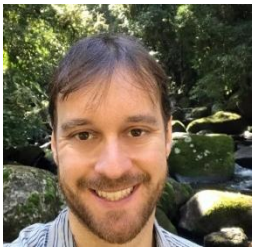
ForestSAT 2026

Association for Forest Spatial Analysis Technologies

May 4-8, 2026 | Gainesville, Florida, USA

Title: Deep-learning based tree species mapping with UAV images



Instructors/Affiliation: Dr. Matheus Pinheiro Ferreira, Department of Forest Sciences, “Luiz de Queiroz” College of Agriculture, University of São Paulo (USP/ESALQ), Piracicaba, SP, Brazil.

Description:

This workshop introduces deep-learning methods for mapping tree species from ultra-high-resolution RGB UAV imagery. We will cover core CNN concepts and their use in individual crown delineation, semantic segmentation, and scene classification. A hands-on component in Python/Jupyter will demonstrate end-to-end pipelines—data preparation, model training, inference, and evaluation—using a public dataset of individual tree crowns (ITCs) and tropical forest UAV images.

Learning Objectives:

- Understand data preparation for UAV imagery (tiling, labeling, train/val splits, augmentation).
- Explain key architectures for canopy tasks (e.g., semantic segmentation and instance/crown extraction).
- Implement training and inference in Python (PyTorch), including loss functions for class imbalance and regularization.
- Compute and interpret metrics (IoU, F1/precision–recall, per-class accuracy) and perform error/uncertainty analysis.
- Apply post-processing for crown masks and integrate outputs into GIS workflows.
- Discuss transfer learning and domain shift for generalizing across sites/sensors.

Target Audience: Graduate students, researchers, and practitioners in remote sensing, forestry, ecology, and geospatial analytics. Prerequisites: basic Python and introductory remote sensing/GIS; prior exposure to PyTorch is helpful but not required.

Format & Activities: Short lectures on CNN fundamentals and applications, followed by guided live-coding labs in Jupyter. Activities include dataset exploration, crown segmentation, semantic segmentation training/inference, and a brief scene-classification exercise. GPU access is recommended.

Expected Outcomes: Participants will leave with runnable notebooks, trained baseline models, and a reproducible workflow to adapt to their own datasets—plus a clear understanding of best practices, common pitfalls, and avenues to improve accuracy and robustness in species mapping from UAV imagery.

Language: English

Requirements: Computer with Cloud Compared installed.

Schedule: March 2nd, 2026, 9:00 AM – 18:00 PM (EST)

Duration: 8 hours.

Instructor Biography: Matheus Pinheiro Ferreira holds a degree in Forest Engineering from the Federal University of Paraná (UFPR, 2010), with complementary training at the University of Freiburg, Germany. He earned his M.Sc. (2012) and Ph.D. (2017) in Remote Sensing from the National Institute for Space Research (INPE). His current research focuses on the monitoring and quantification of forest resources through remote sensing and forest inventories. In recent years, he has been dedicated to developing artificial intelligence methods for tree species mapping, quantifying floristic diversity, and monitoring carbon stocks and sequestration in tropical forests using data from active and passive remote sensors. He has experience in hyperspectral remote sensing and radiative transfer modeling. From 2018 to 2024, he was an Assistant Professor in the Cartographic Engineering Section at the Military Institute of Engineering (IME). He is currently an Assistant Professor at the University of São Paulo (USP), in the Department of Forest Sciences at the “Luiz de Queiroz” College of Agriculture (ESALQ).

Agenda

Eastern Time (ET)	**Topic**	**Instructor**
9:00-11:00 AM	Fundamentals of deep learning	Dr. Matheus Ferreira
11:00-12:00 AM	Dataset presentation	Dr. Matheus Ferreira
12:00 AM – 13:00 PM	Lunch	
13:00-18:00 PM	Hands-on Practical	Dr. Matheus Ferreira