

Haoan Feng

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ABOUT ME

I am a dedicated researcher with a deep passion for exploring the interdisciplinary fields of computer vision and geospatial data analysis. My research interests broadly span **neural representations of geospatial data, neural rendering, topological analysis, generative models, and data visualization techniques**. Believing that collaboration across disciplines is key to driving innovation, my experience working with diverse teams has strengthened my commitment to interdisciplinary research. I am constantly expanding my knowledge in these areas, driven by curiosity and a desire to contribute to advancements in the field.

EDUCATION

Doctor of Philosophy in Computer Science 2021 - expect 2026

University of Maryland, College Park, United States

- ◇ GPA: 4.0/4.0
- ◇ *Related coursework*: Geographical Information Systems and Spatial Databases, Advanced Techniques in Visual Learning and Recognition.
- ◇ *Thesis: (provisional) Neural Representations of Geospatial Data: Analysis, Generation, and Beyond.*

Master of Philosophy in Computer Science 2018 - 2020

Hong Kong University of Science and Technology, Hong Kong, China

- ◇ *Thesis: Linear structure vectorization in large-scale landscape point cloud.*

Bachelor of Engineering in Computer Science Engineering and Electronic and Computer Engineering 2014 - 2018

Hong Kong University of Science and Technology, Hong Kong, China

- ◇ GPA: 3.9/4.3
- ◇ *Related coursework*: Discrete Math Tools, Advanced Computer Graphics, Data Visualization, Probability and Random Processes in Engineering, Signals and Systems.

RESEARCH PROJECTS

Neural Representations of Geospatial Data 2021 - Present

University of Maryland, College Park

Advisor: Prof. Leila De Floriani

- ◇ **Survey on Neural Representations of Geospatial Data (In progress)**: Conducting a comprehensive survey on neural representations for geospatial data storage, rendering, and analysis. Evaluating implicit and explicit representations to enhance flexibility, scalability, parallel computation, and support for physical simulation in geospatial contexts.
- ◇ **Implicit Neural Representation for Terrain Surface Modeling**: Published a practical continuous surface model for terrain data using implicit neural representations. Achieved accurate surface reconstruction, topological analysis, and topographical feature extraction through a neural network pipeline, supported by progressive training strategies for efficiency.

September 15, 2024

- ◇ **Topological Feature Tracking on Triangulated Irregular Networks (TINs) Using a Scale-Space Approach:** Designed and implemented an adaptive scale-space algorithm to track topologically critical features on 2D manifolds discretized as TINs. Adapted previous regular grid-based approaches to work with triangulated irregular networks and accelerated the process using custom GPU kernels.

Researcher and Developer at Vision and Graphics Laboratory

2017 - 2020

Hong Kong University of Science and Technology

Advisor: Prof. Long Quan

- ◇ **Large-Scale Point Cloud Processing, Information Extraction, Semantic Segmentation:** Developed a comprehensive pipeline for processing large-scale noisy point clouds, enhancing PointNet's ability to segment thin and neglected structures. Created algorithms and a GUI tool for feature extraction, clustering, and recovering lost linear structures.
 - Enhanced PointNet with handcrafted features to better identify and segment thin structures in point clouds.
 - Designed a point cloud processing pipeline that statistically removes noisy data, analyzes local geometric features and adaptively segments the cloud for downstream tasks like pointwise classification, surface detection, and structure preservation.
 - Implemented a robust PCA algorithm (Fast-MCD) for fast data clustering and feature extraction as a pretext task.
 - Created algorithms and GUI tools for recovering lost linear structures (e.g., high-voltage powerlines), achieving modeling accuracy comparable to laser-scanning techniques.
- ◇ **3D Web Application for Large-scale Landscape Reconstruction:** Implemented a 3D web application, which loads 3D reconstructions of large-scale landscapes efficiently, and provides simulation of the Earth for user interaction and engineering measurement.
 - Built an efficient 3D data loading pipeline utilizing level-of-detail (LOD) to reduce data streaming by 90%, achieving 60fps on standard devices by optimizing data processing with web workers.
 - Integrated Apple ARKit for AR mode, designing user interactions for large-scale scenarios with precise transformation models.
 - Implemented high-accuracy landscape measurements for point-to-point distances and area calculations, offloading computational tasks to GPU via WebGL for a low-latency experience.
 - Enabled real-time interaction with complex 3D scenes containing billions of triangles using hidden-frame rendering and masking algorithms.

