

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

04/2018 – 06/2024 (Expected)

- 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

09/2017 – 04/2020

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

Harvey Mudd College (HMC)

Claremont, CA

B.S. IN ENGINEERING

08/2013 – 05/2017

- 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, NAVIGATION AND CONTROL INTERN

06/2022 – 08/2022

- 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

01/2019 – Current

- Developed and calibrated 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 [C3]
- Developed advanced open-source benchmark datasets (e.g., SPEED+, SHIRT, SPE3R) using synthetic renders—OpenGL/Unreal Engine—and TRON to train and validate spaceborne vision-based Deep Learning (DL) and navigation algorithms with emphasis on robustness across domain gap between synthetic and spaceborne data [C1, C4, C6, C8, C9, D2–D5, J2, J3, J6]
- Developed robust DL 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 [C5–C7, C10, J4–J6]
- Developed a DL model for 3D reconstruction and pose estimation of an unknown spacecraft from single 2D images [C8]

Dynamics Laboratory, HMC

Claremont, CA

DE PIETRO FELLOW | ADVISOR: DR. ZIYAD DURON

05/2016 – 05/2017

- 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 a lumped element model of dam, reservoir and a spillway

HMC

Claremont, CA

STUDENT RESEARCHER | ADVISOR: DR. PHILIP D. CHA

05/2016 – 05/2017

- Developed a method to accelerate the modal convergence of eigen-characteristics of (non-)uniform rods carrying various lumped attachments [J1]

Publications

🔗 Link to arXiv/official paper/project webpage | 📄 GitHub repository | 📄 Link to paper PDF | 📺 Youtube video

Peer-Reviewed Journal Articles

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

- [J5] Robust Multi-Task Learning and Online Refinement for Spacecraft Pose Estimation across Domain Gap
T. H. Park, S. D'Amico
Advances in Space Research (2023). DOI: 10.1016/j.asr.2023.03.036 [🔗](#) [🔄](#)
- [J4] Leveraging Neural Network Uncertainty in Adaptive Unscented Kalman Filter for Spacecraft Pose Estimation
 L. Pasqualetto Cassinis, **T. H. Park**, N. Stacey et al.
Advances in Space Research (2023). DOI: 10.1016/j.asr.2023.02.021 [🔗](#)
- [J3] Satellite Pose Estimation Competition 2021: Results and Analyses
T. H. Park, M. Märten, M. Jawaid et al.
Acta Astronautica (2023). DOI: 10.1016/j.actaastro.2023.01.002 [🔗](#)
- [J2] Satellite Pose Estimation Challenge: Dataset, Competition Design and Results
 M. Kisantal, S. Sharma, **T. H. Park** et al.
IEEE Transactions on Aerospace and Electronic Systems (2020). DOI: 10.1109/TAES.2020.2989063 [🔗](#)
- [J1] Improved Modal Convergence Using the Assumed Modes Method for Rods Carrying Various Lumped Elements
 P. D. Cha, **T. H. Park**
International Journal of Mechanical Engineering Education (2018). DOI: 10.1177/0306419017720424 [🔗](#)

