Nasik Muhammad Nafi

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G https://scholar.google.com/citations?user=H1s1JWUAAAAJ

🌐 https://nasiknafi.github.io/

Research Summary

I am a Machine Learning (ML) researcher specializing in the intersection of deep Reinforcement Learning (RL), Computer Vision (CV), and generative AI (GenAI). My research aims to develop intelligent agents capable of excelling in out-of-distribution generalization. I advocate for effective representation learning, efficient neural architecture design, and uncertainty modeling to unlock the potential of AI agents in complex, diverse, and dynamic real-world scenarios. I am interested in designing efficient and scalable large foundation models and their faster adaptation for downstream tasks, especially in scientific domains. I explore through a delicate balance between theoretical and experimental methods. As a researcher, my overarching goal is to devise sample-efficient, generalizable, scalable, and robust AI/ML algorithms and actively contribute to pioneering research initiatives.

Education

2019 – 2024	**Ph.D. in Computer Science** Kansas State University, Manhattan, KS. Advisor: *Dr. William H. Hsu* Dissertation title: *Architectural and Algorithmic Strategies for Generalizable Deep Reinforcement Learning*	4.0/4.0
2017 – 2019	**M.Sc. in Computer Science** Kansas State University, Manhattan, KS. Thesis title: *Generative versus Sampling-Based Approaches to Variability of Class Imbalance in Visual Anomaly Detection.*	4.0/4.0
2010 – 2015	**B.Sc. in Computer Science and Engineering** Bangladesh University of Engineering and Technology (BUET), Bangladesh.	

Expertise and Skills

Quantitative	Machine Learning, Deep Learning, Reinforcement Learning, Computer Vision, Generative AI, Statistical Modeling.
Programming Languages	Python, C, C++, Java, SQL, R, SML, Racket, Prolog.
Machine Learning Frameworks	PyTorch, TensorFlow, Keras, Hugging Face, Scikit-learn.
Reinforcement Learning Libraries	Garage, RLlib, Pearl, OpenAI Baselines, Stable Baselines.
Distributed and Scalable Computing	PyTorch Distributed (DDP, FSDP), DeepSpeed, Accelerate.
Miscellaneous	Bash, Git, Docker, Slurm, OpenMP, Visual Studio.

Professional Experience

- **Oak Ridge National Lab** — Oak Ridge, TN
  Postdoctoral Research Associate — Sep 2024 – Present
  - Working at the National Center for Computational Sciences (NCCS) division under the Advanced Computing for Life Sciences and Engineering group. Supported through Leadership Computing Facility (LCF) distinguished postdoctoral program.
  - Developed a Vision Transformer (ViT)-based scalable diffusion model for multimodal microstructure image generation. Leveraged parallelization paradigms such as DDP, FSDP.
  - Worked on ORBIT-2 team developing a foundation model for climate downscaling that handles very long sequences of tokens. This work won the best paper award at SC, 2025.
  - Designed a novel Bayesian approach for online preference alignment in diffusion models.
  - Designing generalizable model for turbulence time series prediction using parameterized neural ODE. Also, enabling distributed training with large batches and adaptive patching.

- **Dept. of Computer Science, Kansas State University** — Manhattan, KS
  Graduate Research/Teaching Assistant — Aug 2017 – Aug 2024
  - Conducted research in the field of reinforcement learning, computer vision, and Android security. Published peer-reviewed research and provided supervision to undergrads.
  - Developed a hybrid actor-critic architecture, a non-contrastive representation learning framework, and horizon regularized value/advantage estimation techniques for better generalization in RL. Led a team of four to build a 3D ConvNet-based multi-stage video classification approach that detects risky tackles from American football practice videos.
  - Assisted in AI, programming, computer architecture, and operating systems courses. Held teaching hours, designed assignments, and graded assignment submissions and exams.

- **DEKA Research and Development** — Manchester, NH
  Machine Learning Engineer Intern — May 2023 – Aug 2023
  - Developed a tool for object segmentation mask labeling leveraging the Segment Anything Model (SAM). Performed drop segmentation in infusion pump images using U-Net.
  - Worked on building an annotated dataset and YoloV7 model for door status detection to facilitate navigation of autonomous robots.

- **C2FO** — Leawood, KS
  Data Scientist Intern — June 2018 – Aug 2018
  - Worked on different stages of the Natural Language Processing (NLP) pipeline.
  - Analyzed the effectiveness of two popular approaches - LDA-based topic modeling and word2Vec-based Doc2Vec - for document classification in C2FO's context.
  - Performed Named Entity Recognition(NER) from email responses using Bi-LSTM-CRF model. This reduces the human effort required for information extraction.

- **REVE Systems Ltd.** — Dhaka, Bangladesh.
  Software Engineer — 2015 – 2016
  - Developed features for an android-based calling and messaging application *iTel Dialer*.

