RIDDHI MANDAL

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EDUCATION

Doctor of Philosophy 2019-2025

Department of Chemical and Physical Sciences, University of Toronto

- **Thesis:** Integrated Theoretical Modeling and Empirical Analysis of Induced Slip and Seismic Hazard: From Parameter Sensitivity to Real-World Case Studies
- Recipient of multiple awards, and grants based on academic merit
- Nominated for OSPP finals at EGU

Master of Science 2017-2019

Indian Institute of Science Education and Research, Kolkata, India

- Conducted research at University of Cambridge
- EGU Early career researcher grant
- Recipient of DST INSPIRE Fellowship (Merit-based scholarship)

Bachelor of Science 2014-2017

Indian Institute of Science Education and Research, Kolkata, India

- Recipient of DST INSPIRE Fellowship (Merit-based scholarship)
- Selected for Vijyoshi 2014 (exclusive scientific development camp)

WORK EXPERIENCE

AI Data Analyst June 2024 - Current

DATech

- Benchmarked ML model performance using Python, statistical analysis, and feature attribution to isolate quality bottlenecks
- Identified optimization targets that improved accuracy and increased Net Promoter Score

Researcher July - December 2024

OutlierAI

- Optimized physics-informed ML models using feature engineering and model tuning
- Improved training efficiency and accuracy, accelerating deployment in resource exploration and signal analysis

PhD Researcher – Statistical Detection of Aseismic Precursors August 2023 - Current

University of Toronto

- Developed real-time anomaly detection for time-series using acoustic emission data and deep learning
- Applied wavelet transforms and neural networks for robust signal identification under high noise
- Applications include early-warning systems, structural failure prediction, and anomaly tracking in complex environments

PhD Researcher – Multi-Parameter Simulation and Reservoir Risk Modeling September 2022 - May 2025

University of Toronto

- Constructed a high-dimensional simulation environment modeling stress evolution in complex 3D systems
- Combined FEM, DEM & FDM solvers, and sensitivity analysis to forecast system instabilities under uncertain inputs
- Applied stress interaction and kinematic modeling tools for analysis under varying parameters

PhD Researcher – Computational Stress Modeling June 2020 - August 2022

University of Toronto

- Simulated material response under stress using 5,000+ variable models with dynamic friction and stress transfer

- Investigated stability domains using parametric stress testing, matrix sensitivity scans, and data-driven thresholds
- Delivered insights for risk mitigation in subsurface operations and structurally sensitive environments

PhD Researcher – Contextual Peak Detection Algorithm
January – September 2021

University of Toronto
- Engineered a high-accuracy peak detection algorithm handling >2000% frequency variance across signal types
- Achieved 96% accuracy and 92% recall, enabling robust detection across time series such as seismic, financial, and biomedical
- Outperformed established peak detection techniques, being almost two orders of magnitude faster than most techniques

Geophysicist – Taiso Alloys
March – August 2019

University of Toronto
- Conducted electromagnetic and gravity surveys, producing subsurface models with interpreted structures
- Implemented geospatial data pipelines and streamlined modeling tools for exploratory field operations
- Conducted Monte Carlo sweeps and grid-based sensitivity analysis to define failure thresholds

Masters Researcher
August 2016 - February 2019

Indian Institute of Science Education and Research, Kolkata
- Conducted integrated surveys using seismic, gravity, and InSAR datasets to model regional stress accumulation
- Performed stress tensor and moment tensor inversions to reconstruct stress fields
- Modeled rupture propagation of a large event using wavelet transforms and back-projection to reveal energy release dynamics
- Provided critical insights into stress transfer, improving regional hazard assessment and advancing deformation models.

RELEVANT PROJECTS

Option Pricing API - *C# .NET 8*
- Built a modular option pricing framework with Binomial Tree, FDM for PDE, Monte Carlo, and Longstaff–Schwartz engines, selectable via a configurable factory.
- Deployed web API with frontend for option prices and Greeks, optimized with a fast tridiagonal solver

SVI Volatility Surface Calibration Tool - *Python, Yahoo Finance API*
- Implemented SVI/SSVI volatility surface calibration with put–call parity and isotonic regression across maturities and strikes.
- Built calibration workflow on live market data to produce static arbitrage-free volatility surfaces.

Portfolio Optimizer - *Node.js, JavaScript*
- Implemented tangency portfolio optimizer using mean–variance analysis to find the maximum Sharpe ratio portfolio.
- Added Monte Carlo simulations to model portfolio returns and stress-test performance under market scenarios.

Credit Risk Modeling & Loan Approval System - *Python (scikit-learn, XGBoost, LightGBM, CatBoost)*
- Built ensemble credit risk model with Random Forests, XGBoost, LightGBM, CatBoost, weighted by a neural network meta-learner.
- Processed borrower data to predict default probability and power a loan approval decision engine.

CAREER RELATED SKILLS
- **Programming Languages:** Python, R, MATLAB, C#, C++, Fortran, JavaScript, Perl
- **High-Performance Computing (HPC):** Parallel programming and optimization; Experience with MPI, OpenMP & SLURM; Scaling and deploying machine learning models in distributed environments
- **Data & Analysis Tools and libraries:** Vertex AI, BigQuery, AutoML, Tensorflow, Pandas, SciKitLearn, OpenCV, Excel, Tableau, PowerBI, Seaborn