NIKUNJ GUPTA

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CS PhD student with an interest in AI, Reinforcement Learning, and Deep Learning

EDUCATION

PhD in computer science, University of Southern California — 2023-Ongoing
MS in computer engineering, New York University (Thesis) — 2021-2023
BTech & MTech in information technology, IIITB (Thesis) — 2014-2019

OBJECTIVE

Learning is central to intelligent behavior. Also, agents can cooperate to tackle large tasks. I study how complex learned behaviors emerge from unsupervised multi-agent interactions and aim to design safe, efficient algorithms for large-scale applications. In the long run, I want to leverage insights from human intelligence to improve machine intelligence and advances in machine intelligence to better understand human cognition.

RESEARCH AREAS

Reinforcement learning, sequential decision-making under uncertainty, learning in multi-agent systems, human-agent collaboration, graph neural networks, generative models.

RESEARCH EXPERIENCE

Mila Quebec AI, Research Intern, Prof. Samira Ebrahimi Kahou — Jan-Jul 2023
NYU Courant, MSc Thesis, Prof. Dennis Shasha — 2022-23
NYU CDS, Research Assistant, Prof. Jacopo Cirrone — Apr-Dec 2022
NYU Tandon, Research Assistant, Prof. Quanyan Zhu — Sep-Dec 2021
University of Alberta, Research Assistant, Prof. Matthew Taylor — 2020-21
Aganitha (an AI startup), Data Scientist — 2019-20
IIITB, MTech Thesis, Prof. GS Raghavan — 2018-19
Ericsson Research India, Research Intern, Dr. Swarup Mohalik — 2018-19
ABB Research India, Research Intern, Dr. Divyasheel Sharma — Summer 2017

PUBLICATIONS

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Under Submission & Ongoing

U3. Deep meta coordination graphs for multi-agent reinforcement learning
Nikunj Gupta, James Hare, Rajgopal Kannan, Viktor Prasanna
Under submission.

U2. Long-range temporal information propagation in MARL via dynamic GNNs
Nikunj Gupta, Ludwika Twardecka, J Hare, J Milzman, R Kannan, Viktor Prasanna
Ongoing work.

U1. Inference of coordination graphs in multi-agent reinforcement learning
Nikunj Gupta, James Hare, Jesse Milzman, Rajgopal Kannan, Viktor Prasanna
Ongoing work.

Journals

J1. HAMMER: Multi-level coordination of RL agents via learned messaging (pdf)(video)
Nikunj Gupta, GS Raghavan, Swarup Mohalik, Nishant Kumar, Matthew Taylor
Neural Computing and Applications 2023 (Impact factor: 6.0 in 2022)
AAMAS 2021: Adaptive and Learning Agents (ALA) workshop (accepted previously)

Conferences

C2. Planning multiple epidemic interventions with reinforcement learning (pdf)(video)
Anh Mai, **Nikunj Gupta**, Azza Abouzied, Dennis Shasha
IJCAI 2023.

C1. Prediction of drug effectiveness in rheumatoid arthritis patients using ML (pdf)
Shengjia Chen, **Nikunj Gupta**, Buz Galbraith, Valay Shah, Jacopo Cirrone
ICBBE 2022.

Workshops

W1. CAMMARL: Conformal action modeling in multi-agent reinforcement learning[(pdf)]
Nikunj Gupta, Somjit Nath, Samira Ebrahimi Kahou
CVPR 2023: Multi-Agent Behavior Workshop

Preprints & Technical Reports

P3. On the calibration of compartmental epidemiological models[(arxiv)(thesis)]
Nikunj Gupta, Anh Mai, Azza Abouzied, Dennis Shasha
Master's Thesis @ NYU Courant, 2023.

P2. Informationally-mosaic reinforcement learning[(pdf)]
Nikunj Gupta, Tao Li, Quanyan Zhu
Preprint 2022.

P1. Fully cooperative multi-agent deep reinforcement learning[(thesis)]
Nikunj Gupta, GS Raghavan, Swarup Mohalik
Master's Thesis @ IIITB, 2019.

Selected Projects

- LLM for credit assignment in dialectic multi-agent collaboration (USC) (Ongoing)
- Subgoal conditioned RL for navigating in grid maps (USC) (Report)(Code)
- Active interactive learning (USC) (Task)(Report)
- Mathematical formulation of a research project (USC) (Task)(Report)
- Low-rank models for missing data imputation in EHRs (NYU) (Arxiv)(Code)
- Optimizing ResNets while being mindful of limited resources (NYU) (Arxiv)(Code)
- Spectral clustering algorithms for directed graphs (NYU) (Arxiv)(Code)
- Text-conditional DCGANs for text-to-image synthesis (IIITB) (Report)(Code)
- Qualitative inference with multi-modal interaction (IIITB) (Report)(Code)

Relevant Courses

USC	CSCI 699 Probabilistic & generative models, CSCI 699 Robot learning, CSCI 599 Autonomous decision-making, CSCI 670 Adv analysis of algos
NYU	Deep learning, mathematical tools for data science, mathematical statistics, optimization, probability and stochastic processes
IIITB	Foundations of big data algorithms, machine learning, artificial intelligence, deep learning, reinforcement learning
Online	Stanford's CS224W Machine learning with graphs (Link)

