SHUBHAM SINGH

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PROFESSIONAL SUMMARY

An experienced and accomplished Ph.D. student specializing in remote sensing and geospatial analysis, with PolSAR and InSAR techniques. Have a strong track record of publishing research in reputable journals. Proficient in monitoring key land biophysical parameters such as LAI, NDVI, RVI, and Soil Moisture using diverse satellite (Sentinel-1/2, RISAT-1A) and UAV datasets (SAR, Optical, and Hyperspectral). Skilled in advanced data analysis and machine learning techniques, extracting valuable insights from complex geospatial data.

EDUCATION

Doctor of Philosphy (Ph.D.), Department of Physics, Indian Institute of Technology (BHU) Varanasi, India

- **Degree award date:** 21 November 2023.
- **Thesis title:** Development of Scattering Algorithm Through Polarimetric Decomposition Technique for Surface and Biophysical Parameters Estimation Using Machine Learning.
- Relevant Coursework: Advanced Mathematical and Statistical Physics, Radar and optical Remote Sensing, Advanced Electromagnetism

BS-MS Dual Degree, Indian Institute of Science Education and Research Bhopal, India July 2012 - June 2017

- **Major:** Physics (Cosmology)
- Relevant Coursework: Linear Algebra, Statistical Physics, Calculus, Numerical Methods.

SKILLS

Technical Skills	High Performance Computation (HPC), TensorFlow, Machine Learning/Deep Learning
Soft Skills	Python, R, FORTRAN, IDL, MATLAB, Mathematica, NumPy, SciPy, Pandas, GDAL
Satellite Data	**SAR:** Sentinel-1/2, RISAT-1A (EOS-04); **Optical:** MODIS, Landsat 8 ; UAV, Drone
Image Proc.	Google Earth Engine (GEE), raster data, ArcGIS, SNAP, PolSARPro, QGIS, ENVI

EXPERIENCE

Post Doctoral Fellow October 2024 - Present
Tufts University *Boston, USA*

- **Develop and implement biophysical models** at local, regional, and global scales to evaluate environmental changes, including climate variations and land use/land cover dynamics.
- **Process and synthesize diverse data sets**, such as SAR and optical remote sensing data, alongside socioeconomic information to conduct multi-level analyses.
- **Assess environmental and societal impacts** through comprehensive analyses of biophysical and socioeconomic data, contributing to informed decision-making in environmental management and policy.

Geospatial Analyst Nov 2023 - July 2024
GalaxEye Space *Bangalore, India*

- Developing pipeline for SAR interferometry (InSAR) for drone and space based imagery.
- Developing algorithms and workflows to automate the CCD and ISAR processes, improving efficiency and accuracy in data analysis.
- Developing custom algorithms and software tools for SAR image formation, focusing on improving resolution, reducing noise, and enhancing image quality.

Research Scholar Jul 2018 - 21 Nov 2023
Indian Institute of Technology (BHU) *Varanasi, India*

- Performed processing of SAR datasets e.g. Cleaning, Calibration, Geometric Correction, Geocoding, noise removal, Speckle filter, radiometric correction, and matrix decomposition.
- Developed scientific algorithm which shows the shortcoming of the sen2cor atmospheric correction algorithm on Sentinel-2 Optical datasets using Bayesian inference.
- Developed deep learning algorithm to fuse SAR and Optical data to increase the validation accuracy upto 91%.
- Developed and implemented scattering models for upscaling and downscaling the spatial resolution alongwith Surface and vegetation feature identification and classification from satellite images.
- Experienced in designing, conducting exploratory analysis, data preprocessing, and post-processing of Earth Observation satellite data and derived datasets at scale.
- Designed and implemented time series data pipeline to process semi-structured data by integrating SAR and Optical data using Python, SNAP, and ArcGIS.

Junior Research Fellow (JRF) Aug 2017 - 31 Dec 2017
Indian Institute of Science Education and Research (IISER) Bhopal *Bhopal, India*

- Developed and implemented a statistical and computational model for polymer translocation through menbrabe nanopore.
- Solved Langevin equation to calculate kinetic, potential, and total energy profile of the system over time using Markov Chain Monte Carlo (MCMC) and Random sampling(RC) Method.
- Analyzed simulation results to identify key factors influencing the underlying mechanism.

