

Tonmoy Hossain

Ph.D. Candidate, Copenhaver Graduate Fellow, CS, University of Virginia

[Google Scholar](#) (🎓), [ResearchGate](#) (✉), [LinkedIn](#) (ln)

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EDUCATION

• University of Virginia	Charlottesville, Virginia
• <i>Doctor of Philosophy - Computer Science</i>	<i>Expected May 2026</i>
Research Domain: Geometric Representation Learning, Image Analysis, Generative AI	
• University of Virginia	Charlottesville, Virginia
• <i>Masters of Computer Science. CGPA: 3.973</i>	<i>Dec 2025</i>

WORK EXPERIENCES

Graduate Research Assistant , MIA Lab, UVA	Aug 2021 - Present
Graduate Teaching Assistant , Dept. of CS, UVA	Aug 2022 - Dec 2025
AI/ML Intern , GE Healthcare	Jun 2025 - Aug 2025
Co-Chair and Graduate Program Representative , CSGSG, UVA	Jan 2022 - Dec 2024
Lecturer , AUST, Bangladesh	Aug 2019 - Aug 2021

RESEARCH EXPERIENCES

RE1. Generative Modeling.

Multimodal/Multi-modal Image Generation and its Robustness

- *Project 1.1: Multimodal Geometric Augmentation.* Developed a novel Multimodal Geometric Augmentation (MGAug), that generates augmenting transformations in a multimodal latent space of geometric deformations.
→ Outperformed all SOTA augmentations by 5% in classification and segmentation tasks (using 10% ground-truth).
- *Project 1.2: Diffeomorphic Image Generation.* Developed a novel diffeomorphic image generation model that for the first time, preserves object topology and geometry in synthesized images using text-guided diffusion models.
→ Generated topology-preserved timepoint images with $90\times$ and $1.366\times$ improved FID and IS scores.

RE2. Representation Learning.

Latent Group Action, Group-wise Image Deformations, Invariant Learning.

- *Project 2.1: Invariant Representation Learning.* Designed an invariant learning framework that jointly captures causally invariant features in an integrated latent spaces.
→ Learned invariant shape features with visual cues in developing robust image classifiers, resulting in 4 – 8% improvement compared to invariant learning and domain generalization models.
- *Project 2.2: Topology-preserving Representation Learning.* Introduced a topology-preserving representation learning model to predict group-wise object deformations directly from the input image with a progressive group-composition decoder.
→ Our group-wise deformation model is the first of its kind, surpassing all template-dependent baselines.
- *Project 2.3: Contrastive Shape Representation Learning.* Proposed a novel framework for Contrastive Representation Learning of Deformable shapes (CoRLD) in learned deformation spaces and demonstrate its effectiveness in the context of image classification.
→ CoRLD's contrastive learning in deformation spaces substantially improved per-class discrimination and boosted classification accuracy when integrated with intensity features across diverse medical imaging datasets.
- *Project 2.4: Learning Latent Group Actions.* Introduced a novel end-to-end framework that for the first time learns group actions on latent image manifolds, automatically discovering transformation-relevant structures without manual intervention.
→ Experiments on synthetic, real-world, and medical images show robust performance across diverse data distributions, demonstrating its ability to automatically learn disentangled latent factors for group actions.

RE3. Geometric Vision Foundation Models.

Shape-aware Foundation Models for Healthcare Imaging

- *Project 3.1: Geometric Shape Foundation Models.* Designing a novel foundation model that incorporates geometric shape descriptors with intensity features, leveraging shape-aware embeddings to improve the robustness of image analysis tasks across both natural and medical domains.
→ Demonstrates promising performance across various computer vision tasks, including segmentation, classification, and reconstruction, particularly in data-scarce scenarios.
- *Project 3.2: Transformation-invariant Deep Networks.* Working on a deep learning model that learn all possible rigid/non-rigid image transformations guided by text information to generate real-time images.
→ Unlike SOTA generative models sensitive to affine and deformable transformations of text-conditioned images, our model generates transformation-invariant outputs in real time.

