

SURBHI GOEL

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EDUCATION

The University of Texas at Austin

August 2015 - June 2020

M.S. and Ph.D. in Computer Science

GPA: 4.0/4.0

Advisor: Adam R. Klivans

Dissertation: [Towards Provably Efficient Algorithms for Learning Neural Networks](#)

Committee: Alex Dimakis, Raghu Meka, Eric Price

Indian Institute of Technology, Delhi

July 2011 - May 2015

B.Tech. in Computer Science and Engineering

Major GPA: 9.55 / 10.0

APPOINTMENTS

University of Pennsylvania, Philadelphia, PA

January 2023 (*expected*)

Magerman Term Assistant Professor, Computer and Information Science

Microsoft Research, New York, NY

July 2020 - November 2022 (*expected*)

Postdoctoral Researcher, Machine Learning Group

Manager: Sham M. Kakade

Institute for Advanced Study, Princeton, NJ

January - May 2020

Visiting Graduate Student, Theoretical Machine Learning Program

Simons Institute for Theory of Computing, Berkeley, CA

May - August 2019

Research Fellow, Foundations of Deep Learning Program

RESEARCH INTERESTS

My research is on the theoretical aspects of the modern practice of machine learning, where my goal is to develop the next generation of principled machine learning methods. In the pursuit of this goal, my work focuses on advancing the theoretical foundations of modern machine learning with an emphasis on quantifying the computational and statistical aspects of deep learning methods, and expanding the toolbox of current algorithms using new theoretically grounded insights.

AWARDS AND FELLOWSHIPS

- 2020 Bert Kay Dissertation Award for best dissertation in CS at UT Austin
- 2019 Rising Stars in ML by University of Maryland
- 2019 Rising Stars in EECS by UIUC
- 2019 The University of Texas at Austin Graduate Dean's Prestigious Fellowship Supplement
- 2019 J.P. Morgan AI PhD Fellowship
- 2019 Simons-Berkeley Research Fellowship for Foundations of Deep Learning program
- 2018 The University of Texas at Austin Graduate Continuing Bruton Fellowship
- 2017 The University of Texas at Austin Graduate School Summer Fellowship
- 2015 ICIM Stay Ahead Award for Undergraduate Thesis
- 2015 Suresh Chandra Memorial Trust Award for Undergraduate Thesis
- 2011 Aditya Birla Scholarship awarded to 12 students from all over India
- 2011 OPJEM Scholarship awarded to 1 out of 850 students in the batch at IIT Delhi
- 2011 All India Rank 37 (Rank 2 in girls) in IITJEE among 450,000 students
- 2010 National Mathematics Olympiad finalist (1 out of 30 from all over India)

PUBLICATIONS

* indicates α - β (alphabetical) ordering.

THESES

Surbhi Goel

Towards Provably Efficient Algorithms for Learning Neural Networks

The University of Texas at Austin, 2020

Received the Bert Kay dissertation award

CONFERENCE PAPERS

Benjamin L. Edelman*, **Surbhi Goel***, Sham M. Kakade*, Cyril Zhang *

Inductive Biases and Variable Creation in Self-Attention Mechanisms

International Conference on Machine Learning (ICML) 2022

Nikunj Saunshi, Jordan T. Ash, **Surbhi Goel**, Dipendra Misra, Cyril Zhang, Sanjeev Arora, Sham M. Kakade, Akshay Krishnamurthy

Understanding Contrastive Learning Requires Incorporating Inductive Biases

International Conference on Machine Learning (ICML) 2022

Jordan T. Ash, Cyril Zhang, **Surbhi Goel**, Akshay Krishnamurthy, Sham M. Kakade

Anti-Concentrated Confidence Bonuses For Scalable Exploration

International Conference on Learning Representations (ICLR) 2022

Jordan T. Ash*, **Surbhi Goel***, Akshay Krishnamurthy*, Dipendra Misra*

Investigating the Role of Negatives in Contrastive Representation Learning

International Conference on Artificial Intelligence and Statistics (AISTATS) 2022

