Zhihao Wang

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Education

University of Maryland *Ph.D., Geographical Information Science; GPA: 3.84* **2020 – 2025 (Expected)**

The Ohio State University *M.A., Geography; GPA: 4.00* **2018 – 2020**

University of Waterloo *B.E.S., Honors Geomatics; Minor, Computer Science; GPA: 3.91* **2016 – 2018**

Wuhan University *B.E., Remote Sensing Science and Technology; GPA: 3.82* **2014 – 2018**

Research Projects

Advanced Deep Learning in Remote Sensing | *Python* **Sep. 2019 – Present**

- *Proj. 1*: Developed Deep-ED, a framework approximating and accelerating the process-based ecological model. Key achievements include: (1) ∼**86% reduction of error accumulation** in long-term forecasting through de-sequencing loss and a multi-scale structure; (2) **mitigation of heterogeneous variable effects** using self-guided learning and a multi-branch network; and (3) **enhanced sampling efficiency** via a geo-physical active learning algorithm.
- *Proj. 2*: Created SimFair, a **physics-guided** and **fairness-aware** deep learning model for temperature estimations. Novelties include: (1) guiding traditional data-driven predictions to align with natural laws through an inverse-modeling design (**53%** RMSE improvement); (2) integrating physics-guided knowledge from radiative transfer models into the learning process; and (3) achieving greater prediction fairness by **73%** in new test regions through a dual-fairness consistency loss. (Under the 2^{nd} review of AAAI'24).
- *Proj. 3*: Designed a U-Net based deep segmentation model for building detection from LiDAR point clouds. The model outperforms other competitors because of (1) **using knowledge-informed features** for more stable and generalizable building representations, and (2) applying **training- and test-time augmentation** with statistical filtering strategies for refined detection.
- *Others*: Implemented various deep learning frameworks for NSF/NASA/Google projects, tackling challenges like satellite image classification, urban change detection, and forest degradation mapping. The state-of-the-art methods include **meta-learning**, **domain adaptation**, **Fourier neural operator**, **masked autoencoder**, and **self-supervised learning** using TensorFlow and PyTorch.

Cloud-Based Data Generation & Satellite Image Classification | *Google Earth Engine* **Jan. 2019 – Dec. 2022**

- Designed a **cloud-based automation pipeline** for extracting spatially and temporally intersected pairs of satellite imagery, enabling the generation of extensive deep learning training datasets on a global scale for long-term analysis.
- Parallelly computed **100k+** spatial and temporal intersections between satellite datasets using SQL in Apache Sedona.
- Designed a **Markov Random Field**-based algorithm to optimize time-series classification consistency using Javascript in GEE, enhancing the accuracy by integrating environmental change principles into the classification process.

NOAA-20 Operational Satellite Data Generation | *Python, C++* **May 2021 - Jun. 2022**

- Developed a long-term albedo climatology dataset for **operational use** in the NOAA-20 VIIRS Global Albedo product.
- Parallelly processed over **3.5 TB** of satellite data using wget and multiprocessing in a Linux computing cluster.
- Engineered a memory-efficient statistical algorithm, achieving a **95% reduction in memory usage**, which optimized information storage in large datasets, and contributed to the test of the satellite operational algorithms.

Selected Publications

- **Wang, Z.**, Xie, Y., Jia, X., Ma, L., & Hurtt, G. High-Fidelity Deep Approximation of Ecosystem Simulation over Long-Term at Large Scale. ACM SIGSPATIAL'23. **(Oral, Acceptance Rate: 20.1%**).
- Chen, W.*, **Wang, Z.***, Li, Z.*, Xie, Y., Jia X., & Li, A. Deep Semantic Segmentation for Building Detection Using Knowledge-Informed Features from LiDAR Point Clouds. ACM SIGSPATIAL'22. **(Top-3 Solution**).

Skills

Languages: Python, MATLAB, R, JavaScript, C++/C, SQL
Tools/Libraries: PyTorch, TensorFlow, Google Earth Engine and Cloud Platform, Apache Sedona, Linux, Git, ArcGIS
Coursework: Machine Learning, Neural Networks and Deep Learning, Computer Vision, Photogrammetry, Data Mining

Honors and Awards

- Top-3 Competition Winner & Travel Grand, ACM SIGSPATIAL CUP 2022, 2023
- Dean's Fellowship, University of Maryland 2020
- Dean's Honor List & Entrance Scholarship, University of Waterloo 2016, 2017, 2018
- Wuhan University Scholarship, 5050 Scholarship, Wuhan University 2016