep Reinforcement Learning. 2021 IEEE Aerospace Conference. IEEE.
- [C8] Allison, T., Burke, W., Constantinou, V., **Goh, E.**, Mattmann, C., Mensikova, A., Southam, P., Stonebraker, R. and Timmaraju, V. (2020). Building a Wide Reach Corpus for Secure Parser Development. 2020 IEEE Security and Privacy Workshops (SPW) 318-326. IEEE.
- [C9] **Goh, E.**, Sirignano, M., Nair, V., Emerson, B., Lieuwen, T. and Seitzman, J. (2017). Modeling of Minimum NOx in Staged-Combustion Architectures at Elevated Temperatures. In ASME Turbo Expo 2017: Turbomachinery Technical Conference and Exposition. American Society of Mechanical Engineers Digital Collection.