

Andrew B. Foerder

Boulder, CO • (206) 310-4076 • andrewfoerder66@gmail.com • [LinkedIn](#) • [GitHub](#) • [Google Scholar](#) • [ORCID](#)

SUMMARY

Applied scientist in computer vision and machine learning for Earth and planetary remote sensing. I build end-to-end detection and measurement pipelines for large image archives where labeled training data does not exist, and deploy them on cloud GPU infrastructure at survey scale. Equally comfortable defending what a model output does and does not support. Ph.D. defending Spring 2027; U.S. citizen, eligible to obtain a security clearance.

TECHNICAL SKILLS

Languages & frameworks Python · PyTorch · scikit-learn · XGBoost · Git

Computer vision U-Net and U-Net++ · Mask R-CNN (Detectron2) · segmentation_models_pytorch · SAM fine-tuning · DINOv3 / Vision Transformers · custom architectures, losses, and samplers

Evaluation & statistics Nested and grouped cross-validation · probability calibration · simulation-based power analysis · data-leakage detection · stacking ensembles · hyperparameter search (Optuna)

Geospatial & imagery rasterio · Cloud-Optimized GeoTIFF (windowed reads) · NASA PDS STAC API · scikit-image · HiRISE and CTX orbital imagery · ArcGIS Pro

Infrastructure AWS Batch (GPU Spot fleets) · S3 · Docker (multi-stage CUDA) · Anthropic API (structured outputs, Batches)

EXPERIENCE

Graduate Research Assistant | University of Tennessee, Knoxville, TN

Aug 2023 – present

- **Built an end-to-end computer vision pipeline** that detects thermal contraction polygons in Mars orbital imagery and classifies fracture-junction geometry into four types, turning a manual mapping task into a quantitative climate variable. Best model labels 84% of junctions correctly and distinguishes terrain types from as few as 25–50 junctions. Manuscript under review at JGR: Machine Learning and Computation.
- **Built and validated the cloud deployment** for a ~55 TB HiRISE corpus: GPU Spot fleets on AWS Batch, an S3 scratch-sync stage, and a kill-switch script so unattended runs cannot overrun budget, packaged in a multi-stage CUDA Docker build separating compile-time and runtime images. Smoke-tested end to end; full corpus run scheduled.
- **Replaced full-image JP2 decoding with windowed Cloud-Optimized GeoTIFF reads**, and wrote a parity test proving byte-identical output across 25,666 rows before merging the change. Built a PDS STAC client to discover HiRISE footprints programmatically rather than tracking product IDs by hand.
- **Ran a controlled architecture comparison** to settle a reviewer question about design choice. On 552 held-out junctions, the staged detect–segment–skeletonize–classify pipeline correctly found and typed 68.7%, against 7.8% and 0% for two single-model alternatives trained end to end.
- **Found and remediated a train/evaluation data-leakage bug** in my own work, rebuilding and re-validating an eight-method model stack on clean data; documented library version sensitivity as a reproducibility risk rather than assuming it away.
- **Built TYXN Labeler**, a browser-based annotation tool, after identifying labeled data as the binding constraint on the project; it produced the hand-labeled junction dataset the classifier trains on.
- **Established the predictability limits of the Mars dust storm record** with a pre-registered assessment, showing the observational record cannot support a precursor-based forecast that beats seasonal climatology, and quantifying the shortfall.
- **Mentored an undergraduate researcher** in scientific applications of machine learning through UTK's Faculty Research Assistants Funding program.

Temporary Researcher, Tolbert Group (CIRES) | University of Colorado Boulder, Boulder, CO Aug 2020 – Nov 2021

- Investigated soil deliquescence and efflorescence as a driver of recurring slope lineae, running humidity-controlled experiments and advising a chemistry-focused team on geologic context (contributing author, Fernanders et al. 2022).

Researcher, Hawai'i Institute of Geophysics & Planetology | University of Hawai'i at Mānoa, Honolulu, HI Jan 2019 – Jul 2020

- Led retrospective studies using Antarctic Dry Valley soils as Mars analogues, comparing rover observations against field and laboratory datasets with reproducible Python workflows; advanced the work into two first-author publications.

Graduate Teaching Assistant | University of Tennessee, Knoxville, TN Aug 2023 – present

- Lead undergraduate laboratory sections across three courses — The Dynamic Earth, The Earth's Environments, and Landscapes: Earth and Elsewhere — teaching, grading, holding office hours, and building supplementary study materials. Previously taught Sedimentology & Stratigraphy labs at the University of Hawai'i (2019).

SELECTED PUBLICATIONS

Foerder, A. B., Magocs, B. L., Thomson, B. J., and Bhidya, H. (under review). *Toward paleoclimate mapping on Mars by detecting and classifying fracture junctions with machine learning*. Journal of Geophysical Research: Machine Learning and Computation.

Foerder, A. B., Englert, P. A. J., Bishop, J. L., et al. (2024). *Don Juan Basin, Antarctica: A chemically altering environment with martian analog potential*. American Mineralogist 109(4): 682–700.

Burton, Z. F. M., Koeberl, C., Bishop, J. L., Englert, P. A. J., Smith, M. P., **Foerder, A. B.**, and Gibson, E. K. (2025). *Controls on cold-climate critical minerals: regolith-hosted REE at three polar desert salt ponds (McMurdo Dry Valleys, Antarctica)*. Cold Regions Science and Technology 239: 104583.

Foerder, A. B., Thomson, B. J., and Magocs, B. L. (2026). *Earth-to-Mars transfer learning: a novel method for the automatic detection of volatile-influenced landforms on Mars*. 57th Lunar and Planetary Science Conference, abstract 1717.

Full publication list, including six additional conference abstracts, available on [Google Scholar](#).

EDUCATION

Ph.D., Earth, Environmental & Planetary Sciences University of Tennessee, Knoxville, TN	expected 2027
Dissertation: machine learning and computer vision for automated landform detection and paleoclimate inference in Mars orbital imagery. Advisor: Dr. Bradley J. Thomson.	
M.Sc., Earth & Planetary Sciences University of Hawai'i at Mānoa, Honolulu, HI	2020
B.A., Geology–Biology Brown University, Providence, RI	2018

ADDITIONAL

NCAA Division I distance runner, four years. Coursework and certifications in deep learning, computer vision, and remote sensing available on request.