Nimatullah

Computational Geophysics Researcher | PhD Scholar, IIT Bombay

24D0455@iitb.ac.in | Webiste | github.com/naimat04 | linkedin.com/in/naimatullah | Mumbai, India

Research Profile

Geophysics student specialising in **forward modelling and inversion**, **high-performance scientific computing**, and **Deep learning** for subsurface characterisation. Hands-on experience deploying ground-based TEM, DC resistivity, VLF-EM, and magnetic instruments in field campaigns; visiting researcher at the **Geological Survey of Finland (GTK)**, working on GPU-accelerated 3-D inversion under the MULTIVERSE project. IIT Bombay (Dept. Earth Sciences) operates a **TEMcompany TEM instrument** providing direct familiarity with TEMcompany hardware and acquisition workflows.

Education

Indian Institute of Technology Bombay (IIT Bombay) *Jul 2024 – ongoing*
(QS World Rank #129, 2026)
PhD, Geophysics CGPA: **9.26** / 10 (ongoing)
Supervisors: Prof. **Anand Singh** | Dr. **Pankaj K. Mishra**.

Indian Institute of Technology Bombay (IIT Bombay) *Aug 2022 – Aug 2024*
(QS World Rank #129, 2026)
MSc, Applied Geophysics CGPA: 7.76 / 10
Coursework: Electromagnetic Methods, Numerical Modelling, Signal Processing, Applied Geophysics, MATLAB.
MSc Dissertation: Modelling and Inversion of Cross-Well Electrical Resistivity Tomography (ERT) Data.

Jamia Millia Islamia (Central University), New Delhi *2019 – 2022*
(NAAC A++; NIRF Rank #3 – Universities, 2025)
BSc, Physics CGPA: 8.45 / 10
Coursework: Mathematical Physics, Electromagnetism, Classical Mechanics, Thermodynamics.

Research & Professional Experience

Visiting Researcher | Geological Survey of Finland (GTK), Espoo, Finland *Dec 2025 – Jan 2026*

- Developed a high-performance **3-D gravity inversion framework in Julia** with data-space inversion strategies and GPU acceleration under the **MULTIVERSE project**; manuscript submitted to *Computers & Geosciences*.
- Designed **backend-agnostic computational kernels** enabling seamless execution across CPU and GPU architectures; demonstrated order-of-magnitude speedups on million-cell models.
- Engaged with GTK researchers on large-scale geophysical modelling and the link between field acquisition and advanced inversion.

PhD Researcher | Dept. of Earth Sciences, IIT Bombay *Jul 2024 – Present*

- *TEM Inversion via Deep Learning (Python):* Built a complete **1-D TEM forward solver** using the digital-filter convolution method to generate multi-channel transient decay curves for layered half-space models; trained a neural network to invert decay transients into conductivity profiles **50× faster** than least-squares inversion.
- *3-D Gravity Inversion Framework (Julia):* Developed a modular CG-based inversion framework with Tikhonov and depth-weighting regularisation; validated on real field data. **Under review**, *Computers & Geosciences*. arXiv:2602.03857
- *Magnetic Inversion via U-Net (PyTorch):* Designed an encoder–decoder network to recover 3-D susceptibility from total-field anomaly grids, incorporating auxiliary inputs for unknown remanent magnetisation direction. **Manuscript in preparation.**
- *Physics-Guided vs. Data-Driven NN for Basement Depth (TensorFlow):* Integrated Granser's forward model as a physics constraint, reducing out-of-distribution depth error by ∼30%. github.com/naimat04/PGNN-Basement-Depth-Estimation

- **Teaching Assistant (IIT Bombay):** GS 543 (Computer Programming for Geosciences), GP 414 (Electrical Methods), GP 505 (Electromagnetic Methods); assisted in laboratory sessions, assignment evaluation, and mentoring undergraduate students.

Summer Intern | Dept. of Earth Sciences, IIT Bombay (Supervisor: Prof. Anand Singh) *May – Jun 2023*

- Conducted **magnetic and VLF-EM field surveys** for groundwater exploration: full workflow from acquisition through processing, inversion modelling, and geological interpretation.

Field Experience

TEM (TEMcompany)	Loop-transmitter and receiver-coil deployment; conductivity-depth inversion of transient decay curves for groundwater	*IIT Bombay*
DC Resistivity & ERT	Wenner and Schlumberger arrays for VES profiling and cross-well ERT; 2-D tomographic imaging; aquifer delineation.	*IIT Bombay*
VLF-EM	Tilt-angle and ellipticity profiling for shallow fault and fracture.	*IIT Bombay*
Ground Magnetics	TMI acquisition with proton-precession; diurnal correction, levelling, reduction to pole, susceptibility inversion.	*IIT Bombay*

Publications

[1] **Nimatullah** et al. "High-Performance 3-D Gravity Inversion in Julia." *Under review, Computers & Geosciences*, 2025. arXiv:2602.03857

[2] **Nimatullah** et al. "Magnetic Inversion Using Deep Learning." *Manuscript in preparation*, 2025.

Technical Skills

Programming	**Python** (Advanced), **Julia** (intermediate), MATLAB (intermediate)
EM & Geophysics	TEM forward modelling (1-D digital-filter, layered earth), 3-D gravity and magnetic inversion, DC resistivity, VLF-EM, spectral analysis, time-gate processing
HPC & Numerics	Sparse linear algebra, PCG and LSQR iterative solvers, Tikhonov regularisation, GPU acceleration (CUDA via Julia), parallel computing, MCMC
ML / DL	PyTorch, TensorFlow/Keras, U-Net, PGNNs and PINNs, physics-constrained loss functions
Hardware	Raspberry Pi, sensor integration, Wi-Fi telemetry, geophysical instrument operation (TEM, DC, VLF, magnetics)
Tools	Git, Linux and HPC cluster environments, Jupyter, LaTeX

Certifications

Advanced Learning Algorithms — Coursera (DeepLearning.AI)	*Jul 2023*
Supervised Machine Learning: Regression & Classification — Coursera	*Jun 2023*
Unconventional Reservoir Geomechanics — edX (Verified)	*Dec 2022*
Programming for Everybody (Python) — Coursera	*Sep 2022*

Additional Information

Languages	English (excellent, written and oral) | Urdu and Hindi (native)
International Exp.	Visiting researcher, GTK Espoo, Finland — 45 days on-site (Dec 2025 – Jan 2026)
Availability	Available from 1 June 2026 (matching project start date)