Shivvrat **Arya**

Dallas TX 75252

(+1) (469) 920 1992 | shivvrat.arya@utdallas.edu | shivvrat.github.io/ | Shivvrat | shivvrat | Shivvrat Arya

Educational Background

Ph.D. in Computer Science *Expected May 2025*

The University of Texas at Dallas, Richardson, Texas *GPA: 4.0/4.0*

- **Dissertation Title:** Neural Network and MILP-Based Effective Inference Algorithms for Probabilistic Models
- **Advisor:** Dr. Vibhav Gogate
- **Co-Advisor:** Dr. Yu Xiang

M.S. in Computer Science *May 2021*

The University of Texas at Dallas, Richardson, Texas *GPA: 4.0/4.0*

B. Tech. in Computer Science and Engineering *May 2019*

Indian Institute of Information Technology Vadodara, India *GPA: 8.39/10.0*

Research Interests

Machine Learning, Deep Learning, Computer Vision, Probabilistic Graphical Models, Neuro-Symbolic Inference, Tractable Probabilistic Modelling, Self-supervised learning, Video Understanding

Research Experience

Center for Machine Learning, The University of Texas at Dallas *Richardson, TX*

Research Assistant *August 2021 - Present*

- Developed accelerated inference algorithms for graphical models in collaboration with faculty and graduate peers.
- Played a key role in the **DARPA Perceptually-enabled Task Guidance (PTG)** program, advancing Neuro-Symbolic Dynamic Probabilistic Models for enhanced representation and reasoning.
- Contributed to the **DARPA Explainable Artificial Intelligence (XAI)** program, focusing on developing interpretable AI systems to support transparent decision-making.
- Participated in the **DARPA Assured Neuro Symbolic Learning and Reasoning (ANSR)** program, focusing on secure and reliable neuro-symbolic learning approaches.
- Contributed to research grants funded by **National Science Foundation (NSF)** and **Air Force Office of Scientific Research (AFOSR)**.

Indian Institute of Technology Indore *Indore, India*

Research Intern *Jan. 2019 to May 2019 / May 2018 to July 2018*

- Researched and benchmarked deep learning architectures for multi-label classification.
- Developed the Kernelized Random Vector Functional Link (KRVFL) network for multi-label classification.

Publications

Highly Refereed Conference Papers

- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."SINE: Scalable MPE Inference for Probabilistic Graphical Models using Advanced Neural Embeddings", *[Under Review]*, 2024
- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."A Neural Network Approach for Efficiently Answering Most Probable Explanation Queries in Probabilistic Models", *The Thirty-eighth Annual Conference on Neural Information Processing Systems*, (**NeurIPS Spotlight: top 3% papers**), 2024
- Rohith Peddi, **Shivvrat Arya**, Bharath Challa, Likhitha Pallapothula, Akshay Vyas, Bhavya Gouripeddi, Qifan Zhang, Jikai Wang, Vasundhara Komaragiri, Eric Ragan, Nicholas Ruozzi, Yu Xiang, Vibhav Gogate ."CaptainCook4D: A Dataset for Understanding Errors in Procedural Activities", *The Thirty-eight Conference on Neural Information Processing Systems, Datasets and Benchmarks Track*, (**NeurIPS: D&B**), 2024
- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."Learning to Solve the Constrained Most Probable Explanation Task in Probabilistic Graphical Models", *27th International Conference on Artificial Intelligence and Statistics*, (**AISTATS**), 2024
- **Shivvrat Arya**, Yu Xiang, Vibhav Gogate."Deep Dependency Networks and Advanced Inference Schemes for Multi-Label Classification", *27th International Conference on Artificial Intelligence and Statistics*, (**AISTATS**), 2024
- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."Neural Network Approximators for Marginal MAP in Probabilistic Circuits", *The 38th Annual AAAI Conference on Artificial Intelligence*, (**AAAI Oral Presentation: top 6% papers**), 2024
- Vikas Chauhan, Aruna Tiwari and **Shivvrat Arya**."Multi-Label classifier based on Kernel Random Vector Functional Link Network", *International Joint Conference on Neural Networks*, (**IJCNN**), 2020

