Hillson Ghimire

PhD Student, Earth, Environmental and Planetary Sciences, Rice University, Houston, TX

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Education

PhD in Earth, Environmental and Planetary Sciences — Aug 2026 – Present
Rice University — Houston, TX
Advisor: Noemi Vergopolan

MS in Geography (GIS Specialization), 4.0/4.0 GPA — Aug 2024 – Jul 2026
South Dakota State University — Brookings, SD
Advisor: Maitiniyazi Maimaitijiang
Thesis: AI-assisted Wheat Spike and Spikelet Detection and Density Mapping Using Multiscale Remote Sensing Data to Support Wheat Grain Yield Forecasting
Relevant Coursework: Machine Learning & Deep Learning for Remote Sensing, High Performance Computing, Agricultural & UAS Remote Sensing, Quantitative Remote Sensing, Enterprise Data Modeling

BE in Geomatics Engineering — 2016 – 2020
Institute of Engineering, Tribhuvan University — Pokhara, Nepal
Thesis: Automated Road Extraction from Sentinel-2 Imagery using a Convolutional Neural Network (with Y. Regmi, A. Chhetri, D. Lamsal, and Z. Kandel)
Relevant Coursework: GIS, Remote Sensing, Photogrammetry, Digital Image Processing, Radar & LiDAR, GPS, Survey Techniques, Python for Geospatial Applications

Research Experience

Doctoral Researcher — Aug 2026 – Present
Rice University — Houston, TX

- Conducting doctoral research on soil moisture and agricultural drought processes.
- Exploring the integration of satellite observations such as SMAP, land surface models, and machine learning to improve high-resolution soil moisture modeling and prediction.

Graduate Research Assistant — Aug 2024 – May 2026
South Dakota State University (SDSU) — Brookings, SD

- Developed deep learning frameworks for high-throughput crop phenotyping, automated trait extraction, and disease assessment using UAV and proximal sensing imagery.
- Designed reproducible geospatial and machine learning pipelines integrating multisource imagery, field observations, and crop phenological information.
- Established cloud-supported data annotation and model development workflows to facilitate collaborative research and dataset management.
- Conducted UAV-based field investigations and interdisciplinary research with plant scientists and breeders, contributing to scientific publications and presentations.

Research Associate — Feb 2022 – Aug 2024
Geoinformatics Center, Asian Institute of Technology — Pathum Thani, Thailand

- Developed operational satellite-based disaster monitoring and rapid damage assessment workflows using SAR, InSAR, and machine learning, supporting international disaster response through the Sentinel Asia initiative.
- Automated flood extent mapping from JAXA's ALOS-2 SAR imagery, reducing disaster response mapping time from approximately one week to under 24 hours.
- Designed and implemented geospatial information systems and analytical workflows for disaster risk management and environmental monitoring.
- Conducted multidecadal Earth observation analyses of vegetation dynamics, biomass decline, and groundwater depletion to inform regional land restoration planning.

Internships

Geospatial Intern
Geoinformatics Center, Asian Institute of Technology
Jun 2021 – Oct 2021
Pathum Thani, Thailand

- Investigated deep learning methods for automated flood extent extraction from SAR imagery to support rapid disaster response.
- Supported the development of geospatial information systems and satellite data processing workflows for disaster risk management.

Geospatial Intern (Remote)
SkyTruth
Sep 2020 – Mar 2021
Shepherdstown, WV, USA

- Developed a deep learning-based road extraction workflow using U-Net and Sentinel-2 imagery to automate infrastructure mapping.
- Applied satellite remote sensing and geospatial analysis to investigate oil spills, extractive activities, and associated environmental impacts across multiple regions.
- Produced geospatial analyses, technical maps, and investigative reports supporting environmental monitoring and public awareness.

Publications

Wheat spike and spikelet detection and counting from high-resolution digital imagery using YOLO with oriented bounding boxes PAPER / DATA
H. Ghimire, M. Maimaitijiang, S. Thapa, S. Kaushal, D. J. Koupal, M. M. Billah, K. Poudel, S. Sehgal, M. Singh, S. Subedi, U. U. R. Janjua, and S. K. Sehgal, *Scientific Reports*, 16, 27355, 2026

WheatAI v1.0: An AI-powered high-throughput wheat phenotyping platform ARXIV / PLATFORM
M. Maimaitijiang, **H. Ghimire**, S. Thapa, M. M. Billah, S. Sehgal, M. Singh, S. Kaushal, K. Poudel, S. Subedi, U. U. R. Janjua, L.-O. Makonga, J. Halder, H. S. Gill, M. Sher, J. S. Sidhu, and S. K. Sehgal, *arXiv:2601.08863*, 2026

Spectral–structural fusion for wheat lodging severity assessment using UAS imagery and deep learning PREPRINT
S. Sehgal, M. Maimaitijiang, J. Halder, K. Poudel, U. U. R. Janjua, **H. Ghimire**, and S. Subedi, *agriRxiv preprint*, 2026

Presentations

Dec 2025 Automated wheat spike detection and counting using UAV-based digital imagery and deep learning
H. Ghimire, M. Maimaitijiang, U. U. R. Janjua, S. Sehgal, M. M. Billah, K. Poudel, et al., *AGU25*, New Orleans, LA

