Kanad Pardeshi

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Research Interests

Machine Learning Theory, Statistical Machine Learning, Machine Learning Algorithms

Education

Carnegie Mellon University — Pittsburgh, PA
Master of Science in Machine Learning — *December 2024*
QPA: 4.11 / 4.00

Indian Institute of Technology Bombay — Mumbai, India
Bachelor of Technology (Honors) in Computer Science and Engineering, Minor in Statistics — *July 2023*
CGPA : 9.75/10 | Honor GPA: 10/10 | Minor GPA: 9.75/10
Courses : Theoretical Machine Learning | Advanced Machine Learning | Reinforcement Learning

Publications and Symposia

- Kanad Pardeshi, Aarti Singh, Ariel Procaccia, and Itai Shapira. Learning Decision-Making Functions Given Cardinal and Ordinal Consensus Data. *AAAI-24 Spring Symposium on Human-Like Learning*, 2024 [1]
- Kanad Pardeshi, Shrey Singla, and Sunita Sarawagi. Staged diffusion models with analytically designed hyperparameters. In *NeurIPS 2023 Workshop on Diffusion Models*, 2023

Research Experience

Statistical Guarantees on Learning Consensus — Pittsburgh, PA
Carnegie Mellon University | Guide: Prof Aarti Singh, Prof Ariel Procaccia — *September 2023 - Present*

- Demonstrated learnability of decision-making functions given feature vectors for actions and their output decision utilities.
- Established PAC guarantees for learning decision-making functions given feature vectors for pairs of actions and preference among them, providing bounds for both equal and different decision weights on different features.
- Proved convergence bound for learning decision-making functions for action preferences given noise from a logistic model.
- Conducting experiments on simulated data, studying the performance of optimization algorithms with dimensionality of feature vector, nature of decision-making process, noise in decisions observed and distribution of action pairs.

Efficient Hyper-parameter Search in Subspace Diffusion Models — Mumbai, India
Indian Institute of Technology Bombay | Guide: Prof Sunita Sarawagi — *August 2022 - July 2023*

- Investigated subspace diffusion models for unconditional generation with emphasis on improving hyper-parameter search.
- Formulated unified ELBO objective accounting for both within-subspace and across-subspace transitions during generation.
- Designed dynamic programming-based method for computation of ELBO objective, obtaining a hyper-parameter search speedup of up to **60**$\times$ over conventional search methods.

Interpretable Reinforcement Learning — Rennes, France
Institut de Recherche en Informatique et Systèmes Aléatoires | Guide: Prof Blaise Genest — *May 2021 - March 2022*

- Engaged in simplifying and interpreting a learnt policy in reinforcement learning for large state and action spaces with noise in the learnt models, with a focus on discrete and finite action spaces.
- Developed a hierarchical variant of the SVM classifier which uses predicted Q-values from the learnt model to better fit the simplified policy to the learnt policy, obtaining higher expected returns on average than the simple SVM.
- Formulated entropy using Q-values for different actions to assign importance to state-action pairs during episodes.

Professional Experience

CNRS @ CREATE and National University of Singapore — Singapore
Engineering Intern | Guide: Prof Arnab Bhattacharya — *May 2023 - July 2023*

- Explored multi-armed bandit algorithms for achieving sub-linear regret with sub-linear arm memory constraint.
- Improved upon and developed new sub-linear memory algorithms empirically achieving up to **11**$\times$ smaller regret.
- Researched adversarial multi-armed bandits with sub-linear memory, focusing on oblivious and adaptive adversaries.

[1] Acceptance received on January 15, 2024, finalized abstract due January 26

Adobe Research Bengaluru, India

Research Intern *May 2022 - July 2022*

- Reviewed literature and devised a novel problem statement in image captioning as part of a team of four interns, defending relevance of problem, its proposed solution, and implemented solution in front of other lab members.
- Implemented BERT-based model with user-controllable detail for image captions, with detail as input on a scale of 1 to 5.
- Devised a metric to better capture extent of detail in image expressed by caption by making use of scene graph.
- Collaborated on patent application 'Image Description Generation with Varying Levels of Detail', recently filed as a US Patent.

Research Projects

Mixed-Curvature Variational Autoencoders *January 2023 - April 2023*

- Studied literature on variational autoencoders in products of non-Euclidean spaces, understanding Riemannian geometry and extensions of normal distribution to non-Euclidean spaces.
- Trained variational autoencoders over various product spaces for the MNIST, Omniglot and CIFAR-10 datasets.

Energy-Based Models (Seminar Project) *January 2022 - May 2022*

- Explored energy-based models and training methods such as Monte Carlo Markov Chains (MCMC), Score Matching and Noise Contrastive Estimation, researching advantages and disadvantages for text generation.
- Investigated energy-based generative flow networks, analyzing time-based evolution on results on simple data.

Image Captioning Using Generative Latent Optimization *January 2022 - May 2022*

- Reviewed Generative Latent Optimization (GLO) Technique, extending application to image captioning using common trainable embedding layer for both image-to-text and text-to-image tasks.
- Trained a model on Flick8K dataset, obtaining an improvement in BLEU score of captions from 51 to 67.

Positions of Responsibility

- **Graduate Admissions Committee** Reviewed and critically analyzed over 40 applications for the CMU MSML program, actively participating in the cumulative application review meetings. *(2023)*
- **Teaching Assistant, CS 101** Designed questions for labs and examinations for the introductory Computer Science course at IIT Bombay, along with guiding students in labs and conducting help sessions for struggling new students. *(2022)*
- **Content Development Specialist** Worked with The Apprentice Project (TAP), an award-winning NGO, to create videos on basic electronics and Social and Emotional Learning (SEL) skills for Indian schoolchildren from low-income backgrounds. *(2022)*
- **Department Academic Mentorship Program** Guided 8 second-year undergraduate students in academic capacity, helped them to adjust to the department and acted as their point of contact with institute authorities. *(2021)*
- **Data Analytics and Visualization Team** Developed an interactive calculator website to estimate the probability of admission for graduate students from the linear regression model obtained on analysis of a dataset. *(2020)*

Academic Achievements

- Secured All India Rank 36 in the National JEE Mains among 935,000 candidates. *(2019)*
- Achieved All India Rank 54 in the National JEE Advanced among 161,000 candidates. *(2019)*
- Awarded AP grade for exceptional performance in Calculus, given to the top 3% of the class at IIT Bombay. *(2019)*
- Secured Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship from the Govt. of India with All India Rank 18. *(2017)*
- Best Observation Award for most accurate astronomical observations in Orientation-Cum-Selection Camp for International Astronomy Olympiad (Jr.) (IAO). *(2016)*

Technical Skills

Programming Languages Python, C++, Java, Javascript, Bash, Lua

Softwares and Tools LaTeX, MATLAB, NumPy, PyTorch, Tensorflow, Linux

Languages English, Hindi, Marathi

Extracurriculars

- Completed a year-long course in Swimming and Aquatics under National Sports Organization of India. *(2019-20)*
- Represented Hostel 16 in the Hostel General Championships 2019 for Aquatics, IIT Bombay. *(2019)*
- Participated in the Logic General Championships 2019, representing Hostel 6, IIT Bombay. *(2019)*
- Participated in Japan-Asia Youth Exchange Program in Science, organized by Government of Japan. *(2017)*
- Secured 2nd position in Sanskrit recitation competition organized by Pt. Satavlekar Pratishthan, Pune, India. *(2014)*