

Kristie Hu

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Application Data Analyst & spatial System Engineer specializing in 3D model reconstruction, infrastructure data architectures, and deep learning–driven spatial intelligence. Experienced in building reliable datasets, reproducible pipelines, validation systems, and decision-support platforms for real-world deployment.

MASTER THESIS

Semantic Modelling of an Indoor Parking Garage Using Hand-held GeoSLAM LiDAR Point Clouds

- Supervisor: **Dr. Jonathan Li**
- Developed a high-quality point cloud dataset from scratch, utilizing a LiDAR-based SLAM system.
- Constructed an annotated indoor parking lot model through advanced techniques such as semantic segmentation (DCTNet), line extraction (LineDetection3D), and surface reconstruction (Revised RANSAC).

EDUCATION

University of Waterloo

Jan 2024

- Master of Science, Geomatics (GPA: **3.9/ 4.0**)

University of Waterloo

Apr 2022

- BES., Honours Geomatics with Computing Minor, Honours Co-op (GPA:**3.7/4.0**)

RESEARCH EXPERIENCE

RESEARCH ASSOCIATE

Waterloo, ON, Canada

May 2022 – Jun 2024

Geospatial Intelligence and Mapping (GIM) Lab, University of Waterloo

- Conducted a comparative study of DNN architectures for semantic segmentation in indoor environments.
- Evaluated 7 DNN models (e.g. **PointNet**, **KPConv**, **BAAF-Net**, etc.) to test the semantic segmentation results.
- Developed **5+ SLAM-based datasets** through field data collection and preprocessing integration; the dataset became a shared benchmark resource and contributed to multiple peer-reviewed research outputs.
- Adapted a Transformer-based architecture (**DCTNet**) for semantic segmentation, achieving **98.65% OA**, **94.88% F1-score**, and **90.74% mIoU**, demonstrating strong performance under low-light and occlusion conditions.
- Performed **3D surface reconstruction** to enhance spatial understanding of indoor infrastructure.
- Built a reconstruction pipeline combining **HDBSCAN clustering**, **pyRANSAC-3D**, and **Ball-Pivoting** modeling.

RESEARCH ASSOCIATE

Waterloo, ON, Canada

Sept 2024 – Apr 2025

Vision and Image Processing (VIP) Lab, University of Waterloo

- Integrated **Radiative Transfer Models (RTM)** with **sensitivity analysis** to enhance LAI detection robustness.
- Coupled **PROSAIL simulations** with PRISMA HSIs using 4 models to improve biophysical parameter retrieval.
- Performed systematic **hyperparameter tuning** and validation against 50 field test points from 8 CLMS sites.
- Applied & fine-tuned **Faster R-CNN** on DFO datasets to increase seal detection accuracy from **52.0%** to **87.7%**.
- Delivered a comprehensive technical report to Fisheries and Oceans Canada (DFO) supporting ecological analysis.
- Generated **3 additional classes** (polar bears, tracks, breathing holes) to expand Arctic wildlife detection capabilities.

PUBLICATIONS & CONFERENCE

- **CSRS 2025:** K. Hu, M. Shpir, D. Clausi, and L. Xu, “Unlocking the potential of PRISMA hyperspectral imagery for precision agriculture mapping,” presented at the CSRS 2025.
- **CSRS 2025:** K. Hu, D. Clausi, and L. Xu, “Enhancing seal detection in Arctic regions through fine-tuning of FasterRCNN: A case study using NOAA and DFO datasets,” presented at the CSRS 2025.
- **ICC 2023:** K. Hu and J. Li, “Using least cost path analysis to plan a new bypass route on Highway 401 to mitigate traffic congestion and impacts in the City of Toronto, Ontario,” in Proc. ICC 2023.
- **ICC 2023:** K. Hu, J. Du, X. Gong, L. Ma, and J. Li, “A comparative study of semantic segmentation using deep neural networks in a GNSS-denied underground parking lot,” in Proc. ICC 2023.

