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 — *Apr. 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 — *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 (GNC) Intern — *Jun. 2022 - Aug. 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 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 GNC 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
- Developed and calibrated the Testbed for Rendezvous and Optical Navigation (TRON) facility at SLAB that is capable of physically simulating spacecraft proximity operations with a mockup satellite model under high-fidelity spaceborne illumination settings and estimating high-accuracy pose labels
- Developed the next-generation 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 training and target spaceborne data
- Organized the second international Satellite Pose Estimation Competition (SPEC2021) in collaboration with the European Space Agency

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

Publications

Peer-Reviewed Journal Articles

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* (2023). DOI: 10.2514/1.G007387.

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* (2023). DOI: 10.1016/j.asr.2023.03.036.

Pasqualetto Cassinis, L., **Park, T. H.**, Stacey, N., D'Amico, S., Menicucci, A., Gill, E., Ahrns, I. and Sanchez-Gestido, M. "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.

Park, T. H., Märtens, M., Jawaid, M., Wang, Z., Chen, B., Chin., T.-J., Izzo, D. and D'Amico, S. "Satellite Pose Estimation Competition 2021: Results and Analyses." *Acta Astronautica* (2023). DOI: 10.1016/j.actaastro.2023.01.002.

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* (2020). DOI: 10.1109/TAES.2020.2989063.

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* (2018). DOI: 10.1177/0306419017720424.

Peer-Reviewed Conference Proceedings

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* (2022). DOI: 10.1109/AERO53065.2022.9843439.

Conference & Workshop Presentations

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).

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).

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).

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).

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>**

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.

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.

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.

Skills

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

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*
'15 - '17	**TBP Tutor,** E72: Engineering Mathematics, E83: Continuum Mechanics, E101: Advanced Systems Engineering, E171: Dynamics of Elastic Systems	*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*