Tom Sander

+49 173 4519175 | tom96.sander@t-online.de | nder.online | @tom-sander | Google Scholar | GitHub

PROFESSIONAL SUMMARY

Machine Learning Engineer with deep expertise in deploying scalable multimodal foundation models and computer vision architectures for complex geospatial data. Highly skilled in PyTorch and Google Cloud Platform (GCP), with a proven history of optimizing Transformer models (1.3B+ tokens) and orchestrating robust cloud training pipelines. Adept at translating cutting-edge academic research into high-performance, production-ready systems.

SKILLS

Programming Languages: Python, Bash, MATLAB

Machine Learning & AI: PyTorch, Hugging Face, Multimodal Transformers, Foundation Models, Masked Autoencoders, Diffusion Models, CNNs

Cloud & MLOps: Google Cloud Platform (GCP), CI/CD Pipelines, Git, Linux Server Administration, Model Deployment

Geospatial & Data Engineering: GDAL, Rasterio, Polars, NumPy, Large-Scale Data Normalization, Remote Sensing

WORK EXPERIENCE

TU Dortmund University
Jun. 2022 – now

Researcher & Ph.D. Student
Dortmund, Germany

- Engineered and scaled multimodal foundation models for geospatial remote sensing, processing over 1.34 billion tokens to push the boundaries of topological surface reconstruction
- Optimized model architectures to utilize 29.7 million trainable parameters and 1.5 million parameters per tokenizer (VQ), deploying and maintaining robust training pipelines within Linux environments
- Accelerated technical output by directing and mentoring 3 concurrent engineering project groups of 6 to 8 students through complex end-to-end machine learning initiatives

SETI Institute
Jun. 2024 – Aug. 2024

FDL Researcher
Mountain View, CA

- Designed a multimodal Transformer foundation model for geospatial data, processing and normalizing complex Geospatial IMG files to ensure high data integrity for lunar science applications
- Built and managed GCP training pipelines across 4 A100 GPUs, enabling full global lunar coverage in hydration cycle analysis using the Moon Mineralogy Mapper (M^3)

Fraunhofer ENAS
May 2018 – Jun. 2022

Research Assistant during my Bachelor's and Master's Degree
Paderborn, Germany

- Developed machine learning models for automated anomaly detection, achieving up to 97.85% accuracy in defect localization and classification on irregularly structured surfaces
- Performed hardware-software integration experiments, mapping PCB magnetic fields and optimizing wireless energy transmission systems

PROJECTS

Multimodal Foundation Transformer Models for Lunar Science

- Constructed a 29.7M-parameter any-to-any multimodal Transformer (Masked Autoencoder) predicting four modalities simultaneously (DEMs, surface normals, albedo, and grayscale imagery) trained on 1.34B tokens from custom VQ tokenizers
- Achieved SSIM 0.945 and PSNR 52.17 dB on DEM reconstruction with only 0.077% relative pixel error; secured first-author publication in Q1 ISPRS Journal (https://doi.org/10.1016/j.isprsjprs.2026.04.008)

Multimodal Lunar Geomap Prediction & NLP Event Analysis

- Building a multimodal Masked Autoencoder (PyTorch Lightning, DDP, bf16) over five heterogeneous LRO modalities including hyperspectral reflectance, geological segmentation maps, and natural-language captions synthesized via the Gemini API
- Enables caption-conditioned geological map synthesis and image-to-geology segmentation from a single checkpoint, directly fusing computer vision with NLP

Lunar Swirls Multimodal Correlation Analysis

- Architected a Multimodal Masked Autoencoder jointly processing 12 heterogeneous remote sensing modalities across 56 globally distributed sites, training on 48M tokens with modality-specific VQ-VAE tokenizers attaining SSIM $>$0.96
- Conducted a global composition-polarization correlation study across 56 known lunar swirl sites, quantifying per-modality impact via LOO ablation (classification F1: 0.492, reconstruction SSIM up to 0.999); Journal submitted

Anomaly / Technosignatures Detection on Lunar Surface

- Benchmarked three unsupervised deep learning architectures (AnoViT, EfficientAD, Cut&Paste) over 1M+ high-resolution image patches; AnoViT attained 98.21% accuracy and 98.74% AUC on Apollo 15
- Outperformed published industry baseline on Apollo 17: Average Precision improved from 49.0% to 62.26% and Precision at Threshold from 5.5% to 43.99% using EfficientAD (Student-Teacher framework)

EDUCATION

TU Dortmund University Jun. 2022 – now
Researcher & Ph.D. Student Dortmund, Germany

Paderborn University Apr. 2019 – Apr. 2022
Master of Science in Electrical Engineering Paderborn, Germany

- **Thesis**: Anomaly Detection on natural wooden surfaces

Paderborn University Oct. 2015 – Mar. 2019
Bachelor of Science in Electrical Engineering Paderborn, Germany

- **Thesis**: Characterization of PCB magnetic fields

SELECTED PUBLICATIONS

- Sander, T., Tenthoff, M., Wohlfarth, K., & Wöhler, C. (2026). The moon's many faces: A single unified transformer for multimodal lunar reconstruction. ISPRS Journal of Photogrammetry and Remote Sensing, 236, 363-379. https://doi.org/10.1016/j.isprsjprs.2026.04.008
- Sander, T. S., & Wöhler, C. W. (2025). Lunar Image Transformation: A Multi-Modal Any-To-Any Generation Approach. LPI Contributions, 3090, 1159.
- Sander, T., & Wöhler, C. (2025). Lunar Technosignatures: A Deep Learning Approach to Detecting Apollo Landing Sites on the Lunar Surface. Proceedings Copyright, 491, 499.