Thainara Munhoz Alexandre de Lima

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PERSONAL PROFILE

Thainara Lima is a PhD student in Agricultural and Biosystems Engineering at Mississippi State University and a NASA Early Career Research Fellow. Her PhD project develops scalable AI pipelines for large-scale geospatial data on HPC/GPU infrastructure, with a focus on global algal bloom detection in coastal waters. She explores Vision Transformers, semantic segmentation, and self-supervised learning for Earth observation, while advancing domain-aware foundational models. Her broader research interests span AI-driven innovation, multimodal learning, and sustainable monitoring solutions that integrate satellite data, computer vision, and high-performance computing for planetary-scale environmental challenges.
She holds a master's degree in Remote Sensing from the Brazilian Institute for Space Research (INPE), Brazil, where she worked on calibrating bio-optical and machine learning models using satellite data. She earned her bachelor's degree in Geomatics and Surveying Engineering, with an internship at the University of New Brunswick in Canada, with a focus on GNSS, precision agriculture, and remote sensing. She possesses extensive experience in mapping and monitoring agricultural crops in Brazil using Earth Observation (EO) and deep learning, building independent, scalable pipelines that integrate data ingestion, advanced augmentation, and active learning loops.
Thainara has collaborated with research groups at the National Research Council of Italy (CNR-IREA) and the Instrumentation Laboratory for Aquatic Systems (LabISA), applying hyperspectral analysis and deep learning to complex aquatic and terrestrial environments.

Research Interest: Remote Sensing, GPU computing, accelerated AI, computer vision for Earth observation, deep learning optimization, and domain-specific foundation models.

EDUCATION

[Aug/2024 - Now] Mississippi State University - MSU, U.S.A.
Doctor of Philosophy, Agricultural and Biosystems Engineering, Current GPA: 4.00/4.00
Project: *Global Algal Bloom Detection System for Nearshore Coastal Waters using Harmonized Landsat-Sentinel-2 data*

[Feb/2021 – Mar/2023] Brazilian Institute for Space Research - INPE, Earth Observation and Geoinformatics Division, Brazil
M.Sc, Remote Sensing
Project: *Mapping of cyanobacteria in the Promissao Reservoir by multispectral and hyperspectral images.*

[Feb/2016 – Jan/2021] University of São Paulo State – UNESP, Brazil
B.Sc, Cartography and Surveying Engineering/Geomatics Engineering, GPA: 3.61/4.00

Project: *Development of a Protocol for Discriminating Eucalyptus Stands at Different Crop Development Stages, Based on Vegetation Indices Derived from OLI/Landsat-8 Imagery*

TECHNICAL SKILLS

Programming & Data Science: Proficient in Python, R, SQL, and MATLAB for data analysis, modeling, and automation; experienced in modular codebase design and unit testing for reproducible, production-ready research workflows.

Deep Learning & AI: Experienced with PyTorch, TensorFlow, Keras, and Hugging Face Transformers for computer vision, semantic segmentation, and self-supervised learning in remote sensing; hands-on with CNNs (ResNet, UNet, DeepLab, YOLO) and state-of-the-art vision architectures including Vision Transformers, SegFormer, and foundational large-scale models such as SAM (Segment Anything Model), ensuring state-of-the-art performance across segmentation and detection tasks.

MLOps & Cloud Infrastructure: Proficient in end-to-end MLOps practices, including model versioning, deployment, monitoring, and retraining workflows using AWS cloud platforms (high experience with EC2, S3, SageMaker, Batch, and EKS), Docker containerization, Git version control, and CI/CD pipelines for scalable and maintainable model delivery.

Remote Sensing & GIS: Skilled in processing large-scale Earth observation data with Google Earth Engine, QGIS, and ArcGIS; expertise in spectral indices, atmospheric correction, and multi-sensor harmonization.

High-Performance & GPU Computing: Hands-on experience with HPC clusters and parallelized workflows for large geospatial datasets; experience with HPC schedulers: PBS and SLURM; exposure to CUDA-enabled GPU acceleration for deep learning model training and optimization.

HONOURS AND FELLOWSHIPS

IOCCG Summer Lecture Series 2026: One of 30 students selected for the 2026 IOCCG Summer Lecture Series "Frontiers in Ocean Optics and Ocean Colour Science", Venice International University and CNR-ISMAR, Venice, Italy (July 2026).

