

# Aryan Mishra

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## EDUCATION

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<b>University of Maryland</b>	College Park, Maryland
<i>PhD – Mathematics and Statistics</i>	May 2030
<b>University of Maryland</b>	College Park, Maryland
<i>Master of Engineering – Robotics</i>	May 2025
<b>Vellore Institute of Technology</b>	Vellore, India
<i>Bachelor of Technology – Electronics and Communication Engineering</i>	June 2023

## RESEARCH AND WORK EXPERIENCE

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**National Institute of Standards and Technology - Gaithersburg, MD** May 2025 – August 2025

### Generative AI Research

Professional Research and Experience Program student from UMD, part of Multimedia Information Group, Information Technology Laboratory

- Developed detector for detecting the fabricated content in CSAM and NCII, used combination of DINO, Vision Transformers and neural network models for an ensemble model.
- Generated robust datasets for evaluation using Flow matching, diffusion, Flux and GAN models, fine-tuned Flux models using LoRa for cloning similar subjects.
- Contributed to the development of the product prototype to be utilized by the concerned authorities.

**National Institute of Standards and Technology - Gaithersburg, MD** November 2024 – May 2025

### Generative AI Engineer

Professional Research and Experience Program student from UMD, part of Multimedia Information Group, Information Technology Laboratory

- Developing pipeline for testing of multi-modal inputs as authentic or fabricated and identifying sensitive contents.
- Generated robust datasets for evaluation using diffusion, Flux and styleGAN models, fine-tuned Flux models using LoRa.
- Deployed anti-spoof, transformer classifier, spatial based image for facial detection, recognition and verification on image and video inputs.

**Department of Statistics, Uni of MD- College Park, MD** August 2024 – May 2025

### Machine Learning Researcher

Worked as a volunteer on Geometric Deep learning, currently taking an independent study for Spring 2025 semester.

- Independent research on geometric deep learning for graphs, grids and data manifolds.

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- Working on understanding and devising novel methods to harness the power of graph neural networks.
- Implemented regularization terms for approximation of high dimensional manifolds in smaller dimensions.

**Department of Mechanical Eng., Uni of MD – College Park, MD.** January 2024 – December 2024

### Machine Learning Research Volunteer

Part of two projects: Development of a soft robotic gripper, Medical Image analysis

- Engineered 3D-printed soft robotic grippers and deployed ML to predict object size, shape, and material from pressure-volume curves
- Deployed VNET with Attention Mechanism on the Stanford Type B Aorta Dissection dataset, achieving a Dice Coefficient of 0.80, Jaccard Mean of 76.3, AsD Mean of 0.98.
- Developed a transformer-based encoder for the VNET architecture.

## RESEARCH PUBLICATION

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### Schreier-Coset Graph Propagation

Submitted for review in ICLR 2026

Summary: Over-squashing occurs in Graph Neural Networks when multiple nodes of a graph collapse to one single node. This cause loss of information. To alleviate this phenomenon, we deployed group theoretic Schreier-Coset graphs to provide alternative pathways. It's been evaluated on datasets like Amazon Computers, Amazon Photos, TU and LRGB. Has applications such as betterment of online recommendation systems, protein synthesis and graph traversal.

## TEACHING

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### Teaching Assistant for MATH 246

August 2025 – December 2025

## PROJECTS

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### Autonomous Scene Segmentation

September 2024 – December 2024

*PyTorch, Swin Transformer, Trans-UNET, Python*

- Devised and trained from scratch Trans-UNET, Swin-Trans-UNET and UNET. Performed pixel-wise segmentation of KITTI Images
- Achieved Dice coefficients of 0.88, 0.80, and 0.87 for three segmentation models, with the Swin Transformer-UNET architecture demonstrating superior performance and attained the lowest cross-entropy loss of 0.27 among the compared approaches.

### Vision Language Model

August 2024 – December 2024

*PyTorch, SigLIP, Python, Google-Gemma, OpenCV*

- Combined 400M SigLIP and 2B Gemma Models into a sub-3B VLM works for VQA, QA tasks and referring segmentation.

### Multimodel Trajectory Prediction

July 2024 – August 2024

*PyTorch, Python, OpenCV*

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- Addressing the uncertainties faced by self-driving vehicles with a Multiple Trajectory Prediction (MTP) model by predicting multiple possible paths and the likelihood of each using probability adhering to geometric and angular meaning using the NuScenes Dataset.

**Retrieval Augmented Generation** June 2024 – July 2024

*PyTorch, RAG, Python*

- Implemented a Retrieval Augmented Generation (RAG) pipeline using the Gemma-2-9b-it LLM model. Achieved high efficiency for real-time query answering, optimizing for scalable performance and reduced latency.

**Generative Adversarial Networks** June 2024

*PyTorch, OpenCV, PIL, Python*

- Deployed multiple GAN models, including Deep Convolution GAN, Cycle GAN, and Progressive GAN, on diverse datasets such as MNIST, Celeb A, and the Summer to Winter Yosemite dataset.

**Hippocampal volumetric quantification of Alzheimer's progression** March 2024 – May 2024

*PyTorch, OpenCV, PIL, Python, UNET, Google-DeepLabV3+*

- Leveraged UNET and DeepLabV3+ architectures to diagnose and monitor Alzheimer's disease progression using 260 NIFTI images from the Medical Decathlon dataset.
- Achieved robust segmentation performance with Mean Dice Coefficient scores of 0.87 and 0.81 and mean Jaccard Index values of 0.77 and 0.785.

**Segmentation of 3D MRI and CT Stanford Type B Aortic Images** Jan 2024 – December 2024

*PyTorch, OpenCV, PIL, Python, VNET, VNET + Transformer*

- leveraging a VNET architecture with an attention mechanism to enhance the segmentation accuracy of 3D MRI and CT images, specifically targeting Type-B Aortic Dissection (TBAD)
- Achieved robust segmentation performance with Mean Dice Coefficient score of 0.88 and Mean Jaccard Index values of 0.76.

## TECHNICAL SKILLS

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- **Languages:** Python, C++, MATLAB, RUST
- **Stats Models:** Perform Statistical Analysis with models such as ANOVA, ANCOVA, and hypothesis testing.
- **Deep Learning Frameworks:** TensorFlow, PyTorch, Keras, CUDA, OpenAI Gym, OpenCV, Jax, LORA training, Hugging Face, Flux, Diffusion Models and Flow Matching.
- **Software/Tools:** AWS, ROS1/2, C-Make, Gazebo, Linux, Git/GitHub, Docker, Robot Perception, Localization, Deep Learning, Computer Vision, Artificial Intelligence, Microsoft Suite, Content Writing