- **XXVII FIG Congress 2022:** K. Hu, M. Mahboubi, Y. Chen, and S. Fatholahi, "Indirect detection of permafrost degradation in eastern Alaska using MODIS and Landsat data," in Proc. XXVII FIG Congress, Warsaw, Poland, 2022.

PROFESSIONAL EXPERIENCE

APPLICATION DATA ANALYST

Toronto, ON, Canada · Hybrid

Beanfield Metroconnect

Apr 2025 – Present

- Developed 5+ end-to-end ETL pipelines processing 450+ files/month via Python and cron-based scripts.
- Built a Streamlit-based API tool for fiber trace validation & internal network analysis to improve operations.
- Reduced capacity reporting time by 75% (from 2 days to <0.5 day per cycle) via scalable automation frameworks.
- Prototyped & deployed Flask REST APIs to enable Google Earth network links and scalable geospatial data access.
- Designed interactive dashboards to visualize network capacity and support infrastructure planning decisions.
- Drafted PostGIS database schemas to support data migration & future digital twin-ready system architecture.
- Maintained technical documentation (Confluence) and GitHub repo to improve knowledge transfer efficiency.

RELEVANT PROJECTS

Spatial Infrastructure Data Validation Framework [Python + ETL + SFTP]

Jan 2026

- Architected auto validation for large-scale infrastructure to detect hierarchy violations & structural inconsistencies.
- Engineered reproducible ETL pipelines integrating audited data pools to ensure reliability across reporting cycles.
- Built standardized schemas enabling scalable quality assurance across evolving infrastructure data environments.

Fiber Trace Validation API Tool [Python + Streamlit]

Oct 2025

- Developed an internal validation API tool to assess fiber routing consistency using automated spatial logic checks.
- Applied backend algorithms detecting conflicts & trace misalignments to improve network trace accuracy by 30%+.
- Delivered user-facing interface enabling non-technical teams to perform validation independently.

Large-scale Infrastructure Dashboard [Leaflet + PostGIS]

Jun 2025

- Visualized capacity across 7,500+ network segments, enabling real-time infrastructure monitoring & spatial analysis.
- Automated monthly DCP reporting pipelines with insights that support faster (-60% time) & precise planning.
- Designed quantitative metrics translating raw records into decision-support statistics for executive stakeholders.

Mitigate Traffic Congestion with Least Cost Path Analysis [GIS + LCPA + NA]

Aug 2021

- Used Least Cost Path Analysis to proposed a new bypass route to mitigate traffics in the GTA.
- Conducted criteria & spatial analysis to get the best route without interfering natural habitats (less cost).
- Generated a report to support the decision-making for optimizing the traffic congestion on Highway 401.

Permafrost Degradation Detection in Western Alaska [MODIS + GEE]

Apr 2021

- Computed NDVI & MNDWI for each image stacks from 2000 -2020 (four 5-year interval composites).
- Performed Mann-Kendall trend test to examine the increasing & decreasing trend of vegetation.
- Visualized the land surface temperature & Sen' slope of Enhanced Vegetation Index (EVI).

HONORS AND AWARDS

- Caivan Future Cities Graduate Scholarship Award [May 2022]
- International Masters Award of Excellence (IMAE) [May 2022]
- Term Distinction & Dean Honours List [Apr 2021]

TECHNICAL SKILLS

- **Programming:** Python, SQL (PostgreSQL/PostGIS), R, Bash, JavaScript (React), HTML/CSS, LaTeX.
- **ML & Computer Vision:** PyTorch, TensorFlow, Scikit-learn, MMDetection, Faster R-CNN, Transformer-based Models, Semantic & Instance Segmentation, Hyperparameter Tuning.
- **3D Geomatics & Sensing:** LiDAR Data Processing, SLAM, CloudCompare, BIM, AutoCAD, ArcGIS, QGIS, Google Earth Engine (GEE), Spatial Optimization.
- **Data Engineering & Tools:** ETL pipelines, RESTful API (Flask/Streamlit), Git, Linux, Jupyter, SPSS.