Didarul Islam, Ph.D.

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SUMMARY OF EXPERTISE

- Expertise in Local Climate Zones (LCZ) mapping, 3D urban structure mapping and heat stress analysis.
- Utilizing GeoAI techniques in urban building height mapping, urban digital twins, and addressing urban challenges.
- Advanced spatial statistical and ML models development for trend and pattern analysis of geospatial data.
- Designing data pipeline to integrate diverse datasets from multiple sources and AI workflow automation.
- Spatial-ML & transfer learning model development to address spatial autocorrelation in ML and transferring knowledge geographically.
- Skilled in processing and analyzing multispectral, hyperspectral, LiDAR, SAR, and other remote sensing data for environmental, agricultural and urban applications.
- Strong background in quantitative analysis, predictive modeling, cluster analysis, and machine learning techniques for accurate data-driven insights.
- Application of remote sensing and AI for monitoring forest cover, detecting wildfires, and mapping deforestation across diverse landscapes.
- Use of GIS, remote sensing, and AI for monitoring crop health, growth, and yield, providing critical predictions for agricultural planning.

EDUCATION

George Mason University | Fairfax, VA, USA — Aug. 2021 – May. 2024

Ph.D. in Earth Systems & Geoinformation Sciences

- Dissertation: A Decision-Rule & Spatial Transfer Learning-based Approach for Automated Local Climate Zones (LCZs) Mapping Using Multi-Source Geospatial and Remote Sensing Data.

Central Michigan University | Mount Pleasant, MI, USA — Aug. 2018 – May. 2021

M.S. in Geographic Information Sciences

- Thesis: Incorporating spatial information in machine learning: The Moran eigenvector spatial filter approach.

Khulna University | Khulna, Bangladesh — Jan. 2014 – Dec. 2017

B.S. in Urban & Regional Planning

- Thesis: Land-Use change modeling using Convolution Neural Network (CNN).

SKILLS

- **Programming Languages:**
  - Python (proficient in Arcpy, NumPy, Pandas, GDAL, Geopandas, Scikit-learn, PyDeck, Plotly, Cartopy, Folium, Xgboost, Tensorflow, Keras, PyTorch, SciPy, geemap, Rasterio, segment-geospatial, PySal, Xarray, Open-CV, PySpark, and any libraries related to GIS, RS and ML)
  - R (proficient in lidR, raster, rgdal, rGEDI, caret, randomForest, car, plot3D, ggplot, spmoran etc.)
  - Python API for Google Earth Engine (GEE), JavaScript, MySQL
- **Software:** ArcGIS products (ArcGIS Pro, ArcGIS Online, ArcGIS Dashboard, ArcGIS API and Extensions), QGIS, ERDAS, ENVI, eCognition, CloudCompare, ESA SNAP
- **Sensors:** GEDI, ICESat-2, airborne LiDAR, terrestrial LiDAR, ALOS PALSAR 1&2, Sentinel 1 & 2, Landsat series (5, 7, 8, 9), MODIS, AVIRIS, VIIRS, and Commercial Satellites / UAS
- **Cloud Services:** Amazon Web Services (AWS), Google Cloud Platform (GCP), ARGO/HOPPER (GMU)
- **Back-End GIS Development:** GeoDjango, PostgreSQL, PostGIS, Leaflet, HTML, CSS

WORK EXPERIENCE

Position	**Postdoctoral Research Fellow**	Oct. 2024 - Oct. 2025
	Research Assistant	July 2024 - Oct. 2024
Organization	Center for Spatial Information Science and Systems (CSISS) | Fairfax, VA	
Responsibilities	**Project:** NSF Convergence Accelerator Track J Phase 2: CropSmart. Funded by: NSF	

- Contribute to the "NSF Convergence Accelerator Track J Phase 2: CropSmart" project, which aims to develop a digital twin for nationwide cropping decisions.

- Utilize geospatial and remote sensing technologies to analyze and monitor agricultural lands for precision farming.
- Apply machine learning algorithms and statistical methods to forecast crop yield, classify crop types, and determine optimal harvest times.
- Integrate weather data into predictive models to assess the potential impact of severe weather on crop loss, enhancing decision-making for harvest strategies.

Position **Graduate Research Assistant** Aug. 2021-May 2024
Organization Center for Spatial Information Science and Systems (CSISS) | Fairfax, VA
Responsibilities **Projects:**

Local Climate Zones (LCZs) Mapping using Spatial Transfer Learning Model & Multi-source Geospatial and Remote Sensing Data. Funded by: NASA IDS

- Developed data pipeline with open-source Python libraries for extracting and processing multi-source geospatial and remote sensing data, including GEDI LiDAR, Sentinel 1, 2, nighttime light, building footprint and OSM data.
- Calculated and integrated over 15 indices to characterize Local Climate Zones (LCZs) with support from LiDAR height and neighborhood characteristics.
- Applied innovative spatial transfer learning model capable of addressing spatial dependency & transferring knowledge geographically to map LCZs.
- Automated the production of worldwide LCZ maps.

