

Boaz Mwubahimana

Ph.D. Candidate, Photogrammetry & Remote Sensing (LIESMARS, Wuhan University) | GeoAI Research Engineer | Remote Sensing & GIS Specialist

Graduate Student Member, IEEE

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Professional Summary

Ph.D. candidate in Photogrammetry and Remote Sensing at the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS), Wuhan University, and Geospatial AI Engineer with over seven years of professional experience in GIS and Earth observation, including GIS-based Monitoring and Evaluation (M&E) systems for development programs. Research interests include deep learning semantic mapping for large-scale remote sensing applications, visual occlusion content completion, and forest information extraction. Author of peer-reviewed publications in IEEE TGRS, IEEE JSTARS, and the International Journal of Remote Sensing, with proven expertise in CNN-ViT hybrid architectures for multimodal data fusion (optical, SAR, LiDAR) and large-scale spatiotemporal analytics. Currently leading the development of a novel deep neural regression framework for forest degradation assessment and carbon sink estimation using multi-temporal satellite imagery on Google Earth Engine. Adept at translating complex geospatial insights into actionable policy guidance, with ongoing collaborations across research institutions and government agencies in sub-Saharan Africa and beyond.

Education

Ph.D. Wuhan University , Photogrammetry and Remote Sensing	Sept 2024–Present
- State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS) - Research direction: deep learning semantic mapping for large-scale remote sensing, visual occlusion content completion, and forest information extraction	
M.EngWuhan University , Photogrammetry and Remote Sensing	Sept 2022–June 2024
- LIESMARS, ranked the leading global laboratory in GIS and remote sensing engineering for eight consecutive years; focus on advanced remote sensing, machine learning, and geospatial analytics - Thesis: “Cross-Probabilistic Weak Supervision Learning for High-Resolution Land Cover Enhancement” [GitHub] - Specialized in multimodal Earth observation data processing and AI model development	
B.Sc. University of Rwanda , Spatial Planning	Sept 2017–Aug 2021
Specialization: GIS, Remote Sensing, Environmental Spatial Analysis	

Professional Experience

Land Use Compliance and Inspection Specialist , National Land Authority	Apr 2025–2026
- Implemented AI-powered land use monitoring and governance systems - Developed high-level geospatial data analytics for policy compliance and inspection workflows - Designed intelligent systems for multitemporal land use change detection	
GeoAI Research Engineer , Charis UAS	Jan 2024–2025
- Developed machine learning models for airborne and drone datasets supporting land cover mapping and precision agriculture - Processed large-scale LiDAR datasets for building detection and high-resolution terrain modeling - Created autonomous processing pipelines for DEM/DSM/DTM generation and Canopy Height Models - Managed and analyzed multi-terabyte geospatial datasets using distributed computing systems	
Assistant Lecturer , Kigali Independent University	Oct 2024–Mar 2025
- Lectured on Remote Sensing, Python for GIS, and AI in Earth Observation - Supervised student research projects in geospatial AI and machine learning applications - Developed curriculum integrating modern AI techniques with traditional remote sensing methods	
Young Geospatial Researcher , University of Rwanda at CGIS	Jan 2021–Feb 2023
- Conducted remote sensing and GIS analytics research - Developed geospatial AI tools for urban planning and community-based risk modeling - Participated in interdisciplinary research projects combining geospatial technologies with policy applications	

Publications

Peer-Reviewed Journal Articles

“TagParaFormer: Cross-Hybrid Attention Learning Framework for Topology-Aware Road Network Extraction from Remote Sensing Imagery” • B. Mwubahimana, D. Miao, J. Yan, L. Ma, R. Dukundane, X. Huang, et al. • <i>IEEE Transactions on Geoscience and Remote Sensing (TGRS)</i>, Early Access. DOI: 10.1109/TGRS.2026.3707401 ↗	2026
“FWDNNet: Cross-Heterogeneous Encoder Fusion via Feature-Level TensorDot Operations for Land-Cover Mapping” • B. Mwubahimana, J. Yan, D. Miao, S. K. Roy, Z. Li, L. Ma, C. Kagoyire, et al. • <i>IEEE Transactions on Geoscience and Remote Sensing (TGRS)</i>, vol. 64. DOI: 10.1109/TGRS.2026.3652451 ↗	2026
“Cross-Causal CarbonFormer: Rethinking Forest Carbon Density Estimation with a Causal Spatiotemporal Framework” • B. Mwubahimana, J. Yan, D. Miao, Z. Li, L. Ma, Y. Ishimwe, et al. • <i>IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (JSTARS)</i>, Open Access. DOI: 10.1109/JSTARS.2026.3695334 ↗	2026
“C2FNet: Cross-Probabilistic Weak Supervision Learning for High-Resolution Land Cover Enhancement” • B. Mwubahimana, J. Yan, D. Miao, Z. Li, H. Guo, L. Ma, et al. • <i>IEEE Transactions on Geoscience and Remote Sensing (TGRS)</i>, vol. 63. DOI: 10.1109/TGRS.2025.3598681 ↗	2025
“Vision Transformer-Based Feature Harmonization Network for Fine-Resolution Land Cover Mapping” • B. Mwubahimana, J. Yan, M. Mugabowindekwe, X. Huang, E. Nyandwi, J. Tuyishimire, et al. • <i>International Journal of Remote Sensing</i>, vol. 46, no. 10, pp. 3736–3769. DOI: 10.1080/01431161.2025.2491816 ↗	2025
Conference Papers	
“Top0CoverNet: Cross-Near 0 End-to-End Framework for Topologically Consistent Land Cover Mapping” • B. Mwubahimana, D. Miao, J. Yan • <i>IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2026)</i>, Washington, DC, USA — accepted for oral presentation; awarded conference travel grant	2026
Preprints and Under Review	
“Cross Deep Neural Regression Learning for Aboveground Carbon Density Estimation from Multi-Temporal Multimodal Remote Sensing Data” • B. Mwubahimana, J. Yan, D. Miao, M. Mugabowindekwe, S. K. Roy, et al.	2026
“TAG-Para: Hybrid Deep Attentions and Graphical Representations for Road Network Topological Error Correction” • B. Mwubahimana, J. Yan, M. Mugabowindekwe, X. Huang, E. Nyandwi, et al. • Preprint available at SSRN: 5224096 ↗	2025

