Parth Padalkar

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Education

2021–2025 **University of Texas at Dallas, USA**,
Computer Science, Ph.D, GPA: 3.87/4.0.

2019–2021 **University of Texas at Dallas, USA**,
Computer Science, Master of Science.

2015–2019 **National Institute of Technology Jalandhar, India**,
Instrumentation and Control Engineering, Bachelor of Technology.

Professional Experience

May '20 - Aug '20 **Computer Vision Intern**, Tech For Good Inc., Boston, MA.
- Coordinated a team to annotate a 5,000-image dataset of firearms in active shooter scenarios, achieving 90% accuracy after experimenting with various object detection models such as YOLO, FastRCNN and FasterRCNN.

Sept '19 - May '20 **Research Analyst**, Schizophrenia and Social Cognition lab, UTD.
- Worked on analyzing schizophrenic patient data and developing an ML model to predict the occurrence of the disease in subjects with an 89% accuracy.

May '17 - July '17 **Research Intern** , IIM Amritsar, India.
- Created a software by integrating various decision-making techniques such to find the degree of impact of the enablers and barriers to sustainable manufacturing.

Publications

Published Research

NeSyFOLD: A Framework for Interpretable Image Classification [paper],
Parth Padalkar, Huaduo Wang, Gopal Gupta, AAAI 2024, oral presentation (<4% selection rate).
- Introduced a neurosymbolic framework, NeSyFOLD, aimed at creating interpretable predictions for image classification tasks, using Convolutional Neural Networks (CNNs).
- A rule-set generated from the CNN, along with the CNN serves as the interpretable model for making predictions. Showed an average increase of 8% in accuracy and an 83% reduction in rule-set size than previous SOTA.

Using Logic Programming and Kernel-Grouping for Improving Interpretability of Convolutional Neural Networks [paper],
Parth Padalkar, Huaduo Wang, Gopal Gupta,
Practical Aspects of Declarative Languages (PADL) 2024.
- Improved on NeSyFOLD. Developed a novel algorithm for grouping the outputs of similar kernels in the CNN.
- Showed that using groups of kernels for generating a rule-set leads to comparable performance and a 14% drop in the rule-set size on average, than using individual kernels.

Automated interactive domain-specific conversational agents that understand human dialogs [paper],
Yankai Zeng, Abhiramon Rajasekharan, Parth Padalkar, Kinjal Basu, Joaquín Arias, Gopal Gupta,
Practical Aspects of Declarative Languages (PADL) 2024.
- Developed a chat-bot using LLMs and logic programming that is more reliable than using an LLM-based chatbot.
- Showed application as a hotel concierge that can recommend restaurants with more reliability than Bing AI.

Reliable Natural Language Understanding with Large Language Models and Answer Set Programming [paper],
Abhiramon Rajasekharan, Yankai Zeng, Parth Padalkar, Gopal Gupta,
International Conference on Logic Programing (ICLP) 2023.

- Proposed STAR, a framework that combines LLMs with Answer Set Programming (ASP) to improve reasoning in natural language understanding tasks.
- Applied the STAR framework to tasks involving qualitative reasoning, mathematical reasoning, and goal-directed conversations and demonstrated its superior performance to vanilla LLMs.

Copyrights

Sept 2019 **Software for efficient matrimonial match-making**.

- Copyright from Govt. of India on a software created for efficient matrimonial matchmaking. (Ref no: SW-12849/2019)

July 2018 **Program for Identifying Cause and Effect Relationships Between Factors**.

- Copyright from Govt. of India on a software that automates popular decision making techniques such as DEMATEL, MMDE, ISM (Ref no: SW-10923/2018)

Projects

Oct 2023 **Efficient learning using Neurosymbolic Methods**.

- Inspired by Yang et.al (IJCAI 2020), created a neurosymbolic model using a CNN and a goal-directed ASP solver s(CASP) for learning to recognize digit pairs from images, given their sum.

Nov 2022 **Multiagent Reinforcement Learning with a Centralized Controller [code] [report]**.

- Implemented a multi-agent RL system using the options framework for solving a task in a variation of the Box World environment. Demonstrated the significance of using a planner to allocate high level tasks to agents.

Jun 2021 **Bilevel Optimization Algorithm for robust Learning [code]**.

- Implemented a Bilevel optimization algorithm to improve the performance of an ML model on imbalanced datasets.

Professional Achievements

Oct 2023 Presented a poster on XAI using logic programming at AAAI Fall Symposium Series 2023

May 2023 Mentored a high school student in publishing their first paper in Journal of Emerging Investigators

Aug 2022 Reviewer for AAAI 2022

May 2021 Reviewer for SUBSETML workshop at ICML 2021

Technical Skills

- Profecient in Python, Prolog, Answer Set Programming, along with frameworks such as PyTorch, TensorFlow, Pandas and NumPy.
- Solid grasp of LLMs, Machine Learning, Computer Vision, and Deep Learning algorithms coupled with the ability to solve complex problems in an elegant manner.

Relevant Courses

Computational Logic and Logic Programming, Convolutional Neural Networks, Deep Learning for NLP, Advanced Machine Learning, Reinforcement Learning, Optimization in ML and Neurosymbolic learning

Extra Curriculars

May 2023 Intramural Team Chess Champion

June 2021 Intramural Champion Badminton doubles at UTD

Jan 2021 Tutored Middle school students as a part of CS outreach program at UTD

References

Gopal Gupta,
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Sriraam Natarajan,
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Computer Science Department, UT Dallas,
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