SAYANTAN MANDAL New Delhi, INDIA | +91 7003151282 | sayantanonfire@gmail.com | LinkedIn | GitHub | ORCID ID | Google Scholar

PROFESSIONAL SUMMARY

Geospatial Data Scientist & PhD researcher (Delhi School of Economics) specializing in GIS (9+ years), Remote Sensing and AI/ML for multi-hazard modelling, DEM enhancement, and climate/disaster risk analytics. Built deep-learning and ensemble pipelines that achieved up to 95.3% ROC-AUC for drought zonation; designed dual-stage DEM void-repair + super-resolution (CRPAG→DS-HAT) for Himalayan terrain; and delivered end-to-end, reproducible Python/GeoAI workflows for rainfall, flood, and land-surface analysis. Trusted to translate complex geospatial data into actionable insights for planners and policy teams.

CORE SKILLS

Geospatial & RS: ArcGIS Pro, QGIS, Erdas Imagine, Global Mapper, MapInfo, Google Earth Engine; DTM/DEM processing (TWI/TPI, curvature), LULC (ML Classifier), NDVI; HEC-RAS, GlabTop, Edge Enhancement, Dark Image Subtraction, Computer Vision, Segment Anything Model, HecRAS Simulation Google Earth Engine (GEE), Geo-AI.

Programming / Data: Python (JupyterLab/Colab/VS_Code/Spyder), MATLAB, Advanced Excel; SPSS. Java Script Basic.

Python libraries (frequently used): numpy, pandas, **geopandas**, shapely, pyproj, fiona, **rasterio**, **rioxarray**, **xarray**, netCDF4, **cfgrib**, zarr, numcodecs, dask (arrays), matplotlib, seaborn, plotly, contextily, folium; scikit-learn, **xgboost**, statsmodels; tensorflow/keras, pytorch; **SHAP**. Plotly, leaflet, xarray, hvplot, Synxflow. GitHub+1

ML/AI: CNN/DenseNet, MLP; stacking/ensemble learning (RF/XGBoost), SVM, Random Forest, Deep Ensemble Learning, CNN-LSTM,; anomaly detection (Isolation Forest, t-SNE); explainable AI (SHAP); super-resolution & generative approaches; SAM-based object extraction. Encoder, Decoder, Generator, RRBs,

Data & Formats: GeoTIFF, Shapefile/GeoPackage, Raster / Vector data NetCDF, GRIB, Zarr; ERA5/IMERG ingestion and gridded analytics. GitHub+1

PROFESSIONAL EXPERIENCE

Senior Research Fellow (SRF) — Dept. of Geography, Delhi School of Economics, University of Delhi | Jan 2022–Present

- Leading PhD on multi-hazard assessment (Joshimath, Uttarakhand) using advanced RS/GIS + deep learning + MLOps + Data architecture.
- **Landslide susceptibility (DenseNet-169):** 18 preconditioning factors; AUC-ROC validation with novel GCP-based field checks; DenseNet outperformed MLP-NN & XGBoost (87% vs 85%/84%).
- **DEM enhancement (CRPAG→DS-HAT):** Dual-stage, multi-modal pipeline fusing Sentinel-2 texture with topography; improved RMSE (P95 ≈ 9.2 m) and SSIM vs baselines over high-relief terrain. Novel Algorithm generation and detailed workflow/pipeline provided. Github+1 Github+2

- **Risk analytics:** Applied SAM to auto-detect buildings near landslide hazard zones to prioritize mitigation. Github+1

Project Lead — School of Disaster Management, TISS | Apr 2025–Jun 2025 Github+1

- Oversaw a short-term disaster-risk geospatial project; aligned RS pipelines and stakeholder reporting using ML based data driven approaches. Used Random Forest with 95% accuracy.

Policy Intern — WWF-India | 2019

- Nation-wide selection (MoEFCC sponsored); contributed to conservation policy briefs.

SELECTED GITHUB PROJECTS

- **NASA IMERG rainfall & cloudburst predictions (Pipeline)** — hourly IMERG NetCDF ingestion, **>100 mm/day** cloudburst detection, Himachal overlay, heatmaps, seasonal stats; exports to shapefiles. *Python, xarray, geopandas, matplotlib.* GitHub
- **ERA5 hourly reanalysis toolkit (Pipeline)** — GRIB/NetCDF loaders; variable subsetting; mapping & time-series; packages include **xarray, cfgrib, zarr/numcodecs, folium, matplotlib**. GitHub
- **Flood prediction (Random Forest)** — vector→raster pipeline; feature engineering; RF model with explainability; libs: **geopandas, scikit-learn, rasterio, statsmodels, SHAP, contextily Accuracy >95%**. GitHub
- **Geospatial data balancing via spatially-stratified sampling** — Spatial Randomness Maximization methodology repo addressing class imbalance in spatial ML. GitHub
- **"-9999" GIS Data Cleaner** — Developed a Software to detect/replace sentinel missing values and visualize gaps in rasters. GitHub
- **Deep ensemble for drought prediction** — multi-model DL ensemble; linked to peer-reviewed ESPR article accuracy > 90% . GitHub

