

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 2026

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

PROFESSIONAL EXPERIENCE

Graduate Research Assistant (Advisor: Dr. Anuj Karpatne)

Knowledge-Guided Machine Learning Lab, Virginia Tech

Sep 2022 – Present

Blacksburg, Virginia

- **Hierarchical** conditioning of **Stable Diffusion**, for studying species evolution and accelerating scientific discoveries (**ECCV'24**)
- Training **Bio-Diffusion** a **foundational diffusion model** for predicting evolution of animalia due to environmental changes
- **Multimodal scientific benchmark dataset** for Vision Language Models (**VLMs**) including **GPT-4o**, LLaVa, BLIP (**NeurIPS'24**)
- Building **VLM4Bio** using Retrieval-augmented generation (**RAG**) to provide species-specific trait information from images.

Software Engineer

Theremin.ai

May 2020 - July 2022

Mumbai, India

- Designed and built a **Trading Platform (OMS)** handling over **\$10 Million** in Indian stock markets. Mentoring **2 interns**.
- Achieved a **15x increase** in volume to support **1,500 securities** by implementing **Kafka** for real-time stock data streaming.
- Deployed the **event-driven architecture** framework on **AWS**, and integrated **ETL** pipelines with database using custom **APIs**

Software Engineer

Fractal Analytics

June 2019 - Apr 2020

Mumbai, India

- Built multiple ML models for **Comcast's** target marketing leveraging methods like **Random Forest** and **XGBoost**.
- Big data processing **10,000+ variables & 2M rows**, reducing dimensionality by **97%** using **PCA**, variable binning & **clustering**.
- Developed models for maximum likelihood estimation, achieved an F1 score of **77%**, a **10% increase** from previous models.

ML Research Intern (Advisor: Dr. R. Venkatesh Babu)

Vision and AI Lab, IISc Bangalore

May 2018 - July 2018

Bangalore, India

- 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** (zero-shot, one-shot and few-shot) for generating numeral-aware news headlines.
- Fine-tuned **Llama-2** using **LoRA**, **T5-large**, **XLM-Roberta** to first accurately generate numeral values and then the headline.

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, RockschooL, **Trinity College of London**.

PROFESSIONAL SERVICE

- Reviewer for **ICLR 2024 (invited)**
- Reviewer for **NeurIPS 2023-2024** Workshops and **AAAI 2024** Workshops.

TECHNICAL SKILLS

- **Programming Languages:** Python, C++, Shell Scripting, SQL, no-SQL, Git, MATLAB
- **Technologies:** PyTorch, HuggingFace, Tensorflow, AWS, Docker, OpenCV, Scikit-learn, WandB, Kafka, MongoDB

SELECTED PUBLICATIONS & PREPRINTS

6. **Mridul Khurana**, Arka Daw, M. Maruf, ..., Anuj Karpatne. “Hierarchical Conditioning of Diffusion Models Using Tree-of-Life for Studying Species Evolution”. **ECCV 2024** - European Conference on Computer Vision ([Paper](#))
5. **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](#))
4. Mohannad Elhamod, **Mridul Khurana**, Harish Babu Manogaran, ..., Anuj Karpatne. “Discovering Novel Biological Traits from Images using Phylogeny-guided Neural Networks”. **KDD 2023 (Oral)** - Knowledge Discovery and Data Mining- ([Paper](#))
3. 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](#))
2. 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](#))
1. 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”. (preprint under review) ([Paper](#))