Rapid Rice Yield Estimation Using Integrated Remote Sensing and Meteorological Data and Machine Learning. Funded by: NASA SERVIR

- Developed data pipeline for extracting time-series vegetation indices and weather data from GEE.
- Applying ML model using time-series data to forecast rice yield in Hindu-Kush region.

GeoWeaver: Building An Open-Source Platform for Enabling Ad Hoc Management, Open Sharing, and Robust Reuse of NASA Earth Data-Driven Hybrid AI Workflows. Funded by: NASA ACCESS

- Utilized Argo/HOPPER computer cluster to process large weather data.
- Developed ML model to forecast Ozone (O_3) concentration in the USA.

Position **Graduate Research Assistant** May 2020-June 2020
Organization Central Michigan University | Mount Pleasant, MI
Responsibilities **Project:** Addressing Spatial Dependence in Machine Learning.

- Conducted experiments to extract spatially filtered eigenvectors that capture spatial dependence characteristics
- Developed method to incorporate selected eigenvectors into machine learning to address spatial autocorrelation issues
- Additionally, conducted spatial statistical analysis and machine learning modeling to forecast housing prices

Position **Graduate Teaching Assistant** Aug. 2019-May 2021
Organization Central Michigan University | Mount Pleasant, MI
Responsibilities
- Designing & Assisting lab GEO 303: Geographic Information Science (Fall 2019, Fall & Spring 2020)
- Instructing and grading GIS labs & geography courses

Position **Research Assistant** Feb. 2019-July 2019
Organization Center for Sustainable, Healthy and Learning Cities and Neighborhoods
Responsibilities **Project:** Bangladesh: National Urban Policies and City Profiles for Dhaka and Khulna.

- Land cover classification from remote sensing data
- Patterns analysis of land cover changes/urban expansion, and urban sprawl using machine learning models
- Data extraction, and geospatial data management
- Spatial data modeling and automated workflow development

Position	**GIS Instructor**	Aug. 2018-Dec. 2018
Organization	Geo-Planning for Advance Development (GPAD) | Dhaka, Bangladesh	
Responsibilities	Conducted training for GO/NGO clients on GIS Software (ArcGIS, QGIS), Remote Sensing Software (ERDAS IMAGINE, ENVI), and Python GIS Programming.	

Training Programs:

- Instructor of 'GIS Programming for Professionals: Python Programming Language' training program, Organized by: Geo- Planning for Advanced Development (GPAD).
- Instructor of 'Fundamentals of QGIS and Spatial Analysis' training program, Organized by: Geo-Information for Urban Planning and Adaptation to Climate Change (GPAC).

Position	**Jr. GIS Analyst**	Feb. 2018-July 2018
Organization	Geo-Planning for Advance Development (GPAD) | Dhaka, Bangladesh.	
Responsibilities	Contributed to several projects by developing workflows and preparing geospatial models for nationwide vulnerability analysis in agriculture, livestock, fisheries, biodiversity, water resources, infrastructure, human and health sectors.	

Projects:

- Nationwide Climate Vulnerability Assessment of Bangladesh: Climate Finance Governance. Implemented by: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ).

PUBLICATIONS

Research Papers

- **Islam, M.D.,** Sultana, M. (2024). A Spatial Machine Learning-Based Approach for Automated High-Resolution Building Height Estimation and Mapping Using Open-Source Remote Sensing Data. (in preparation).
- **Islam, M.D.,** Di, L., Zhang, C. (2024). A Decision-Rule & Spatial Machine Learning-based Approach for Automated Local Climate Zones (LCZs) Mapping using Multi-source Geospatial and Remote Sensing Data. *Remote Sensing of Environment.* (under review).
- **Islam, M.D.,** Di, L., Zhang, C., Yang, R., Qu, J., Tong, D., Guo, L., Lin, L., Pandey, A. (2024). A Decision Rule and Machine Learning-Based Hybrid Approach for Automated Land-Cover Type Local Climate Zones (LCZs) Mapping using Multi-Source Remote Sensing Data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*. doi: 10.1109/JSTARS.2024.3386389
- **Islam, M.** D., Di, L., Qamer, F. M., Shrestha, S., Guo, L., Lin, L., Mayer, T. J., & Phalke, A. R. (2023). Rapid rice yield estimation using integrated remote sensing and meteorological data and machine learning. *Remote Sensing, 15(9), 2374.* https://doi.org/10.3390/rs15092374
- **Islam, M**. D., Li, Bin, Lee, C., & Wang, X. (2022). Incorporating spatial information in machine learning: The Moran eigenvector spatial filter approach. *Transactions In GIS, 26(2), 902-922.* https://doi.org/10.1111/tgis.12894
- **Islam, M. D.**, Li, B., Islam, K., Ahasan, R., Mia, M., & Haque, M. (2022). Airbnb rental price modeling based on Latent Dirichlet Allocation and MESF-XGBoost composite model. *Machine Learning With Applications, 7, 100208*. https://doi.org/10.1016/j.mlwa.2021.100208
- **Islam, M. D.,** Islam, K., Ahasan, R., Mia, M., & Haque, M. (2021). A data-driven machine learning-based approach for urban land cover change modeling: A case of Khulna City Corporation area. *Remote Sensing Applications: Society And Environment, 24, 100634.* https://doi.org/10.1016/j.rsase.2021.100634
- Lei, L., Di, L., Zhang, C., Guo, L., Zhao, H., **Islam, M. D.**, Li, H. J., Liu, Z. A., & Middleton, G. (2024). Modeling urban redevelopment: A novel approach using time-series remote sensing data and machine learning. *Geography and Sustainability*. https://doi.org/10.1016/j.geosus.2024.02.001
- Bappa, S., Malaker, T., Mia, M. and **Islam, M. D.,** (2022. Spatio-temporal variation of land use and land cover changes and their impact on land surface temperature: A case of Kutupalong Refugee Camp, Bangladesh. *Heliyon, 8(9).* https://doi.org/10.1016/j.heliyon.2022.e10449
- Mia, M. R., Islam, K. S., & **Islam, M. D.** (2021). Automatic building footprint extraction from high resolution stereo satellite image. *Plan Plus, 11(1), Article 1*. https://doi.org/10.54470/planplus.v11i1.2