AGU Fall Meeting Travel Grant: Selected and awarded financial support for presenting research at the AGU Fall Meeting (2020).

Crea-SP Professional Training Award: Regional Council of Engineering and Agriculture of the State of São Paulo, recognizing excellence in professional development (2022).

WORK EXPERIENCE

[Jun/2025 – Aug/2025] Summer Research Intern, *High Performance Computing Collaboratory at MSU. MSU/USDA Graduate Summer Research Experience in High-Performance Computing and Agriculture.*

Development of a web portal to generate insights in the intersection of agriculture, geospatial analysis, AI/ML, and climate science in the Mississippi River Basin.

[Aug/2024 - now] Graduate Assistant, *Department of Agricultural and Biological Engineering, Mississippi State University, USA*

Remote Sensing; Geospatial computing solutions.

[Oct/2023 – Jun/2024] GIS Analyst, *Agrotools, Brazil*

Mapping and monitoring of agricultural crops using EO data. Spatial data analysis using remote sensing and geoprocessing techniques. Development of scripts in Python and GEE for automated geospatial and geostatistics modeling.

[Mar/2023 – Sep/2023] Crop Intelligence Analysis, *MERX, Brazil*

Spatial data analysis and data collection using remote sensing and geoprocessing techniques to manipulate, extract, locate, and analyze geographic data. Create, develop, and run scripts to perform automated and manual geospatial and statistical analysis on datasets using Python and JavaScript (Google Earth Engine). Basic SQL queries in relational data management.

[2021 – 2023] Research Student, *Instrumentation Laboratory for Aquatic Systems – LabISA, Brazil*

Planning and execution of field campaigns to collect radiometric and limnological data in continental water bodies; laboratory analysis of pigments; digital image processing; algorithm calibration. Member of the project: MAPAQUALI - Inland water quality monitoring by satellite

[06/2022 – 11/2022] Research Student, *National Research Council of Italy - Electromagnetic Sensing of the Environment (CNR-IREA), Italy*

Development/calibration of algorithms for estimating water quality parameters; digital image processing; development of Python algorithms for process automation; hyperspectral data processing.

[2019 – 2020] Intern, *AYA Engineering Company, Brazil*

Georeferencing of rural properties and vectorization of urban properties; assistance in the execution of projects concerning urban land regularization of specific and social interest; subdivision and condominium approvals (urban, landscaping, earthworks, drainage, paving and electrical projects).

[2019 – 2020] Volunteer Work - Leader in Executive Presidency, *Núcleo Bauru, Brazil*

[2019-2020] Volunteer Work - Project Manager, *EJECart - Junior Cartographic Engineering Company, Brazil*

[2018-2019] Research Student, *University of New Brunswick – UNB, Canada*

Evaluation of different models to correct atmospheric effects on the GNSS signal; Training to use GAPS software (GPS Analysis and Positioning Software).

TRAINING

[2025] Introduction to Machine Learning – *Computer Science Engineering, MSU*
[2024] Artificial Intelligence applied to Geotechnologies - *AmbGEO*
[2024] TensorFlow 2.0: Deep Learning and Artificial Intelligence - *Udemy*
[2022] Neural Network: Deep Learning with PyTorch – *Alura*
[2022] Machine Learning: Classification with SKLearn – *Alura Courses*
[2022] Decision Trees: Diving deeper into Machine Learning models – *Alura Courses*
[2022] Atmospheric Correction of Satellite Images – *RadarGeo*
[2021] Digital Image Processing in R – *RadarGeo*
[2020] Advanced Webinar: Forest Mapping and Monitoring with SAR Data – NASA-Applied Remote Sensing Training - *ARSET*
[2020] Understanding Phenology with Remote Sensing - NASA-Applied Remote Sensing Training – *ARSET*
[2019] Complete Google Earth Engine for Remote Sensing and GIS – *Udemy*

SPONSORED RESEARCH PROJECT ENGAGEMENT

[2024-2028] Global Algal Bloom Detection System for Nearshore Coastal Waters using Harmonized Landsat-Sentinel-2 data. Period: 2024 – 2028. Source: ***NASA Early Career Research (ECR) Program***. (Role: PhD Research Fellow). PI: Dr. Vitor Martins, Mississippi State University (MSU), USA.

