HAO-YU (HOWARD) LIAO, Ph.D.

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LinkedIn | Google Scholar | Web of Sci. | ORCID | GitHub | Kaggle

EDUCATION

PhD **University of Florida, Environmental Engineering Sciences** May 2024

- **GPA: 3.97/4.0**
- PhD Dissertation: "Consideration of operator safety and robotic capability in human-robot collaboration for e-waste disassembly: a combination of optimization and artificial intelligence techniques," *University of Florida*. ufdc.ufl.edu/ufe0060572/00001

Graduate Machine Learning Certificate **UF, Department of Electrical and Computer Engineering** May 2023

MS **National Taiwan University, Bioenvironmental Systems Engineering** July 2016

- **GPA: 3.93/4.0**
- MS Thesis: "Applying the tabu search to develop an urban flood warning system," *National Taiwan University*. doi.org/10.6342/NTU201601908

BS **National United University, Civil and Disaster Prevention Engineering** July 2014

- **GPA: 4.0/4.0**
- BS Independent study: Liao, H.-Y., Wen-Cheng Liu, 2014, "Applying one-dimensional river routing model and artificial neural networks to forecast water stage of the tidal river during typhoons," Supported by the *Ministry of Science and Technology of Taiwan* under grant no. 102-2815-C-239-028-E (in Chinese with English abstract).

PUBLICATIONS

Journal Publications (14+3)

J1 **Liao, H.-Y.**, et al., 2026, "A Multi-City Benchmark Dataset for Individual Tree Detection in NAIP Aerial Imagery: Model Comparison and Geographic Transferability," *In Progress*.

J2 **Liao, H.-Y.**, et al., 2026, "Advanced Hedonic Price Model with Cultural Ecosystem Service Flows from a Large Vision-Language Model and MaxEnt: A One-Shot In-Context Learning Approach Within a Presence-Only Framework," *In Progress*.

J3 **Liao, H.-Y.**, et al., 2026, "Mapping Cultural Ecosystem Service Flows from Social Media Imagery with Vision–Language Models: A Zero-Shot CLIP Framework," *In Progress*. Preprint available on *EcoEvoRxiv*. doi.org/10.32942/X29S8C

J4 Zhao, C., Song, J., Dubeux, J. C. B., Grunwald, S., Bretas, I. L., **Liao, H.-Y.**, et al., 2026, "Spatiotemporal controls on soil organic carbon stocks in subtropical grazing lands: An uncertainty-aware digital soil mapping approach," Geoderma, 473, 118004. doi.org/10.1016/j.geoderma.2026.118004

J5 Chen, Y., **Liao, H.-Y.**, Luo, Y., Behdad, S., and Hu, B., 2026, "Human-robot collaboration for e-waste disassembly: Task modeling, allocation, and ergonomic assessment," Ergonomics. doi.org/10.1080/00140139.2026.2650455

J6 Song, J., Zhao, C., Oduor, K. T., **Liao, H.-Y.**, Tang, Z., Bretas, I. L., ... & Shao, W., 2025, "Mapping invasive Opuntia stricta in Kenya's Drylands using explainable machine learning with time-series remote sensing and geographic context," *International Journal of Applied Earth Observation and Geoinformation*, *144*, 104867. doi.org/10.1016/j.jag.2025.104867

J7 **H.-Y. Liao**, P. Terrin, J. R. Petters, and S. Behdad, 2025, "A Disassembly Scoring Framework for Human–Robot Collaboration Based on Robotic Capabilities," *Journal of Mechanical Design*, *147*(6), 062002. doi.org/10.1115/1.4068476
2024 DFMLC Best Paper Award at the ASME IDETC Conference

J8 **H.-Y. Liao**, Y. Chen, B. Hu, X. Liang, and S. Behdad, 2025, "Forecasting the Range of Possible Human Hand Movement in Consumer Electronics Disassembly Using Machine Learning," *Journal of Computing and Information Science in Engineering*, *25*(5), p.051001. doi.org/10.1115/1.4067987

J9 **H.-Y. Liao**, Behzad Esmaeilian, S. Behdad, 2024, "Automated evaluation and rating of product repairability using artificial intelligence-based approaches," *Journal of Manufacturing Science and Engineering*, *146*(2), **(IF: 4.0).** doi.org/10.1115/1.4063561

J10 Y. Chen, **H.-Y. Liao**, S. Behdad, B. Hu, 2023, "Human Activity Recognition in an End-Of-Life Consumer Electronics Disassembly Task," *Applied Ergonomics* **(IF: 3.94)**, **Co-first author.** doi.org/10.1016/j.apergo.2023.104090

