

Nasik Muhammad Nafi

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🔗 <https://scholar.google.com/citations?user=H1s1JWUAAAJ>

🌐 <https://nasiknafi.github.io/>

Research Summary

I am a Machine Learning (ML) researcher specializing in the intersection of deep Reinforcement Learning (RL) and Computer Vision (CV). My research aims to develop intelligent agents capable of excelling in zero-shot generalization. I advocate for effective representation learning, neural architecture design, and uncertainty modeling to unlock the potential of AI agents in complex, diverse, and dynamic real-world scenarios. I explore through a delicate balance between theoretical and experimental methods. As a researcher, my overarching goal is to devise sample-efficient, generalizable, 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*
- 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.*
- 2010 – 2015 **B.Sc. in Computer Science and Engineering**
Bangladesh University of Engineering and Technology (BUET), Bangladesh.

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, Scikit-learn.
Reinforcement Learning Libraries	Garage, RLlib, Pearl, OpenAI Baselines, Stable Baselines.
RL/CV/NLP Tools	OpenAI Gym, Gymnasium, Mujoco, OpenCV, NLTK
Web Development	HTML, CSS, PHP, JavaScript, Apache Web Server.
Miscellaneous	Bash, Git, Docker, Slurm, OpenMP, Microsoft Visual Studio.

Employment

- **Oak Ridge National Lab** Oak Ridge, TN
Postdoctoral Research Associate Sep 2024 – Present
 - Working with the Advanced Computing for Life Sciences and Engineering group of the Science Engagement Section at the National Center for Computational Sciences division.
 - Developing transferable model for medical image segmentation task and designing generalizable model for turbulence modeling problems.

- **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 and presented research work at top conferences. Supervised undergrad students for research projects and assisted in lab management.
 - Assisted in AI, programming, computer architecture, and operating systems courses. Held teaching hours, designed assignments, and graded assignment submissions and exams.
 - Developed a hybrid actor-critic architecture, a non-contrastive representation learning framework, and value/advantage estimation techniques for better generalization in RL.
 - Led a team of four to build a 3D ConvNet-based multi-stage approach and a Multiscale Vision Transformers (mViT)-based video classification model that detects risky tackles directly from American football practice videos. Achieved 12% improvement in terms of F1-score utilizing spatio-temporal segmentation.

- **DEKA Research and Development** Manchester, NH
Machine Learning Engineer Intern May 2023 – Aug 2023
 - Performed data annotation, literature review, tool development, ML model development and training, model evaluation, and git repository management.
 - 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 the android application *iTel Dialer* for calling and messaging.

Research Publications

Peer-Reviewed Conference Papers

- C1 **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)*.
- C2 **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)*.
- C3 **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)*.
- C4 **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)*.
- C5 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*.
- C6 **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)*.
- C7 **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)*.
- C8 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)*.
- C9 **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.]**
- C10 **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)*.

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 International 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)*.
- W₆ **Nafi, N.M.**, Glasscock, C. and Hsu, W. (2021). "Attention-based Partial Decoupling of Policy and Value for Generalization in Reinforcement Learning." in *Deep Reinforcement Learning Workshop at International Conference on Neural Information Processing Systems (NeurIPS)*.

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)*.

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
Fall 2018	CIS 505/705: Programming Languages

Mentorship Experience

- 2023 *Mason Vick* | Senior, K-State
- 2023 *Tatenda Sekabanja* | Sophomore, K-State
- 2023 *Giovanni Poggi-Corradini* | Sophomore, K-State
- 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

Honors and Awards

Awards and Achievements

- 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. Secondary 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 (HEQEP).

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 **Department of CS Travel Grant** to attend IEEE ICMLA 2022.
- 2022 **Graduate Student Council Travel Award** to attend MLDM 2022, ICMLA 2022.
- 2022 **DeepMind Travel Grant** to attend DARL workshop at ICML 2022.
- 2021 **Graduate Student Council Travel Award** to attend DRL workshop, NeurIPS 2021.
- 2020 **Graduate Student Council Travel Award** to attend IWSSIP 2020.

Professional Service

Program Committee / Co-Chair

- 2023 Session Chair, International Joint Conference on Neural Networks (IJCNN).
- 2022 5th AI - Diversity, Belonging, Equity, and Inclusion (AIDBEI) workshop at IJCAI 2022.

Professional Service (continued)

2022 4th AI - Diversity, Belonging, Equity, and Inclusion (AIDBEI) workshop at AAMAS 2022.

Reviewer

2024 NeurIPS 2024.
2023 Unifying Representations in Neural Models Workshop at NeurIPS 2023.
2022 8th Deep Reinforcement Learning (DRL) Workshop at NeurIPS 2022.
2022 International Conference on Automated Machine Learning, 2022.
2022 AIDBEI Workshops at AAMAS and IJCAI 2022.
2022 Artificial Intelligence Review Journal.
2021 Meta-Learning Workshop at NeurIPS 2021.

Leadership Activity

Affiliations

2021–2022 **President**, Computer Science Graduate Student Association, K-State.
2020–2021 **Secretary**, Computer Science Graduate Student Association, K-State.
2015 **Organizer**, Voice of Visuals, International Photography Exhibition.
2015 **Organizer**, Annual Festival of Computer Science Department, BUET.
2014–2015 **President**, Greater Rangpur Students' Welfare Association, BUET.
2014–2015 **Treasurer**, BUET Photographic Society (BUETPS).
2014–2015 **Mentor**, Bangladesh Science Outreach (BSO).

Certification

2022 **Graduate Student Leadership Development Program.**
Staley School of Leadership Studies, Kansas State University.