Saurabh Garg

Google Scholar Profile

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Education

Ph.D. in Machine Learning. **2019 – Present**
School of Computer Science, Carnegie Mellon University (CMU)
GPA: 4.22/4.33
Advisors: Zachary Lipton, Sivaraman Balakrishnan

Bachelors (with honors) in Computer Science and Engineering. **2014 – 2018**
Minor in Applied Statistics and Informatics,
Indian Institute of Technology (IIT) Bombay
GPA: 9.51/10.0
Awards: Excellent in Research Award (1 among 100 students), Institute Academic Award

Selected Research & Publications

Overview: Published eight peer-reviewed conference papers (three competitive oral and spotlight presentations) and 2 journal papers in machine learning and its applications in venues such as NeurIPS, ICML, EMNLP and MICCAI with additional machine learning papers in submission. Work in my main line of research includes:

Leveraging Unlabeled Data to Predict Out-of-Distribution Performance. Saurabh Garg, Sivaraman Balakrishnan, Zachary Lipton, Behnam Neyshabur, Hanie Sedghi. NeurIPS DistShift Workshop 2021.

RATT: Leveraging Unlabeled Data to obtain Generalization Guarantees. Saurabh Garg, Zico Kolter, Sivaraman Balakrishnan, Zachary Lipton. ICLR Robust ML, 2021. *ICML 2021 (**Oral**).*

Mixture Proportion Estimation and PU Learning: A Modern Approach. Saurabh Garg, Yifan Wu, Alex Smola, Sivaraman Balakrishnan, Zachary Lipton. *ICML UDL, 2021. NeurIPS 2021 (**Spotlight**).*

A Unified View of Label Shift Estimation. Saurabh Garg, Yifan Wu, Sivaraman Balakrishnan, Zachary Lipton. *ICML UDL, 2020 (**Oral**). NeurIPS 2020.*

On Proximal Policy Optimization's Heavy-Tailed Gradients. Saurabh Garg, Emilio Parisotto, Adarsh Prasad, Zico Kolter, Zachary Lipton, Sivaraman Balakrishnan, Ruslan Salakhutdinov, Pradeep Ravikumar. *ICML 2021*

Selected Awards & Honors

Amazon Graduate Research Fellowship (incoming)	2022
Invited to attend Deep Learning Theory Summer School at Princeton (remote)	2021
Excellence in Research Award (1 among 110 students) from CSE dept, IIT Bombay	2018
Undergraduate Research Award, IIT Bombay	2018
EMNLP non-student travel grant	2018
ISCA student travel grant	2018
Institute Academic Award, IIT Bombay	2015
All India Rank 93 in JEE Main (out of 1.4 million)	2014
All India Rank 154 in JEE Advanced (out of 126k)	2014

Work Experience

Google Brain **Mountain View, CA (remote)**
Student Researcher under Hanie Sedghi and Behnam Neyshabur Sept '21 – Dec' 03
Research Intern under Hanie Sedghi and Behnam Neyshabur June '21 – Aug '21

- Real-world machine learning deployments are characterized by mismatches between the training and test distributions that may cause performance drops. Developed a method for predicting the target domain accuracy using only labeled source data and unlabeled target data. Paper from this work is under submission.

Samsung Research HQ **Suwon, South Korea**

Research Engineer Sept. '18 – July '19

Research Intern May '17 – July '17

- Explored AI-based decision making and close loop automation policies for intelligent 5G network deployment. Developed a RL framework for self-learning algorithms that are able to learn the network behaviour.
- Studied Software Defined Networking (SDN) and designed automation tools on Open Network Operating System (ONOS) to test OpenFlow during internship. Received a Pre-Placement offer based on performance and post-internship interviews.

Microsoft Research **Banglore, India**

Research Intern with Sunayana Sitaram Dec '17

- Lack of conversational monolingual Hindi text is a major issue in building a powerful Language Model
- Developed a robust transliteration system to utilize large amounts of Roman text data from the web which resembles properties of conversational speech text.

Purdue University **West Lafayette, USA**

Research Internship under Prof. Alex Pothen May '16 - July '16

- Worked on designing an approximation algorithm with a high degree of concurrency for a variant of stable fixtures problem. Implemented the algorithm and analyzed its performance on various graph structures.

Publications

Workshops/Pre-print

P1. **Leveraging Unlabeled Data to Predict Out-of-Distribution Performance**
Saurabh Garg, Sivaraman Balakrishnan, Zachary Lipton, Behnam Neyshabur, Hanie Sedghi
NeurIPS Workshop on Distribution Shift (DistShift), 2021
Under review at ICLR, 2021; scores: 8,8,8,6,5 [openreview]

Conference

C7. **Mixture Proportion Estimation and PU Learning: A Modern Approach**
Saurabh Garg, Yifan Wu, Alex Smola, Sivaraman Balakrishnan, Zachary Lipton
Spotlight at Advances in Neural Information Processing (NeurIPS), 2021
ICML Workshop on Uncertainty & Robustness in Deep Learning (UDL), 2021

C6. **RATT: Leveraging Unlabeled Data to obtain Generalization Guarantees**
Saurabh Garg, Zico Kolter, Sivaraman Balakrishnan, Zachary Lipton [Paper]
Long Talk at International Conference of Machine Learning (ICML), 2021
ICLR Workshop on Robust Machine Learning (RobustML), 2021

C5. **On Proximal Policy Optimization's Heavy-Tailed Gradients**
Saurabh Garg, Joshua Zhanson, Emilio Parisotto, Adarsh Prasad, Zico Kolter, Zachary Lipton, Sivaraman Balakrishnan, Ruslan Salakhutdinov, Pradeep Ravikumar [Paper]
International Conference of Machine Learning (ICML), 2021
ICLR Workshop on Science and Engineering of Deep Learning (SEDL), 2021

