Prahlada Varada Mittal

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Areas of Interest : Computational Modeling & Inversion, Geodynamics, Remote Sensing, Seismology, Machine Learning

Education

Australian National University, Australia Jun 2024 - Jun 2025
Masters Thesis in Geodynamics, RSES
Future Research Talent Award

Indian Institute of Technology Roorkee, India Aug 2020 - Jun 2025
Integrated Masters (B.Tech + M.Tech) in Geophysical Technology
CGPA: 8.87/10.0 (Class Rank - 3)

Scholar's Academy, Roorkee (CBSE), India Apr 2020
Higher Secondary Education
Grade 12 Percentage : 93 % (2nd in School)

Scholar's Academy, Roorkee (CBSE), India Apr 2018
Secondary Education
Grade 10 Percentage : 92 % (2nd in School)

Achievements

Future Research Talent Award - 8,500 AUD 2024
College of Science, Australian National University

Best M.Tech Thesis 2025
Deptt. of Earth Science, IIT Roorkee

GAIP Scholar 2022
School of Computing, National University of Singapore

Cleared IIT-JEE with 99.2%ile 2020
Entrance Exam for IITs

Journal Publications

Unsupervised learning framework for region based damage assessment on xBD, a large satellite imagery Published Jun 2023
PV Mittal, R Bafna, A Mittal
Pg 1619-1643, Vol 118, Natural Hazards, Springer (2023) | **Link to Paper**

- Developed an unsupervised framework to assess regional damage from natural hazards using satellite imagery.
- Designed a density-based clustering algorithm and integrated a disaster navigation tool with Google Maps.
- Achieved region-wise damage mapping without labeled data, enabling scalable disaster response.

Machine Learning Models for Mining Social Media Data for Effective Natural Disaster Assessment Jun 2024
PV Mittal, S Karki, S Parasher, S Narang, A Mittal
Natural Hazards Review, ASCE (In Review) | **Link to Paper**

- Built an integrated text-and-image ML framework to assess disaster impact from social media data.
- Developed damage-type classifiers and designed tools to deliver timely, tailored aid to affected individuals.
- Enabled real-time damage analysis to enhance response efficiency during natural disasters.

From Field to Diagnosis: Leveraging Farmer Query to Detect Crop Diseases in a Changing Climate Sept 2024
DS Rawat, A Agarwal, *PV Mittal*, A Mittal, N Yeril
IEEE Transactions on AgriFood Electronics (In Review)

- Developed a machine learning pipeline to detect crop diseases from farmer queries under climate stress.
- Created labeled datasets using N-grams and expert input, and trained models linking disease to environmental factors.
- Enabled customized support for farmers and authorities through automated disease identification and response.

Conferences

Natural Disaster Twitter Data Classification using CNN and Logistic Regression Aug 2023
S Parasher, *PV Mittal*, S Karki, S Narang, A Mittal
International Conference on Soft Computing for Problem Solving (SocProS 2023), Aug 11-13, 2023
Link to Paper

- Developed a classification system for assessing disaster-related Twitter content using CNN and logistic regression.
- Contributed to model training for damage and panic classification based on textual social media signals.
- Enabled rapid disaster response through real-time analysis of public sentiment and damage reports.

Integrating GRACE Satellite Data and ML for Groundwater Level Analysis and Prediction in UP Mar 2024
M Sharma, *PV Mittal*, K Raj, A Karunakalage, M Taqi Daqiq, R Sharma
International Conference on Computations and Data Sciences(CoDS-2024), March 8-10, 2024

- Investigated groundwater level variations in Uttar Pradesh using GRACE satellite-derived storage anomalies.
- Applied machine learning models to relate GRACE data with hydrogeological features for spatial prediction.
- Provided insights into geological controls and predictive mapping for sustainable water management.

Research Projects

Constraining mantle properties by inverting for observations of dynamic topography - Masters Thesis Jun 2024 - Jun 2025
Dr. Sia Ghelichkhan & Prof. Rhodri Davies (Australian National University), Prof. Pitambar Pati (IIT Roorkee)
Link to Thesis

- Investigated mantle viscosity and density by inverting synthetic dynamic topography observations.
- Performed forward modeling using finite element methods and solved Stokes' equations for mantle flow.
- Employed adjoint-based inversion to recover spatial sensitivity of mantle viscosity and temperature.