Teaching

Introduction to Programming, USC	Fall 2023
Introduction to Reinforcement Learning, IIITB	Summer 2019
Applied Machine Learning by Videoken, TCS Bangalore, IIITB	Spring 2019
Mathematics for Machine Learning, IIITB	Fall 2018

Service

Reviewer, ICLR 2025, KDD 2025, NCAA journal 2023/24
Publicity Chair, HiPC 2024
Travel Awards Chair, HiPC 2023

Activities & Awards

Research grants, assisted in writing 8 NSF/USC/ARL grant proposals	2023-24
Mentoring 2 CS undergraduate students, USC CS Mentoring Program (flyer)	2024
Graduate scholarship (USD 12000), NYU Tandon	2021-23
Mentored 2 interns, Intelligent Robot Learning Lab, University of Alberta	2021
Mentored 5 students, IIITB Student Mentoring Program, IIITB	2017-18
Volunteer, CGNet Swara, Microsoft Research India (link)	2017
Organizer, Tug of War and Badminton in IIITB's sports fest	2016/2018
Winner (1500+ teams nation-wide), HackMania hackathon, built SPUC	Oct 2016
Winner (15 teams; 65 students), IIITB's DS hackathon, built FitWit	Feb 2016
Ranked in top 1% (1.5M+ candidates) in All India engineering exam	Apr 2014

SELECTED TALKS & PRESENTATIONS

"*Cooperative Artificial Intelligence*", USC — 2024
"*On the confluence of multi-agent reinforcement learning and graphs*", USC
"*Learning to communicate with deep multi-agent reinforcement learning*", USC
"*SIRL: Similarity-based implicit representation learning*", USC
"*Sim-to-real reinforcement learning for deformable object manipulation*", USC
"*Decision-making under uncertainty via MARL*", USC — 2023
"*CAMMARL*" (accepted paper), CVPR 2023 (MABE workshop), Mila
"*Spectral Clustering on directed graphs*", NYU — 2022
"*Low-rank-models for missing data imputations in EHRs*", NYU
"*Informationally-Mosaic Reinforcement Learning*", NYU
"*HAMMER*" (accepted paper), AAMAS 2021 (ALA workshop) — 2021
"*Bringing RL to the Real World!*", IMPRS-IS PhD Symposium (2021)
"*MARL for Warehouse Logistics*", Ericsson Research India, RISE Conf'19 — 2019
"*Fully Cooperative Multi-Agent RL: Business Angle*", Aganitha (an AI startup)
"*A comprehensive survey of multi-agent reinforcement learning*", IIITB
"*Introduction to reinforcement learning*", AI Club, IIITB
"*Region-based CNNs*", Advanced machine perception seminar, IIITB
"*CGNet Swara: an Indian voice-based portal*", Microsoft Research India — 2017
"*SPUC: Smart Pollution Under Control*", Hackmania Hackathon (Winner) — 2016

PROGRAMMING STRENGTHS

(Languages) Python, C, C++, MATLAB
(AI/DL) PyTorch, Tensorflow, Keras, Pandas, Numpy, Scikit-learn, Scipy
(RL) OpenAI Gym, Stable baselines, RLlib, PytorchRL, MuJoCo, PettingZoo, OpenMPE
(Cloud) USC CARC, NYU HPC, Compute Canada, Slurm, Amazon AWS, Microsoft Azure

OPEN SOURCE CONTRIBUTIONS

As contributor

- wendelinboehmer/dcg
- marlbenchmark/on-policy
- oxwhirl/smacv2
- Wei9711/GACG
- huda-lab/RL-Epidemic-Benchmark
- ArnaudFickinger/gym-multigrid
- sisl/DICG
- LantaoYu/MARL-Papers

As maintainer (selected high-starred repositories)

- Nikunj-Gupta/Efficient-ResNets
- Nikunj-Gupta/FCMADRL
- Nikunj-Gupta/conformal-agent-modelling
- Nikunj-Gupta/HAMMER
- Nikunj-Gupta/Text-to-Image-Synthesis
- Nikunj-Gupta/Brain-Tumor-Segmentation

MENTORING

- Ludwika Twardecka, PhD CS @ USC — Ongoing
- Claire Dang, BS CS @ USC — Ongoing
- Nitin Bhuyyar, research intern from MS CS @ USC — (Summer 2024)
- Nishant Kumar, research intern at UofA (from IIT-BHU) — (Next: Mastercard AI)
- Dikshant Shehmar, intern at UofA (from IIT-B) — (Next: Honda R&D)

RECOMMENDATIONS (> 1-YEAR COLLABORATION)

- **Prof. Viktor Prasanna**, Professor, University of Southern California
- **Prof. Matthew E. Taylor**, Professor, University of Alberta
- **Prof. GS Raghavan**, Professor, IIITB
- **Dr. Swarup Mohalik**, Prinicipal Research Engineer, Ericsson
- **Prof. Dennis Shasha**, Professor, New York University

OTHER INTERESTS AND PROJECTS

- Have sporadically developed AI-driven solutions for diverse medical applications.
- Guided many young undergraduate students to pursue research.
- Active in various sports (currently badminton, tennis, swimming).
- Enjoy storytelling and creative writing.
- Passionate about music; play the piano and am learning to play the guitar.