# Tae Ha (Jeff) **Park**

Ph.D. Candidate, Department of Aeronautics & Astronautics, Stanford University

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## Education

### Stanford University — *Stanford, CA*

Ph.D. in Aeronautics & Astronautics | Advisor: Dr. Simone D'Amico — *Apr. 2018 - Current*

- Title: Robust Machine Learning for Vision-Based Navigation about Non-Cooperative Resident Space Objects
- Teaching Assistant for AA279A: Space Mechanics (2019, 2021, 2022).

### Stanford University — *Stanford, CA*

M.S. in Aeronautics & Astronautics — *Sep. 2017 - Apr. 2020*

- Conducted research on deep learning, computer vision, spacecraft swarm navigation and optimization

### Harvey Mudd College (HMC) — *Claremont, CA*

B.S. in Engineering — *Aug. 2013 - May 2017*

- Graduated with High Distinction (GPA: 3.81/4.0)
- Member of the Tau Beta Pi Engineering Honors Society
- De Pietro fellow in Civil Engineering

## Experience

### Infinite Orbits SAS — *Toulouse, France*

Computer Vision and Guidance, Navigaton and Control Intern — *Jun. 2022 - Aug. 2022*

- Constructed a satellite rendezvous simulator and scene renderer based on Unreal Engine 5 and C++ to train and validate convolutional neural networks for monocular pose estimation and tracking of known noncooperative spacecraft

### Space Rendezvous Laboratory (SLAB), Stanford University — *Stanford, CA*

Research Assistant | Advisor: Dr. Simone D'Amico — *Jan. 2019 - Current*

- Developed robust deep learning models and navigation algorithms for vision-based Rendezvous and Proximity Operations (RPO) in space to support various missions (e.g., on-orbit servicing, debris removal) for sustainable space development
- Developed the Testbed for Rendezvous and Optical Navigation (TRON) facility at SLAB that can simulate various RPO scenarios using a mockup satellite model under high-fidelity spaceborne illumination settings
- Developed advanced open-source benchmark datasets (e.g., SPEED+, SHIRT) using TRON to train and validate spaceborne vision-based deep learning and navigation algorithms with emphasis on robustness across domain gap between synthetic and spaceborne data

### Dynamics Laboratory, HMC — *Claremont, CA*

De Pietro Fellow | Advisor: Dr. Ziyad Duron — *May 2016 - May 2017*

- Developed a method to assess the functionality of steel anchors embedded within a concrete dam based on the Performance-Based Testing using spectral analysis, spectrogram, and model verification
- Analyzed the earthquake response of Monticello dam by constructing and evaluating a lumped element model of dam, reservoir and a spillway

### HMC — *Claremont, CA*

Student Researcher | Advisor: Dr. Philip D. Cha — *May 2016 - May 2017*

- Developed a method to accelerate the modal convergence of eigen-characteristics of (non-)uniform rods carrying various lumped attachments

## Publications

### Preprints

[P1] **T. H. Park**, S. D'Amico. "Online Supervised Training of Spaceborne Vision during Proximity Operations using Adaptive Kalman Filtering." *arXiv preprint arxiv:2309.11645* (2023). arXiv

### Peer-Reviewed Journal Articles

[J6] **T. H. Park**, S. D'Amico. "Adaptive Neural-Network-Based Unscented Kalman Filter for Robust Pose Tracking of Noncooperative Spacecraft." *Journal of Guidance, Control, and Dynamics* (2023). DOI: 10.2514/1.G007387.

[J5] **T. H. Park**, S. D'Amico. "Robust Multi-Task Learning and Online Refinement for Spacecraft Pose Estimation across Domain Gap." *Advances in Space Research* (2023). DOI: 10.1016/j.asr.2023.03.036.

[J4] L. Pasqualetto Cassinis, **T. H. Park**, N. Stacey et al. "Leveraging Neural Network Uncertainty in Adaptive Unscented Kalman Filter for Spacecraft Pose Estimation." *Advances in Space Research* (2023). DOI: 10.1016/j.asr.2023.02.021.

[J3] **T. H. Park**, M. Märtens, M. Jawaid et al. "Satellite Pose Estimation Competition 2021: Results and Analyses." *Acta Astronautica* (2023). DOI: 10.1016/j.actaastro.2023.01.002.

[J2] M. Kisantal, S. Sharma, **T. H. Park** et al. "Satellite Pose Estimation Challenge: Dataset, Competition Design and Results." *IEEE Transactions on Aerospace and Electronic Systems* (2020). DOI: 10.1109/TAES.2020.2989063.