Jordan T. Ash, **Surbhi Goel**, Akshay Krishnamurthy, Sham M. Kakade

Gone Fishing: Neural Active Learning with Fisher Embeddings

Neural Information Processing Systems (NeurIPS) 2021

Naman Agarwal*, **Surbhi Goel***, Cyril Zhang*

Acceleration via Fractal Learning Rate Schedules

International Conference on Machine Learning (ICML) 2021

Anthimos-Vardis Kandiros, Yuval Dagan, Nishanth Dikkala, **Surbhi Goel**, Constantinos Daskalakis

Statistical Estimation from Dependent Data

International Conference on Machine Learning (ICML) 2021

Surbhi Goel*, Adam R. Klivans*, Pasin Manurangsi*, Daniel Reichman*

Tight Hardness Results for Learning One-Layer ReLU Networks

Innovations in Theoretical Computer Science (ITCS) 2021

Surbhi Goel*, Adam R. Klivans*, Frederic Koehler*

From Boltzmann Machines to Neural Networks and Back Again

Neural Information Processing Systems (NeurIPS) 2020

Surbhi Goel*, Aravind Gollakota*, Adam R., Klivans*

Statistical-Query Lower Bounds via Functional Gradients

Neural Information Processing Systems (NeurIPS) 2020

Surbhi Goel*, Aravind Gollakota*, Zhihan Jin*, Sushrut Karmalkar*, Adam R. Klivans*

Superpolynomial Lower Bounds for Learning One-Layer Neural Networks using Gradient Descent

International Conference on Machine Learning (ICML) 2020

Omar Montasser, **Surbhi Goel**, Ilias Diakonikolas, Nathan Srebro

Efficiently Learning Adversarially Robust Halfspaces with Noise

International Conference on Machine Learning (ICML) 2020

Jessica Hoffmann, Soumya Basu, **Surbhi Goel**, Constantine Caramanis

Learning Mixtures of Graphs from Epidemic Cascades

International Conference on Machine Learning (ICML) 2020

Ilias Diakonikolas*, **Surbhi Goel***, Sushrut Karmalkar*, Adam R. Klivans*, Mahdi Soltanolkotabi*

Approximation Schemes for ReLU Regression

Conference on Learning Theory (COLT) 2020

Surbhi Goel

Learning Ising and Potts Models with Latent Variables

International Conference on Artificial Intelligence and Statistics (AISTATS) 2020

Surbhi Goel*, Sushrut Karmalkar*, Adam R. Klivans*

Time/Accuracy Trade-offs for Learning a ReLU with respect to Gaussian Marginals

Neural Information Processing Systems (NeurIPS) 2019

Selected for a spotlight presentation

Surbhi Goel*, Daniel Kane*, Adam R. Klivans*

Learning Ising Models with Independent Failures

Conference on Learning Theory (COLT) 2019

Surbhi Goel*, Adam R. Klivans*

Learning Neural Networks with Two Nonlinear Layers in Polynomial Time

Conference on Learning Theory (COLT) 2019

Surbhi Goel*, Adam R. Klivans*, Raghu Meka*

Learning One Convolutional Layer with Overlapping Patches

International Conference on Machine Learning (ICML) 2018

Selected for a full oral presentation

Surbhi Goel*, Adam R. Klivans*

Eigenvalue Decay Implies Polynomial-Time Learnability for Neural Networks

Neural Information Processing Systems (NeurIPS) 2017

Surbhi Goel*, Varun Kanade*, Adam R. Klivans*, Justin Thaler*

Reliably Learning ReLU in Polynomial Time

Conference on Learning Theory (COLT) 2017

WORKSHOP PAPERS

Jessica Hoffmann, Soumya Basu, **Surbhi Goel**, Constantine Caramanis

Disentangling Mixtures of Epidemics on Graphs

Graph Representation Learning, Neural Information Processing Systems (NeurIPS) 2019