J11 **H.-Y. Liao**, Y. Chen, B. Hu, and S. Behdad, 2022, "Optimization-Based Disassembly Sequence Planning Under Uncertainty for Human–Robot Collaboration." *Journal of Mechanical Design*, 145(2), 022001. **(IF: 3.441)** doi.org/10.1115/1.4055901

J12 **H.-Y. Liao**, S. Behdad, 2021, "Markov Chain Optimization of Repair and Replacement Decisions of Medical Equipment," *Resources, Conservation and Recycling,* 105609. **(IF: 10.204) Ranking: 5/54** in Engineering, Environmental doi.org/10.1016/j.resconrec.2021.105609

J13 **H.-Y. Liao**, W. Cade, S. Behdad, 2021, "Forecasting Repair and Maintenance Services of Medical Devices Using Support Vector Machine." *Journal of Manufacturing Science and Engineering*, 144(3), 031005. (**IF: 3.033**) doi.org/10.1115/1.4051886

J14 Pan, T.-Y., H.-T. Lin, **H.-Y. Liao**, 2019, "A Data-Driven Probabilistic Rainfall-Inundation Model for Flash-Flood Warnings," Water, 11, 2534. (**IF: 2.524**) doi.org/10.3390/w11122534

J15 **H.-Y. Liao**, T.-Y. Pan, H.-K. Chang, C.-T. Hsieh, J.-S. Lai, Y.-C. Tan and M.-D. Su, 2019, "Using Tabu Search Adjusted with Urban Sewer Flood Simulation to Improve Pluvial Flood Warning Via Rainfall Thresholds," Water, 11, 348. (**IF: 2.524**) doi.org/10.3390/w11020348

J16 Chen, C.-K., M.-J. Chang, H.-K. Chang, **H.-Y. Liao** and Y.-F. Cheng, 2019, "Hourly Streamflow Forecasting for Agriculture Water Supply Using Artificial Neural Network," *Journal of Taiwan Agricultural Engineering*, vol. 65, iss. 3. (in Chinese with English abstract) (EI-Compendex) 10.29974/JTAE.201909_65(3).0006

J17 **H.-Y. Liao**, T.-Y. Pan, Y.-C. Tan, J.-S. Lai and M.-D. Su, 2018, "Applying the Tabu Search to Optimize a Rainfall-Inundation Warning Threshold: Case Studies in Wenshan, Taipei City, and Xindian, New Taipei City," *Journal of Taiwan Agricultural Engineering*, vol. 64, iss. 1. (in Chinese with English abstract) (EI-Compendex) 10.29974/JTAE.201803_64(1).0002

Book Chapter Publications (2)

B1 **H.-Y. Liao**, C. Zhao, 2026, "Ecosystem Degradation." *Data-Driven Earth Observation for Disaster Management*. Elsevier, 303-325. doi.org/10.1016/B978-0-443-33803-8.00021-4

B2 B. Esmaeilian, **H.-Y. Liao**, and S. Behdad, 2025, "Circular Economy through Blockchain and Data Analytics." *Blockchain for Good*. CRC Press. 170-188. ISBN 9781032598062. doi.org/10.1201/9781003456346-10

Peer-Reviewed Full Conference Papers (9)

P1 **H.-Y. Liao**, C. Zhao, J. Song, and W. Shao, 2025. "Mapping Cultural Ecosystem Services Using One-Shot In-Context Learning with Multimodal Large Language Models." In *Proceedings of the 33rd ACM International Conference on Advances in Geographic Information Systems*, pp. 1071-1074. doi.org/10.1145/3748636.3764178 **[Presented by H.-Y. Liao]**

P2 J. Song, C. Zhao, **H.-Y. Liao**. and W. Shao, 2025. "FoundationSoil: Enhancing Soil Organic Carbon Mapping Using a Multi-Temporal Geospatial Foundation Model." In *Proceedings of the 33rd ACM International Conference on Advances in Geographic Information Systems*, pp. 1067-1070. doi.org/10.1145/3748636.3764177

P3 **H.-Y. Liao**, P. Terrin, J. R. Petters, and S. Behdad, 2024, "A disassembly score for human-robot collaboration considering robots' capabilities," *ASME 2024 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC/CIE*, August 25-28, 2024, Washington, DC, USA. doi.org/10.1115/DETC2024-143517

P4 **H.-Y. Liao**, Y. Chen, B. Hu, X. Liang, and S. Behdad, 2023, "Forecasting the range of possible human hand movement in consumer electronics disassembly using machine learning," *Proceedings of the ASME 2023 18th International Manufacturing Science and Engineering Conference*, June 12-16, 2023, New Brunswick, New Jersey, USA. doi.org/10.1115/MSEC2023-104792 **[Presented by H.-Y. Liao]**

