Saad Lahrichi

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Curious Ph.D. student specializing in applied Machine Learning to remote sensing and metamaterial design

Education

University of Missouri	PhD student in Computer Science	May 2027
University of Missouri	Master of Science in Computer Science	May 2025
Duke University	Bachelor of Science in Data Science (dual degree)	May 2023
Duke Kunshan University	Bachelor of Science in Data Science - cum laude honors	May 2023

Experience

Malof Lab, University of Missouri — **Columbia, MO**
Doctoral Research & Teaching Assistant — *August 2023 – Present*

- Improved deep learning models for wildfire spread prediction, improving accuracy by 37% over past benchmarks, and informing disaster preparedness and firefighter response
- Discovered two limitations of the Tandem model for inverse metamaterial design, and designed a novel loss function (Direct Inverse Loss), addressing the found limitations and resulting in over 90% reduction in error rates
- Conducted the first systematic evaluation of Meta's Segment Anything Model (SAM) on 7 public overhead imagery benchmark datasets (covering 5M+ km^2), providing critical insights for the remote sensing community (150+ citations)
- Delivered 4 Advanced Algorithms lectures on Divide & Conquer techniques and designed 3 Deep Learning lab sessions, guiding students through the complete deep learning pipeline (preprocessing, fine-tuning, evaluation, and visualization)

Capital One — **McLean, VA**
Data Science PhD Intern — *June 2025 – August 2025*

- Developed an LLM-based framework for automated ontology creation and management, standardizing 7,200+ attributes
- Used Agentic RAG and a FAISS Vector DB for efficient and consistent knowledge graph creation
- Achieved 87% consistency with manually created relationships in the existing ontology

Energy Data Analytics Lab, Duke University — **Durham, NC**
Research Assistant, Tracking Climate Change Causes and Consequences with Satellites and AI — *May 2022 – May 2024*

- Curated GeoNet, a large and diverse dataset (1M+ satellite images spanning 36M km^2), developed specifically for extracting climate change-relevant content from remote sensing imagery
- Pretrained foundation vision models using Self-Supervised Learning (SSL) on GeoNet, achieving competitive finetuning performance compared to ImageNet-trained models on several benchmark tasks
- Surpassed SotA supervised models' accuracy in 6 classification and semantic segmentation benchmarks by up to 23%

Data Science Research Center, Duke Kunshan University — **Kunshan, China**
Research Scholars Fellow: How Fintech Empowers Asset Valuation — *May 2021 – June 2022*

- Designed and evaluated a data pipeline for algorithmic trading strategies, providing a systematic approach to compare different algorithms in finance and cryptoeconomics
- Demonstrated the effectiveness of the pipeline by evaluating it on 4 algorithms (SMA crossover, VWAP, sentiment analysis, and statistical arbitrage)
- Achieved an 849.8% ROI increase compared to buy-and-hold strategy using SMA crossover in backtested ETH trading
- Reviewed 11 tech solutions in the crypto market, guiding investors in selecting portfolio trackers and trading platforms

Computer Science Department, Duke Kunshan University — **Kunshan, China**
Teaching Assistant & Peer Tutor — *June 2020 – March 2022*

- Developed, tested, and maintained the CS department's first autograder (in use for CS201 & CS301 since Fall 2020)
- Solved 20+ Java Data Structures problems and implemented optimal and alternative solutions in the autograder
- Facilitated 32+ hours of weekly tutoring sessions, assisting 12+ students during Fall 2021 and Spring 2022

Addictest College Preparation Center — **Casablanca, Morocco**
College Admissions Counselor & Standardized Test Tutor — *March 2020 – December 2021*

- Mentored 100+ high school students through the college admission process to universities abroad (US, Europe, Asia)
- Led weekly group and individual SAT Math & English classes, receiving outstanding student feedback

Miscellaneaous

- Technical Skills: Python, PyTorch, Docker, Kubernetes, OpenCV, Linux, Git, Tensorflow, Keras, scikit-learn, Java
- Spoken Languages: Fluent in Arabic, French, English, Spanish, Intermediary Chinese
- Interests: Refugee Resettlement, Competitive Debate, Weighlifting, Spanish Soccer, Matcha

