TAO LIU

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tao.liu.sunny@gmail.com

EDUCATION

PhD University of Florida, **Geomatics** Aug 2014~August 2018
Dissertation: "Multi-Angle Analysis of UAV Images Using Statistical Model, Photogrammetry & Machine Learning"
Committee: Amr Abd-Elrahman (chair)

MS University of Florida, **Statistics** Aug 2014 ~August 2016

MS ESF State University of New York, RS and GIS Engineering Aug 2011~May 2014
Thesis: "Using LiDAR point data for Individual Tree Crown Delineation"
Advisor: Jungho Im (chair)

BS Northwest A&F University, Forestry, China Sep 2007~May 2011

HONORS AND AWARDS

NSF NRT (NSF, CoI, $ 1,999,992.00) 2023~2028
Data Science-Enabled Sensing of the Environment for Climate Adaptation

NASA Land Use/Land Cover (NASA, CoI, $449,817.00) 2021~2024
Water scarcity in the Serbian Danube: Agricultural land use change and irrigation

NSF MRI (NASA, SP, $432,000.00) 2022~2024
MRI: Acquisition of a GPU-accelerated cluster for research, training and outreach

USDA McIntire-Stennis (PI,24,000) 2020-present
This is a three-year grant focusing on using deep learning and remote sensing techniques to develop individual tree crown delineation methods.

USDA Forest Mortality Mapping (PI, $80,000) 2020-2022

NASA Innovation Corps Award 2024 Spring
Selected by NASA to attend Wildfire Technology Management Cohort as team led

NCAR HPC Derecho Computation Resource Award 2023~2024
Awarded 100 million core hours on HPC Derecho

NCAR-NEON Workshop Award 2023 Summer
Selected by NCAR to attend model simulation for NEON sites in Boulder, CO

NCAR Earth Modelling Workshop Award 2023 Summer
Selected by NCAR to attend earth modelling workshop in Boulder, CO

University of Florida Outstanding Geomatics Doctoral Student 2014

University of Florida Graduate Fellowship 2014

APPOINTMENTS

Assistant Professor **Aug 2025-Present**
University of Georgia
Assistant Professor Aug 2020-June 2025
Michigan Technological University

Postdoc Research Associate Aug 2018 ~ Aug 2020
Oak Ridge National Laboratory

TEACHING EXPERIENCE

Michigan Technological University, Houghton
Assistant Professor, College of Forest Resources and Environmental Science

A. FW 4540 & 5540, Remote Sensing of Environment Lectures and Labs (Evaluation 4.91/5)
   - Basics theory of remote sensing
   - Passive remote sensing
   - Active remote sensing
   - Google Earth Engine
   - ArcGIS Pro

B. FW 5560, Digital Image Processing Lectures and Labs(to be taught in 2025 Spring)
   - Using industry software ERDAS to perform various types of remote sensing tasks

C. FW 5553, Python Programming for GIS(Evaluation 4.40/5)
   - Raster data processing with arcpy
   - Vector data processing with arcpy
   - Raster data processing with open-source package such as gdal, RasterIO
   - Vector data processing with open-source package such as geopandas

D. Advanced Remote Sensing Data Processing and Deep Learning with PyTorch (46 registration)
   - Deep Learning and Pytorch basics
   - Creating a deep learning model from scratch
   - Use off-shelf deep learning models for remote sensing applications
   - Customize the data loader for custom dataset
   - Data augmentation techniques

E. Object-based analysis of very high resolution images for natural land cover classification
   - eCognition basics
   - Object generation
   - Training sample preparation
   - Object classification
   - Accuracy assessment

UNIVERSITY SERVICE

Invited Committee Service
- MTU Environmental Data Science Degree Working Group
- **Invited** by CFRES Dean David Flaspohler, 2022

- MTU Artificial Intelligence Working Group
- **Invited** by MTU Provost and Senior Vice President Andrew Storer, 2023

Volunteer Committee Service
- MTU CFRES Curriculum Committee, 2020
- MTU Ford Center and Forest Advisory Committee, 2024

STUDENT ADVISING

A. Chaired Graduate Committees

Ph.D.

I. In progress in Michigan Tech
- Judy Long, "Forest Health Mapping and Forecasting Using Deep Learning Techniques"
- Stelle Barone, "Wildfire Behavior Forecasting Using Multimodal Data Fusion Based on Deep Learning Models"

MS

I. Completed in Michigan Tech
- Sri Renganath Rengarajan, "Individual Tree Segmentation using LiDAR Data based on 3D Object Detection Model"

II. Completed in Michigan Tech
- Ashish Mahaur, "Forest Above Ground Biomass Estimation using Deep Learning Models with NEON and GEDI Data"

B. Graduate Committees

Ph.D.