SELECTED PUBLICATIONS

Google Scholar Citations: 715, h-index - 9, i10-index - 9

- Farhana Hossain Swarnali, Miao Zhao, **Tonmoy Hossain**, “Learning Group Actions In Disentangled Latent Image Representations”, *Accepted at @WACV2025*
- **Tonmoy Hossain**, Bruno Astuto Arouche Nunes, Fei Tan, Ashok Vardhan Addala, Ravi Soni, “Learning Diffeomorphic Augmentations via Conditional Variational Latent Modeling”, *Under Review*
- **Tonmoy Hossain**, Miao Zhao, “Topology-preserved Representation Learning Of Deformable Objects For Image Classification”, *Under Review @Medical Image Analysis Journal*
- Swakshar Deb, **Tonmoy Hossain**, Miao Zhao, “Learning to Transform Via Diffusion Models In Deformation Space”, *Under Review @International Journal of Computer Vision*
- **Tonmoy Hossain**, Miao Zhao, “CoRLD: Contrastive Representation Learning Of Deformable Shapes In Images”, In *International Conference on Information Processing in Medical Imaging 2025*
- **Tonmoy Hossain**, Jing Ma, Jundong Li, Miao Zhao, “Invariant Shape Representation Learning For Image Classification”, In *IEEE/CVF Winter Conference on Applications of Computer Vision 2025*.
- **Tonmoy Hossain** and Miao Zhao. “MGAug: Multimodal Geometric Augmentation in Latent Spaces of Image Deformations,” In *Medical Image Analysis Journal* (2025).
- Nivetha Jayakumar, **Tonmoy Hossain**, Yangfeng Ji, Miao Zhao, “TPIE: Topology-Preserved Image Editing With Text Instructions”, *Under Review @IEEE Transactions on Medical Imaging Journal*.
- Nivetha Jayakumar, **Tonmoy Hossain**, and Miao Zhao. “SADIR: Shape-Aware Diffusion Models for 3D Image Reconstruction.” In *MICCAI 2023, International Workshop on Shape in Medical Imaging*, pp. 287-300. Cham: Springer Nature Switzerland, 2023.
- Nivetha Jayakumar, Jiarui Xing, **Tonmoy Hossain**, Fred Epstein, Kenneth Bilchick, Miao Zhao. Diffusion Models To Predict 3D Late Mechanical Activation From Sparse 2D Cardiac MRIs. In *Machine Learning for Health (ML4H)*. PMLR, 2023. ****Best Thematic and Proceedings Paper in Generative AI****
- **Tonmoy Hossain**, Zoraiz Qureshi, Nivetha Jayakumar, Thomas Eluvathingal Muttikal, Sohil Patel, David Schiff, Miao Zhao, and Bijoy Kundu, “Multimodal Deep Learning to Differentiate Tumor Recurrence from Treatment Effect in Human Glioblastoma”, In *International Symposium on Biomedical Imaging (ISBI 2023)*.
- **Tonmoy Hossain**, Sujan Sarker, Sejuti Rahman, Md Atiqur Rahman Ahad (2021) “Skeleton-Based Human Action Recognition on Large-Scale Datasets”. In *Vision, Sensing and Analytics: Integrative Approaches. Intelligent Systems Reference Library, vol 207. Springer, Cham*.
- Shithi Maitra, **Tonmoy Hossain**, Khan Md. Hasib and Fairuz Shadmani Shishir, “Graph Theory for Dimensionality Reduction: A Case Study to Prognosticate Parkinson’s,” 2020 11th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), ****Best Paper Award**** under Data Mining and Data Analytics and Big Data Category.

SKILLS SUMMARY

- **Languages:** Python, PHP, C++, Java, SQL
- **Data Analysis:** (Self/Un/Semi)-supervised learning, Point Cloud Processing (PCL) and Time series/Statistical analysis.
- **Frameworks:** PyTorch\Lightning, TensorFlow, NLTK, SpaCy, Keras, Hugging Face, XGBoost, DeepSpeed, Monai.
- **Tools:** Docker, Git, GitHub, GitLab, Jupyter Notebook, PyCharm
- **Platforms and Web Development:** Linux, Windows, HTML, CSS

HONORS AND AWARDS

- Copenhaver Charitable Trust Bicentennial Fellow, *UVA Endowed Fellowship*
- Best Paper Award at *ML4H Symposium 2023, IEEE-IEMCON 2020*, and *ICCIT 2020*.
- Best Thematic and Proceedings Paper in Generative AI, *Machine Learning for Health (ML4H 2023)*
- Outstanding Reviewer Award at *AISTATS 2025, ECCV 2024*
- Graduate Service Award, *Department of Computer Science, UVA*
- Student and Travel Scholarship, *AAAI 2026 and 2024*
- First year Ph.D. fellowship, *Department of Computer Science, UVA*
- Dean’s List of Honor, *AUST* (based on undergraduate result)
- 7th Place out of 200 students, *Inter-University Mathematics Olympiad 2019, Bangladesh*

VOLUNTEER EXPERIENCE

- **Program Committee Member and Reviewer.** AAAI 2026, 2025, 2024, 2023 | AISTATS 2026, 2025 | BMVC 2025, 2024 | CVPR 2026, 2025 | ECCV 2024 | ICCV 2025 | ICML 2025 | ICLR 2026, 2025 | IJCAI 2025 | IJCNN 2025 | ISBI 2026, 2025, 2024 | MICCAI 2025, 2024 | MICCAI ShapeMI 2024 | ML4H 2024, 2023 | MIDL 2023 | NeurIPS 2025, 2024 || IEEE TMI | IEEE TNNLS | Medical Physics Journal
- **Mentoring.** Farhana Hossain Swarnali, Student Researcher, CSE, AUST | Ishita Gupta, Grad Student, CS, UVA | David Joseph Jagga, UGrad Student, CS and Data Science, UVA | Clara Li, UGrad Student, UVA | Hyemin Yang, UGrad Student Researcher, DGIST, South Korea
- **Leadership.** Elected and served as a *Co-Chair* and *Graduate Program Representative* at the UVA CSGSG.