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

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*

- Collaborated with faculty and graduate peers to develop accelerated inference algorithms for graphical models.
- Contributed to the DARPA Perceptually-enabled Task Guidance (**PTG**) program, specializing in the advancement of Neuro-Symbolic Dynamic Probabilistic Models as a comprehensive tool for representation and reasoning.
- Contributed to the DARPA Assured Neuro Symbolic Learning and Reasoning (**ANSR**) program.
- Contributed to the DARPA Explainable Artificial Intelligence (**XAI**) program, focusing on the development of transparent AI systems that offer interpretable decision-making.

Indian Institute of Technology Indore *Indore, India*

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

- Investigated the multi-label classification problem and summarized the performance of various deep learning architectures for multi-label classification.
- Collaborated with faculty and graduate students to design a kernelized random vector functional link (KRVFL) network for multi-label classification

Publications

Highly Refereed Conference Papers

Shivvrat Arya, Tahrima Rahman, Vibhav Gogate. "A Neural Network Approach for Efficiently Answering Most Probable Explanation Queries in Probabilistic Models". , [Under Review]

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". , [Under Review]

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 (Oral Presentation)***, 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". ***TPM (Best Paper Award)***, 2024

Shivvrat Arya, Tahrima Rahman, Vibhav Gogate. "Neural Network Approximators for Marginal MAP in Probabilistic Circuits". ***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). pages 1-2

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***, 2023

Vikas Chauhan, Aruna Tiwari and **Shivvrat Arya**. "Multi-label Classification based on Broad Learning System". ***Neural Computing and Applications Journal***, [Under Review]

Vikas Chauhan, Aruna Tiwari and **Shivvrat Arya**. "Multi-label Classification based on Random Vector Functional Link Neural Networks". ***Soft Computing Journal***, [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, conducted office hours and prepared homework solutions for selected courses

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

Guest Lecturer *Jan. 2024 - May 2024*

- **Course:** Artificial Intelligence
- **Responsibilities:** Prepared lectures and class activities focusing on topics related to AI.

Work Experience

TechnoUniverse *Indore, India*

Android Development Intern *May 2017 to July 2017*

- Developed an Android application from the ground up for InvestoCafe, a financial services firm, ensuring design consistency 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

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

Professional Recognition and Honors

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

2024 **Neural Network Approximators for Marginal MAP in Probabilistic Circuits selected for *oral presentation***, AAAI 24

2019 **Jonsson School $1000 Graduate Study Scholarship**, The University of Texas at Dallas

2015 **Central Sector Scheme of Scholarships for College and University Students**, The Department of Higher Education, India

Academic And Personal Projects

- **Learning algorithms for Bayesian Networks** **PGM**, *Spring 2020*
  Implementation of various structure and parameter learning algorithms for Bayesian networks.
- **Sampling-based Variable Elimination and Conditioning** **PGM**, *Spring 2020*
  Implementation of the Sampling-based Variable Elimination and Conditioning algorithm for inference on PGM's.
- **Non Iterative Neural Network** **Machine Learning**, *Fall 2019*
  Implemented two non-iterative neural network methods, RVFL and ELM to do classification and regression tasks on various datasets.
- **DART Database** **Database Design**, *Fall 2019*
  Implemented the complete database for the DART system. Designed the EER diagram, converted the EER to relational schema, created the database on SQL and created views and queries for the database.
- **Compressed Sensing** **Computer Vision**, *Fall 2018*
  Implemented and evaluated an algorithm for multi-view tracking and 3-D voxel reconstruction from 2-D images.
- **Kakuro solver** **Artificial Intelligence**, *Spring 2018*
  Designed a bot to solve Kakuro puzzles, applying derived rules and handling various puzzle instances.
- **Autoencoder for anomaly detection** **Deep Learning**, *Spring 2018*
  Developed an autoencoder-based method for anomaly detection, tested on a credit card fraud dataset.
- **LEARN** **Compiler Design**, *Spring 2018*
  Created a new programming language LEARN, using yacc and lex, aimed at easing the learning curve for beginners.
- **Fatal Disease Detector** **IIITV Hackathon**, *Fall 2018*
  Implemented a k-means clustering algorithm to detect patterns indicative of disease spread using Twitter data.
- **SoT (Security of Things)** **Cryptography**, *Fall 2017*
  Developed an Android app for monitoring real-time environmental temperature changes, incorporating AES for data encryption.
- **Hatsphere** **Software Development**, *Fall 2017*
  Developed a seller's platform for e-commerce, enabling traditional craftsmen to connect with a larger market.
- **Cocktail Party Effect** **Speech Science and Technology**, *Fall 2017*
  Implemented an algorithm to separate voice from noise in audio signals.
- **Movie Recommender** **Database Design**, *Spring 2016*
  Created a user interface for database interaction and managed system data for a movie recommendation system.

Organizational Responsibilities Undertaken

2016 - 2019 **Head**, Sports Committee

2016 - 2019 **Core Member**, Organizing Team - Krieva 2016, Krieva 2017, Cerebro 2018, Ventura 2016, Ventura 2018

2016 - 2019 **Core Member**, Literary Society – Pensive

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