PUBLICATIONS

Published / Accepted

1. *From Gaps to Granularity: CRPAG-DSHAT multi-modal deep learning framework for DEM void repair and super-resolution in the Himalayas.* **ISPRS Open Journal of Photogrammetry & Remote Sensing, accepted** Citation Score- 10.9 **DOI :** https://doi.org/10.1016/j.ophoto.2025.100101 (Applied 18 Accuracy assessment techniques for comprehensive validation.)
2. *An innovative ensemble approach of deep learning models with soft computing techniques for GIS-based drought-zonation mapping in Rarh Region, West Bengal.* **Environmental Science & Pollution Research**, 2025. **DOI:** 10.1007/s11356-025-36634-7. (ROC-AUC up to **95.3%**.)
3. *A novel deep learning-based spatial ensemble approach and Segment Anything Model for landslide risk assessment in Chamoli district, Garhwal Himalayas.* **Nature Scientific Reports, accepted** 2025. **DOI:** 10.1038/s41598-025-01958-4. https://doi.org/10.1038/s41598-025-01958-4

4. *A Novel Deep Learning Approach for GIS-based Landslide Susceptibility Prediction in the Himalayas (Chamoli, Uttarakhand)*. **Journal of the Indian Society of Remote Sensing**, Manuscript **ISRS-D-25-00835**, first revision completed, 2025. Link to Manuscript.

Under Review / In Revision

1. *Decoding the Non-Farm Transformation: a t-SNE–SHAP stacking ML audit of rural livelihood transformation in India's Rarh Region.* **Global Environmental Change**, Manuscript **GEC-D-25-01581**, first revision, 2025. (Stacking accuracy ≈ **93%**; t-SNE + SHAP anomaly checks ≈ **19%** flagged.) Link to Manuscript.

2. *(Co-author) A comparative study of AHP vs ML for groundwater-potential mapping in South Delhi.* **Science of the Total Environment**, Manuscript **STOTEN-D-25-08688**, 2025 Link to Manuscript. Link to Manuscript

ACADEMIC PROJECT HIGHLIGHTS

- **Landslide & multi-hazard analytics:** DenseNet LSM with 18 factors; spatial-ensemble risk maps; field-verified via GCP/AUC-ROC.
- **DEM reconstruction:** Dual-stage CRPAG→DS-HAT pipeline; RMSE and SSIM gains over MCU-Net/U-Net baselines in high-curvature terrain.
- **Socio-economic ML:** Stacking classifier (RF/SVM/DT) with SHAP interpretability; introduced **t-SNE + Isolation Forest** QA to flag ~19% anomalous responses.
- **Flashflood and hydrodynamic analysis:** Physics guided ML model for runoff; **CN-LSTM-CNN** runoff estimation per pixel. Runoff on grid topography for flash flood hydrodynamic simulation (Velocity, depth and extent).
- **Miscellaneous :** AI based Post disaster analysis (Notebook LM) using HecRAS 2D modelling and NASA IMERG data pipeline development.

WEBINAR (TUTORIAL) AND PRESENTATION (*related to research*)

Webinar Link+1 Presentation Link+1 Current Projects / Unpublished work - (PDF Version)

EDUCATION

Ph.D., Geography (GIS/RS/AI ML) — Delhi School of Economics, University of Delhi | 2022–Present (Thesis: Multi-Hazard Assessment using AI/ML; Joshimath, Uttarakhand, India).
M.A., Geography — Delhi School of Economics | 2021 (GIS & RS, DIP, DTM).
B.Sc., Geography — Presidency University, Kolkata | 2019.

AWARDS

- ANRF ITS (formally DST SERB) for MEDGU 2025 International Conference.
- **1st Prize (Best Paper),** 43rd INCA International Conference (ISRO NRSC, Jodhpur), Nov 2023. Link to INCA Annual Report (Page No.- 639): Link to award page

- **UGC NET-JRF:** Nov 2020 & Mar 2023;
- **WB-SET:** 2022.

TRAININGS & WORKSHOPS

Geospatial Science & Technology (Level-2), DTU (21 days, May–Jun 2024) • Glaciology (Level-2), Univ. of Kashmir (22 days, Sep 2024) • Indo-Swiss Workshop on Rock-Ice Avalanche Modelling, CSIR-CBRI, IIT Roorke (Sep 2023) • Climate Change & Hydrological Impact Assessment, NIH Roorkee (Dec 2022) • Optical Luminescence Dating, IISER Kolkata (Jan 2023).