[J1] P. D. Cha, **T. H. Park** "Improved Modal Convergence Using the Assumed Modes Method for Rods Carrying Various Lumped Elements." *International Journal of Mechanical Engineering Education* (2018). DOI: 10.1177/0306419017720424.

### Conference Proceedings & Presentations

[C8] **T. H. Park**, S. D'Amico. "Rapid Abstraction of Spacecraft 3D Structure from Single Image." *2024 AIAA SciTech Forum* (2024). **[Accepted]**

[C7] J. Kruger, T. Guffanti, **T. H. Park** et al. "Modular and Flexible Architecture for Autonomous Guidance, Navigation and Control of Spacecraft During Rendezvous and Proximity Operations." *34th AIAA/AAS Space Flight Mechanics Meeting* (2024). **[Accepted]**

[C6] **T. H. Park**, S. D'Amico. "Adaptive Neural Network-based Unscented Kalman Filter for Spacecraft Pose Tracking at Rendezvous." *2022 AAS/AIAA Astrodynamics Specialist Conference*, Charlotte, North Carolina, August 7-11 (2022).

[C5] **T. H. Park**, S. D'Amico. "Robust Multi-Task Learning and Online Refinement for Spacecraft Pose Estimation across Domain Gap." *11th International Workshop on Satellite Constellations & Formation Flying*, Milano, Italy, June 7-10 (2022).

[C4] **T. H. Park**, M. Märtens, G. Lecuyer et al. "SPEED+: Next-Generation Dataset for Spacecraft Pose Estimation across Domain Gap." *2022 IEEE Aerospace Conference* (2022). DOI: 10.1109/AERO53065.2022.9843439.

[C3] **T. H. Park**, J. Bosse, S. D'Amico. "Robotic Testbed for Rendezvous and Optical Navigation: Multi-Source Calibration and Machine Learning Use Cases." *2021 AAS/AIAA Astrodynamics Specialist Conference*, Virtual, August 8 - 12 (2021).

[C2] **T. H. Park**, S. D'Amico. "Generative Model for Spacecraft Image Synthesis using Limited Dataset." *2020 AAS/AIAA Astrodynamics Specialist Conference*, South Lake Tahoe, California, August 9 - 13 (2020).

[C1] **T. H. Park**, S. Sharma, S. D'Amico. "Towards Robust Learning-Based Pose Estimation of Noncooperative Spacecraft." *2019 AAS/AIAA Astrodynamics Specialist Conference*, Portland, Maine, August 11 - 15 (2019). **<Best Paper Award>**

### Datasets

[D3] **T. H. Park**, S. D'Amico. "SHIRT: Satellite Hardware-In-the-loop Rendezvous Trajectories Dataset." *Stanford Digital Repository* (2022). Available at https://purl.stanford.edu/zq716br5462.

[D2] **T. H. Park**, M. Märtens, G. Lecuyer et al. "Next Generation Spacecraft Pose Estimation Dataset (SPEED+)." *Stanford Digital Repository* (2021). Available at https://purl.stanford.edu/wv398fc4383.

[D1] S. Sharma, **T. H. Park**, S. D'Amico. "Spacecraft Pose Estimation Dataset (SPEED)." *Stanford Digital Repository* (2019). Available at https://purl.stanford.edu/dz692fn7184.

## Activities

**Organizer** **Kelvins Satellite Pose Estimation Competition** (2021)

**Reviewer** **Journal of Spacecraft and Rockets** (2020), **Journal of Aerospace Information Systems** (2021 - 22), **Advances in Space Research** (2022), **IEEE Transactions on Aerospace and Electronic Systems** (2022 - 23), **Journal of Guidance, Control, Dynamics** (2023)

## Skills

**Programming** MATLAB/Simulink, Python, C/C++, LaTeX

**Deep Learning** PyTorch, LibTorch, ONNXRuntime, TensorRT, MATLAB Deep Learning Toolbox™

**Libraries** OpenCV, OpenMP, CVX/CVXPY

**Rendering** OpenGL, Unreal Engine

**Languages** Korean (native), English (fluent), Japanese (proficient), Chinese (elementary), French (elementary)

## Honors & Awards

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| 2019 | **Best Paper Award**, 2019 AAS/AIAA Astrodynamics Specialist Conference | *Portland, ME* |
| 2015 | **Tau Beta Pi Engineering Honors Society**, HMC | *Claremont, CA* |
| 2015 | **De Pietro Fellowship in Civil Engineering**, HMC | *Claremont, CA* |
| 2013 | **Harvey S. Mudd Merits**, HMC | *Claremont, CA* |
| 2013-17 | **Dean's List**, HMC | *Claremont, CA* |