Aneesh Komanduri

CONTACT INFORMATION

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GitHub: https://github.com/akomand

RESEARCH INTERESTS

My research interests generally lie in the areas of causal inference, representation learning, and generative modeling, with applications in trustworthy and robust machine learning. I am also interested in exploring interpretability and control in large-scale pretrained generative models.

EDUCATION

University of Arkansas — Fayetteville, Arkansas

Ph.D., Computer Science — **2021 - 2026**

- **Advisor:** Dr. Xintao Wu

M.S., Computer Science, GPA: 4.0 — **2021 - 2024**

- **Relevant Courses:** Statistical Methods, Regression Analysis, Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, Advanced Information Retrieval, AI Ethics

B.S., Computer Science/Engineering & Applied Mathematics — **2017 - 2021**

- Graduated *Summa Cum Laude*

RESEARCH EXPERIENCE

Social Awareness & Intelligent Learning Lab (SAIL) — Fayetteville, Arkansas

Graduate Research Assistant — **Oct 2021 - Present**

- Working at the intersection of causal inference and representation learning using generative models to obtain disentangled causal representations for robust learning in downstream tasks
- Proposed theory and learning frameworks toward identifiable causal representation learning in the label-supervised setting using VAE and flow-based models
- Currently working on counterfactual generation via diffusion-based causal representation learning, applications of causal generative models in fairness-aware learning, and causality in large-scale generative models such as large language models (LLMs) and pre-trained diffusion models

Data Science & Artificial Intelligence Lab — Fayetteville, Arkansas

Undergraduate Research Assistant — **Aug 2019 - May 2021**

- Research focused on graph representation learning and using Bayesian methods to account for uncertainty in noisy graph data to improve node classification
- Designed and developed a cyber-argumentation discourse-based platform and utilized natural language processing and knowledge graph-based deep learning models to understand how user opinions change over time

PEER-REVIEWED PUBLICATIONS

Aneesh Komanduri, Chen Zhao, Feng Chen, and Xintao Wu. "Causal Diffusion Autoencoders: Toward Counterfactual Generation via Diffusion Probabilistic Models." *Proceedings of 27th European Conference on Artificial Intelligence (ECAI)*. 2024. (Acceptance rate: 23.1%)

Aneesh Komanduri, Yongkai Wu, Feng Chen, and Xintao Wu. "Learning Causally Disentangled Representations via the Principle of Independent Causal Mechanisms." *Proceedings of the 33rd International Joint Conference on Artificial Intelligence (IJCAI)*, 2024. (Long oral: top 2.3%)

Aneesh Komanduri, Xintao Wu, Yongkai Wu,and Feng Chen. "From Identifiable Causal Representations to Controllable Counterfactual Generation: A Survey on Causal Generative Modeling."

Transactions on Machine Learning Research (TMLR). 2024.

Aneesh Komanduri, Yongkai Wu, Wen Huang, Feng Chen, and Xintao Wu. "SCM-VAE: Learning Identifiable Causal Representations via Structural Knowledge." *2022 IEEE International Conference on Big Data (BigData)*, 2022.

Aneesh Komanduri and Justin Zhan, "Neighborhood Random Walk Graph Sampling for Regularized Bayesian Graph Convolutional Neural Networks." *2021 20th IEEE International Conference on Machine Learning and Applications (ICMLA)*, 2021.

Teaching & Mentorship Experience

UNITE, Army Educational Outreach Program (AEOP) Fayetteville, Arkansas

Lead Research Mentor (`https://github.com/akomand/AEOP_Research_2021`) **2020, 2021**

- Guided High School students from underrepresented communities with research in data science and machine learning
- Created lesson plans to teach data/text preprocessing, classification/regression, word embeddings, entity extraction, topic modeling, language models, transformers, implementations in Python, deep learning pipeline in PyTorch (including fine-tuning large language models), and applications in sentiment analysis and question answering
- Assisted students in the development of a machine learning research paper and helped students present research to be evaluated by the Department of Defense education initiative
  Mentored Manuscript: Kate Pearce, Tiffany Zhan, **Aneesh Komanduri**, Justin Zhan. "A Comparative Study of Transformer-based Language Models on Extractive Question Answering". *arXiv*. 2021.

University of Arkansas Fayetteville, Arkansas

Teaching Assistant **Jan 2020 - Dec 2020**

- **Courses:** CSCE 2004 (Programming Foundations I) and CSCE 3193 (Programming Paradigms)
- Topics include C++ in a UNIX environment, object-oriented programming, web programming, and functional programming
- Taught two lab sections weekly for a total of over 45 computer science & engineering students and held office hours for over 200 students
- Created, debugged, graded, and provided feedback on object-oriented and functional programming assignments (C++/Java/Python) and exams and held office hours for 200+ students

Honors and Awards

Doctoral Academy Fellowship	2021-2025
Congressional Letter for STEM Outreach, U.S. House of Representatives	July 2021
Blanche Bledsoe Rosecrans and Clarence J. Rosecrans Scholarship	2020-2021
Lawrence Jesser Toll, Jr. Endowed Scholarship (Dept. of Mathematical Sciences)	2020-2021
Silas Hunt Distinguished Scholarship	2017-2021

Service

Conference Reviewer

- The Thirty-eighth Conference on Neural Information Processing Systems (NeurIPS), 2024
- IEEE International Conference on Machine Learning and Applications, 2024 (PC member)

Journal Reviewer

- Journal of Data-centric Machine Learning Research (DMLR), 2024
- Springer International Journal of Data Science and Analytics (IJDSA), 2024

Workshop Reviewer

- ICML Workshop on Structured Probabilistic Inference and Generative Modeling, 2024

Skills

- Languages: Python, C/C++, Java, Javascript, SQL
- ML Frameworks: PyTorch, Tensorflow, scikit-learn, Pyro
- Machine Learning: Large Language Models, Diffusion Probabilistic Models, Parameter Efficient Fine-tuning (e.g., LoRA), Variational Autoencoders, Normalizing Flows, Causality
- Technologies: Flask, Django, AWS, Databricks, Postgres, Apache Spark, ReactJS
- Applications: LaTeX, Jupyter Notebook, VSCode, PyCharm, Git, RStudio, MATLAB

Industry Experience

Phillips 66 Bartlesville, Oklahoma

Digital Security and Cloud Engineering Intern **May 2020 - Aug 2020**

- Developed infrastructure as code templates with Terraform and built CI/CD pipelines for the creation of resources such as SQL Servers, Blob Storages, Key Vaults, and Firewall rules for Azure Data Factory in a production environment
- Utilized AWS Security Console and Dome9 to keep inventory on cloud instance security group rules for accounts throughout the company and automated the process by creating a Python script to pull data using the Dome9 REST API