P5 **H.-Y. Liao**, M. Zheng, B. Hu, S. Behdad, 2022, "Human Hand Motion Prediction in Disassembly Operations," *ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC/CIE*, August 14-17, 2022, St. Louis, Missouri, USA. doi.org/10.1115/DETC2022-89967 **[Presented by H.-Y. Liao]**

P6 **H.-Y. Liao**, Y. Chen, B. Hu, S. Behdad, 2022, "Optimization-Based Disassembly Sequence Planning Under Uncertainty for Human-Robot Collaboration," *ASME 2022 17th International Manufacturing Science and Engineering Conference, MSEC*, June 27-July 1, 2022, West Lafayette, Indiana, USA. doi.org/10.1115/MSEC2022-85383 **[Presented by H.-Y. Liao]**

P7 **H.-Y. Liao,** W. Cade, S. Behdad, 2021, "Machine Learning to Predict Medical Devices Repair and Maintenance Needs," *ASME 2021 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2021*, Aug. 19, 2021, virtual meeting. doi.org/10.1115/DETC2021-71333 **[Presented by H.-Y. Liao]**

P8 S. Hu, X. Zhang, **H.-Y. Liao**, X. Liang, M. Zheng, S. Behdad, 2021, "Deep Learning and Machine Learning Techniques to Classify Electrical and Electronic Equipment," *ASME 2021 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2021*, Aug. 19, 2021, virtual meeting. doi.org/10.1115/DETC2021-71403

P9 **H.-Y. Liao**, W. Cade, S. Behdad, 2021, "Forecasting Repair and Maintenance Services of Medical Devices Using Support Vector Machine." *Proceedings of the ASME 2021 16th International Manufacturing Science and Engineering Conference, MSEC 2021*, June 21, 2021, virtual meeting. doi.org/10.1115/MSEC2021-63966 **[Presented by H.-Y. Liao]**

Conference Presentations

C1 **H.-Y. Liao**, C. Zhao, C. Koylu, H. Cao, J. Qiu, C. Callaghan, J. Song, W. Shao, 2025, "Mapping Cultural Ecosystem Service Flows from Crowdsourced Imagery: A Zero-Shot Learning Approach with the Vision–Language Model CLIP," *The Conference of American Geophysical Union (AGU)*, New Orleans, LA, USA, December 11-19.

C2 C. Zhao, **H.-Y. Liao**, D. C. Gogineni, C. Koylu, 2024, "Mapping Flows of Nature-based Outdoor Recreational Services at Large-scale based on Crowdsourced Data and Multimodal Learning," *A Community on Ecosystem Services (ACES) conference*, Dec. 9-12, 2024, Austin, Texas, USA. conference.ifas.ufl.edu/aces/index.php

C3 **H.-Y. Liao**, C. Zhao, 2024, "Advancing Ecosystem Services Assessment Through Geospatial Artificial Intelligence (GeoAI): A Comprehensive Review and Future Directions," *The Symposium on Spatiotemporal Data Science*, Jul 23-24, 2024, Virginia Tech Research Center, Virginia, VA, USA. stds2024.stcenter.net/index.php/test/#CLT-1-i

C4 **H.-Y. Liao**, S. Behdad, 2023, "An artificial intelligence-based framework to assess product repairability," *2023 Production and Operations Management Society, POMS*, May 25, 2023, Orlando, FL, USA. pomsmeetings.org/conf-2023/documents/Full-Schedule-PDF.pdf

C5 **H.-Y. Liao**, S. Behdad, 2021, "Deep Transfer Learning to Evaluate Product Repairability," *The 2021 INFORMS Annual Meeting*, October 24-27, 2021, Anaheim, CA.

C6 **H.-Y. Liao**, W. Cade, S. Behdad, 2020, "Machine Learning, Frequency Analysis and Markov Chain Model for Analyzing Product Repair and Maintenance Service Decisions," *IDETC/CIE 2020*, virtual meeting, technical presentation. event.asme.org/Events/media/library/resources/idetc-cie/IDETC-Virtual-Technical-Session-Breakdown.pdf

C7 Lin, Y.-J., **H.-Y. Liao**, H.-K. Chang, R.-K. Shang, H.-C. Kuo, J.-S. Lai and Y.-C. Tan, 2017, "A Web-Based Tamsui River Flood Early-Warning System with Correction Of Real-Time Water Stage Using Monitoring Data," *The Conference of American Geophysical Union (AGU)*, New Orleans, LA, USA, December 11-15. ui.adsabs.harvard.edu/abs/2017AGUFMNH41A0150L

