Nikhil Dadheech

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Education

PhD, University of Washington Seattle, WA (Sept 2021 – Present)
Advisor: Dr Alex Turner

BTech, Indian Institute of Technology (IIT Delhi) Delhi, India (July 2015 – May 2019)
Advisor: Dr Mukesh Khare

Experience

Research Assistant, University of Washington Sept 2021 – Present

- Trained physics-guided distributed model to identify high-impact emission sources, reduced analysis time by 1000×
- Developed a high-resolution real-time AI-driven GHG emission monitoring framework, achieving a 650× speed up.
- Developed an ML emulator of transport that outperforms physics-based transport models in flux inversions.

Applied Scientist Intern, Amazon Web Services June 2025 - Sept 2025

- Built webstream-based **multimodal AI assistant** (vision, audio, & text) to automate AWS bug troubleshooting.
- Deployed a low-latency, real-time video call enabling end-to-end live multimodal AI-based AWS services support.
- Demonstrated autonomous case resolution by multimodal AI assistant with **86%** accuracy on AWS services.
- This work was accepted as an oral presentation at **Amazon Machine Learning Conference (AMLC; 2025)**.

Data Scientist, Innoplexus July 2019 – Sept 2021

- Developed AI-driven semi-supervised healthcare key opinion leaders clustering pipeline using graph learning.
- Pre-processed, created, & managed biomedical knowledge graph of 400M entities with 1.5B relationships in Neo4j.
- Developed entity recognition & relationship extraction models to identify biomarkers with 96% accuracy.
- Received "Award of Excellence" for rapid learning ability & exceptional performance in entity normalization.

Data Science Intern, Innoplexus May 2018 – July 2018

- Developed Named-Entity-Recognition model using NLP for identifying hierarchy in entities for normalization.
- Trained ML model to detect junk entities, increasing data cleaning efficiency by 20% in pre-processing pipeline.
- Received a **full-time offer** as a data scientist for exemplary performance and accomplishment of deliverables.

Relevant Projects

Large Scale Distributed Learning for Physics-Guided Scientific Computing

- Developed a deep learning model to approximate Jacobian sensitivities for spatiotemporal observing systems.
- Designed a high-throughput Distributed Data Parallel pipeline, achieving 1000x speedup over physics-based solvers.

Building a Multimodal (Vision) Language Transformer

- Built a multimodal transformer model inspired by PaliGemma from first principles; implemented Vision Transformer, SigLIP, rotary positional embeddings, grouped-query attention, and KV-cache for efficient inference.
- Implemented inference strategies including top-p, temperature-controlled generation, greedy, and beam search.

From-Scratch Implementation of Llama 4 and Llama 2 with Custom Decoding Strategies

- Re-implemented the Llama 4 & Llama 2 architectures from first principles, including mixture of experts, vision modality, rotary positional encodings, KV cache, scalable softmax, and RMS normalization.
- Developed and benchmarked multiple inference algorithms (greedy, top-k, top-p) to evaluate decoding trade-offs.

Missing Data Reconstruction in Images using Diffusion Models

- Adapted a conditional Stable Diffusion framework to reconstruct missing regions in images.
- Leveraged multimodal conditioning (image + text) within Stable Diffusion to improve reconstruction fidelity

Characteristics of Photochemical Pollutants over Indo-Gangetic Plain

- Developed regression models using Random Forest to predict the ozone concentrations over Indo-Gangetic Plain.
- Selected for the **Best BTech Project** Award bestowed to only one student in the entire graduating class.

Awards

- Future Investigator in NASA Earth and Space Science and Technology (NASA FINESST; Sept 2022 – Dec 2025)
  - Proposed a 3-year research plan for AI-driven hybrid models for greenhouse gas monitoring and climate modeling.
- Integral Environment Big Data Research Fund (2021 – 2022)
  - Proposed a one-year research plan to the Integral Charitable Foundation on leveraging big data and machine learning for improving GHG emissions inventory for climate models.
- Department of Atmospheric Sciences Scholar Award (2021)
  - Merit-based award for excellent academic performance.
- IIT Delhi Department of Civil Engineering Best B.Tech. Project (Mr. & Mrs. Prem Sheel Bhatnagar Award 2019)
  - Awarded to the top student in the graduating class for outstanding research, published in Chemosphere journal.
- Centre of Excellence for Research on Clean Air Grant (2019)
  - Merit-based award for undergraduate research on air pollution in Indo-Gangetic Plain.
- Dakshana Foundation Scholarship (2013 – 2019)
  - Awarded the merit-based high-school and undergraduate scholarship after passing a national-level written test.

Publications

Dadheech, N., and Turner, A. J. (2025). Simulating out-of-sample atmospheric transport to enable flux inversions. Atmospheric Chemistry and Physics, 26(1), 427-441.

Dadheech, N., He, T. L., and Turner, A. J. (2025). High-resolution greenhouse gas flux inversions using a machine learning surrogate model for atmospheric transport. Atmospheric Chemistry and Physics, 25(10), 5159-5174.

Dadheech, N., He, T. L., Thompson, T. M., and Turner, A. J. (2025). FootNet v1.0: development of a machine learning emulator of atmospheric transport, Geosci. Model Dev., 18, 1661–1671,

Shukla, K., **Dadheech, N.**, Kumar, P., & Khare, M. (2021). Regression-based flexible models for photochemical air pollutants in the national capital territory of megacity Delhi. Chemosphere, 272, 129611.

Extracurricular Activities

Department Colloquium Committee Member May 2024 – Present

Graduate Student member

- Coordinating with professors and students in the department to invite external speakers for weekly colloquia.
- Leading collaboration efforts with students to host external speakers and ensure diversity among speakers.

Student Advisory Council Sept 2021 – Dec 2022

Graduate Student Advisor

- Elected student member of the council of the dean of the College of Environment at the University of Washington.
- Advocated for student perspectives on key issues and promoted an inclusive, interdisciplinary college community.

Mentorship Sept 2021 - Aug 2022

Undergraduate students

- Lauren Yarrington, Detecting natural gas leaks from space using computer vision.
- Simon Zhang, Conducting GHG flux inversion with iterative methods. Next position:PhD student at U. Minnesota.