Refereed Workshop Papers

- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."A Neural Network Approach for Efficiently Answering Most Probable Explanation Queries in Probabilistic Models", *UAI Tractable Probabilistic Modeling*, (**TPM: Best Paper Award**), 2024
- **Shivvrat Arya**, Tahrima Rahman, Vibhav Gogate."Neural Network Approximators for Marginal MAP in Probabilistic Circuits", *UAI Tractable Probabilistic Modeling*, (**TPM**), 2024
- Benjamin Rheault, **Shivvrat Arya**, Akshay Vyas, Jikai Wang, Rohith Peddi, Brett Benda, Vibhav Gogate, Nicholas Ruozzi, Yu Xiang, Eric Ragan."Predictive Task Guidance with Artificial Intelligence in Augmented Reality", *IEEE Conference on Virtual Reality and 3D User Interfaces*, (**IEEE VR**), 2024
- Rohith Peddi, **Shivvrat Arya**, Bharath Challa, Likhitha Pallapothula, Akshay Vyas, Qifan Zhang, Jikai Wang, Vasundhara Komaragiri, Nicholas Ruozzi, Eric Ragan, Yu Xiang, Vibhav Gogate."Put on your detective hat: What's wrong in this video?", *DMLR Data-centric Machine Learning Research*, (**DMLR Workshop**), 2023

Journal Papers

- Chiradeep Roy*, Mahsan Nourani*, **Shivvrat Arya***, Mahesh Shanbhag, Tahrima Rahman, Eric D Ragan, Nicholas Ruozzi, Vibhav Gogate."Explainable Activity Recognition in Videos using Deep Learning and Tractable Probabilistic Models", *ACM Transactions on Interactive Intelligent Systems*, (**TiiS**), 2023

Teaching Experience

Department of Computer Science, The University of Texas at Dallas *Richardson, TX*

Teaching Assistant *August 2020 - August 2021*

- **Courses:** Statistical Methods in AI and Machine Learning, Database Systems, Discrete Mathematics for Computing II
- **Responsibilities:** Graded assignments, held office hours, conducted project demonstrations, and developed supplementary materials and homework solutions for the courses.

Department of Computer Science, The University of Texas at Dallas *Richardson, TX*

Guest Lecturer *Jan. 2024 - May 2024*

- **Course:** Artificial Intelligence (Senior Level)
- **Responsibilities:** Delivered lectures and facilitated class activities, with a focus on core topics in Artificial Intelligence.

Department of Computer Science, The University of Texas at Dallas *Richardson, TX*

Guest Lecturer *August. 2024 - December 2024*

- **Course:** Artificial Intelligence (Graduate Level)
- **Responsibilities:** Taught lectures and guided class discussions, concentrating on advanced topics in Artificial Intelligence.

Department of Computer Science, The University of Texas at Dallas *Richardson, TX*

Guest Lecturer *August. 2024 - December 2024*

- **Course:** Machine Learning (Graduate Level)
- **Responsibilities:** Delivered instructional content and moderated discussions, focusing on advanced Machine Learning concepts.

Summer School Programs *India*

High School Teacher *Summer 2015, 2016, 2017*

- **Subjects:** Mathematics (2015), Computer Science and Mathematics (2016, 2017)
- **Responsibilities:** Taught 80 to 100 students with varying familiarity levels, simplified complex concepts, utilized interactive discussions and hands-on examples, and created an inclusive learning environment.