I. Completed in Michigan Tech

- Parth Bhatt, "Fine Scale Mapping of Laurentian Mixed Forest Natural Habitat Communities Using Multispectral NAIP And UAV Datasets Combined with Machine Learning Methods"
- Tiff L. DeGroot, "Assessing Tropical Mammal Diversity and Distribution Using Noninvasive Methods"

II. In Progress in Michigan Tech

- Eleanor Serocki, "Carbon Flux Dynamics in An Interior Alaskan Fen: Leveraging Water Table and Community Relationships to Map Potential Carbon Loss"

PUBLICATIONS

Under Peer Review

[30]. Rengarajan, S., **Liu, T.,** (2025), Scalable individual tree segmentation across multiple Lidar systems, *Remote Sensing of Environment*
[29]. Long, J., **Liu, T.,** (2024), Comparing the pixel-wise and image-patch based approach for large scale crop mapping, *Remote Sensing of Environment*
[28]. Long, J., **Liu, T.,** (2024), An exploration of best practice for large-scale pixel-wise crop mapping using satellite imageries, *Remote Sensing of Environment*
[27]. Mahaur, A., **Liu, T**., (2024), Aboveground Biomass Density Estimation Using Deep Learning: Insight from NEON Ground-Truth Data and Simulated GEDI Waveform, *Remote Sensing of Environment*
[26]. Jamshid Jalali , Nishan Bhattarai, Jillian Greene, **Tao Liu**, Oskar Marko, Mirjana Radulović, Molly Sears, Sean A. Woznicki 1. (2024). Climate change threatens water resources for major crops in Serbia Danube Basin by mid-21 century. *Earth's Future*

Peer Reviewed Publications (Google Scholar Citation 1499)
(Journal ranking is based on SJR Scimago Journal & Country Rank)

[25]. Ma, L., Yan, Z., Li, M., **Liu, T**., Tan, L., Wang, X., ... & Blaschke, T. (2024). Deep Learning Meets Object-Based Image Analysis: Tasks, challenges, strategies, and perspectives. IEEE Geoscience and Remote Sensing Magazine.

[24]. Kayastha, M.B., **Liu, T**., Titze, D., Havens, T.C., Huang, C. and Xue, P., 2023. Reconstructing 42 Years (1979–2020) of Great Lakes Surface Temperature through a Deep Learning Approach. *Remote Sensing*, 15(17), p.4253.

[23]. Zheng, C., **Liu, T**., Abd-Elrahman, A., Whitaker, V.M. and Wilkinson, B., 2023. Object-Detection from Multi-View remote sensing Images: A case study of fruit and flower detection and counting on a central Florida strawberry farm. *International Journal of Applied Earth Observation and Geoinformation*, 123, p.103457.

[22]. Xue, P., Wagh, A., Ma, G., Wang, Y., Yang, Y., **Liu, T**. and Huang, C., 2022. Integrating Deep Learning and Hydrodynamic Modeling to Improve the Great Lakes Forecast. *Remote Sensing*, 14(11), p.2640.

[21]. Monahan, W.B., Arnspiger, C.E., Bhatt, P., An, Z., Krist, F.J., **Liu, T**., Richard, R.P., Edson, C., Froese, R.E., Steffenson, J. and Lammers, T.C., 2022. A spectral three-dimensional color space model of tree crown health. *Plos one*, 17(10), p.e0272360.

[20]. Qin,R., **Liu, T.**[*] "A Review of Landcover Classification with Very-high Resolution Remotely Sensed Optical Images – Analysis Unit, Model Scalability and Transferability", *Remote Sensing, 2022, 14(3), 646;*

[19]. Thakur, Gautum, et al. "Accelerated Assessment of Critical Infrastructure in Aiding Recovery Efforts During Natural and Human-made Disaster", *SIGSPATIAL '21: Proceedings of the 29th International Conference on Advances in Geographic Information Systems*, November 2021 Pages 195–206https://doi.org/10.1145/3474717.3483947

[18]. Ning, H., Ye, X., Chen, Z., **Liu, T**. and Cao, T., 2021. Sidewalk extraction using aerial and street view images. *Environment and Planning B: Urban Analytics and City Science*, p.2399808321995817.