C8 **H.-Y. Liao**, T.-Y. Pan, M.-D. Su, M.-C. Hsieh and Y.-C. Tan, 2016, "Optimization of Rainfall Thresholds for A Flood Warning System to Taiwan Urban Areas During Storm Events," *The Conference of European Geosciences Union (EGU)*, Vienna, Austria, April 17-22. ui.adsabs.harvard.edu/abs/2016EGUGA..1810875L

H.-Y. Liao and S. Behdad, 2020, "Machine Learning, Frequency Analysis and Markov Chain Model for Analyzing Product Repair and Maintenance Service Decisions," ASME IDETC/CIE, Virtual, August 17, 2020. [Technical Presentation]

Preprint (3)

Liao, H. Y., Zhao, C., Koylu, C., Cao, H., Qiu, J., Callaghan, C. T., ... & Shao, W. (2025). "Mapping Cultural Ecosystem Service Flows from Social Media Imagery with Vision–Language Models: A Zero-Shot CLIP Framework." *EcoEvoRxiv.*

Gao, G., **Liao, H. Y.**, & Hu, Z. (2024). AI for equitable tennis training: Leveraging ai for equitable and accurate classification of tennis skill levels and training phases. *arXiv preprint arXiv:2406.16987*.

Chen, Y., Liao, H.-Y., Behdad, S., & Hu, B. (2022). "Task Recognition in Human-Robot Collaboration for Consumer Electronics Disassembly." SSRN Electronic Journal.

Patent (1)

Gao, G., Gao, Y., Wang, F., **Liao, H.Y.** and Liu, P., 2024. "*Machine-Learning Based Motion Analysis and Training Method and System*." U.S. Patent Application 18/519,196. patents.google.com/patent/US20240420819A1/

HONORS AND AWARDS

UF Postdoctoral Travel Award, UF Postdoc Association and Postdoctoral Affairs (UFPDA) 2024
DFMLC Best Paper Award, International Design Engineering Technical Conferences (IDETC) 2024
Florida AWMA Scholarship Award, Florida Section Air & Waste Management Association (FLAWMA) 2022
Don Maurer Memorial Scholarship Award, Department of EES, University of Florida 2022
MSEC Student Travel Award, North American Manufacturing Research Conference (NAMRC) and International Manufacturing Science and Engineering Conference (MSEC) 2022
MSEC Student Travel Award, NAMRC and MSEC 2021
International Academic Conferences Scholarship, Research Center of Climate Change and Sustainable Development 2018
International Academic Conferences Scholarship, Research Center of Climate Change and Sustainable Development 2017
International Academic Conferences Scholarship, Ministry of Science and Technology of Taiwan 2016
Kuo Hsi-Liu Foundation Scholarship, Kuo Hsi-Liu Foundation 2016
Chi-Sing Irrigation Association Scholarship, Chi-Sing Irrigation Association 2015
College Student Research Scholarship, Ministry of Science and Technology of Taiwan 2013
Academic Achievement Award, National United University 2013
Academic Achievement Award, National United University 2011

PROFESSIONAL EXPERIENCE

Postdoctoral Associate – Geospatial Artificial Intelligence (GeoAI) May 2024 – Present
University of Florida, Gainesville, FL

- **Project: Multimodal Large Language Models for Mapping Cultural Ecosystem Services**
  - Developed scalable multimodal AI pipelines using vision-language models (Qwen2.5-VL, Gemma-3, and Aya Vision) for zero-shot and one-shot classification of cultural ecosystem services.
  - Processed 3.42 million geotagged Flickr images across six southeastern U.S. states to quantify and map cultural ecosystem service flows.
  - Applied CLIP-based zero-shot learning and genetic algorithm-driven prompt optimization to improve ecosystem service classification.
  - Leveraged HiPerGator HPC and NVIDIA GPUs for large-scale AI inference and geospatial analysis.
- **Project: Deep Learning for Urban Tree Detection and Remote Sensing**
  - Developed and evaluated deep learning approaches for individual tree detection using high-resolution NAIP aerial imagery.
  - Applied object detection architectures, including DeepForest and RF-DETR, to support large-scale tree canopy mapping and ecosystem service assessments.
  - Integrated geospatial imagery processing, model inference, and spatial analysis into reproducible GeoAI workflows.
- **Project: Geospatial Machine Learning for Environmental and Carbon Monitoring**
  - Collaborated on interdisciplinary research applying machine learning and remote sensing to soil organic carbon mapping and invasive species monitoring.
  - Developed the AgroES Grazing Land SOC Explorer, an interactive Web-GIS platform visualizing 30 m soil organic carbon stock predictions and associated uncertainty across Florida's grazing lands.
  - Implemented synchronized side-by-side maps to compare spatial SOC estimates and 90% prediction intervals, supporting carbon monitoring, land management, and environmental decision-making.
- **Project: Interactive Web-GIS Mapping and Geospatial Visualization**
  - Developed interactive Web-GIS applications using Leaflet.js, JavaScript, Bootstrap, and Google Earth Engine to visualize AI-derived environmental and ecosystem service predictions.

