Website: sawhney-medha.github.io LinkedIn: medha-sawhney

Medha Sawhney

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EDUCATION

Virginia Tech, Blacksburg, Virginia, USA **GPA: 4.00 / 4.00** *May 2023 - Present*
PhD in Computer Science. Advisor: Anuj Karpatne

Virginia Tech, Blacksburg, Virginia, USA **GPA: 4.00 / 4.00** *Aug 2021 - May 2023*
MS Thesis in Computer Science. Advisor: Anuj Karpatne

Manipal Institute of Technology, MAHE, Manipal, India **GPA: 8.34 / 10.00** *Aug 2016 - Aug 2020*
Bachelor's in technology, Major -Electronics and Communication Engineering, Minor -Data Science

Research Focus

My research broadly focuses on physics-guided machine learning and generative AI for scientific discovery, including diffusion-based models and neural operators for inverse problems, modular symbolic regression for equation discovery, and scientific knowledge–guided methods for understanding complex biological systems.

CORPORATE EXPERIENCE

Deep Learning Automation Intern, NVIDIA *May 2024 – Aug 2024*

- Crafted a multitask learning model capable of dynamically training on multiple heterogeneous datasets with varying class counts and image-resolutions, achieving over 90% accuracy across all datasets despite significant imbalances.Challenges: Dataset imbalances (custom batch sampler and dataloader and splitting functions for train set to maintain proportions), high-res image training (patching and padding), multi-GPU efficiency (pipeline parallelism), gradient mixing.
- Designed and validated models for detecting video corruption across diverse defect types.Enhanced accuracy by 15% in an existing video corruption detection model for GPU validation, reducing false positives by 60% and false negatives by 50%, leading to significant reliability improvements.

Machine Learning Engineering Intern, Twitter *Jun 2022 – Aug 2022*

- End to end development and deployment of a broadly applicable ML model using XGBoost within the account health space
- Boosted Key performance indicators by 74%. Challenges: Data imbalance, feature sparsity, enormous data, data distribution drift

Machine Learning Engineer Hewlett-Packard R&D, Bangalore, India *Jan 2020 – June 2021*

- Engineered a self-resolution tool for PC issues, with a 3x BLEU score, employing AWD-LSTM and Natural Language Processing.
- Designed and implemented a dynamic troubleshooting tool for printer issues based on Recurrent Neural Networks
- Applied optimization strategies to build hardware-efficient and reliable ML models, including a) identifying performance bottlenecks using CUDA Kernel Profiling with NVIDIA Nsight Systems & Compute and b) examining ML models for bias

Automatic Driver Assistant Systems Team Intern, The Hi-Tech Robotic Systems, Gurgaon, India *May 2018 – Jul 2018*

- Developed a Computer Vision based Distraction Detection module using Deep Learning algorithms such as CNNs
- Cross-compiled a drowsiness detection product on ARM and constructed a unit testing framework for it, using Google test, in C++

ACADEMIC EXPERIENCE

Graduate Research Assistant, Science Guided Machine Learning Lab, Virginia Tech *Aug 2021– Present*

- Developing Physics guided machine learning diffusion models for equation discovery from videos and simulating PDE flows
- Designed a unified framework, via latent space translations, for jointly training forward and inverse problems in seismic imaging
- Constructed an algorithm to detect and track microscopic bacteria cells with a 95% precision by utilizing artificially generated motion and temporal cues for an NSF funded cancer research project. Challenge: Hard to distinguish from background media
- Engineered an approach to predict force applied by a human cell on underlying fiber intersections using multi-object detection techniques in Computer Vision like RetinaNet

Graduate Research Assistant, Informatics Lab, University Libraries, Virginia Tech *Aug 2021 – Dec 2021*

- Developed a Computer Vision solution to detect plant wilting. Improved performance accuracy by 10% with traditional methods like Support Vector Machines and feature engineering. Challenges: class imbalance, small dataset, images of varying resolutions

Research Intern, IIIT Hyderabad, Hyderabad, India *May 2019 – Jul 2019*

- Designed and deployed an object recognition tool on NVIDIA Jetson TX2 board, funded by Defence Organisation (DRDO), India
- Successfully identified landmarks in aerial imagery also from viewpoints different than trained on, using YOLO and Deep Learning

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AWARDS / HONORS/Talks

- Lightning talk at Imageomics workshop, AAAI 2024 on "Motion Enhanced Multi-Level Tracker (MEMTrack): A Deep Learning-Based Approach to Microrobot Tracking in Dense and Low-Contrast Environments."
- Lighting talk at CV4Science workshop, CVPR 2025 on "Physics-guided Diffusion Neural Operators for Solving Forward and Inverse PDEs."
- Scholarship to attend Grace Hopper Celebration Conference by AnitaB.org and Virginia Tech, 2022
- Best Paper Presentation for "An Efficient Approach to Detect Driver Distraction during Mobile Phone Usage", ICECNS-GOA 2018
- 2nd place for building a conversational agent to raise awareness of STDs, OK Google: Let's Build Hackathon, WTM Manipal, 2018
- 2nd position in Advanced Robotics Challenge by World Robot Olympiad Association (WRO) for Tetris solving bot, 2017

