

# MRIDUL KHURANA

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## EDUCATION

<b>Virginia Tech</b>	<b>Aug 2022 – Dec 2024</b>
M.S. in Computer Engineering, <i>Advisor: Dr. Anuj Karpatne</i> GPA 4.0/4.0	<i>Blacksburg, Virginia</i>
<b>Courses:</b> Natural Language Processing (NLP), Computer Vision, Advanced Machine Learning, Deep Reinforcement Learning	
<b>Delhi Technological University</b>	<b>Aug 2015 - May 2019</b>
Bachelor of Technology (B.Tech.), Electrical Engineering	<i>New Delhi, India</i>

## PROFESSIONAL EXPERIENCE

<b>Graduate Research Assistant (Advisor: Dr. Anuj Karpatne)</b>	<b>Sep 2022 – Present</b>
<i>Science-Guided Machine Learning Lab, Virginia Tech</i>	<i>Blacksburg, Virginia</i>
<ul style="list-style-type: none"> <li>Working on Generative AI &amp; multimodal vision using techniques - <b>Stable Diffusion</b>, <b>GANs</b> &amp; variational autoencoders (<b>VAEs</b>)</li> <li>Introduced Hierarchical Conditioning in <b>Diffusion models</b> using <b>Trees</b> for studying species evolution. (in review <b>ECCV 2024</b>)</li> <li>Benchmarked Vision Language Models (<b>VLM</b>) including <b>GPT-4V</b>, CogVLM on <b>multimodal scientific data</b> (in review <b>KDD'24</b>)</li> </ul>	
<b>Software Engineer (Quantitative Trading)</b>	<b>May 2020 - July 2022</b>
<i>Theremin.ai</i>	<i>Mumbai, India</i>
<ul style="list-style-type: none"> <li>Designed and built a <b>Trading Platform</b> handling more than <b>\$10 Million</b> in the Indian stock markets. Mentored <b>2 interns</b>.</li> <li><b>10x</b> volume increase to <b>1000</b> securities using <b>Kafka</b> for streaming real-time price data from the stock exchange</li> <li>Deployed the <b>event-driven architecture</b> framework on <b>AWS</b>, and upgraded <b>ETL</b> pipelines using custom <b>APIs</b></li> </ul>	
<b>Software Engineer</b>	<b>June 2019 - Apr 2020</b>
<i>Fractal Analytics</i>	<i>Mumbai, India</i>
<ul style="list-style-type: none"> <li>Built multiple ML models for <b>Comcast</b> leveraging ensemble methods like <b>Random Forest</b> and <b>XGBoost</b>.</li> <li>Big data processing with <b>10,000+ variables</b> using feature engineering like <b>PCA</b>, <b>variable binning</b> and clustering.</li> <li>Developed models for maximum likelihood estimation, achieved an F1 score of <b>77%</b>, improving the existing client models.</li> </ul>	
<b>Research Intern (Advisor: Dr. R. Venkatesh Babu)</b>	<b>May 2018 - July 2018</b>
<i>Vision and AI Lab, IISc Bangalore</i>	<i>Bangalore, India</i>
<ul style="list-style-type: none"> <li>Developed <b>monocular depth estimation</b> models using <b>CNNs</b> (ResNet-50) &amp; fovea transformations for outdoor scenes.</li> <li>The absolute and squared relative errors were reduced by 0.7% and 2% resp on the KITTI stereo dataset.</li> <li>Employed Fully Convolutional Residual Networks (<b>FCRN</b>) using <b>unsupervised learning</b> for indoor scenes in Tensorflow.</li> </ul>	

## PROJECTS

<b>Numeral-Aware Large Language Models (LLMs)</b>	<a href="#">GitHub</a>	<b>Sep 2023 – Dec 2023</b>
<ul style="list-style-type: none"> <li><b>Prompt tuning</b> (zero-shot, one-shot and few-shot) for generating Numeral Aware news headline.</li> <li>Fine-tuned <b>Llama-2</b> using <b>LoRA</b>, <b>T5-large</b>, <b>XLM-Roberta</b> to first accurately generate numeral values and then the headline.</li> </ul>		
<b>Decision Transformers in Near Real-World</b>	<a href="#">GitHub</a>	<b>Feb 2023 - May 2023</b>
<ul style="list-style-type: none"> <li>Evaluated <b>Decision Transformers'</b> (DT) efficacy on near real-world <b>Reinforcement Learning</b> tasks.</li> <li>Used offline-RL datasets <b>D4RL</b> &amp; <b>NeoRL</b> on tasks which mimic near real-world tasks such as robotic hand, FinanceRL</li> </ul>		

## TECHNICAL SKILLS

- Programming Languages:** Python, C++, Shell Scripting, SQL, Git, MATLAB,
- Technologies:** PyTorch, Tensorflow, OpenCV, AWS, RDS, EC2, Kafka, PostgreSQL, MongoDB, OOPs, WandB, Jira

## ACADEMIC SERVICES

- Reviewer for **NeurIPS 2023** Workshops:
  - Generative AI and Biology (GenBio) & Machine Learning and Physical Sciences (ML4PS)
- Reviewer for **AAAI 2024** Workshops: Responsible Language Models (ReLM) & Imageomics

## ACHIEVEMENTS

- National-level **Gold medalist** in Taekwondo, India. Basketball - (**Gold Medal** at AAHVAAAN'17, **Silver medalist** at SPORTECH'17 and UDGHOSH'17)
- Certified **Grade 2** drummer by Rockschoool, **Trinity College of London**.

## PUBLICATIONS

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### PEER-REVIEWED CONFERENCES

- **Mridul Khurana**, Arka Daw, M. Maruf, ..., Anuj Karpatne. “Hierarchical Conditioning of Diffusion Models Using Tree-of-Life for Studying Species Evolution” (in review **ECCV 2024**)
- Mohannad Elhamod, **Mridul Khurana**, Harish Babu Manogaran, ..., Anuj Karpatne. “Discovering Novel Biological Traits from Images using Phylogeny-guided Neural Networks”. In *Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD) 2023 (Oral Presentation)* ([Paper](#))
- M. Maruf, Arka Daw, Medha Sawhney, Kazi S. Mehrab, Harish B. Manogaran, **Mridul Khurana**, ..., Anuj Karpatne. “On the Zero-Shot Effectiveness of Pre-trained Vision Language Models (VLMs) for Understanding Scientific Images: A Case Study in Organismal Biology”. (in review **KDD 2024**)

### PEER-REVIEWED WORKSHOPS

- **Mridul Khurana**, Arka Daw, M. Maruf, ..., Anuj Karpatne. “Conditioning Diffusion Models Using the Knowledge of Phylogeny for Understanding Species Evolution”. In *first workshop of Imageomics at Association for the Advancement of Artificial Intelligence (AAAI) 2024 (Lightening Talk)* ([Poster](#))
- Mohannad Elhamod, **Mridul Khurana**, Harish Babu Manogaran, ..., Anuj Karpatne. “Discovering Novel Biological Traits from Images using Phylogeny-guided Neural Networks”. In *Computer Vision and Pattern Recognition Workshop - CV4Animals (CVPR) 2023 (Oral Presentation)* ([Poster published + Oral](#))