- Integrated geospatial model outputs with interactive mapping and spatial analysis tools to support environmental monitoring and decision-making.

Graduate Researcher – Optimization and AI in Human-Robot Collaboration Jan. 2020 – May 2024
University of Florida, Gainesville, FL

- **Project: AI for Human-Robot Collaboration & Disassembly (NSF FW-HTF-RL: #2026276)**
  - Developed real-time hand motion forecasting models using ConvLSTM and YOLO for human-robot collaboration in remanufacturing.
  - Developed a new Sequence-based correction (SBC) algorithm with IMU-based deep learning models such as CNN, LSTM, and GoogLeNet for the human activity recognition system
  - Built GRU, LSTM, and BNN with Monte Carlo Dropout and Bagging algorithm for three-dimensional hand motion (x, y, z) possible movement area on IMU sensors.
  - Proposed an optimization model with the multi-attribute utility function for disassembly sequence planning and work settings in human-robot collaboration.
  - Proposed a disassembly scoring framework considering component weight, shape, size, accessibility, and positioning to evaluate robotic capabilities using UR5e as an example.
  - Analyzed safety risks for human operators and wrote academic papers on human-robot collaboration research

- **Project: AI-driven Decision Models for Medical Device Remanufacturing (NSF GOALI: #2017971)**
  - Data analysis and life cycle analysis by implementing frequency analysis to evaluate the performance of different healthcare medical devices.
  - Developed the DTMC (Discrete-Time Markov Chain) optimization decision-making model for the medical device in repair or replacement determination, increasing income benefits.
  - Developed a repair and maintenance forecasting model using Support Vector Machine (SVM) to predict failures in medical devices
  - Built an automated rating system of 111 different brands of smartphone repairability by K-mean clustering and ConvNeXt, GoogLeNet, ResNet, and VGG with an ablation study.

Research Assistant – Artificial Intelligence for Real-Time Flood Warning Systems July 2016 – Dec. 2019
National Taiwan University, Taipei, Taiwan

- **Project: AI-Based Flood Forecasting Models in 2D and 3D Web-GIS Systems (Link)**
  - Developed **machine learning pipelines (SVM, BPNN)** for **real-time flood forecasting** and deployed them with IoT integration.
  - Developed a web-based Tamsui River flood early-warning system by using HTML, CSS3, JavaScript, MySQL, PHP, and Python.
  - Developed a web-based Taipei summer storm experiment (TASSE) information system using Google Maps API and 3D visualization by using CesiumJS.

Research Assistant – Rainfall thresholds for early flooding warning July 2014 – June 2016
National Taiwan University, Taipei, Taiwan

- **Project: Applying the tabu search to develop an urban flood warning system (Link)**
  - Developed and applied tabu search optimization algorithms to improve the accuracy of flooding risk prediction.
  - Conducted statistical modeling, such as frequency analysis and data analysis, for flood forecasting.
  - Delivered practical research outcomes enhancing disaster warning systems and public safety.

TEACHING EXPERIENCE

Guest Lecturer Fall 2026
Agronomy Department, University of Florida, Gainesville, FL
Course: **AGR 6932 Geospatial AI for Sustainability Science**

- Delivered a guest lecture on geospatial visualization and interactive mapping, covering 2D/3D mapping, interactive dashboards, story maps, and digital twins, with hands-on demonstrations of Google Earth Engine (GEE) application development and deployment for interactive Web-GIS applications.

Guest Lecturer Spring 2026
Department of Horticultural Science, NC Plant Sciences Initiative, College of Agriculture and Life Sciences, North Carolina State University, Raleigh, NC
Course: **HS 495/590 Special Problems in Horticultural Science (Plant Phenomics: Fundamentals, Techniques, and AI)**

- Delivered a guest lecture on Geospatial Artificial Intelligence (GeoAI) for ecosystem services mapping, introducing remote sensing, machine learning, and practical geospatial analysis workflows for assessing and visualizing ecosystem services.