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Conference Papers

- Zhang, C., Marfatia, P., Farhan, H., Di, L., Lin, L., Zhao, Hui L., **Islam, M.D.**, Yang, Z. (2023). Enhancing USDA NASS cropland data layer with segment anything model. *2023 11th International Conference on Agro-Geoinformatics (Agro-Geoinformatics)*. doi:10.1109/agro-geoinformatics59224.2023.10233404
- **Islam, M. D.**, Di, L., Mia, M. and Sithi, M. (2022). Deforestation Mapping of Sundarbans Using Multi-Temporal Sentinel-2 Data & Transfer Learning. *2022 10th International Conference on Agro-geoinformatics (Agro-Geoinformatics)*. doi: 10.1109/Agro-Geoinformatics55649.2022.9858968
- **Islam M. D.**, Islam, K.S., Chakraborti T., Alam M. S. (2019). Urban Heat Island Effect Analysis Using Integrated Geospatial Techniques: A Case Study of Khulna City, Bangladesh. *International Conference on Climate Change (ICCC-2019)*
- Chakraborty, T., Alam, M. S., & **Islam, M. D.** (2019). Landslide susceptibility mapping using XGBoost model in Chittagong District, Bangladesh. *In Proceedings on International Conference on Disaster Risk Management, Dhaka, Bangladesh (pp. 431-434).*
- Chakraborty, T., Alam M.S., **Islam, M. D**. (2019). Land Cover Classification from Multispectral Remote Sensing Image Using K-Nearest Neighbor, Deep Neural Network, Random Forest and SVM Algorithms: A Machine Learning-Based Approach". *International Conference on Urban and Regional Planning, 2019.*
- Alam, M. S., Chakraborty, T., & **Islam, M. D.** (2019). Assessment of social vulnerability to flood hazard using NFVI framework in Satkhira District, Bangladesh. *International Conference on Disaster Risk Management-2019, Dhaka, Bangladesh.*
- Alam, M. S., Chakraborty, T., & **Islam, M. D.** (2019). Community resilience of urban slums to climate change induced events: A case study of five major slum in Khulna city, Bangladesh. *ICCC-2019, Dhaka, Bangladesh.*

Book Chapters

- Alnuaim (Alnaim), A., Sun, Z., & **Islam, M. D.** (2023). AI for improving ozone forecasting. *Artificial Intelligence in Earth Science, 247–269.* https://doi.org/10.1016/b978-0-323-91737-7.00002-5

GRANTS & PROPOSALS

- Intended for NASA/NSF (in preparation): "Automatic Multi-Sensor High-Resolution LCZ Mapping to Improve Urban Weather and Environmental Forecasting." Role: Co-Principal Investigator.
- Intended for NASA/NSF (in preparation): "High-Resolution Building Height Mapping Using Multi-Sensor Open-Source Remote Sensing Data for Urban Environmental Forecasting." Role: Co-Principal Investigator.

AWARDS & HONORS

- Central Michigan University Summer Research Grant. May 2020 – July 2021

SUPERVISION OF STUDENT RESEARCH

- "*A Rule Based Machine Learning Approach to Vegetation Classification using Remote Sensing Data"* by Aran Pandey, Aspiring Scientists Summer Internship Program (ASSIP) in 2023 at George Mason University. Role: Supervisor.

HOBBIES & INTERESTS

I often use my free time to learn new methods & techniques in GIS, Remote Sensing, and Data Science. These activities keep me engaged and help me grow both personally and professionally.

Additionally, I love outdoor activities such as hiking, climbing, kayaking, camping, and traveling. I also enjoy orchestral music, watching documentaries about history and archaeology. I'm curious about different cultures and cuisines and love visiting historical and archaeological sites.