Surbhi Goel*, Adam R. Klivans*

Learning Depth-Three Neural Networks in Polynomial Time

Deep Learning: Bridging Theory and Practice, Neural Information Processing Systems (NeurIPS) 2017

Surbhi Goel*, Varun Kanade*, Adam R. Klivans*, Justin Thaler*

Reliably Learning ReLU in Polynomial Time

Optimization for Machine Learning (OPT), Neural Information Processing Systems (NeurIPS) 2016

Selected for an oral presentation

WORKING PAPERS

Surbhi Goel*, Sham M. Kakade*, Adam T. Kalai*, Cyril Zhang *

Hidden Progress in Deep Learning: SGD Learns Parities Near the Computational Limit

In submission, 2022

Boaz Barak*, Benjamin L. Edelman*, Surbhi Goel*, Sham M. Kakade*, Eran Malach*, Cyril Zhang*

RCNNs Learn Succinct Learning Algorithms in Polynomial Time

In submission, 2022

UNPUBLISHED PAPERS

Surbhi Goel*, Rina Panigrahy*

Learning Two layer Networks with Multinomial Activation and High Thresholds

Manuscript, 2019

Matthew Jordan, Naren Manoj, Surbhi Goel, Alexandros Dimakis

Quantifying Perceptual Distortion of Adversarial Examples

Manuscript, 2019

Simon Du*, Surbhi Goel*

Improved Learning of One-hidden-layer Convolutional Neural Networks with Overlaps

Manuscript, 2018.

INVITED TALKS

The Hidden Progress Behind Loss Curves

Workshop on Learning: Optimization and Stochastics at EPFL

July 2022

Demystifying Attention-based Architectures in Deep Learning

Workshop on Algorithms for Learning and Economics in Naxos, Greece

June 2022

Principled Algorithm Design in the Era of Deep Learning

CS/CSE Colloquium at NYU Courant/Tandon

April 2022

CS Colloquium at UW-Madison

March 2022

CS Colloquium at Halicioglu Data Science Institute, UCSD

March 2022

CS Colloquium at UMD

February 2022

SCS Talk at CMU

February 2022

CS Colloquium at Duke

February 2022

CIS Colloquium at UPenn

February 2022

CS Colloquium at Cornell University

February 2022

Talks at TTIC

February 2022

What Functions do Self-attention Blocks Prefer to Represent?

ML Symposium at USC

December 2021

ELLIS Talk Series at IST Austria

December 2021

Learning Theory Workshop at Google

October 2021

Computational Barriers For Learning Some Generalized Linear Models

Information-Computation Trade-offs Workshop at Simons Institute [[video](#)]/[[slides](#)]

September 2021

Computational Complexity of ReLU Regression

The Multifaceted Complexity of Machine Learning Workshop at IMSI [[video](#)]

April 2021

Computational Complexity of Learning Neural Networks over Gaussian Marginals

MIC Seminar at NYU

May 2020

Algorithms Seminar at Duke University

October 2020

ML Theory Seminar at Harvard University [[video](#)]

October 2020

ARC Colloquium at Georgia Tech

November 2020

IDEAL Seminar at TTIC

November 2020

TOC Colloquium at MIT

December 2020

SILO Seminar at UW-Madison

January 2020

Statistics Seminar at Stanford University

July 2021

Learning Ising and Potts Models with Latent Variables

International Conference on Artificial Intelligence and Statistics (AISTATS)

August 2020

Approximation Schemes for ReLU Regression

Conference on Learning Theory (COLT) [[video](#)]