Guest Lecturer Fall 2025
Agronomy Department, University of Florida, Gainesville, FL
Course: *AGR 6932* **Geospatial AI for Sustainability Science**

- Presented the lecture for Geo-visualization and Interactive Mapping including tools and techniques for 2D/3D mapping; interactive dashboards; story maps; digital twins for sustainability applications.

Teaching Assistant Fall 2023
Environmental Engineering Sciences, University of Florida, Gainesville, FL
Course: *ENV 4601* **Environmental Resources Management** Syllabus

- Graded assignments, taught undergraduate courses, prepared assignment solutions, and supervised examinations.

Guest Lecturer Fall 2022
Environmental Engineering Sciences, University of Florida, Gainesville, FL
Course: *ENV 6932* **System Analysis for Sustainable Design and Lifecycle Decisions** Syllabus

- Presented the lecture for multi-attribute utility function, frequency analysis, and the house of quality (product planning matrix).

Guest Lecturer Fall 2021
Environmental Engineering Sciences, University of Florida, Gainesville, FL
Course: *ENV 6932* **Artificial Intelligence and Machine Learning with Engineering Applications**

- Presented the technical modules on supervised learning algorithms and AI-driven decision-making in environmental systems.

Teaching Assistant Fall 2014
Bioenvironmental Systems Engineering**, National Taiwan University**, Taipei, Taiwan
Course: Special Topics on Bioenvironmental Systems Engineering

- Graded course assignments and assisted invited speakers for seminars.

MENTORING EXPERIENCE

- Undergraduate and Graduate Research Mentorship – Urban Agriculture GeoAI, University of Florida | Summer 2026 – Present
  - ➢ Mentoring a team of approximately five undergraduate and graduate students on urban agriculture mapping using high-resolution aerial imagery and geospatial artificial intelligence.

  Project 1: Urban Agriculture Data Annotation: Supervising students in identifying, labeling, and quality-checking urban farms and community gardens in NAIP imagery to develop training and validation datasets.
  Project 2: Geospatial Foundation Models for Segmentation: Guiding students in exploring and evaluating geospatial foundation models for semantic segmentation of urban agriculture farms from remote sensing imagery.
- High School Research Mentorship – Cultural Ecosystem Services (CES), University of Florida | Summer 2026 – Present
  - ➢ Mentoring a high school student on a Cultural Ecosystem Services (CES) research project, applying Random Forest models to analyze and predict temporal dynamics of ecosystem services.
- Active Learning Program (ALP) Summer 2025 Intern, University of Florida, 2025
  - ➢ Mentored undergraduate students for the project: National wide-scale image labelling for training ML models.
- Active Learning Program (ALP) Spring 2025 Intern, University of Florida, 2025
  - ➢ Mentored undergraduate students for the project: Bootstrap responsive website development.
- Active Learning Program (ALP) Fall 2024 Intern, University of Florida, 2024
  - ➢ Mentored undergraduate students for the projects:

  Project 1: Perform manual data annotation of urban tree canopy on NAIP aerial images for the regulation service
  Project 2: Assess the content of Flickr photographs with an image labeling software (i.e., LabelMe) to assign images into different outdoor recreation classes and cross-verify human annotations for cultural service.

- Research project "Leveraging Machine Learning for Accurate Classification of Tennis Skill Levels and Training Phases", 2023-2024
  - Mentored a high school student who was recognized at the symposium for outstanding performance:
    - State Recognition Award in Florida Junior Science and Humanities Symposium (JSHS), 2024
    - First place in the computer science category at the 2024 Alachua County Science Fair, 2024
    - Finalist in the 2024 Florida State Science and Engineering Fair (SSEF), 2024
  - Writing guidance for the machine learning research paper published in the *International Journal of High School Research* (Peer-reviewed full paper). doi.org/10.36838/v7i4.1

GRANT PROPOSAL EXPERIENCE

Co-Principal Investigator (Co-PI), "Climate-Adaptive Urban Forestry in Miami: A GeoAI Framework for Individual Tree Monitoring and Decision Support," submitted to the Southeast Climate Adaptation Science Center (SE CASC), 2026 Consortium Project Ideas (Opportunity 1), 2026.

Technical Writer, "Harnessing Active Learning and Geospatial AI for Enhanced Agroecosystem Services Monitoring", submitted to USDA DSFAS program, 2025.