[2021-2023] MAPAQUALI - Satellite monitoring of inland water quality. Period: 2021 – 2023. Source: ***Sao Paulo Research Foundation (FAPESP)***. (Role: Collaborator). PI: Dr. Cláudio Clemente Faria Barbosa, Brazilian Institute for Space Research (INPE), Brazil.

[2021-2023] Cyanobacteria mapping in Promissão reservoir by hybrid algorithms and images from OLCI/Sentinel-3 sensor. Period: 2021 – 2023. Source: ***Sao Paulo Research Foundation (FAPESP)***. (Role: Master Student Fellow). PI: Dr.

Cláudio Clemente Faria Barbosa, Brazilian Institute for Space Research (INPE), Brazil.

[Jun/2022 – Nov/2022] Water quality analysis from hyperspectral observations. Period: June 2022 – November 2022. Source: *Sao Paulo Research Foundation (FAPESP)*. (Role: Master Student Fellow). PI: Dr. Cláudio Clemente Faria Barbosa, Brazilian Institute for Space Research (INPE) and National Research Council of Italy - Electromagnetic Sensing of the Environment (CNR-IREA).

[2017-2020] Tropospheric Modeling: Study and Analysis of Different Models. Period: 2017 – 2020. Source: *Sao Paulo Research Foundation (FAPESP)*. (Role: Scientific Initiation Fellow). PI: Dra. Daniele Barroca Marra Alves, Sao Paulo State University (UNESP), Brazil.

[Dec/2018 – Mar/2019] Analysis of different tropospheric models considering different regions. Period: December 2018 – March 2019. Source: *Sao Paulo Research Foundation (FAPESP)*. (Role: Scientific Initiation Fellow). PI: Dra. Daniele Barroca Marra Alves, Sao Paulo State University (UNESP) and University of New Brunswick.

PUBLICATIONS

[2026] Hester, D.; Martins, V.S.; Ferreira, L.B.; Lima, T.M.A.; Araujo, J.A. Flow matching for Sentinel-2 super-resolution: Implementation, application, and implications. ISPRS Open Journal of Photogrammetry and Remote Sensing, 2026. Under review.

[2026] Aires, U.R.V.; Martins, V.S.; Hester, D.J.; Lima, T.M.A.; Ferreira, L.B. National-scale open cattle feedlot detection using deep learning and high-resolution aerial images: Spatial distribution and animal welfare analysis. Science of Total Environment, v. 1015, 181451, 2026. https://doi.org/10.1016/j.scitotenv.2026.181451

[2026] Paulino, R.S.; Martins, V.S.; Caballero, C.B.; Lima, T.M.A.; Liu, B.; Ashapure, A.; Werdell, J. PACE (Plankton, Aerosol, Cloud, ocean Ecosystem): Preliminary analysis of the consistency of remote sensing reflectance product over aquatic systems. ISPRS Journal of Photogrammetry and Remote sensing, v. 232, 2026. https://doi.org/10.1016/j.isprsjprs.2025.12.003

[2025] Paulino, R.S.; Martins, V.S.; Caballero, C.B.; Lima, T.M.A.; Liu, B.; Maciel, D.A.; Santos, J.C.P.; Liu, B. Performance of glint correction algorithms for Sentinel-3 OLCI data. Frontier in Remote Sensing, v. 5, 2025. https://doi.org/10.3389/frsen.2025.1690337

[2025] Hester, D.; Martins, V.S.; Ferreira, L.B.; Lima, T.M.A. Learning with less: label-efficient land cover classification at very high spatial resolution using self-supervised deep learning. ArXiv, 2025. arXiv:2511.03004

[2025] Hester, D.; Martins, V.S.; Ferreira, L.B.; Lima, T.M.A. On the use of deep learning semantic segmentation for land use and land cover classification at very high spatial resolution – a review of data sources, algorithms, and future directions, 2025. In progress.

[2025] Lima, T.M.A.; Martins, V.S. Landsat-Sentinel-2 algal bloom mapping using Vision Transformers: model description, implementation, and examples, 2025. In progress.