July 2020

Deep Learning Program Reunion at Simons Institute

August 2020

Provably Efficient Algorithms for Learning Neural Networks

Microsoft Research New York

February 2020

Microsoft Research New England

February 2020

Microsoft Research Redmond

February 2020

Time/Accuracy Tradeoffs for Learning a ReLU wrt Gaussian Marginals

Spotlight Talk at Neural Information Processing Systems (NeurIPS)

December 2019

Exploring Surrogate Losses for Learning Neural Networks

TTIC Young Researcher Seminar Series

December 2019

Efficiently Learning Simple Neural Networks

Rising Star in ML Talk at University of Maryland

September 2019

Learning Ising Models with Independent Failures

Conference on Learning Theory (COLT)

July 2019

Research Fellows Talk at Simons Institute

July 2019

Learning Neural Networks with Two Nonlinear Layers in Polynomial Time

Conference on Learning Theory (COLT)

July 2019

Efficiently Learning Simple Convolutional Networks

China Theory Week at Tsinghua University

September 2019

Learning One Convolutional Layer with Overlapping Patches

Google Research Theory Reading Group

June 2018

International Conference on Machine Learning (ICML)

July 2018

Reliably Learning the ReLU in Polynomial Time

Conference on Learning Theory (COLT)

July 2017

OPT-ML Workshop at Neural Information Processing Systems (NeurIPS)

December 2016

WORK EXPERIENCE

Google, Mountain View CA

Research Intern

May - August 2018

Supervisor: Rina Panigrahy

Dell, Round Rock TX

Research Intern

June - August 2017

Google, New York, NY

Research Intern

May - August 2016

Supervisor: Natalia Ponomareva

Google, Mountain View CA

Software Engineering Intern

May - August 2014

Supervisor: Neha Jha

University of Michigan, Ann Arbor MI

Research Scholar

May - July 2013

Supervisor: Atul Prakash

TEACHING EXPERIENCE

University of Texas at Austin

Course: Data Mining (Hons.)

Spring 2018

Guest Lecture

University of Texas at Austin

Course: Distributed Computing (Hons.)

Spring 2016

Teaching Assistant

University of Texas at Austin

Course: Data Structures

Fall 2015

Teaching Assistant

Indian Institute of Technology Delhi

Course: Data Structures

Spring 2015

Teaching Assistant

OUTREACH

Co-founder

Learning Theory Alliance (LeT-All)

2020-Present

Co-organized the COLT 2022 Mentoring Panel

Co-organized the ALT 2022 Mentoring Workshop

Co-organized the Graduate Applications Support Program

Co-organized the COLT 2021 Mentoring Workshop

Co-organized the ALT 2021 Mentoring Workshop

Mentor

Women in Machine Learning Theory (WiML-T) Mentoring Program

2021-Present

Panelist

New Horizons in Theoretical Computer Science
VMware Nirman for Women in Tech

June 2022
January 2021

Mentor

UT Austin's Women in CS (GWC-WiCS) Mentoring Program

2018-19

SERVICE ROLES**Virtual Experience Chair**

2021

Conference on Learning Theory (COLT)

Co-organized the virtual part of the hybrid conference, including the 2-day virtual-only program

Co-organizer

2020-2021

One World Machine Learning Seminar Series

Treasurer

2016-17

Graduate Representative Association of Computer Sciences (GRACS)

Program Committee

International Conference on Algorithmic Learning Theory (ALT)

2021/22

Conference on Learning Theory (COLT)

2021/22

Conference Reviewing

Symposium on Theory of Computing (STOC)

2019/20/21

Neural Information Processing Systems (NeurIPS)

2018 (top 30%)/20/21

Conference on Learning Theory (COLT)

2018/19/20

International Conference on Learning Representations (ICLR)

2019/20

Symposium on Discrete Algorithms (SODA)

2020

Foundations of Computer Science (FOCS)

2020/22

International Conference on Machine Learning (ICML)

2019 (top 5%)

Journal Reviewing

Journal of Machine Learning Research

2021

IEEE Transactions on Information Theory

2020