Technical Writer, "Collaborative Research: Inclusive and Advanced Learning of Education in Robotics (I-ALERT)", submitted to *NSF RITEL* program, 2024. (NSF, $737,161, PI: Dr. Sara Behdad)

Technical Writer, "Advanced Autonomous Solutions for Marine Debris Collection and Recovery", submitted to *NSF TRAILBLAZER* program, 2023. (PI: Dr. Sara Behdad)

Technical Writer, "Applying Data Driven and Optimization Theory to Build a Fast and Practical Flooding Warning Mechanism", MOST 104-2625-M-002-017- (in Chinese forms with English report content), Submitted to National Science and Technology Council (NSTC) Program, Taiwan, Funded 386,000 TWD (Around 12,450 USD), 2016 (PI: Dr. Tsung-Yi Pan)

PROFESSIONAL SERVICE

Academic Peer Reviewer: 47 verified reviews across 20 journals (ORCID: orcid.org/0000-0001-5021-8356; Web of Science: KRO-8697-2024).
Agronomy
Algorithms
Biomimetics
Cleaner and Responsible Consumption
Data
Earth Science Informatics
Energy, Ecology and Environment
Environmental Monitoring and Assessment
Information
ISPRS Journal of Photogrammetry and Remote Sensing
Journal for Nature Conservation
Limnology
Procedia CIRP
Remote Sensing in Earth Systems Sciences
Robotics and Computer-Integrated Manufacturing
Scientific Reports
Sensors
Signal, Image and Video Processing
The Journal of Supercomputing
Water

Conference Peer Reviewer
ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE)

Conference Session Organization & Chairing
- Chair & Early Career Convener, GC31H – GeoAI for Ecosystem Services and Biodiversity: Innovations in Monitoring, Modeling, and Integration (Poster), AGU Fall Meeting 2025, New Orleans, LA, Dec 17, 2025. Link

PROFESSIONAL INVOLVEMENT

Data Science Competitions – Kaggle
Kaggle Profile: Howard Liao (kaggle.com/haoyuliao14116)

- Binary Prediction with a Rainfall Dataset (2025): Solo ranking 11/4,381 (top 0.25%). Developed an AutoGluon-based machine learning pipeline for rainfall prediction.
- Detect AI vs. Human-Generated Images (2025): Solo ranking 41/554 (top 7%). Developed a PyTorch-based deep learning model for AI-generated image detection.

ESSIE Poster Symposium (2024): Presented "Automated Evaluation and Rating of Product Repairability Using Artificial Intelligence-Based Approaches." Link
ASABE Robotics Student Design Competition (2023): Developed a Unified Robot Description Format (URDF) model for robotic manipulation using ROS2 and MoveIt 2; participated in a robotic cotton-harvesting system. Social media: x.com/UF_ABE/status/1679172578479599616; Poster: Link
Professional Membership
Sigma Xi, The Scientific Research Honor Society — Full Member (Elected 2026)
Association for Computing Machinery (ACM)
Chi Epsilon (XE) — Civil Engineering Honor Society

INVITED TALKS

H.-Y. Liao et al., "Advancing Ecosystem Services Assessment Through Geospatial Artificial Intelligence (GeoAI): A Comprehensive Review and Future Directions." Invited Plenary Vision Panel, Symposium on Spatiotemporal Data Science, Virginia Tech Research Center, Virginia, USA, July 23, 2024.
H.-Y. Liao and S. Behdad, "Optimization-Based Disassembly Sequence Planning Under Uncertainty for Human-Robot Collaboration." Invited Talk, Future of Human-Robot Partnerships in Remanufacturing Workshop, Virtual, August 11, 2022.

PROFESSIONAL SKILLS

Programming & Web Development: Python, R, MATLAB, C++, JavaScript, HTML, CSS, PHP, MySQL, Bootstrap
Machine Learning & Deep Learning: PyTorch, TensorFlow/Keras, Scikit-learn, OpenCV, AutoGluon, cuML, Random Forest, LSTM, GRU
Computer Vision: RF-DETR, YOLO, DeepForest, image classification, object detection, semantic segmentation
Foundation Models & Multimodal AI: CLIP, DINOv3, Geospatial Foundation Models, Hugging Face Transformers, Qwen-VL, DeepSeek-Janus, Vision-Language Models (VLMs), Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), zero-shot and few-shot learning
Geospatial AI & Data Processing: Google Earth Engine, GeoPandas, Rasterio, Shapely, GDAL, lidR, QGIS, ArcGIS Pro
Remote Sensing & Earth Observation: NAIP, Landsat, Sentinel-2, MODIS, LiDAR point clouds, multispectral imagery, time-series analysis
Web-GIS & Geospatial Visualization: Leaflet.js, CesiumJS, Google Maps API, Google Earth Engine Apps, interactive Web-GIS dashboards
Backend & API Development: Flask, REST APIs, HTTP GET/POST web services
Cloud, HPC & Deployment: HiPerGator HPC, NVIDIA GPU computing, Google Cloud, Azure Machine Learning, Cloudflare Workers, GitHub Pages, Docker, CI/CD workflows
Robotics & Autonomous Systems: ROS2, Gazebo, MoveIt 2, Nav2, UR5e
Environmental Modeling & Decision Support: PCSWMM, EPA SWMM, EPA WARM
Development Tools & Platforms: Git, GitHub, Linux, Conda/Anaconda, Hugging Face, Kaggle, AutoCAD