PROJECTS

Masters Project. In this work, I undertook a comprehensive investigation of the Cosmic Microwave Background (CMB) anisotropy, focusing on the anomalies at low multipole. Through a rigorous analysis of the CMB temperature anisotropy, I formulated a novel observable that can accurately measure the CMB statistics.

RESEARCH PUBLICATION

Published (click on the name of the paper to open)

- **Fusion of Optical and SAR Data Using Three Approaches for the Estimation of LAI With Modified Integral Equation Model.**
  First Author, IEEE Geoscience and Remote Sensing Letters (2024).
- **Incorporation of first-order backscattered power in Water Cloud Model for improving the leaf area index retrieval using dual-polarized Sentinel-1 SAR datas.**
  First Author, Remote Sensing of Environment (2023).
- **Improved accuracy of volume power estimated from optimized dual polarized SAR decomposition.**
  First Author, International Journal of Remote Sensing (2023).
- **Synergy of dual – polarimetric radar vegetation descriptor and Gaussian processes regression algorithm for estimation of leaf area index.**
  First Author, International Journal of Remote Sensing (2022).
- **Development of a new vegetation modulated soil moisture index for the spatial disaggregation of SMAP soil moisture data product.**
  Co-Author, Physics and Chemistry of the Earth (2024).
- **Far-ield bistatic scattering simulation for rice crop biophysical parameters retrieval using modified radiative transfer model at X-and C-band.**
  Co-Author, Remote Sensing of Environment (2022).

- **Time-series polarimetric bistatic scattering decomposition using comprehensive modified first-order radiative transfer model at C-band for vegetative terrain and validation.**
  Co-Author, International Journal of Remote Sensing (2022).
- **Roughness characterization and disaggregation of coarse resolution SMAP soil moisture using single-channel algorithm**
  Co-Author, Journal of Applied Remote Sensing(2021).
- **A Comparison of Machine-Learning Regression Algorithms for the Estimation of Lai Using Landsat-8 Satellite Data**
  Co-Author, International Society for Photogrammetry and Remote Sensing

Under review/Submitted

- **Enhanced First-Order Radiative Transfer Model for Soil Moisture and LAI Retrieval from Sentinel-1 SAR Data: A Monostatic Approach**
  Second-Author, Submitted to Remote Sensing of Environment(2024) and is under revision.
- **Estimating biophysical and biochemical parameters from a novel half range pseudo hyperspectral image generated from UAV imagery**
  Co-Author, Submitted to International Journal of Remote Sensing (2024). and is under revision
- **Analytically Modified Anisotropic First-order Radiative Transfer Model Calibration via X and L Band Bistatic Radar Measurements over Vegetation**
  Co-Author, Submitted to IEEE Transactions on Geoscience and Remote Sensing (TGRS) (2024).
- **Evaluating Various Vegetation Indices in the Triangle Method for High-Resolution Soil Moisture Estimation Co-Author**, Submitted to International Journal of Remote Sensing (2024)).

CONFERENCES AND WORKSHOPS

1. National Seminar on Grand Challenges in Earth System Sciences 2023
Institute of Environment and Sustainable Department. *BHU, India*

2. Investigation of Optimized Modified Water Cloud Model with Semi-Empirical and Physical Surface Scattering Model for Retrieval of Leaf Area Index 12-16 Dec 2022
Poster Presentation, American Geophysical Union (AGU), Fall meeting. *Chicago, IL, USA*

3. Techniques in Hyperspectral Data Analysis and Processing 2020
Institute of Environment and Sustainable Department. *BHU, India*

4. 101 Indian Science Congress 2014
University of Jammu. *Jammu, India*

AWARDS

- INSPIRE Fellowship (for Ph.D.) funded by the Department of Science and Technology (DST), Government of India.
- INSPIRE Scholar for five years (during BS-MS) funded by DST, Government of India.
- Among the top 1% successful candidate in Senior Secondary Exam, Uttar Pradesh State of India.

LEADERSHIP

- I have had the privilege of guiding and mentoring numerous students, including new Research Scholars., M.Sc., M.Tech., and B. Tech candidates, in their projects and final year thesis. With a focused vision and strategic approach, I empower my research group to tackle challenges head-on and devise inventive solutions. I am dedicated to nurturing emerging talent, fostering innovation, and delivering exceptional outcomes through proactive problem-solving and effective project management.