PUBLICATIONS

Conference Articles

- [1] **Feng, H., Song, Y., & De Floriani, L. (2024). Critical Features Tracking on Triangulated Irregular Networks by a Scale-Space Method.** In *The 32nd ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL '24)*, October 29-November 1, 2024, Atlanta, GA, USA. ACM, New York, NY, USA, 13 pages. <https://doi.org/10.1145/3678717.3691218>. **(Oral Presentation, 📄)**

- [2] **Feng, H.**, Xu, X., & De Floriani, L. (2024). **ImplicitTerrain: a Continuous Surface Model for Terrain Data Analysis**. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (pp. 899-909). **(Oral Presentation @ 1st Implicit Neural Representation for Vision Workshop, [🔗](#))**
- [3] Zhen, M., Li, S., Zhou, L., Shang, J., **Feng, H.**, Fang, T., & Quan, L. (2020). **Learning discriminative feature with crf for unsupervised video object segmentation**. In *Computer Vision–ECCV 2020: 16th European Conference, Glasgow, UK, August 23–28, 2020, Proceedings, Part XXVII 16* (pp. 445-462). Springer International Publishing.

Preprint(s)

[1]

Other(s)

- [1] **Feng, H.** (2020). **Linear structure vectorization in large-scale landscape point cloud** (MPhil dissertation).

PRESENTATIONS

1. ImplicitTerrain: a Continuous Surface Model for Terrain Data Analysis, *CVPR 2024 Workshop on Implicit Neural Representation for Vision*, Seattle, United States (June 18, 2024).

SKILLS

Programming

- Python:

- ◇ Primary development language for published research, implementing machine learning algorithms using the PyTorch framework.
- ◇ Developed GPU-accelerated algorithms with Python bindings and CUDA kernel programming.
- ◇ Evaluated and visualized experimental results using Python packages (e.g., OpenCV, Matplotlib), and collaborated with teammates on the W&B platform for project tracking and experimentation.

- C++:

- ◇ Implemented scale-space algorithms and data structures for analyzing triangulated irregular networks, following object-oriented programming principles.
- ◇ Optimized algorithm inference speed using parallel computation with the OpenMP library, improving efficiency by parallelizing tasks on leaf nodes in tree structures.

- Others:

- ◇ Development primarily in Unix (CentOS) environments, managing computational tasks with SLURM.
- ◇ Practical experience in database management (MySQL, MongoDB) and professional engineering software (QGIS, MATLAB, MeshLab).

- ◇ Experienced in full-stack web development, including backend (NodeJS, PHP) and frontend (ReactJS).

Languages

- ◇ Mandarin (native), English (fluent), Cantonese & Japanese (amateur)

ACADEMIC SERVICE

Conference reviewer:

- ◇ International Conference on Pattern Recognition (ICPR 2024)

EXPERIENCE

Guest Lectures

- ◇ **Machine Learning Algorithms for Point Clouds** in the course *CMSC401: Algorithms for Geospatial Computing*, Spring 2024

Teaching Assistant

University of Maryland, College Park, MD, US 2021 - 2024

- ◇ CMSC414: Computer and Network Security, Fall 2022 & Fall 2024
- ◇ CMSC401: Algorithms for Geospatial Computing, Spring 2023 & Spring 2024
- ◇ CMSC416: Introduction to Parallel Computing, Fall 2023
- ◇ CMSC454: Algorithms for Data Science, Spring 2022
- ◇ CMSC427: Computer Graphics, Fall 2021

Hong Kong University of Science and Technology 2018 - 2020

- ◇ Introduction to Computer Science in Python and Multimedia Computing
- ◇ Object-Oriented Programming and Data Structures

Moodle Software Developer and Technical Support 2021

Hong Kong University of Science and Technology, Hong Kong, China

- ◇ Implemented LaTeX file compilation, encoding, and distribution features in the Moodle course management system as part of a copyright protection scheme.
- ◇ Developed web app user interfaces and system plugins for diverse applications using PHP and MySQL.

CERTIFICATIONS & AWARDS

- ◇ Chair's Graduate Fellowship 2021 - 2023
- ◇ Simatelex Charitable Foundation Scholarship 2015 - 2018
- ◇ University's Scholarship Scheme for Continuing Undergraduate Students (HKUST top 2% CGA Award) 2015 - 2018
- ◇ Champion Team in HackUST (Healthcare Theme), Hong Kong 2017
- ◇ First Runner-up in VAST Challenge 2016 (Global Data Visualization Competition) 2016
- ◇ First Prize in Chinese Western Mathematical Olympiad 2012

September 15, 2024

EXTRACURRICULAR ACTIVITIES

- ◇ Volunteer teaching and cultural experience program at Bali, Indonesia 2017
- ◇ General Secretary of the Model United Nations Club, HKUSTSU 2015 - 2016

REFERENCES

References available upon request.