Distributed Acoustic Sensing for Near-Surface Imaging: Modeling and Inversion Framework Jun 2025 - Present
Prof. Bharath Shekar (IIT Bombay)

- Building a Python-based framework for DAS data modeling and inversion using Rayleigh wave analysis.
- Implementing sensitivity kernel computations and damped least-squares inversion with *SPECFEM* and *Swprocess*.
- Designed for glaciated terrains to support high-resolution DAS-based shallow subsurface imaging.

Image Super-Resolution Using SRCNN and ESRGAN Dec 2022 - Jan 2023
Dr. Amirhassan Monajemi (National University of Singapore)

- Enhanced low-resolution images using deep learning-based super-resolution techniques (SRCNN and ESRGAN).
- Trained and evaluated models across multiple parameters to assess performance and visual quality.
- Compared results using PSNR, MSE, and SSIM metrics for quantitative evaluation.

Time-series analysis and feature extraction of past LPT signals from Aso Volcano Japan Apr 2023 - Sep 2023
Prof. Alex Song, University College London

- Investigated seismic signals from Aso Volcano to forecast eruptive activity using past tremor patterns.
- Performed time-series analysis and extracted features dominant during volcanic unrest phases.
- Identified characteristic precursors aiding in improved interpretation of long-period volcanic tremors.

RMT and TEM Modelling of HFT Zone Mar 2023 - Apr 2023
Prof. Bülent Tezkan (University of Cologne), Prof. M Israil (IIT Roorkee)

- Explored subsurface resistivity structure of the Himalayan Frontal Thrust using RMT and TEM methods.
- Processed and modeled field data to generate 3D geoelectric profiles of the faulted region.
- Provided insight into fault zone conductivity and its tectonic implications.

Analysis of Seismic Records of North-East India Sep 2022 - Oct 2022
Prof. Sagarika Mukhopodhyay (IIT Roorkee)

- Analyzed seismic records from the North-East India network to identify and locate regional earthquake events.
- Used Seisan software for P- and S-wave arrival picking, event classification, and hypocenter determination.
- Helped refine regional seismicity maps and event catalogs for the area.

Technical Skills

Programming languages : Python / MATLAB (Proficient), C++, C, R (Familiar)
Softwares and Tools : Jupyter Notebook, Firedrake, Paraview, MS Azure, MS Excel, LATEX, Orange
Python Lib : OpenCV, Numpy, Pandas, SciPy, Scikit-learn, Matplotlib, Pyvista, Pyadjoint, PetSc, Tensorflow
Geophysics : GAdopt, ObsPy, QGIS, Rokdoc, GMSH, Seisan, Res3DInv, KiKNet

Relevant Coursework

Computer Programming(C/C++)	Digital Image Processing	Economics
Machine Learning for Engineers	Plate Tectonics	Seismology
Strong Motion Seismology	Numerical Modelling	Well-logging
Probability and Statistics	Geoinformatics	Hydrology
Multi-dimensional Mechanics	Signal Processing	Field Theory
Physical and Structural Geology	Marine Geophysics	Petrophysics
Multi-variable Calculus	EM Prospecting	Field Training
Fundamentals of Electronics	Economic Geology	Geology of India

Teaching Experince

Mentor, Raman Classes, Roorkee: Jan 2021 - Jul 2023
Teaching Maths & Physics to students of Class 10-12 for IIT-JEE

Student Mentor, SMP, IIT Roorkee: Sep 2023 - Apr 2024
Mentoring and guiding first year students in academic courses and college adaptation

Mentor in Workshops at IIT Roorkee, COER Univ and KRM Univ: Jul 2023 - Jun 2024
Conducted workshops and provided hands-on mentoring in QGIS, machine learning, and Orange

Extracurricular Activities

Member, Marketing and Development, Raman Classes, Roorkee: Jan 2021 - Aug 2022
Marketing, Course Preparation

Participant, Hamrock Cricket Tournament, IIT Roorkee: Feb 2024 - May 2024
Bowling allrounder – helped team secure a 2nd place finish

Participant, Institute Open Championship, IIT Roorkee: March 2023, 2024
Participant in Badminton Championship - Singles

Participant, Inter IIT Trials, IIT Roorkee: September 2022
Participant in Squash and Table Tennis

Member, National Sports Organisation, IIT Roorkee: Dec 2020 - Dec 2021
Working to increase interest of youth in sports

References

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