[17]. Huang, X., Zhu, D., Zhang, F., **Liu, T**., Li, X. and Zou, L., 2021. Sensing Population Distribution from Satellite Imagery via Deep Learning: Model Selection, Neighboring Effects, and Systematic Biases. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*. (**Top Tier Journal**)

[16]. **Liu, T**., Yang, L., and Lunga, D.D., "Change Detection Using Deep Learning Approach with Object-based Image Analysis," *Remote Sensing of Environment*, 256 (2021): 112308. (**Top Tier Journal**)

[15]. Shao, Z., Cai, J., Fu, P., Hu, L. and **Liu, T.,** 2019. Deep learning-based fusion of Landsat-8 and Sentinel-2 images for a harmonized surface reflectance product. *Remote Sensing of Environment*, 235, p.111425. (**Top Tier Journal**)

[14]. Nishan, B., and **Liu, T.**. "LandMOD ET mapper: A new matlab-based graphical user interface (GUI) for automated implementation of SEBAL and METRIC models in thermal imagery." *Environmental Modelling & Software* 118 (2019): 76-82. (**Top Tier Journal**)

[13]. **Liu, T.**, Abd-Elrahman, A., Dewitt, B., Smith, S., Morton, J. and Wilhelm, V.L., 2019. Evaluating the potential of multi-view data extraction from small Unmanned Aerial Systems (UASs) for object-based classification for Wetland land covers. *GIScience & Remote Sensing*, 56(1), pp.130-159. (**Top Tier Journal**)

[12]. **Liu, T.,** Abd-Elrahman, A., Zare, A., Dewitt, B.A., Flory, L. and Smith, S.E., 2018. A fully learnable context-driven object-based model for mapping land cover using multi-view data from unmanned aircraft systems. *Remote sensing of environment*, 216, pp.328-344. (**Top Tier Journal**)

[11]. **Liu, T.** and Abd-Elrahman, A., 2018. Multi-view object-based classification of wetland land covers using unmanned aircraft system images. *Remote Sensing of Environment*, 216, pp.122-138. (**Top Tier Journal**)

[10]. **Liu, T.** and Abd-Elrahman, A., 2018. Deep convolutional neural network training enrichment using multi-view object-based analysis of Unmanned Aerial systems imagery for wetlands classification. *ISPRS Journal of Photogrammetry and Remote Sensing*, 139, pp.154-170. (**Top Tier Journal**)

[9]. **Liu, T.,** Abd-Elrahman, A., Morton, J. and Wilhelm, V.L., 2018. Comparing fully convolutional networks, random forest, support vector machine, and patch-based deep convolutional neural networks for object-based wetland mapping using images from small unmanned aircraft system. *GIScience & remote sensing*, 55(2), pp.243-264. (**Top Tier Journal**)

[8]. **Liu, T**. and Abd-Elrahman, A., 2018. An object-based image analysis method for enhancing classification of land covers using fully convolutional networks and multi-view images of small unmanned aerial system. *Remote Sensing*, 10(3), p.457. (**Top Tier Journal**)

[7]. Pande-Chhetri, R., Abd-Elrahman, A., **Liu, T.**, Morton, J. and Wilhelm, V.L., 2017. Object-based classification of wetland vegetation using very high-resolution unmanned air system imagery. *European Journal of Remote Sensing*, 50(1), pp.564-576.

[6]. **Liu, T**., Im, J. and Quackenbush, L.J., 2015. A novel transferable individual tree crown delineation model based on Fishing Net Dragging and boundary classification. *ISPRS Journal of Photogrammetry and Remote Sensing*, 110, pp.34-47. (**Top Tier Journal**)

[5]. Li, M., Im, J., Quackenbush, L.J. and **Liu, T**., 2014. Forest biomass and carbon stock quantification using airborne LiDAR data: A case study over Huntington Wildlife Forest in the Adirondack Park. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 7(7), pp.3143-3156. (**Top Tier Journal**)

[4]. **Liu, T.**, Yang, L. and Lunga, D.D., 2019, November. Towards misregistration-tolerant change detection using deep learning techniques with object-based image analysis. In *Proceedings of the 27th ACM SIGSPATIAL international conference on advances in geographic information systems* (pp. 420-423).

[3]. **Liu, T.,** Yang, L., "A Fully Automatic Method for Rapidly Mapping Impacted Area by Nature Disaster", In *Proceedings of 2020 IEEE International Geoscience and Remote Sensing Symposium* (IGARSS)

[2]. **Liu, T.,** Lunga, D., "Automatically Generating High Quality Training Samples from OpenStreetMap (OSM) Dataset for Road Network Mapping", In *Proceedings of 2020 IEEE International Geoscience and Remote Sensing Symposium* (IGARSS)

Books

[1]. **Liu, T.,** & Abd-Elrahman, A. (2019). Multi-View, Deep Learning, and Contextual Analysis: Promising Approaches for sUAS Land Cover Classification. Applications of Small Unmanned Aircraft Systems: Best Practices and Case Studies, 133.

