

# Tae Ha (Jeff) Park

PHD CANDIDATE, DEPARTMENT OF AERONAUTICS & ASTRONAUTICS, STANFORD UNIVERSITY

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## Education

### Stanford University

PH.D. IN AERONAUTICS & ASTRONAUTICS

Stanford, CA

Expected June 2024

- Topic: Robust deep learning in spaceborne computer vision and autonomous navigation.
- Advisor: Dr. Simone D'Amico.

### Stanford University

M.S. IN AERONAUTICS & ASTRONAUTICS

Stanford, CA

April 2020

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

### Harvey Mudd College (HMC)

B.S. IN ENGINEERING

Claremont, CA

May 2017

- Graduated with High Distinction (GPA: 3.81/4.0).

## Research

### Space Rendezvous Laboratory (SLAB), Stanford University

Stanford, CA

RESEARCH ASSISTANT. ADVISOR: DR. SIMONE D'AMICO

January 2019 - Current

- Developing robust deep learning models and GN&C algorithms for vision-based relative navigation in space to support future mission concepts such as on-orbit servicing and debris removal with the ultimate goal of improving the sustainability of the Earth's orbit.
- Developing and calibrating the robotic Testbed for Rendezvous and Optical Navigation (TRON) facility at SLAB to (1) physically simulate spacecraft proximity operations against a mockup satellite model under high-fidelity space-like illumination settings and (2) generate high-accuracy pose labels.
- Developing the next-generation 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 training and target spaceborne data.
- Organizing the second international Satellite Pose Estimation Competition (SPEC2021) in collaboration with the European Space Agency. [\[link\]](#)

### 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 the eigen-characteristics of uniform and non-uniform rods carrying various lumped attachments.

## Internship

### Infinite Orbits SAS

Toulouse, France

COMPUTER VISION AND GUIDANCE, NAVIGATION AND CONTROL (GNC) INTERN

June 2022 - August 2022

- Integrated a PyTorch-based neural networks into the MATLAB/Simulink-based closed-loop GNC simulator.
- Constructed a satellite rendezvous simulator and scene renderer based on Unreal Engine 5 (UE5) and C++ to train and validate neural networks for monocular pose estimation and tracking.

## Publications

### Journal Articles

**Park, T. H.**, Märtens, M., Jawaid, M., Wang, Z., Chen, B., Chin., T.-J., Izzo, D., D'Amico, S. "Satellite Pose Estimation Competition 2021: Results and Analyses." *Special Issue on AI for Space, Acta Astronautica* (2022). **(Revision under Review)**

**Park, T. H.** and D'Amico, S. "Robust Multi-Task Learning and Online Refinement for Spacecraft Pose Estimation across Domain Gap." *Advances in Space Research* (2022). **(Submitted)**

**Park, T. H.** and D'Amico, S. "Adaptive Neural Network-based Unscented Kalman Filter for Robust Pose Tracking of Noncooperative Spacecraft." *Journal of Guidance, Control, and Dynamics* (2022). **(Submitted)**

Pasqualetto Cassinis, L., **Park, T. H.**, Stacey, N., D'Amico, S., Menicucci, A., Gill, E., Ahrens, I., Sanchez-Gestido, M. "Leveraging Neural Network Uncertainty in Adaptive Unscented Kalman Filter for Spacecraft Pose Estimation." *Advances in Space Research* (2022). (Submitted)

Kisantal, M., Sharma, S., **Park, T. H.**, Izzo, D., Märtens, M. and D'Amico, S. "Satellite Pose Estimation Challenge: Dataset, Competition Design and Results." *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 56, No. 5, pp. 4083-4098 (2020). DOI: 10.1109/TAES.2020.2989063. [\[link\]](#)

Cha, P. D. and **Park, T. H.** "Improved Modal Convergence Using the Assumed Modes Method for Rods Carrying Various Lumped Elements." *International Journal of Mechanical Engineering Education*, Vol 46, Issue 1, pp. 3-30 (2018). DOI:10.1177/0306419017720424. [\[link\]](#)

## Conference Proceedings

**Park, T. H.** and D'Amico, S. "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). [\[arXiv\]](#)

**Park, T. H.** and D'Amico, S. "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). [\[arXiv\]](#) [\[code\]](#)

**Park, T. H.**, Märtens, M., Lecuyer, G, Izzo, D. and D'Amico, S. "SPEED+: Next-Generation Dataset for Spacecraft Pose Estimation across Domain Gap." *2022 IEEE Aerospace Conference (AERO)*, 2022, pp. 1-15, DOI: 10.1109/AERO53065.2022.9843439. [\[link\]](#) [\[code\]](#)

**Park, T. H.**, Bosse, J. and D'Amico, S. "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). [\[pdf\]](#)

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

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

## Datasets

**Park, T. H.** and D'Amico, S. "SHIRT: Satellite Hardware-In-the-loop Rendezvous Trajectories Dataset." *Stanford Digital Repository* (2022). Available at <https://purl.stanford.edu/zq716br5462>. <https://doi.org/10.25740/zq716br5462>. [\[project\]](#)

**Park, T. H.**, Märtens, M., Lecuyer, G, Izzo, D. and D'Amico, S. "Next Generation Spacecraft Pose Estimation Dataset (SPEED+)." *Stanford Digital Repository* (2021). Available at <https://purl.stanford.edu/wv398fc4383>. <https://doi.org/10.25740/wv398fc4383>.

Sharma, S., **Park, T. H.** and D'Amico, S. "Spacecraft Pose Estimation Dataset (SPEED)." *Stanford Digital Repository* (2019). Available at <https://purl.stanford.edu/dz692fn7184>. <https://doi.org/10.25740/dz692fn7184>.

## Skills

<b>Programming</b>	MATLAB/Simulink, Python, C++, HTML, $\LaTeX$
<b>Libraries</b>	PyTorch, OpenCV, CVX
<b>Tools</b>	Unreal Engine
<b>Languages</b>	Korean (native), English (fluent), Japanese (proficient), Chinese (intermediate), French (intermediate)

## Leadership

'16 - '17	<b>Secretary</b> , Tau Beta Pi (TBP) Engineering Honors Society, HMC chapter	Claremont, CA
'16	<b>Clinic Project Leader</b> , leading a 6-person team on a year-long project sponsored by Hewlett Packard, Inc.	Claremont, CA

## Teaching

'19, '21, '22	<b>Teaching Assistant</b> , AA279A: Space Mechanics	Stanford, CA
'16 - '17	<b>Proctor</b> , E79/80: Engineering Systems	Claremont, CA
'16	<b>Tutor</b> , E171: Dynamics of Elastic Systems	Claremont, CA
'15 - '17	<b>TBP Tutor</b> , E72: Engineering Mathematics, E83: Continuum Mechanics, E101: Advanced Systems Engineering	Claremont, CA

## Honors & Awards

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