Research Publications

Conference Proceedings

C1 Wang, X., Choi, J., Kurihaya, T., Lyngaas, I., Yoon, H., Xiao, X., Pugmire, D., Fan, M., **Nafi, N.M.**, Tsaris, A, et al. (2025). "Orbit-2: Scaling Exascale Vision Foundation Models for Weather and Climate Downscaling.." in *Proceedings of the International Conference for High Performance Computing, Networking, Storage, and Analysis, (SC '25)*. **[Best Paper Award.]**

C2 **Nafi, N.M.**, Ali, R.F., Hsu, W., Duong, K. and Vick, M. (2024). "Policy Optimization with Horizon Regularized Advantage to Improve Generalization in Reinforcement Learning." in *23rd International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*.

C3 **Nafi, N.M.**, Ali, R.F. and Hsu, W. (2024). "Analyzing the Sensitivity to Policy-Value Decoupling in Deep Reinforcement Learning Generalization." in *2024 International Joint Conference on Neural Networks (IJCNN)*.

C4 **Nafi, N.M.**, Poggi-Corradini, G. and Hsu, W. (2023). "Policy Optimization with Augmented Value Targets for Generalization in Reinforcement Learning." in *2023 International Joint Conference on Neural Networks (IJCNN)*.

C5 **Nafi, N.M.**, Rediger, A., Dietrich, S. and Hsu, W. (2023). "Relevant Instance Segmentation in American Football Practice Images to Aid Risky Tackle Detection." in *IEEE 22nd International Conference on Machine Learning and Applications (ICMLA)*.

C6 Ali, R.F., Duong, K., **Nafi, N.M.** and Hsu, W. (2023). "Multi-Horizon Learning in Procedurally-Generated Environments for Off Policy Reinforcement Learning (Student Abstract)." in *AAAI Conference on Artificial Intelligence*.

C7 **Nafi, N.M.**, Glasscock, C. and Hsu, W. (2022). "Attention-based Partial Decoupling of Policy and Value for Generalization in Reinforcement Learning." in *IEEE 21st International Conference on Machine Learning and Applications (ICMLA)*.

C8 **Nafi, N.M.**, Dietrich, S. and Hsu, W. (2022). "Risky Tackle Detection from American Football Practice Videos using 3D Convolutional Networks." in *18th International Conference on Machine Learning and Data Mining (MLDM)*.

C9 Okerinde, A., Hsu, W., Theis, T., **Nafi, N.M.**, and Shamir, L. (2021). "eGAN: Unsupervised Approach to Class Imbalance using Transfer Learning." in *19th International Conference on Computer Analysis of Images and Patterns (CAIP)*.

C10 **Nafi, N.M.** and Hsu, W.H. (2020). "Addressing Class Imbalance in Image-Based Plant Disease Detection: Deep Generative vs. Sampling-Based Approaches." in *27th International Conference on Systems, Signals and Image Processing (IWSSIP)*. **[Best Paper Award.]**

C11 **Nafi, N.M.**, Bose, A., Khanal, S., Caragea, D. and Hsu, W.H. (2020). "Abstractive Text Summarization of Disaster-Related Documents." in *17th International Conference on Information Systems for Crisis Response and Management (ISCRAM)*.

Doctoral Consortium

D1 **Nafi, N.M.** (2023). "Learning Representations and Robust Exploration for Improved Generalization in Reinforcement Learning." in *2023 International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*.

Research Publications (continued)

Peer-Reviewed Workshop Papers

W1   **Nafi, N.M.**, and Hsu, W. (2023). "Reinforcement Learning with Augmentation Invariant Representation: A Non-contrastive Approach." in *Generalization in Planning (GenPlan) Workshop at International Conference on Neural Information Processing Systems* **(NeurIPS)**.

W2   **Nafi, N.M.** and Hsu, W. (2023). "MetaVHAR: Meta-Learning for Video-Based Human Activity Recognition." in **AAAI Workshop on User-Centric Artificial Intelligence for Assistance in At-Home Tasks**.

W3   **Nafi, N.M.**, Ali, R.F. and Hsu, W. (2022). "Analyzing the Sensitivity to Policy-Value Decoupling in Deep Reinforcement Learning Generalization." in *Deep Reinforcement Learning (DRL) Workshop at Int. Conference on Neural Information Processing Systems* **(NeurIPS)**.

W4   **Nafi, N.M.**, Ali, R.F. and Hsu, W. (2022). "Hyperbolically Discounted Advantage Estimation for Generalization in Reinforcement Learning." in *Decision Awareness in Reinforcement Learning (DARL) Workshop at International Conference on Machine Learning* **(ICML)**.

W5   Ali, R.F., **Nafi, N.M.**, Duong, K. and Hsu, W. (2022). "Efficient Multi-Horizon Learning for Off-Policy Reinforcement Learning." in *Deep RL Workshop at International Conference on Neural Information Processing Systems* **(NeurIPS)**.

Recent Posters and Presentations

P1   **Nafi et al.** (2025). "Enabling Multimodal Microstructure Image Generation through Vision Transformer-based Scalable Diffusion Model." in *22nd Smoky Mountains Computational Sciences and Engineering Conference* **(SMC)** *2025*.