Professional Recognition and Honors

2024 ***"A Neural Network Approach for Efficiently Answering Most Probable Explanation Queries in Probabilistic Models"* selected as Spotlight: top 3% papers**, NeurIPS 24

2024 **Best Paper Award for *"A Neural Network Approach for Efficiently Answering Most Probable Explanation Queries in Probabilistic Models"***, TPM 24

2024 **Neural Network Approximators for Marginal MAP in Probabilistic Circuits selected for *oral presentation : top 3% papers***, AAAI 24

2019 **Awarded the Jonsson School Graduate Study Scholarship**, The University of Texas at Dallas

2015 **Awarded the Central Sector Scheme of Scholarships for College and University Students, covering the full duration of Undergraduate and Graduate studies**, The Department of Higher Education, India

Professional Service

Journal Reviewer

IEEE Robotics and Automation Letters (RA-L)

Conference Reviewer

Conference on Uncertainty in Artificial Intelligence (UAI)	2024
Neural Information Processing Systems (NeurIPS)	2024
International Conference on Learning Representations (ICLR)	2024

Work Experience

TechnoUniverse *Indore, India*

Android Development Intern *May 2017 to July 2017*

- Developed a full-featured Android application for InvestoCafe, a financial services firm, ensuring seamless design alignment with their existing website.

Technical Skills

Programming Languages:	Python, R, SQL, Java, C, Cython
Machine Learning Tools:	TensorFlow, PyTorch, scikit-learn, Keras
Data Analysis:	Pandas, NumPy, SciPy, Matplotlib, Seaborn
Cloud Platforms:	AWS, Google Cloud Platform, Azure
Version Control:	Git, GitHub
Productivity Suite:	MS Office, LaTeX, Libre Office, Movie Maker
Other:	Docker, Kubernetes

Academic Projects

Completed at The University of Texas at Dallas

- **Parameter and Structure Learning Algorithms for Bayesian Networks** **Statistical Methods in AI and ML**, *Spring 2020*
  Implemented several structure learning algorithms for Bayesian Networks, including FOD-Learn (fully observed data, known structure), POD-Learn (partially observed data, known structure), and Mixture-Random-Bayes (fully observed data, unknown structure). Conducted a comparative analysis of these algorithms based on different data and structure conditions.
- **Sampling-based Variable Elimination and Conditioning** **Statistical Methods in AI and ML**, *Spring 2020*
  Implemented Sampling-based Variable Elimination and Conditioning algorithm for performing inference on probabilistic graphical models.
- **Learning Algorithms for Bayesian Networks** **Machine Learning**, *Fall 2019*
  Implemented four algorithms: Independent Bayesian Networks, Tree Bayesian Networks (using Chow-Liu), Mixtures of Tree Bayesian Networks using EM, and Mixtures of Tree Bayesian Networks using Random Forests.
- **Non-Iterative Neural Networks** **Machine Learning**, *Fall 2019*
  Implemented two non-iterative neural network models for classification and regression tasks across multiple datasets.
- **Collaborative-Filtering** **Machine Learning**, *Fall 2019*
  Implemented collaborative filtering algorithms using a subset of the Netflix Prize movie ratings data. Evaluated model performance using Mean Absolute Error and Root Mean Squared Error metrics.
- **DART Database System** **Database Design**, *Fall 2019*
  Designed and implemented the DART system's complete database, from EER diagram creation to relational schema design, SQL-based database construction, and query/view generation.

Completed at Indian Institute of Information Technology Vadodara, India

- **Compressed Sensing** **Computer Vision**, *Fall 2018*
  Developed and evaluated an algorithm for multi-view tracking and 3D voxel reconstruction using 2D images.
- **Kakuro Puzzle Solver** **Artificial Intelligence**, *Spring 2018*
  Designed and implemented a bot to solve Kakuro puzzles by applying derived rules to handle diverse puzzle instances.
- **Autoencoder for Anomaly Detection** **Deep Learning**, *Spring 2018*
  Developed an autoencoder-based anomaly detection method, successfully tested on a credit card fraud dataset.