[2025] Lima, T.M.A.; Martins, V.S.; Paulino, R.; Caballero, C.; Barbose, C.C.F.; Ashapure, A. AQUAVis: Landsat-Sentinel Virtual Constellation of Remote Sensing Reflectance (Rrs) Product for Coastal and Inland Waters. Science of Remote Sensing, 2025. https://doi.org/10.1016/j.srs.2025.100294

[2025] Maciel, D.A.; et al. A bio-optical database for the remote sensing of water quality in BRAZil coAstal and inland waters (BRAZA). Scientific Data, v. 12, 2025. https://doi.org/10.1038/s41597-025-05609-1

[2025] Chasles, R.G.; et al. Accuracy assessment of PlanetScope SuperDove products for aquatic reflectance retrieval over Brazilian inland and coastal waters. ISPRS Journal of Photogrammetry and Remote Sensing, v/ 227, 2025. https://doi.org/10.1016/j.isprsjprs.2025.06.036

[2025] Lima, T.M.A.; Martins, V.S.; Paulino, R.S.; Caballero, C.B.; Maciel, D.A.; Giardino, C. A general bandpass adjustment function (SBAF) for harmonizing Landsat-Sentinel over inland and coastal waters. Science of Remote Sensing, v. 11, 100225, 2025. https://doi.org/10.1016/j.srs.2025.100225

[2025] Lima, T.M.A.; Barbosa, C.F.C.; Nordi, C.S.F.; Begliomini, F.N.; Martins, V.S.; Watanabe, F.S.Y.; Wanderley, R.L.N.; Paulino, R.S. A novel hybrid approach cyanobacteria mapping approach for inland reservoirs using Sentinel-3 imagery. Harmful Algae, v. 144, 102836, 2025.

[2025] Paulino, R.S.; Martins, V.S.; Novo, E.M.L.M.; Barbosa, C.C.F.; Maciel, D.A.; Wanderley, .L.N.; Portela, C.I.; Caballero, C.B.; Lima, T.M.A. Generation of robust 10-m Sentinel-2/# synthetic aquatic reflectance bands over inland waters. Remote Sensing of Environment, v. 318, 114593, 2025. https://doi.org/10.1016/j.rse.2024.114593

[2025] Caballero, C.B.; Martins, V.S.; Paulino, R.S.; Butler, E.; Sparks, E.; Lima, T.M.A.; Novo, E.M.L.M. The need for advancing algal bloom forecasting using remote sensing and modeling: Progress and future directions. Ecological Indicators, v. 172, 113244, 2025. https://doi.org/10.1016/j.ecolind.2025.113244

[2023] Begliomini, F.N.; Barbosa, C.C.F.; Martins, V.S.; Novo, E.M.L.M.; Paulino, R.S.; Maciel, D.A.; Lima, T.M.A.; O'Shea, R.E.; Pahlevan, N.; Lamparelli, M.C. Machine Learning for cyanobacteria mapping on tropical urban reservoirs using PRISMA hyperspectral data. ISPRS Journal of Photogrammetry and Remote Sensing. https://doi.org/10.1016/j.isprsjprs.2023.09.019

[2023] Pellegrino, A.; Fabbretto, A.; Bresciani, M.; Lima, T.M.A.; Braga, F.; Pahlevan, N.; Brando, V.; Kratzer, S.; Gianinetto, M.; Giardino, C. Assessing the accuracy of PRISMA L2d reflectance products in globally distributed aquatic sites, Remote Sensing. https://doi.org/10.3390/rs15082163

[2023] Lima, T.M.A.; Giardino, C.; Bresciani, M.; Barbosa, C.C.F.; Fabbretto, A.; Pellegrino, A.; Begliomini, F.N. Assessment of estimated phycocyanin and chlorophyll-a concentration from PRISMA and OLCI in Brazilian inland waters: A comparison between semi-analytical and machine learning algorithms, Remote Sensing. https://doi.org/10.3390/rs15051299

[2022] Lima, T.M.A.; Santos, M.; Alves, D. B. M.; Nikolaidou, T.; Gouveia, T.A.F. Assessing ZWD models in delay and height domains using data from stations in different climate regions, Applied Geomatics, https://doi.org/10.1007/s12518-