Jake H. Lee

CONTACT INFORMATION

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RESEARCH INTERESTS

Machine learning and deep learning for science applications, onboard science instrument autonomy for deep space exploration, ML/DL for remote sensing, Interpretable/Explainable AI.

EDUCATION

Columbia University, New York, New York, USA
SEAS Department of Computer Science
M.S., Computer Science, May 2020
B.S., Computer Science, May 2019

ACADEMIC EXPERIENCE

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA

Data Scientist **July 2020 - Current**
Machine Learning and Instrument Autonomy Group. Projects include:
Onboard Science Instrument Autonomy for the Ocean Worlds Life Surveyor.
ML detection of methane plumes in airborne and spaceborne hyperspectral observations.
Dense global vegetation height mapping with deep learning.
Martian digital elevation model generation for machine learning detection of recurring slope lineae

Undergraduate Summer Research Intern **Summer 2017, 2018, 2019**
Intern under Kiri Wagstaff in the Machine Learning and Instrument Autonomy group. Multi-year research project of an explainable method to discover novel and interesting images in large data sets. Presented and published across three different venues.

Columbia University, New York, New York, USA

Graduate Research Student **Fall 2019 - Spring 2020**
Student researcher under Prof. Junfeng Yang at the Software Systems Lab.
Self-directed research quantifying the shift-invariance of image features extracted from CNNs.

Head Teaching Assistant **Spring 2020**
Computational Linear Algebra course taught by Prof. Tony Dear.
Contributed to curriculum and assignment development for a brand new course.
Duties included TA team management, office hours, and biweekly recitations.

Teaching Assistant **Fall 2019**
Artificial Intelligence course taught by Prof. Tony Dear.
Contributed to developing new programming assignments, including autograding on Gradescope.
Duties included grading, office hours, and biweekly recitations.

Research Assistant **Fall 2017 - Spring 2018**
Assistant at the Columbia Plasma Physics Laboratory (HBT-EP).
Integrated and maintained a high-speed camera for visual plasma observations.
Reviewed and optimized Tokamak fusion reactor control programs written in C/CUDA.

Research Assistant **Fall 2016 - Fall 2017**
Assistant at the Lamont-Doherty Earth Observatory Ocean and Climate Physics laboratory.
Analyzed and visualized radiation albedo data from airborne observations of Svalbard.
Integrated and maintained a polarimeter for fieldwork on the R/V Falkor.

Publications

S. Mauceri, **J. Lee**, M. Wronkiewicz, L. Mandrake, G. Doran, J. Lightholder, Z. Cieslarova, M. Kok, M. F. Mora, A. C. Noell. "Autonomous CE Mass-Spectra Examination (ACME) for the Ocean Worlds Life Surveyor". *Earth and Space Science*, 9, 2022.

F. H. Wagner, R. Dalagnol, A. H. Sánchez, M. C. M. Hirye, S. Favrichon, **J. Lee**, S. Mauceri, Y. Yang, S. Saatchi. "K-textures, a self-supervised hard clustering deep learning algorithm for satellite image segmentation". *Frontiers in Environmental Science*, 10, 2022.

M. Dubay, N. Johnston, M. Wronkiewicz, **J. Lee**, C. Lindensmith, J. Nadeau. "Quantification of Motility in Bacillus subtilis at Temperatures Up to 84°C Using a Submersible Volumetric Microscope and Automated Tracking". *Frontiers in Microbiology*, 13, 2022.

H. Kerner, U. Rebbapragada, K. L. Wagstaff, S. Lu, B. Dubayah, E. Huff, **J. Lee**, V. Raman, S. Kulshrestha. "Domain-agnostic Outlier Ranking Algorithms (DORA)-A Configurable Pipeline for Facilitating Outlier Detection in Scientific Datasets". *Frontiers in Astronomy and Space Sciences*, 9, 2022.

J. Lee, K. Wagstaff. "Visualizing Image Content to Explain Novel Image Discovery". *Data Mining and Knowledge Discovery*, 34, 1777-1804, 2020.