Conference Proceedings & Presentations

- [C10] Online Supervised Training of Spaceborne Vision during Proximity Operations using Adaptive Kalman Filtering
T. H. Park, S. D'Amico
2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan (2024). [🔗](#) **[ACCEPTED]**
- [C9] SPEED-UE-Cube: A Machine Learning Dataset for Autonomous, Vision-Based Spacecraft Navigation
 Z. Ahmed, **T. H. Park**, A. Bhattacharjee et al.
46th AAS Guidance, Navigation and Control Conference, Breckenridge, Colorado, February 2-7 (2024). [🔗](#) [🔄](#)
- [C8] Rapid Abstraction of Spacecraft 3D Structure from Single 2D Image
T. H. Park, S. D'Amico
2024 AIAA SciTech Forum (2024). DOI: 10.2514/6.2024-2768 [🔗](#) [🔗](#) (Correction) [🔄](#)
- [C7] Adaptive End-to-End Architecture for Autonomous Spacecraft Navigation and Control During Rendezvous and Proximity Operations
 J. Kruger, T. Guffanti, **T. H. Park** et al.
2024 AIAA SciTech Forum (2024). DOI: 10.2514/6.2024-0430 [🔗](#)
- [C6] Adaptive Neural Network-based Unscented Kalman Filter for Spacecraft Pose Tracking at Rendezvous
T. H. Park, S. D'Amico
2022 AAS/AIAA Astrodynamics Specialist Conference, Charlotte, North Carolina, August 7-11 (2022). [🔗](#)
- [C5] Robust Multi-Task Learning and Online Refinement for Spacecraft Pose Estimation across Domain Gap
T. H. Park, S. D'Amico
11th International Workshop on Satellite Constellations & Formation Flying, Milano, Italy, June 7-10 (2022). [🔗](#)
- [C4] SPEED+: Next-Generation Dataset for Spacecraft Pose Estimation across Domain Gap
T. H. Park, M. Märten, G. Lecuyer et al.
2022 IEEE Aerospace Conference (2022). DOI: 10.1109/AERO53065.2022.9843439 [🔗](#) [🔄](#) [📺](#)
- [C3] Robotic Testbed for Rendezvous and Optical Navigation: Multi-Source Calibration and Machine Learning Use Cases
T. H. Park, J. Bosse, S. D'Amico
2021 AAS/AIAA Astrodynamics Specialist Conference, Virtual, August 8 - 12 (2021). [🔗](#)
- [C2] Generative Model for Spacecraft Image Synthesis using Limited Dataset
T. H. Park, S. D'Amico
2020 AAS/AIAA Astrodynamics Specialist Conference, South Lake Tahoe, California, August 9 - 13 (2020). [🔗](#)
- [C1] Towards Robust Learning-Based Pose Estimation of Noncooperative Spacecraft
T. H. Park, S. Sharma, S. D'Amico
2019 AAS/AIAA Astrodynamics Specialist Conference, Portland, Maine, August 11 - 15 (2019). [🔗](#) **<BEST PAPER AWARD>**

Open-Source Datasets

- [D5] **Spacecraft Pose Estimation Dataset of a 3U CubeSat using Unreal Engine (SPEED-UE-Cube)**
T. H. Park, Z. Ahmed, A. Bhattacharjee et al.
Stanford Digital Repository (2024). [🔗](#)
- [D4] **SPE3R: Synthetic Dataset for Satellite Pose Estimation and 3D Reconstruction**
T. H. Park, S. D'Amico
Stanford Digital Repository (2024). DOI: 10.25740/pk719hm4806
- [D3] **SHIRT: Satellite Hardware-In-the-loop Rendezvous Trajectories Dataset**
T. H. Park, S. D'Amico
Stanford Digital Repository (2022). DOI: 10.25740/zq716br5462 [🔗](#)
- [D2] **Next Generation Spacecraft Pose Estimation Dataset (SPEED+)**
T. H. Park, M. Märten, G. Lecuyer et al.
Stanford Digital Repository (2021). DOI: 10.25740/wv398fc4383
- [D1] **Spacecraft Pose Estimation Dataset (SPEED)**
S. Sharma, **T. H. Park**, S. D'Amico
Stanford Digital Repository (2019). DOI: 10.25740/dz692fn7184 [📺](#)

Activities

- Co-organizer** Kelvins Satellite Pose Estimation Competition (2021) [🔗](#)
AI4Space (CVPR workshop) (2024) [🔗](#)
- Reviewer** Advances in Space Research (3 papers)
Astrodynamics (1)
IEEE Transactions on Aerospace and Electronic Systems (2)
Journal of Aerospace Information Systems (3)
Journal of Guidance, Control, Dynamics (1)
Journal of Spacecraft and Rockets (1)

Skills

- Programming** MATLAB/Simulink, Python, C/C++, CUDA, \LaTeX
- Deep Learning** PyTorch (Python & C++), ONNXRuntime, TensorRT, MATLAB Deep Learning Toolbox™
- Libraries** OpenCV, PyTorch3D, OpenMP, CVX/CVXPY
- Rendering** OpenGL, Unreal Engine
- Languages** Korean (native) , English (fluent) , Japanese (proficient) , French (conversational)

Honors & Awards

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