

Shivvrat Arya

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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**, Tahrira 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**, Tahrira 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**, Tahrira 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 Ruozi, 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 Ruozi, 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 Ruozi, Vibhav Gogate."Explainable Activity Recognition in Videos using Deep Learning and Tractable Probabilistic Models", *ACM Transactions on Interactive Intelligent Systems*, (**Tiis**), 2023
- Vikas Chauhan, Aruna Tiwari and **Shivvrat Arya**."Multi-label Classification based on Broad Learning System", (**Under Review**)
- Vikas Chauhan, Aruna Tiwari and **Shivvrat Arya**."Multi-label Classification based on Random Vector Functional Link Neural Networks", (**Under Review**)

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

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

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| 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	2024

Work Experience

TechnoUniverse

ANDROID DEVELOPMENT INTERN

Indore, India

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

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| • Mathematics for Machine Learning: Linear Algebra - <i>Present License</i> E5PBMECK8B4M | Apr 2019 |
| • What is Data Science? - <i>Present License</i> 5WS64BF2G2SY | Feb 2019 |
| • Introduction to Programming with MATLAB - <i>Present License</i> VGPWCM8WH73K | Feb 2019 |
| • Deep Learning Specialization - <i>Present License</i> J9V32CC6VTB5 | Nov 2018 |
| • Sequence Models - <i>Present License</i> 5E9VFH59THG4 | Nov 2018 |
| • Convolutional Neural Networks - <i>Present License</i> G888N3WXPXLN | Sep 2018 |
| • Python Programming Essentials - <i>Present License</i> TZXYXTF796L | Jun 2018 |
| • Structuring Machine Learning Projects - <i>Present License</i> JJNYAQTUFUPR | May 2018 |
| • Neural Networks and Deep Learning - <i>Present License</i> JSAR6KKVC5Y7 | Apr 2018 |
| • Improving Deep Neural Networks - <i>Present License</i> MRVNDFNWUHPQ | Apr 2018 |
| • Machine Learning - <i>Present License</i> FPWNJ39A5LWQ | Mar 2018 |
| • Python Data Structures - <i>Present License</i> DS5N3NM69PQ6 | Mar 2018 |
| • Programming for Everybody - <i>Present License</i> XS6H2XUBJ66U | Jan 2018 |

UDEMY COURSE CERTIFICATES

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