Tae Ha "Jeff" Park

PhD Candidate, Department of Aeronautics & Astronautics, Stanford University

✉ tpark94@stanford.edu | 🏠 taehajeffpark.com | tpark94 | in taehajeffpark | 🎓 Tae Ha Park

Education

Stanford University *Stanford, CA*
Ph.D. in Aeronautics & Astronautics *April 2018 - Current*
- Topic: Robust deep learning in spaceborne computer vision and autonomous navigation.
- Advisor: Dr. Simone D'Amico.

Stanford University *Stanford, CA*
M.S. in Aeronautics & Astronautics *September 2017 - April 2020*
- Conducted research on deep learning, computer vision, spacecraft swarm navigation and optimization.

Harvey Mudd College (HMC) *Claremont, CA*
B.S. in Engineering *August 2013 - 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 mdodel 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, Navigaton 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). (Accepted for Publication)

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., Ahrns, 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

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

Leadership

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

Teaching

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

Honors & Awards

'19	**Best Paper Award**, 2019 AAS/AIAA Astrodynamics Specialist Conference	*Portland, ME*
'15	**Tau Beta Pi Engineering Honors Society**, HMC	*Claremont, CA*
'15	**De Pietro Fellowship in Civil Engineering**, HMC	*Claremont, CA*
'13	**Harvey S. Mudd Merits**, HMC	*Claremont, CA*
'13-'17	**Dean's List**, HMC	*Claremont, CA*