- **LEARN: A Programming Language** **Compiler Design**, *Spring 2018*
  Designed and implemented a beginner-friendly programming language LEARN using yacc and lex, aiming to ease the learning curve for new programmers.
- **Fatal Disease Detector Using Twitter Data** **IIITV Hackathon**, *Fall 2018*
  Implemented a k-means clustering algorithm to detect disease spread patterns using Twitter data.
- **SoT (Security of Things)** **Cryptography**, *Fall 2017*
  Developed an Android application to monitor real-time environmental temperature changes with AES encryption for secure data transmission.
- **Hatsphere: E-commerce Platform** **Software Development**, *Fall 2017*
  Developed a platform to enable traditional craftsmen to sell their products online and reach a broader market.
- **Cocktail Party Effect Algorithm** **Speech Science and Technology**, *Fall 2017*
  Implemented an algorithm to separate human voice from noise in audio recordings.
- **Movie Recommendation System** **Database Design**, *Spring 2016*
  Developed a user interface and managed a database system for a movie recommendation engine, utilizing PostgreSQL and C for backend management.

Organizational Responsibilities

Completed at The University of Texas at Dallas

2019 - 2020 **Associate Officer Internal Projects**, Research Club

Completed at Indian Institute of Information Technology Vadodara, India

2016 - 2019 **Head**, Sports Committee
2016 - 2019 **Core Member**, Organizing Team - Krieva 2016, Ventura 2016, Krieva 2017, Cerebro 2018, Ventura 2018
2016 - 2019 **Core Member**, Pensive (Literary Society)
2015 - 2016 **Member**, Hostel Executive Committee
2007 - 2015 **Class Representative**, Vidya Sagar School

Certifications

Coursera Course Certificates

- Mathematics for Machine Learning: Linear Algebra - *Present License* E5PBMECK8B4M — Apr 2019
- What is Data Science? - *Present License* 5WS64BF2G2SY — Feb 2019
- Introduction to Programming with MATLAB - *Present License* VGPWCM8WH73K — Feb 2019
- Deep Learning Specialization - *Present License* J9V32CC6VTB5 — Nov 2018
- Sequence Models - *Present License* 5E9VFH59THG4 — Nov 2018
- Convolutional Neural Networks - *Present License* G888N3WXPXLN — Sep 2018
- Python Programming Essentials - *Present License* TZXYYXTF796L — Jun 2018
- Structuring Machine Learning Projects - *Present License* JJNYAQTVFUPR — May 2018
- Neural Networks and Deep Learning - *Present License* JSAR6KKVC5Y7 — Apr 2018
- Improving Deep Neural Networks - *Present License* MRVNDFNWUHPQ — Apr 2018
- Machine Learning - *Present License* FPWNJ39A5LWQ — Mar 2018
- Python Data Structures - *Present License* DS5N3NM69PQ6 — Mar 2018
- Programming for Everybody - *Present License* XS6H2XUBJ66U — Jan 2018

Udemy Course Certificates

- The Top 5 Machine Learning Libraries in Python — Jan 2019
- MATLAB for scientists: a beginner's course — Jan 2019

References

Dr. Vibhav Gogate
Professor
Department of Computer Science
The University of Texas at Dallas
Richardson, TX
972-883-4245
Vibhav.Gogate@utdallas.edu

Dr. Sriraam Natarajan
Professor
Department of Computer Science
The University of Texas at Dallas
Richardson, TX
972-883-4163
Sriraam.Natarajan@utdallas.edu

Dr. Guy Van den Broeck
Professor
Computer Science
University of California, LA
Los Angeles, CA
310-206-6552
guyvdb@cs.ucla.edu

Dr. Yu Xiang
Assistant Professor
Department of Computer Science
The University of Texas at Dallas
Richardson, TX
972-883-3891
Yu.Xiang@UTDallas.edu

Dr. Nicholas Ruozzi
Associate Professor
Department of Computer Science
The University of Texas at Dallas
Richardson, TX
972-883-4918
Nicholas.Ruozzi@utdallas.edu