P2   **Nafi, N.M.**, Meena, M.G., Lyngaas, I., and de Bruyn Kops, S. (2025). "Generalizing Time-series Modeling of Stably Stratified Turbulence using Parameterized Neural ODE." in *13th Annual Oak Ridge Postdoctoral Association Research Symposium 2025* .

P3   **Nafi, N.M.**, Hsu, W. (2025). "A Minimalist Approach to Augmentation-based Self-Supervised Representation Learning for On-policy Reinforcement Learning." in *24th International Conference on Autonomous Agents and Multi-Agent Systems* **(AAMAS)**.

Under Review and Work-in-Progress

O1   Sarkar, A.*, **Nafi, N.M.***, and Vorobeychik, Y. (2026). "PAPA: Online Personalized Active Preference Alignment." in *2026 IEEE/CVF conference on computer vision and pattern recognition (CVPR).* [Under Review]

O2   **Nafi, N.M.**, Meena, M.G., Lyngaas, I., and de Bruyn Kops, S. (2025). "Generalizing across Physical Parameters of Turbulence using Parameterized Neural ODE." [In-Progress]

O3   **Nafi, N.M.**, Meena, M.G., and Lyngaas, I. (2025). "Enabling Large-Batch Distributed Training through Asynchronous Updates with Delayed Integration." [In-Progress]

O3   **Nafi, N.M.**, Lyngaas, I., Meena, M.G., and de Bruyn Kops, S. (2025). "Potential Vorticity-Guided Adaptive Patching for Large-Scale Turbulence Pressure Prediction." [In-Progress]

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[1] * denotes equal contribution.

Honors and Awards

Awards and Achievements

2025   **Best Paper Award**, International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'25).

2025   **Finalist**, ACM Gordon Bell Prize for Climate Modeling.

2023   **Outstanding Graduate Student**, Carl R. Ice College of Engineering, Kansas State University. (Link to K-State Announcement)

2021   **International Student Scholarship**, Kansas State University Alumni Association.

2020   **Best Paper Award**, 27th IEEE International Conference on Systems, Signals and Image Processing. (Link to IEEE IWSSIP Proceedings)

2018   **Special Recognition**, by Google Android Security Awards Program.
Associate developer of the winning team. (Link to K-State Announcement)

2015   **Best Poster-papers Award**, 2nd Undergraduate Thesis Poster Presentation, BUET. Awarded to top 15, sponsored by Higher Education Quality Enhancement Project.

Travel Grants

2024   **Graduate Student Council Travel Award** to attend AAMAS 2024.

2023   **Graduate Student Council Travel Award** to attend ICMLA 2023, NeurIPS 2023.

2023   **Department of CS Travel Grant** to attend IEEE IJCNN 2023.

2022   **DeepMind Travel Grant** to attend DARL workshop at ICML 2022.

Professional Service

Program Committee / Co-Chair

2025   Organizer, Muslims in ML Workshop at ICML 2025 and NeurIPS 2024, 2025.

2023   Session Chair, International Joint Conference on Neural Networks (IJCNN).

2022   5th AI - Diversity, Belonging, Equity, and Inclusion (AIDBEI) workshop at IJCAI 2022.

Reviewer

2025   ICML, AISTATS, ICLR, NeurIPS 2025.

2024   NeurIPS 2024.

2023   Unifying Representations in Neural Models Workshop at NeurIPS 2023.

2022   AutoML 2022, Artificial Intelligence Review Journal, DRL Workshop at NeurIPS 2022.

2021   Meta-Learning Workshop at NeurIPS 2021.

Teaching Experience

Graduate Teaching Assistant | Dept. of Computer Science, Kansas State University

Spring 2024	CIS 520: Operating Systems I
Fall 2020	CIS 505/705: Programming Languages
Spring 2020	CIS 520: Operating Systems I
Fall 2019	CIS 530/730: Principles of Artificial Intelligence
Spring 2019	CIS 450: Computer Architecture and Operations

Mentorship Experience

2023   *Tatenda Sekabanja* | Senior, K-State

2023   *Giovanni Poggi-Corradini* | Senior, K-State

2023   *Mason Vick* | BS, K-State → Software Developer at EARP Distribution.

2022   *Ashley Rediger* | BS, K-State → Technology Transformation Associate, Grant Thornton

2021   *Creighton Glasscock* | BS, K-State → MS at the University of Michigan, Ann Arbor

2021   *Yelling Hu* | MS, K-State → Software Developer at JPMorgan Chase & Co.

2020   *Sidharth* | BS, K-State → Data Scientist, 1Data Lab

Leadership and Professional Development

2025   **Selected Participant**, Early Career Program, Supercomputing 2025, St. Louis, MO.

2021–2022   **President**, Computer Science Graduate Student Association, K-State.

2022   **Spring'22 Cohort**, Graduate Student Leadership Development Program, K-State.

2020-2021   **Secretary**, Computer Science Graduate Student Association, K-State.

2015   **Organizer**, Annual Festival of Computer Science Department, BUET.

2014–2015   **President**, Greater Rangpur Students' Welfare Association, BUET.

2014–2015   **Mentor**, Bangladesh Science Outreach (BSO).