PROFESSIONAL CERTIFICATIONS (LINK)

CIRTL Associate Certificate (University of Florida, Center for Teaching Excellence)	2026
Preparing Future Faculty (PFF) Program (University of Florida, Center for Teaching Excellence)	2026
Fundamentals of Accelerated Data Science (NVIDIA)	2025
Building Transformer-Based Natural Language Processing Applications (NVIDIA)	2025
Fundamentals of Deep Learning (NVIDIA)	2025
Data Parallelism: How to Train Deep Learning Models on Multiple GPUs (NVIDIA)	2025
Completed 5-Day Gen AI Intensive (Google & Kaggle)	2025
Machine Learning (ECE, UF)	2023
Professional Civil Engineer in Taiwan (PE in Civil) (No. 014887)	2018
Data Structure & Advanced C++ Programming (No. 2950288, NTU)	2018
Advanced JavaScript and Front-End Engineering (No. 2770167, NTU)	2017
Interactive Data Visualization with D3.js - Basic (No. 2760167, NTU)	2017

PHP & MYSQL Active Webpages Programming (No. 2760125, NTU) 2017
Linux (No. 2770196, NTU) 2017
Python Programming (No. 2750187, NTU) 2016
HTML5, CSS3, jQuery, Bootstrap - Frontend Web Development (No. 2750079, NTU) 2016

PROJECTS, OPEN-SOURCE CONTRIBUTIONS & INITIATIVES

GeoAI, Research Software & Web Applications

GeoAI Earth eXplore (GEX) – Founder & Maintainer: Founded and maintain an open-source resource hub for GeoAI, Earth observation, remote sensing, and environmental research. Curated datasets, geospatial foundation models, AI/GIS tools, GeoAI agents, and educational resources. GitHub | Website

FL-CES-Flows-CLIP – Zero-Shot Vision–Language Models for Cultural Ecosystem Services Mapping: Developed an open-source workflow integrating CLIP, Binary Random Forest filtering, and zero-shot classification to map CES flows from Flickr imagery. GitHub | Web-GIS

AgroES Grazing Land SOC Explorer: Developed an interactive Web-GIS platform visualizing 30 m SOC predictions and 90% prediction intervals across Florida grazing lands, with synchronized maps for uncertainty comparison. Web-GIS

AgroES Cultural Ecosystem Services Mapping Platform: Developed an interactive Web-GIS application for exploring cultural ecosystem services and spatial patterns for environmental research. Web-GIS

Miami Tree Canopy Explorer: Developed an interactive GeoAI Web-GIS integrating NAIP aerial imagery and deep learning-based individual tree predictions for urban tree monitoring. Web-GIS

2026 IALE Workshop – Ecosystem Services Mapping: Contributed educational materials and practical geospatial workflows for teaching GeoAI-based ecosystem services mapping and visualization. Workshop Materials

Other AI & Machine Learning Projects

Foundation Models & Multimodal AI: Built a DeepSeek-Janus-Pro-based multimodal AI pipeline for text-image understanding. Kaggle

Personal Finance AI Agent: Developed a generative AI agent using Gemini for financial reasoning and buy, sell, and hold recommendations. Kaggle

AI in Autonomous Systems: Developed a reinforcement learning agent using Deep Q-Networks (DQN) to play Connect-X. Kaggle

AI-Driven Product Repairability Scoring: Developed machine learning models for automated repairability assessment of consumer electronic products. GitHub

Deep Learning for Song Classification: Developed CNN, GoogLeNet, and ResNet-50 models to classify music using audio-to-image representations. GitHub

Building ML Models to Play Tic-Tac-Toe: Implemented KNN, SVM, and multilayer perceptrons for interactive gameplay. GitHub

Deep Colorization for Grayscale Images: Developed a Fully Convolutional Network (FCN) for automatic grayscale-to-color image transformation. GitHub

Image Semantic Segmentation and Detection for Hard Drive Devices: Implemented deep learning using GoogLeNet, ResNet-50, and FCN for component recognition and segmentation. GitHub

Image Classification of Different Types of Bricks: Applied Edge Histogram Descriptors and Probabilistic Generative Classifiers to classify brick types and other objects. GitHub