Select Publications

Published

- **S. Lahrichi**, E.J. Mick, M. B. Lindsay, S. D. Kovaleski, D. T. Anderson, J. M. Malof, S. R. Price, S. R. Price., "Deep inverse modeling the near field response of optical metasurfaces," Advanced Optics for Imaging Applications: UV through LWIR X, SPIE, May 2025
- E. J. Mick, M. B. Lindsay, S. D. Kovaleski, D. T. Anderson, **S. Lahrichi**, J. M. Malof, "Key Considerations for Robust Near-Field Response Prediction and Optical Metasurface Inverse Design", Advanced Optics for Imaging Applications: UV through LWIR X, SPIE, May 2025
- **S. Lahrichi**, Z. Sheng, S. Xia, K. Bradbury, and J. M. Malof, "Is Self-Supervised Pre-training on Satellite Imagery Better than ImageNet? A Systematic Study with Sentinel-2", arXiv preprint arXiv:2502.10669, Feb. 2025
- S. Ren, F. Luzi[*], **S. Lahrichi**[*], K. Kassaw[*], L. M. Collins, K. Bradbury, and J. M. Malof, "Segment Anything, From Space?", IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Jan. 2024
- L. Zhang, T. Wu[*], **S. Lahrichi**[*], C.-G. Salas-Flores, and J. Li, "A Data Science Pipeline for Algorithmic Trading: A Comparative Study of Applications for Finance and Cryptoeconomics", IEEE International Conference on Blockchain (Blockchain), Aug. 2022
- Z. D. Calhoun, **S. Lahrichi**, S. Ren, J. M. Malof, and K. Bradbury, "Self-Supervised Encoders Are Better Transfer Learners in Remote Sensing Applications", Remote Sensing, Jan. 2022
- S. Ren[*], **S. Lahrichi**[*], Y. Deng, W. Padilla, L. M. Collins, and J. M. Malof, "Does Deep Active Learning Work in the Wild?", arXiv preprint arXiv:2302.00098, Dec. 2024

In Review

- **S. Lahrichi**, J. Bova, J. Johnson, and J. M. Malof, "Advancing Time Series Wildfire Spread Prediction: Modeling Improvements and the WSTS+ Benchmark"
- **S. Lahrichi**, E. Song, G. Spell, W. Padilla, and J. M. Malof, "Toward a Loss Function for Learning Direct Inverse Mappings"

Posters & Invited Talks

- "Towards a Foundational Model for Predicting Wildfire Spread". American Geophysical Union (AGU) Annual Meeting, Washington, DC, December 2024
- "GeoNet: A Global Dataset and Foundation Model for Deep Learning on Optical Satellite Imagery". American Geophysical Union (AGU) Meeting, Washington, DC, December 2024 2024
- "Predicting Wildfire Rate of Spread Using Machine Learning and Remote Sensing". 3rd Place Award - Duke University Energy Data Analytics Symposium, Durham, NC, October 2023
- "Tracking Climate Change Causes & Impacts with Satellites and AI". Duke University Data+. Durham, NC, July 2022

Leadership / Extracurricular

Mizzou Muslim Student Organization
Columbia, MO

Hospitality Chair
September 2024 – May 2025

- Set up conference venue including 2 lecture halls, refreshment room, and lunch and dinner areas over two days
- Coordinated lunch and dinner service for 280+ attendees

International Rescue Committee
Missoula, MT

Volunteer Interpreter
August 2023 – June 2024

- Provided live interpretation during Cultural Orientation sessions for 20+ newly arrived refugees
- Communicated essential information about local laws and available educational, health, and financial resources
- Translated official documents between Arabic and English

Duke Arabic Debate Team
Durham, NC

Debater, Assistant Coach
August 2022 – May 2024

- Coached the 2024 International Universities Debating Championship team and organized mock debate practice
- Won the 2023 US Universities Arabic Debating Championship and earned 9th best speaker overall award (out of 132)
- Won the 2022 US Universities Arabic Debating Championship and earned 6th best speaker overall award (out of 145)

Duke Muslim Student Association
Durham, NC

Co-Treasurer
August 2022 – May 2023

- Managed $36.000+ yearly student group budget award
- Organized weekly Friday events, speaker series event, and flagship banquets, attended by 300+ students from NC