Shashank Rajput

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Ph.D. Student and Research Assistant, UW-Madison

Research Interests

Machine Learning, Distributed Optimization, Robust Learning, and High-Dimensional Statistics.

Education

Aug 2017 - Present Ph.D. Student, Computer Sciences, *UW Madison*.

Jul 2011 - May 2015 B.Tech. (Hons.), Computer Science and Engineering, *IIT Kharagpur*.

Publications

Optimal Lottery Tickets via SubsetSum: Logarithmic over-parameterization is sufficient
Shashank Rajput, Ankit Pensia, Alliot Nagle, Harit Vishwakarma, and Dimitris Papailiopoulos.
Neural Information Processing Systems (NeurIPS) - Spotlight paper, 2020.

Attack of the tails: Yes, you really can backdoor Federated Learning
Hongyi Wang, Kartik Sreenivasan, **Shashank Rajput**, Harit Vishwakarma, Saurabh Agarwal, Jy-yong Sohn, Kangwook Lee, and Dimitris Papailiopoulos.
Neural Information Processing Systems (NeurIPS), 2020.

Closing the convergence gap of SGD without replacement
Shashank Rajput, Anant Gupta, and Dimitris Papailiopoulos.
International Conference on Machine Learning (ICML), 2020.

DETOX: A redundancy-based framework for fast and robust gradient aggregation
Shashank Rajput, Hongyi Wang, Zachary Charles, and Dimitris Papailiopoulos.
Neural Information Processing Systems (NeurIPS), 2019.

Does data augmentation lead to positive margin?
Shashank Rajput, Zhili Feng, Zachary Charles, Po-Ling Loh, and Dimitris Papailiopoulos.
International Conference on Machine Learning (ICML), 2019.

Preprints

Permutation-Based SGD: Is Random Optimal?
Shashank Rajput, Kangwook Lee, and Dimitris Papailiopoulos.
arXiv preprint arXiv:2102.09718, 2021.

Convergence and margin of adversarial training on separable data
Zachary Charles, **Shashank Rajput**, Stephen Wright, and Dimitris Papailiopoulos.
arXiv preprint arXiv:1905.09209, 2019.

Ongoing Projects

Developing pruning algorithms that work provably
Pruning (removing weights and neurons from a neural network) can be used to obtain neural networks that are small in size, and yet perform well. Most of the existing algorithms for pruning do not have theoretical guarantees. We aim to develop an algorithm that works provably.

Exploring the expressive capabilities of binary networks
We aim to prove that binary-weighted networks with sign activations are as powerful as ReLU networks with real weights. We also aim to come up with a provable training algorithm for these networks.

Experience

Jun 2016 - Jul 2017 **Applied Scientist**, *Bing Related Searches, Microsoft India*.
Trained a Recurrent Neural Network to generate artificial suggestions for low frequency queries.
Developed a system to generate suggestions for low frequency queries using mined patterns and entity types.
Clustered queries based on user's intent over dynamic query stream to create a graph of related queries.

Jun 2015 - Jun 2016 **Software Engineer**, *Bing Autosuggest, Microsoft India*.
Updated the auto-suggest api to make it more RESTful, secure, and support images and HTML.
Won the Innovation Award in Bing India Hackathon 2016.

May 2014 - Jul 2014 **Summer Intern**, *Samsung R&D Institute India.*
Developed an open sourced secure P2P file transfer android application with serverless discovery of peers using the Tox protocol and DHTs to store peer information, and the NaCl library for encryption.

May 2013 - Jun 2013 **Research Intern**, *POSL Research Group, Kyushu University, Japan.*
Mined the Mozilla Firefox bug repository and created a model for predicting the location of bugs in the source code using crash reports. Paper details here, published (in Japanese) in the FOSE 2013 workshop.

Relevant Courses Taken

Graduate level

- Mathematical foundations of machine learning
- Theoretical foundations of machine learning
- Advanced learning theory
- Nonparametric methods in machine learning
- Nonlinear optimization 1
- Nonlinear optimization 2
- Convex analysis
- Advanced algorithms
- Information theory
- Modern discrete probability
- Robustness theory
- Optimal transport
- Program verification and synthesis
- Probability theory
- Real analysis

Undergraduate level

- Analysis 2
- Intro. to stochastic processes
- Intro. to artificial neural networks
- Intro. to artificial intelligence
- Intro. to machine learning
- Distributed systems
- Natural language processing
- Complex networks

Undergraduate Projects

Outlier subgraph detection, B.Tech. thesis, *under Prof. Animesh Mukherjee.*
Devised new techniques to find interesting outliers in co-authorship networks and studied their properties.

RPC framework, Course: Distributed systems, *under Prof. Arobinda Gupta.*
Developed an RPC framework which supported custom idl formats and transmission of complex data structures.

Mixed-script lyrics retrieval, Course : Natural language processing, *under Prof. Pawan Goyal.*
Built a search engine for retrieval of Hindi song lyrics for a mixed script query.
Won the best project award sponsored by Yahoo.

Technical Skills

Proficient in Python, C++, Matlab, C, and C#.
Worked with Tensorflow, Pytorch, R, Java, Octave, and JavaScript.

Services and Awards

- Reviewer for NeurIPS (2019, 2020), ICML (2020, 2021), ICLR (2021) and AISTATS (2021).
- Institute for Foundations of Data Science (IFDS) Research Assistant under Prof. Stephen Wright and Prof. Dimitris Papailiopoulos, Spring and Fall 2020, and Spring 2021.
- Student Travel Award recipient, NeurIPS 2019.
- Volunteer at the National Service Scheme (NSS) India, July 2011 - July 2013.

This document was generated on February 21, 2021.