RAHUL RAVI

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PROFILE

Interested in developing machine learning solutions across interdisciplinary domains such as power electronics, geophysics, biomedical and geophysical Skilled in Python, PyTorch, and machine learning.

EDUCATION

MSc (Integrated) Computer Science, University of Nottingham Sept 2021 – July 2025
2:1 Honours

Specialization – Machine Learning, Data Science, Computer Vision.

WORK EXPERIENCE

Research Assistant – Power Electronics & Machines Centre, Uni of Nottingham Feb 2025 – Present

- Developed and deployed AI-powered tools for electrical machine design by leveraging a combination of machine learning and design automation principles.
- Built a user interface (UI) to enhance design automation powered by Ansys MotorCAD by integrating database management and machine learning techniques.
- Collaborated with domain experts and potential stakeholders to guide user-centric development, ensuring alignment with engineering workflows.
- Designed a scalable machine design generation framework parallel physics-based simulations constrained by power electronics principles, to generate multiple valid designs concurrently.

Research Intern – High-Performance Computing (HPC), Shell Jun 2023 – Sept 2023

- Built a semi-automatic segmentation tool for mineral exploration through seismic image processing powered by modern computer vision methods, enabling decision support.
- Applied deep learning and AI acceleration techniques to enhance scientific computing workflows.
- Collaborated with researchers to streamline HPC pipelines using Python and PyTorch in production environments.

RESEARCH EXPERIENCE

Seismic Hazard Modelling using Geological Priors and Catalog Features Nov 2025 – Present

- Developed a spatio-temporal earthquake forecasting pipeline combining adaptive spatial windows, temporal event sequencing, and graph neural networks to model short-term seismic hazard.
- Engineered a target labelling strategy using DBSCAN-derived adaptive radii and time-windowed future-event detection, allowing robust in-distribution evaluation without arbitrary spatial thresholds.
- Benchmarked static feature models vs. temporal GNNs, demonstrating measurable improvement (AUC from 0.62 to 0.68) and statistically significant gains ($p = 0.02$, Wilcoxon).
- Outlined a pathway to cross-regional generalization, including geological-feature clustering and multimodal imaging features to support zero-shot transfer to new tectonic settings.

Deep Learning for Electron Microscopy, University of Nottingham July 2025 – Present

- Denoised high resolution images from scanning and high-resolution transmission electron microscopes.
- Developed adaptive patch-based methods to train self-supervised deep learning algorithms (Noise2Void) due to the lack of ground truth.
- Applied popular image processing techniques (segmentation and sharpening) to generate robust contours to enhance regions of interest (e.g., gold lattice).

Breast Cancer Treatment Response Prediction, University of Nottingham Sept 2023 – May 2025

Breast Cancer Neoadjuvant Chemotherapy Treatment Response Prediction Using Aligned Longitudinal MRI and Clinical Data (https://arxiv.org/abs/2512.17759)

Best individual CS research project prize (runner up).

- Introduced a pipeline to predict clinical outcomes by modelling treatment response amongst 600 breast cancer patients.
- Produced tumour masks for both baseline and endpoint MRI scans (~1700) using an interactive image segmentation tool.
- Trained an intensity-based image registration network to align longitudinal MRI scans.
- Extracted radiomic and deep features 4 extractors (1 radiomic and 3 deep-feature) to enhance the representation of data for modelling.
- Built and evaluated 5 statistical machine learning models to predict treatment response (PCR) and relapse-free survival (RFS).
- Found that image registration improves predictive performance significantly.

PROJECTS

Thyroid Cancer Treatment Response Modelling (Group Project – University of Nottingham)

- Developed ML models to predict treatment response and recurrence using clinical data from 383 patients.
- Applied 3 feature selection methods, 5-fold cross-validation, and a 4-parameter per model, grid search for robust evaluation.
- Achieved AUC of 0.83 (response) and 0.93 (recurrence) on hold-out test data.

Scalable Clustering of Large-Scale Trajectory Data (Joint Research Project – University of Nottingham)

- Designed and implemented unsupervised clustering methods on large GPS trajectory datasets containing highly unstructured, spatiotemporal data.
- Analysed scalability trade-offs using 2 lightweight algorithms (DBSCAN and K-Means) and dimensionality reduction techniques (e.g., TRACLUS).
- Optimized performance under constrained compute settings by benchmarking across batch sizes, memory usage, sampling, and partitioning strategies (e.g. 100x100, 200x200 grid-based).
- Gained hands-on experience with geospatial data pipelines, clustering evaluation metrics, and performance profiling tools.

CERTIFICATIONS

Generative AI with Diffusion Models – NVIDIA Deep Learning Institute Jun 2024

- Covered foundational and advanced concepts in generative AI.
- Deployed diffusion-based models for image synthesis and enhancement tasks using PyTorch and NVIDIA GPUs.

SKILLS

- **Programming**: Python, MATLAB, SQL
- **Machine Learning & Deep Learning:** PyTorch, Scikit-Learn.
- **Tools & Platforms:** GIS, ROS, Git, CUDA, Databricks.
- **Soft Skills**: Teamwork, Problem Solving, Leadership, Accountability.