Dec 2025 Predicting wheat grain yield and quality using multitemporal and multispectral UAS imagery with transformer models
K. Poudel, M. Maimaitijiang, S. Subedi, S. Kaushal, M. M. Billah, **H. Ghimire**, et al., *AGU25*, New Orleans, LA

Nov 2025 Integrating genomics and high-throughput phenotyping with machine learning for predictive breeding in winter wheat ABSTRACT
S. Kaushal, S. K. Sehgal, M. Maimaitijiang, M. M. Billah, M. Singh, D. Koupal, H. Gill, S. Thapa, J. Halder, **H. Ghimire**, and S. Subedi, *CANVAS 2025*, Salt Lake City, UT

Nov 2025 Advancing wheat disease phenotyping through YOLOv11 and YOLOv12: Automated detection of FHB severity and damaged kernels ABSTRACT
S. Thapa, M. Singh, **H. Ghimire**, D. Koupal, S. Kaushal, J. Halder, K. Kaur, S. Ali, J. Zhang, M. Maimaitijiang, and S. K. Sehgal, *CANVAS 2025*, Salt Lake City, UT

Nov 2025 From image to insight: AI-driven wheat monitoring and yield prediction with multi-scale sensing ABSTRACT
M. Maimaitijiang, S. K. Sehgal, S. Kaushal, M. M. Billah, U. U. R. Janjua, S. Subedi, **H. Ghimire**, S. Thapa, and J. Halder, *CANVAS 2025*, Salt Lake City, UT

Apr 2025 Deep learning-assisted wheat yield estimation through spike and spikelet counting from high-resolution imagery
H. Ghimire, M. Maimaitijiang, S. Kaushal, D. Koupal, K. Poudel, S. Thapa, M. Singh, S. Subedi, U. U. R. Janjua, and S. K. Sehgal, *56th Annual SDSU Geography Convention*, Brookings, SD

Mar 2025 Deep learning-based detection and counting of wheat spikes and spikelets using high-resolution field imagery for improved yield estimation
H. Ghimire, M. Maimaitijiang, S. Kaushal, D. Koupal, K. Poudel, S. Subedi, U. U. R. Janjua, and S. K. Sehgal, *2025 McFadden Symposium*, Nebraska

Feb 2025 Wheat spike and spikelet detection on close-range digital imagery using deep learning ABSTRACT
H. Ghimire, M. Maimaitijiang, S. Kaushal, D. Koupal, K. Poudel, S. Thapa, S. Subedi, U. U. R. Janjua, J. Halder, and S. K. Sehgal, *SDSU Data Science Symposium 2025*, Brookings, SD

Nov 2024 Wheat head detection from close-range digital imagery using deep learning PHOTO
H. Ghimire, M. Maimaitijiang, S. Kaushal, D. J. Koupal, and S. K. Sehgal, *2024 EROS Fall Poster Session*, EROS Center, SD

Oct 2024 Wheat head detection from close-range digital imagery using deep learning
H. Ghimire, M. Maimaitijiang, and S. K. Sehgal, *2024 GPRM Annual Meeting*, Utah Valley University, UT

Dec 2022 The intricacies in the implementation of integrated geospatial platform, database, and application for disaster risk management in Uttarakhand PAPER
H. Ghimire and M. K. Hazarika, *OHOW 2022*, Pattaya, Thailand

Teaching Experience

Teaching Assistant – Remote Sensing for Disaster Response
Beaver Works Summer Institute (BWSI), MIT Lincoln Laboratory
Jun 2026 – Aug 2026
Cambridge, MA



- Developed technical course materials, Jupyter notebooks, and hands-on geospatial programming exercises.
- Mentored participants in satellite data analysis, computational workflows, and applied problem-solving.
- Delivered a guest lecture on satellite-based hailstorm damage assessment using PlanetScope imagery, accompanied by reproducible analysis resources.

Data and Software

- Wheat spike and spikelet benchmark dataset (portion of the study dataset, with oriented bounding box annotations), Zenodo, 2026. DOI: 10.5281/zenodo.20215489
- WheatAI, a web-based wheat phenotyping platform (co-developer), 2026.

Honors and Awards

- Ken Kennedy Institute Computational Science and Engineering Recruiting Fellowship ($15,000), Rice University, Aug 2026
- 3rd Place, UAV Track, NDSU AgTech Hackathon, 2026
- Dr. Fritz Gritzner Outstanding Graduate Geography Student Award, South Dakota State University, Jan 2026
- USDA North Central SARE Graduate Student Grant ($19,999) for Wheat-TDM, Oct 2025

Service

- GIS Volunteer, URISA's GISCorps, Jun 2020 – Present. Contributed geospatial data digitization and mapping to NASA's COVID-19 research initiative.
- Session Manager, IEEE International Geoscience and Remote Sensing Symposium (IGARSS), Sep 2020.

Technical Skills

- **Programming:** Python, SQL, Bash, Git
- **Machine Learning:** PyTorch, scikit-learn, deep learning, computer vision
- **Geospatial:** ArcGIS Pro, QGIS, FME, Google Earth Engine, PostGIS, GDAL
- **Remote Sensing:** SAR and InSAR analysis, multispectral analysis, UAV photogrammetry
- **Computing:** Linux, high-performance computing, Docker, Google Cloud
- **AI Tools:** LLMs and agentic coding tools (Claude Code, OpenAI Codex)