Academic Service

Peer Reviewer: *IEEE Transactions on Geoscience and Remote Sensing (TGRS)*, *IEEE Geoscience and Remote Sensing Letters (GRSL)*, *Artificial Intelligence in Geosciences*, Cluster computing and other international journals and conferences

Professional Membership: Graduate Student Member, IEEE and IEEE Geoscience and Remote Sensing Society (GRSS)

Selected Projects

VCRP: Volcano Community Resilience Project • Served as GeoAI engineer for large-scale land cover mapping using multispectral imagery with a deep learning framework, and forest information extraction using LiDAR technology — funded by the World Bank	2024–2025
Ending Malaria with AI • Applied multispectral airborne sensors and an AI-powered learning paradigm to detect malaria hot-spot breeding sites from drone imagery — funded by the Bill & Melinda Gates Foundation	2024–2025
Carbon Sink Estimation and Forest Degradation Mapping in Kigali • Designed a deep neural regression framework for estimating aboveground carbon density (ACD) from multi-temporal Landsat imagery • Integrated spectral-temporal indices (NDVI, EVI, SAVI, MSAVI) with topographic variables in a cloud-based pipeline on Google Earth Engine • Applied the model for ecological mapping of Kigali’s peri-urban and urban forests to support carbon accounting and climate resilience planning • Cross-validation yielded $R^2 = 0.94$ and $RMSE = 12.3$ Mg C/ha across 8,600+ pixel samples	2024–2025
sKwanda-V2 GeoAI Dataset	2024–2025

- Created large-scale training datasets from Rwanda and USA imagery for machine learning applications - Developed comprehensive ground truth datasets supporting open science and reproducible research - Available on GitHub: github.com/BoazGithub/sKwanda_V2	
CNN-ViT Hybrid Architecture for Land Cover Mapping	2023–2024
- Developed dual-loss function models for fine-scale segmentation of heterogeneous landscapes - Implemented attention mechanisms for interpretable feature learning and model explainability - Achieved significant improvements in classification accuracy for complex terrain types	
SAR for Wetland Monitoring	2024
- Built SAR-based models for ecological assessment and greenhouse gas estimation - Developed time-series analysis workflows for wetland ecosystem monitoring	

Conference Presentations

IEEE IGARSS 2026, Washington, DC, USA	2026
Oral presentation of Top0CoverNet: a cross-near-0 end-to-end framework for topologically consistent land cover mapping (travel grant awarded)	
Global AI Summit on Africa	2024
- Presented “Ending Malaria with AI” — demonstrating AI applications for public health - Presented “Autonomous Crop Phenological Mapping” — showcasing precision agriculture innovations	
International Conference on Spatial and Spatiotemporal Modelling	2024
- Represented the Rwanda National Land Authority on the integration of spatial and temporal modelling for climate resilience using state-of-the-art AI - Collaborated with the Ministry of Health of Rwanda, University College London, and the African Institute for Mathematical Sciences	
International Doctoral Conference on Big Data Geospatial Intelligence Processing, Wuhan, China	2024
- Participated in the international doctoral forum co-organized by Wuhan University (LIESMARS), Peking University, and Hong Kong Polytechnic University - Presented early-stage research on weakly supervised deep learning for land cover enhancement from historical pseudo-labels - Engaged with editors and scholars from the <i>Geo-Information</i> journal and global geospatial AI networks	

Technical Skills

Programming Languages: Python (Advanced), R (Intermediate), SQL, Bash, JavaScript
Machine Learning: PyTorch, CNNs, Vision Transformers, Weak Supervision, Data Augmentation, Xarray, Deep Learning Frameworks
Geospatial Tools: ArcGIS, QGIS, ENVI, Global Mapper, Google Earth Engine, PostGIS, LiDAR Processing, Point Cloud Analysis
Specialization Areas: Land Use Classification, Urban Planning, Hydrological Modeling, Climate Change Analysis, Precision Agriculture

Professional Skills

Languages: English (professional proficiency), Kinyarwanda (native), Chinese (intermediate)
Research Competencies: Large-scale data processing, Statistical analysis, Scientific writing, Project management, International collaboration, Peer review

References

Professor Yan Jianguo(Full professor), at State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing of Wuhan University
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