

MRIDUL KHURANA

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EDUCATION

Virginia Tech

PhD. in Computer Science, *Advisor: Dr. Anuj Karpatne* GPA 4.0/4.0

Aug 2022 – May 2027

Blacksburg, Virginia

Courses: Computer Vision (CV), Natural Language Processing (NLP), Deep Reinforcement Learning (RL), Adv Machine Learning

Delhi Technological University

Bachelor of Technology (B.Tech.), Electrical Engineering

Aug 2015 - May 2019

New Delhi, India

RESEARCH INTERESTS

My research focuses on multimodal generative AI for scientific discovery, developing diffusion models for fine-grained and controllable species image generation guided by novel modalities - taxonomic trees and environmental data - to study species

SELECTED PUBLICATIONS & PREPRINTS

9. **Mridul Khurana**, Arka Daw, M. Maruf, ..., Anuj Karpatne. "Hierarchical Conditioning of Diffusion Models Using Tree-of-Life for Studying Species Evolution." **ECCV 2024** ([Paper](#))
8. Amin Karimi Monsefi, **Mridul Khurana**, Rajiv Ramnath, Anuj Karpatne, Wei-Lun Chao, Cheng Zhang. "TaxaDiffusion: Progressively Trained Diffusion Model for Fine-Grained Generation and Trait Discovery." **ICCV 2025** ([Paper](#))
7. Kazi S. Mehrab, M. Maruf, Arka Daw, Harish. B. Manogaran, Abhilash Neog, **Mridul Khurana**, ..., Anuj Karpatne "Fish-Vista: A Multi-Purpose Dataset for Understanding & Identification of Traits from Images". **CVPR 2025** ([Paper](#))
6. Medha Sawhney, Abhilash Neog, **Mridul Khurana**, Amartya Dutta, Arka Daw, Anuj Karpatne. "Physics-guided Diffusion Neural Operators for Solving Forward and Inverse PDEs." **CVPR 2025 Workshop** on CV4Science.
5. Amartya Dutta, K.S. Mehrab, Medha Sawhney, Abhilash Neog, **Mridul Khurana**, ..., Anuj Karpatne. "Open World Scene Graph Generation using Vision Language Models." **CVPR 2025 Workshop** on CV in Wild. ([Paper](#))
4. Mohannad Elhamod, **Mridul Khurana**, Harish Babu Manogaran, ..., Anuj Karpatne. "Discovering Novel Biological Traits from Images using Phylogeny-guided Neural Networks." **KDD 2023 (Oral)** ([Paper](#))
3. **Mridul Khurana**, Arka Daw, M. Maruf, ..., Anuj Karpatne. "Conditioning Diffusion Models Using the Knowledge of Phylogeny for Understanding Species Evolution". **AAAI 2024 Workshop (Oral)** on Imageomics ([Poster](#))
2. M. Maruf, Arka Daw, Kazi S. Mehrab, Harish. B. Manogaran, Abhilash Neog, Medha Sawhney, **Mridul Khurana**, ..., Anuj Karpatne. "VLM4Bio: A Benchmark Dataset to Evaluate Pretrained Vision-Language Models for Trait Discovery from Biological Images." **NeurIPS 2024** ([Paper](#))
1. Mohannad Elhamod, **Mridul Khurana**, Harish Babu Manogaran, ..., Anuj Karpatne. "Discovering Novel Biological Traits from Images using Phylogeny-guided Neural Networks." **CVPR 2023 Workshop (Oral)** on CV4Animals ([Poster](#))

PROFESSIONAL EXPERIENCE

AMD

Research Intern

San Jose, CA

Jan 2025 – May 2025

- **Model optimization** using sparsity-aware **quantization (SpQR)** of LLMs like **Llama-3**, Falcon for near-lossless inference.
- Extending **Quark quantization** capabilities to **Mixed-Precision** using SpQR and improving over **GPTQ** to near loss-less.
- Taming **Diffusion Transformers** with **RoPE** for high-resolution image synthesis – inference first perspective.

Knowledge-guided ML Lab, Virginia Tech (Advisor: Dr. Anuj Karpatne)

Graduate Research Assistant

Blacksburg, VA

Sep 2022 – Present

- **Hierarchical** conditioning of **Stable Diffusion**, for studying species evolution and accelerating scientific discoveries (**ECCV'24**)
- Progressive training of **Text-to-Image** models for **Fine-Grained** generation and Trait discovery. (**CVPR'25 Workshop**)
- **Multimodal scientific benchmark dataset** for Vision Language Models (VLMs) including **GPT-4o**, LLaVa, BLIP (**NeurIPS'24**)

Theremin.ai (Quant startup)

Software Engineer

Mumbai, India

May 2020 -July 2022

- Designed and built a **Trading Platform (OMS)** handling over **\$10 Million** in Indian stock markets. Mentoring **2 interns**.
- Achieved a **15x increase** in data volume to support **1,500 securities**, deploying **event-driven trading** framework on **AWS**.

Website: mridulk97.github.io

LinkedIn: [mridulk97](#) | [Google Scholar](#)

Fractal Analytics

Mumbai, India

Software Engineer

June 2019 – Apr 2020

- Built ML models with **10,000+ variables** reducing dimensionality by **97%** using **PCA**, variable binning & **clustering**.
- Used **Random Forest** and **XGBoost**, achieving **10% increase** on an F1 score from previous models.

Vision and AI Lab, IISc Bangalore (Advisor: Dr. R. Venkatesh Babu)

Bangalore, India

Research Intern

May 2018 – July 2018

- Developed **monocular depth estimation** models using **CNNs** (ResNet-50) & fovea transformations for outdoor scenes.
- The absolute & squared relative errors were reduced by 0.7% and 2% resp. on the KITTI stereo dataset (at par with SOTA).
- Employed Fully Convolutional Residual Networks (**FCRN**) using **unsupervised learning** for indoor scenes in Tensorflow.

PROJECTS

Mitigating Simple and Adversarial Attacks on Vision Language Models (VLMs)

[GitHub](#)

Feb 2024 - May 2024

- Jailbreaking and mitigating positional biases & adversarial vulnerabilities in VLMs on MCQA tasks.
- Proposed **Visual Latent Smoothing** enhancing robustness of LLaVa & BLIP VLMs against adversarial attacks by **9% & 4%** resp

Numeral-Aware Large Language Models (LLMs)

[GitHub](#)

Sep 2023 – Dec 2023

- **Prompt tuning** and Instruction fine-tuning **Llama-2** using **LoRA** for accurately generating numeral-aware news headlines.

INVITED TALKS AND AWARDS

- **Tree-of-Life Meets AI**: Knowledge-guided Generative Models, hosted by Voxel51, Nov. 2024
- Received **Travel Award** from CS Department, Virginia Tech for attending ECCV 2024.
- **Taekwondo**: State level **Gold medalist**, India. **Music**: Certified **Grade 2** drummer, Rockschoool, **Trinity College of London**.

PROFESSIONAL SERVICE

- Reviewer for **ICLR 2024**, **ICML 2025** Workshops, **NeurIPS 2023-2024** Workshops and **AAAI 2024-2025** Workshops.

TECHNICAL SKILLS

- **Programming Languages**: Python, C++, Shell Scripting, SQL, NoSQL, Git, MATLAB
- **Technologies**: PyTorch, HuggingFace, vLLM, Tensorflow, AWS, Docker, OpenCV, Scikit-learn, WandB, MongoDB