Saurabh Patil

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Education

- **Carnegie Mellon University** — Pittsburgh, USA
  Master of Science in Mechanical Engineering; GPA: 3.95/4.0 — *Jan 2021 – Dec 2022*
- **Vellore Institute of Technology** — Chennai, India
  Bachelor of Technology in Mechanical Engineering; GPA: 9.13/10.0 — *Jun 2016 – Jun 2020*

Experience

- **Graylark Technologies** — Remote
  AI Research Engineer (Full-time) — *Oct 2025 – Present*
  - Proposed and implemented a patch-level cross-attention framework to enhance alignment between visual and geospatial embeddings for image geolocalization.
  - Designed a curriculum learning training pipeline inspired by progressive human learning, improving model robustness and generalization across diverse geographic regions.
  - Delivered state-of-the-art results on the IM2GPS3K benchmark, outperforming prior geolocalization methods across multiple top-k retrieval metrics.
- **IIT Roorkee** — Remote
  Research Assistant (Full-time) — *Jan 2025 – Sept 2025*
  - Contributed to geospatial AI research focused on large-scale cross-modal image geolocalization and retrieval systems.
  - Performed extensive benchmarking and failure-mode analysis to identify retrieval bottlenecks and guide model and reranking improvements.
  - Developed a multimodal reranking framework combining image and location embeddings, significantly improving retrieval precision compared to unimodal baselines.
- **Carnegie Mellon University** — Pittsburgh, PA
  Research Assistant (Full-time) — *Jan 2023 – Jan 2024*
  - Developed the Hyena neural operator, exploiting its sub-quadratic complexity and global receptive field to achieve data-dependent, context-aware weighting for learning PDE solution operators.
  - Benchmarked the Hyena operator against the Fourier neural operator on diffusion-reaction and Navier-Stokes equations, demonstrating competitive accuracy at substantially reduced computational cost.
  - Architected the Latent Neural PDE Solver (LNS), a nonlinear autoencoder that projects full-order PDE representations onto a mesh-reduced latent space, significantly cutting training costs associated with fine-grid discretizations.
- **Carnegie Mellon University** — Pittsburgh, PA
  Graduate Research Assistant (Intern) — *May 2022 – Aug 2022*
  - Leveraged conditional diffusion models to generate solutions for steady-state heat conduction and incompressible fluid flow directly from observational data, without relying on known governing equations.
  - Replaced traditional iterative numerical solvers with a learned generative approach that produces accurate physical field predictions conditioned on arbitrary boundary conditions and geometries.
  - Achieved high test accuracy (MAE $< 1\%$) in generating physics-consistent solutions across varied domains using diffusion-based architectures.

Projects

- **Forecasting COVID-19 Cases with Transformers**: Built a Transformer-based time-series model to forecast new COVID-19 cases in India, Russia, and Brazil, outperforming CNN and LSTM baselines with a test MAE below 0.2%. (Dec '22)
- **Adversarial Robustness of 3D Point Cloud Classifiers**: Implemented the Fast Gradient Sign Method and Saliency Map attack to probe the robustness of PointNet and DGCNN on the ModelNet40 benchmark, quantifying accuracy degradation under adversarial perturbation. (May '22)
- **Aerodynamic Tail Design for Mobile Robots (AeroDIMA)**: Designed and simulated an aerodynamic tail in SolidWorks using CFD to maximize drag force, enhancing robot stability during high-speed subsonic angular maneuvers. (May '22)

Publications

- **CaFA (arXiv, 2024)**: Li Zijie, Zhou Anthony, **Patil, Saurabh**, and Amir Barati Farimani. "CaFA: Global Weather Forecasting with Factorized Attention on Sphere." *arXiv*, 2024.
- **Latent Neural PDE Solver (J. Comput. Phys., 2025)**: Li Zijie, **Patil, Saurabh**, Francis Ogoke, Dule Shu, Wilson Zhen, Michael Schneier, John R. Buchanan Jr., and Amir Barati Farimani. "Latent Neural PDE Solver: A Reduced-Order Modelling Framework for Partial Differential Equations." *Journal of Computational Physics*, 2025.
- **Hyena Neural Operator (APL Machine Learning, 2023)**: **Patil, Saurabh**, Li Zijie, and Amir Barati Farimani. "Hyena Neural Operator for Partial Differential Equations." *APL Machine Learning*, 2023.
- **Forecasting COVID-19 (medRxiv, 2023)**: **Patil, Saurabh**, Mollaei Parisa, and Amir Barati Farimani. "Forecasting COVID-19 New Cases Using Transformer Deep Learning Model." *medRxiv*, 2023.

Skills Summary

- **Languages**: Python
- **Frameworks**: NumPy, Pandas, Matplotlib, PyTorch, TensorFlow, Keras, Scikit-learn, HuggingFace
- **Platforms**: Linux, AWS, Google Cloud Platform (Compute Engine, Cloud Storage, AI Platform)