PRESENTATIONS AND INVITED LECTURES

Panelist
"Earth, Wind, & Fire",
Attending the event as a presentative of ASPRS, Spectral Session, L3Harris, NV5, 2022

Conference Talk
"A Fully Automatic Method for Rapidly Mapping Impacted Area by Nature Disaster", IGARSS, Virtual conference, 2020

Conference Talk
"Automatically Generating High Quality Training Samples from OpenStreetMap (OSM) Dataset for Road Network Mapping", Virtual conference, 2020

Conference Talk
"Emerging Image Analysis Methods for UAV Images", Virtual Conference, ASPRS, 2020

Conference Talk
"A fully learnable Context-Drive Object-Based Model for Mapping Landcovers", ASPRS, Denver, CO, US, 2018.

Conference Talk
"Individual tree crown delineation using LiDAR point data and DSM", ASPRS, 2013, Baltimore, MD, US

Workshop Presenter
"Advanced Remote Sensing Data Processing and Deep Learning with PyTorch", Workshop lead, ASPRS, February 11, 2024, Denver, CO, US

Workshop Presenter
"Object-based analysis of very high resolution images for natural land cover classification", ASPRS, 2018, *Denver, CO, US*

Workshop Presenter
"Object-based analysis of very high resolution images for natural land cover classification", ASPRS, 2017, *Baltimore, MD, US*.

Invited Guest Speaker
"Novel Methods for Processing UAS Images", invited by Biosense, Serbia, senior scientist, Oskar Marko, 2023, Summer

Invited Guest Speaker
"Object-based image analysis using deep learning technique", invited by Nanjing University, China, Associate Professor Lei Ma, 2023, Spring

Invited Guest Speaker

"Deep Learning Applications for Land Cover Mapping", invited by Florida State University, Assistant Professor Xiao Feng(Xiao Feng transferred to University of North Carolina at Chapel Hill)

Invited Guest Speaker
"Remote Sensing Applications using Deep Learning Techniques with Very High Resolution Images", invited by UC Davis, Professor Yufang Jin, 2021, May

Invited Guest Speaker
"Remote Sensing Applications using Multiview Information", invited by University of Nevada-Las Vegas, assistant professor, Beiyu Lin(Beiyu transferred to the Computer Science department at the University of Oklahoma), 2020, Fall

PROFESSIONAL SERVICE

Regular Academic Seminar Organizer and Initiator
Invited PE&RS Author Bimonthly Virtual Seminar
Lead the planning efforts within ASPRS, seminar to be launched in November 2024

Director
Remote Sensing Application Division
American Society for Photogrammetry and Remote Sensing
2020-present

Associate Chair
The Technical Division Directors Council (TDDC)
American Society for Photogrammetry and Remote Sensing
2023-present

Group Lead
AI\Machine Learning Working Group
American Society for Photogrammetry and Remote Sensing
2023-present

Editorial board
GIScience and Remote Sensing
2023-present

Session chair
Machine Learning Applications Using Very High Resolution Remote Sensing Images, ASPRS 2021

Session Chair

"GeoAI and Deep Learning Symposium: Deep Learning for Landcover Mapping and Object Detection using Remote Sensing Imagery I" and "GeoAI and Deep Learning Symposium: Deep Learning for Landcover Mapping and Object Detection using Remote Sensing Imagery II", AAG, DC, US, 2019

Session Chair
"Deep learning for Remote Sensing Applications"
AAG, New Orleans, LA, US 2018

Guest editor
Special issue "Geographic Object-Based Image Analysis: State-Of-the-Art and Emerging Research Trends", ISPRS International Journal of Geo-Information, 2019-2020

Peer-Reviewed Articles for:

- Drones
- Sensor
- Entropy
- Remote Sensing
- Biosystems Engineering
- ACM Sigspatial Conference
- Advances in Space Research
- GIScience & Remote Sensing
- European Journal of Agronomy
- Remote Sensing of Environment
- Aerospace Science and Technology
- European Journal of Remote Sensing
- Computers Environment and Urban Systems
- ISPRS International Journal of Geo-Information
- ISPRS Journal of Photogrammetry and Remote Sensing