C4. **A Unified View of Label Shift Estimation**
Saurabh Garg, Yifan Wu, Sivaraman Balakrishnan, Zachary Lipton [Paper]
Advances in Neural Information Processing Systems (NeurIPS) 2020
Contributed Talk at ICML Workshop on Uncertainty & Robustness in Deep Learning (UDL), 2020

C3. **Code-Switched Language models using Dual RNNs and Same-Source Pretraining**
Saurabh Garg[*], Tanmay Parekh[*], Preethi Jyothi [Paper] ([*] joint first authors)
Empirical Methods in Natural Language Processing (EMNLP), 2018

C2. **Uncertainty Estimation in Segmentation with Perfect MCMC Sampling in Bayesian MRFs**
Saurabh Garg, Suyash Awate [Paper]
Medical Image Computing & Computer Assisted Intervention (MICCAI), 2018

C1. **Dual Language Models for Code Mixed Speech Recognition**
Saurabh Garg, Tanmay Parekh, Preethi Jyothi [Paper]
Interspeech 2018 (19th Annual Conference of ISCA)

Journal

J2. **Estimating Uncertainty in MRF-based Image Segmentation: An Exact-MCMC Approach**
Suyash Awate*, **Saurabh Garg***, Rohit Jena* [Paper] (*alphabetic ordering)
Medical Image Analysis (MedIA) Journal, 2019

J1. **Neural Architecture for Question Answering Using a Knowledge Graph and Web Corpus**
Uma Sawant, **Saurabh Garg**, Soumen Chakrabarti, Ganesh Ramakrishnan [Paper]
Information Retrieval Journal, 2019
Invited Oral Talk at European Conference on Information Retrieval (ECIR), 2020

Invited Talks

Leveraging Unlabeled Data to Predict Out-of-Distribution Performance
· Google Brain Deep Phenomena Group — Nov '21
· Carnegie Mellon University — Nov '21

Mixture Proportion Estimation and PU Learning: A Modern Approach
· Advances in Neural Information Processing Systems — Dec '21
· Carnegie Mellon University — Sept '21

RATT: Leveraging Unlabeled Data to obtain Generalization Guarantees
· IIT Bombay — Oct '21
· International Conference on Machine Learning 2021 — July '21
· Google Brain Deep Phenomena Group — June '21
· Carnegie Mellon University (Andrej's Reading Group) — June '21

On Proximal Policy Optimization's Heavy-Tailed Gradients
· ICLR Workshop on Science and Engineering of Deep Learning (SEDL) — April '21
· Carnegie Mellon University (Zico's Reading Group) — June '21

Unified View of Label Shift Estimation
· ICML Workshop on Uncertainty and Deep Learning Workshop (UDL) 2020 — July '20

Neural Architecture for Question Answering using KG and Corpus
· European Conference on Information Retrieval (ECIR) 2020 — April '20

Uncertainty Estimation with Perfect MCMC Sampling
· IIT Bombay Seminar — April '18

Code-Switched Language models
· IIT Bombay Seminar — April '18
· Microsoft Research Labs, India — Dec '17

Approximation algorithms for weighted b-Matching
· Purdue University — July '16

Mentorship

Ph.D. in Machine Learning, CMU student: Jennifer Hsia 2021
Exploring domain adaptation for open set multiclass classification with label shift assumption on the previously observed classes.

Bachelors in Computer Science, CMU student: Zachary Novack 2021
Understanding properties of stochastic gradient noise in deep learning.

Academic Service

Reviewer. International Conference on Learning Representations (ICLR) 2022.
Reviewer. NeurIPS Workshop on Distribution Shift 2022.
Reviewer. Advances in Neural Information Processing Systems (NeurIPS) 2021.
External Reviewer. International Conference of Machine Learning 2021.
Reviewer. North American Chapter of the Association for Computational Linguistics 2021.
Reviewer. Association for Computational Linguistics 2021.
External Reviewer. International Conference of Machine Learning 2020.
Reviewer. Association for Computational Linguistics 2020.

Ph.D. Admission's Committee. Machine Learning Department, CMU, 2021

Teaching

Graduate Teaching Assistant, Carnegie Mellon University

· Advanced Introduction to Machine Learning, Prof. Nihar Shah — Fall 2021

Undergraduate Teaching Assistant, IIT Bombay

· Introduction to Machine Learning, Prof. Preethi Jyothi — Spring 2018
· Data Analysis and Interpretation, Prof. Suyash Awate — Autumn 2017
· Computer Programming and Utilisation, Prof. Sunita Sarawagi — Spring 2017
· Computer Programming and Utilisation, Prof. Benard Menezes — Autumn 2016

Outreach & Inclusion

· Launched an **Online Learning Initiative (OLI)** Channel aimed to help student studying in *under-represented* regional languages under National Service Scheme (NSS) (**crossed 10M views** on YouTube by 2020)

· My lecture on Compound Interest in the Hindi Language **crossed 650K views** on Youtube

Selected Coursework

Carnegie Mellon University: Advanced Introduction to Machine Learning (A+), Intermediate Statistics (A+), Advanced Statistical Theory 1 (A+), Convex Opt. (A+), Advanced Machine Learning Theory (A)

IIT Bombay: Web Search and Mining (AA), Organization of Web Information (AA), Optimization (AA), Artificial Intelligence (AA), Automatic Speech Recognition (AA), Linear Algebra (AA), Numerical Analysis (AA), Operating Systems (AA), Compilers (AP), Automata theory and logic (AA)