VOLUNTEER EXPERIENCE

- Mentor at Women in CV Workshop at CVPR 2025
- Conference reviewer for KDD'22, ICLR'25, SDM 2025
- Workshop reviewer: Imageomics AAAI'24, CV4Animals CVPR'24 and CVPR'25, ICLR'25 DeLTa and VerifAI
- Journal reviewer for IJCV'23
- Guided a team of 30+ members as Coding Head, RoboManipal, official robotics student project team at MIT, Manipal 2018-2019
- Mentored 150+ students under the GirlScript Manipal Winter Programme on C++, Java, & Object Detection using OpenCV,2018

TECHNICAL SKILLS

- PyTorch • Jupyter Lab • BigQuery ML • Machine Learning • Deep Learning • TensorFlow
- Programming Languages: Python, Java, C++, MATLAB, R

PUBLICATIONS

Journal Publications

1. **Medha Sawhney***, Bhas Karmarkar*, Eric J. Leaman, Arka Daw, Anuj Karpatne, and Bahareh Behkam. (2024) "Motion Enhanced Multi-Level Tracker (MEMTrack): A Deep Learning-Based Approach to Microrobot Tracking in Dense and Low-Contrast Environments." Advanced Intelligent Systems 6, no. 4 (2024): 2300590. https://doi.org/10.1002/aisy.202300590 (*equal contribution)

Peer-reviewed Conference & Workshop Proceedings

2. Naveen Gupta*, **Medha Sawhney***, Arka Daw*, Youzuo Lin, and Anuj Karpatne. "A Unified Framework for Forward and Inverse Problems in Subsurface Imaging using Latent Space Translations." In The Thirteenth International Conference on Learning Representations, *ICLR 2025*. (*equal contribution)
3. **Medha Sawhney**, Abhilash Neog, Mridul Khurana, Amartya Dutta, Arka Daw. "Physics-guided Diffusion Neural Operators for Solving Forward and Inverse PDEs." CV4Science *Workshop at CVPR2025*.
4. Amartya Dutta, **Medha Sawhney***, K.S. Mehrab*, Abhilash Neog, Mridul Khurana, Sepideh Fatemi, Aanish Pradhan, M. Maruf, Ismini Lourentzou, Arka Daw, Anuj Karpatne. "Open World Scene Graph Generation using Vision Language Models." *CVPR 2025 Workshop*, (CV in the Wild).
5. Abhilash Neog, **Medha Sawhney**, K.S. Mehrab, Sepideh Fatemi Khorasgani, Anuj Karpatne. "Toward Scientific Foundation Models for Aquatic Ecosystems." Foundation Models for Structured Data at *ICML 2025*.
6. Sepideh Fatemi1, Abhilash Neog, Emma Marchisin, Amartya Dutta, **Medha Sawhney**, Paul C Hanson, Anuj Karpatne. "Scientific Equation Discovery using Modular Symbolic Regression via Vision-Language Guidance." *CV4Science at CVPR2025*.
7. Maruf, M., Arka Daw, Kazi Sajeed Mehrab, Harish Babu Manogaran, Abhilash Neog, **Medha Sawhney**, Mridul Khurana et al. "VLM4Bio: A Benchmark Dataset to Evaluate Pretrained Vision-Language Models for Trait Discovery from Biological Images." Advances in Neural Information Processing Systems, *NeurIPS 2024.*
8. **Medha Sawhney***, Bhas Karmarkar*, Eric J. Leaman, Arka Daw, Anuj Karpatne, and Bahareh Behkam. "Detecting and Tracking Hard-to-Detect Bacteria in Dense Porous Backgrounds." In Computer Vision for Animal Behavior Tracking and Modeling (CV4Animals) *Workshop at CVPR 2023*
9. **Medha Sawhney**, Vasundhara Acharya, and Krishna Prakasha. "An Efficient Approach to Detect Driver Distraction during Mobile Phone Usage." International Journal of Engineering and Technology (UAE) 7, no. 4.41 (2018): 86-90.

Preprints

10. Abinash Padhi*, Arka Daw*, **Medha Sawhney**, Maahi M. Talukder, Atharva Agashe, Sohan Kale, Anuj Karpatne and Amrinder Nain. "Deep Learning Enabled Label-free Cell Force Computation in Deformable Fibrous Environments." bioRxiv (2022): 2022-10