

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

April 2018 - Current

- 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

September 2017 - April 2020

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

Harvey Mudd College (HMC)

B.S. IN ENGINEERING

Claremont, CA

August 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

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

Toulouse, France

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 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

RESEARCH ASSISTANT | ADVISOR: DR. SIMONE D'AMICO

Stanford, CA

January 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 [\[youtube1\]](#) [\[youtube2\]](#)
- 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 [\[link\]](#)

Dynamics Laboratory, HMC

DE PIETRO FELLOW | ADVISOR: DR. ZIYAD DURON

Claremont, CA

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

STUDENT RESEARCHER | ADVISOR: DR. PHILIP D. CHA

Claremont, CA

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

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). (Submitted) [\[arXiv\]](#)

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). (Submitted) [\[arXiv\]](#) [\[code\]](#)

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). (Submitted)

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. (Accepted) [link]

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). [pdf]

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). [pdf]

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/C++, HTML, \LaTeX

Libraries PyTorch, 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	<i>Portland, ME</i>
'15	Tau Beta Pi Engineering Honors Society , HMC	<i>Claremont, CA</i>
'15	De Pietro Fellowship in Civil Engineering , HMC	<i>Claremont, CA</i>
'13	Harvey S. Mudd Merits , HMC	<i>Claremont, CA</i>
'13-'17	Dean's List , HMC	<i>Claremont, CA</i>