Ph.D Candidate at IIT Delhi
and Senior Researcher at Fujitsu Research
(+91) 7674972017
i.vishal1990@gmail.com
vshlroot.github.io/

Vishal Sharma

Research Interests

I am interested in developing techniques that facilitate the generalization of deep neural networks trained on smaller instances of a problem to larger ones. I have worked on learning generalized object-centric neural policies for reinforcement learning (RL) and relational planning, i.e. policies that can be applied to an unseen variation of a given environment. This is unlike the typical RL (and planning) setting, where the policy is learned for a single environment. Recently, I have started working in the area of large graph AI. In the past, I have also worked on developing transferable lifted inference approaches for Probabilistic Graphical Models.

Areas of Research: Large Heterogeneous Graph AI, Deep Reinforcement Learning, Zero-shot Transfer, Generalized Neural Planning, Object-centric representations.

Academic Profile

2016-Present **Ph.D**, *Department of Computer Science & Engineering, Indian Institute of Technology Delhi.*
Area*: Deep Transfer Learning for Reinforcement Learning and Planning.* **Advisor***: Prof. Parag Singla*

2012-2014 **M.Tech**, *Department of Computer Science & Engineering, National Institute of Technology Allahabad, CGPA* **9.44/10**

2007-2011 **B.Tech**, *Department of Computer Science & Engineering, Punjab Technical University, Percentage* **86.3%**

2007 **Intermediate**, *Kendriya Vidyalaya No. 1, Jalandhar Cantt., Percentage* **84.6%**

2005 **Matriculation**, *Kendriya Vidyalaya No. 1, Jalandhar Cantt., Percentage* **85.8%**

Work Experience

Aug 2023- Present **Senior Researcher** at Fujitsu Research India
Responsibilities include leading a team that develops and publishes novel deep learning-based solutions for AI/ML tasks on large heterogeneous Graphs in real-world settings. Responsibilities also include data collection, EDA and deployment of the Graph AI pipeline on client data.

June 2014- July 2016 **Application Developer** at Oracle India Private Limited
Responsibilities included developing new functionalities and maintaining product code on database, middleware and application level, which required working on Java, SQL, Pl/Sql and Oracle Applications Framework.

Conference Publications and Research Projects

2023 (Under Review at ICAPS 2024) **Object-Centric Learning of Neural Policies for Zero-shot Transfer over Domains with Varying Quantities of Interest**

Vishal Sharma, Aniket Gupta, Prayushi Kamleshbhai Faldu, Rushil Gupta, Mausam, and Parag Singla

Unlike most modern deep reinforcement learning agents that overfit on the training environment, we target to learn an agent that generalizes, in a zero-shot manner, across variation in the training environment (e.g., number of objects, motion dynamics etc.). We propose an object-centric deep reinforcement learning agent that takes raw images as input, extracts various objects in the scene, and then learns a Graph Neural Network based policy capable of generalization to unseen variations of the training environment.

UAI 2023 **SymNet 3.0: Exploiting Long-Range Influences in Learning Generalized Neural Policies for Relational MDPs**

Vishal Sharma, Daman Arora*, Mausam, and Parag Singla* (* denotes equal contribution)

We theoretically identify the shortcoming of current state-of-the-art for learning generalized neural policies for relational planning and show that they can not learn certain policies requiring information collation among state variables with long-range dependency. We propose a novel influence graph that captures these long-range dependencies and can be plugged into the existing method to counter the shortcoming.

UAI 2022 **SymNet 2.0: Effectively handling Non-Fluents and Actions in Generalized Neural Policies for RDDL Relational MDPs**

Vishal Sharma, Daman Arora, Florian Geißer, Mausam, and Parag Singla

We focus on learning generalized neural policies for offline Relational Planning (Relational-MDP) such that the policies are trained on smaller problem instances and are transferred in a zero-shot manner to any unseen larger problem instance. We leverage the relational transition model to develop a neuro-symbolic deep neural architecture based on Graph Neural Network to learn a generalized neural policy.

UAI 2018 **Lifted Marginal MAP Inference**

(**Oral**) *Vishal Sharma, Noman Ahmed Sheikh, Happy Mittal, Vibhav Gogate, and Parag Singla*

We present the first application of lifting rules for marginal MAP (MMAP), which requires finding MAP assignment to only a set of random variables while marginalizing over the rest. Exploiting symmetries in Markov Logic Network, we propose new rules that, when satisfied, allow the transfer of the solution of the Marginal MAP problem of a smaller size to a problem of any size.

Workshop Publications

PRL-IJCAI 2023 **Object-Centric Learning of Neural Policies for Zero-shot Transfer over Domains with Varying Quantities of Interest**

Vishal Sharma, Aniket Gupta, Prayushi Kamleshbhai Faldu, Rushil Gupta, Mausam, and Parag Singla

PRL-IJCAI 2023 **SymNet 3.0: Exploiting Long-Range Influences in Learning Generalized Neural Policies for Relational MDPs**

Vishal Sharma, Daman Arora*, Mausam, and Parag Singla* (* denotes equal contribution)

WSRL-IJCAI 2021 **Towards an Interpretable Latent Space in Structured Models for Video Prediction**

Rushil Gupta, Vishal Sharma*, Yash Jain, Yitao Liang, Guy Van den Broeck and Parag Singla*

StaRAI-IJCAI 2018 **Lifted Marginal MAP Inference**

Vishal Sharma, Noman Ahmed Sheikh, Happy Mittal, Vibhav Gogate and Parag Singla

Relevant Courses

Deep Learning, Deep Reinforcement Learning, Probabilistic Graphical Models, Digital Image Analysis

Course Projects

- Implemented multiple state-of-the-art neural models for Visual Question Answering competition.
- Developed a simulator for the game of Go to organize a competition as a Teaching Assistant.

Frameworks/Languages

PyTorch, Pytorch Geometric, TensorFlow, Python, Shell Scripting.

Scholastic Achievements and Awards

- *Invited Talk at TCS Virtual Research Café (ReCafe)*, July 2021.
- *Awarded TCS Research Scholar Fellowship* for the period of 2018 - 2022.
- Lifted Marginal MAP Inference paper selected for *Oral Presentation* at UAI 2018.
- Received *Microsoft travel grant* to attend UAI 2018 held in Monterey, California.
- *Attended Amazon India Summer School* 2021 (invitation by selection test).
- Achieved *All India rank 464* amongst more than 150,000 students in GATE 2012.

Services/Positions of Responsibility

2016-2024 **Mentorship** Worked as a mentor for **13 Undergraduate and Masters students** towards their theses.

2016-2021 **Teaching Assistant** at Indian Institute of Technology Delhi

Reinforcement Learning (Fall '19), Machine Learning (Spring '17, Spring '18, Fall '20), Artificial Intelligence (Fall '18), Analysis and Design of Algorithms (Fall '17, Fall '16), Introduction to CS (Spring '16).

2019 **Web-Chair** for The ACM India Joint International Conference on Data Science & Management of Data (CoDS-COMAD) 2019 — 6th ACM IKDD CoDS and 24th COMAD.

2023-2024 **Reviewer** for the AISTATS (2024), UAI (2023, 2024).

Aug 2021 **Teaching Assistant** for the AI Siksha Reinforcement Learning course.

References

Parag Singla, Professor, Indian Institute of Technology, Delhi. **parags@cse.iitd.ac.in**

Mausam, Professor, Indian Institute of Technology, Delhi. **mausam@cse.iitd.ac.in**