Papers in preparation

M. Wronkiewicz, **J. Lee**, J. Lightholder, G. Doran, S. Mauceri, T. Schibler, E. Moorjani, J. Nadeau, C. Lindensmith, L. Mandrake. "Identifying and Characterizing Motile and Fluorescent Microorganisms in Microscopy Data Using Onboard Science Autonomy".

Conference Presentations

J. Lightholder, M. Wronkiewicz, **J. Lee**, T. Schibler, S. Mauceri, G. Doran, E. Moorjani, C. Lindensmith, L. Mandrake. "Domain-agnostic Outlier Ranking Algorithms (DORA)-A Configurable Pipeline for Facilitating Outlier Detection in Scientific Datasets". *AGU 2021 Fall Meeting*, New Orleans, LA, 2021.

A. Rao, S. Mauceri, A. Thorpe, **J. Lee**, S. Jongaramrungruang, R. Duren. "Improving Imaging Spectrometer Methane Plume Detection with Large Eddy Simulations". *AGU 2021 Fall Meeting*, New Orleans, LA, 2021.

J. Lee, S. Mauceri, J. Lightholder, M. Wronkiewicz, G. Doran, L. Mandrake, Z. Cieslarova, M. Kok, M. Mora, A. Noell. "Onboard Autonomous Summarization and Prioritization of CE-ESI MS Data for the Ocean Worlds Life Surveyor". *AGU 2021 Fall Meeting*, New Orleans, LA, 2021.

J. Lee, S. Mauceri, S. Dey, A. Rao, R. Alimo, A. Thorpe, S. Jongaramrungruang, R. Duren. "Methane Plume Detection weith Future Orbital Imaging Spectrometers". *AGU 2021 Fall Meeting*, New Orleans, LA, 2021.

D. E. Stillman, K. M. Primm, B. Bue, K. L. Wagstaff, **J. Lee**, A. Ansar. "RSL Geostatistics Show Slopes Above the Angle of Repose and Significant Enhancement After Mars Year 34 Dust Storm". *52nd Lunar and Planetary Science Conference*, Virtual, 2021.

K. Wagstaff, S. Lu, E. Dunkel, K. Grimes, B. Zhao, J. Cai, S. B. Cole, G. Doran, R. Francis, **J. Lee**, L. Mandrake. "Mars Image Content Classification: Three Years of NASA Deployment and Recent Advances". *35th AAAI Conference on Artificial Intelligence*, Virtual, 2021.

P. Horton, S. Ravichandar, **J. Lee**, H. R. Kerner, A. Natha, T. K. Soliman, K. Grimes, K. Wagstaff, R. Verma, J. McAuley. "Novelty and Discovery Content Analysis Methods for the Planetary Data System Image Atlas". *AGU 2020 Fall Meeting*, Virtual, 2020.

J. Lee, J. Yang, Z. Wang. "What Does CNN Shift Invariance Look Like? A Visualization Study". *2020 European Conference on Computer Vision Workshop on Real-World Computer Vision from Inputs with Limited Quality (RLQ-TOD)*, Virtual, 2020.

S. Lu, K. L. Wagstaff, J. Cai, G. Doran, K. Grimes, **J. Lee**, L. Mandrake. "Content-based Classification of Mars Imagery for the PDS Image Atlas". *AGU 2019 Fall Meeting*, San Francisco, CA, 2019.

S. Lu, K. L. Wagstaff, J. Cai, G. Doran, K. Grimes, **J. Lee**, L. Mandrake, Y. Yue. "Improved Content-Based Image Classifiers for the PDS Image Atlas". *4th Planetary Data Workshop*, Flagstaff, AZ, 2019.

K. L. Wagstaff, **J. Lee**. "Interpretable Discovery in Large Image Data Sets". *ICML Workshop on Human Interpretability in Machine Learning*, Stockholm, Sweden, 2018.