

# SURBHI GOEL

<https://www.surbhigoel.com>

goel.surbhi@microsoft.com

## EDUCATION

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**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

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**Microsoft Research, New York, NY** July 2020 - Present  
*Postdoctoral Researcher, Machine Learning Group* Manager: Sham M. Kakade

**Institute for Advanced Studies, 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

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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, particularly 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

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- 2020 Bert Kay Dissertation Award for PhD dissertation
- 2019 Rising Stars in ML
- 2019 Rising Stars in EECS
- 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

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*Authors are ordered alphabetically unless specified with \*.*

### THESIS

**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

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

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

**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*

## PREPRINTS

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

**Inductive Biases and Variable Creation in Self-Attention Mechanisms**

In submission, 2021

Jordan T. Ash, **Surbhi Goel**, Akshay Krishnamurthy, Dipendra Misra  
**Investigating the Role of Negatives in Contrastive Representation Learning**  
In submission, 2021.

Jordan T. Ash\*, Cyril Zhang, **Surbhi Goel**, Akshay Krishnamurthy, Sham M. Kakade  
**Anti-Concentrated Confidence Bonuses For Scalable Exploration**  
In submission, 2021

**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

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**What Functions do Self-attention Blocks Prefer to Represent?** 2021  
*Learning Theory Workshop at Google [virtual]*

**Computational Barriers For Learning Some Generalized Linear Models** 2021  
*Rigorous Evidence for Information-Computation Trade-offs Workshop at Simons Institute [virtual]*

**Computational Complexity of ReLU Regression** 2021  
*The Multifaceted Complexity of Machine Learning Workshop at IMSI [virtual]*

**Computational Complexity of Learning Neural Networks over Gaussian Marginals 2020-21**  
*MIC Seminar at NYU [virtual]*  
*Algorithms Seminar at Duke University [virtual]*  
*ML Theory Seminar at Harvard University [virtual]*  
*ARC Colloquium at Georgia Tech [virtual]*  
*IDEAL Seminar at TTIC [virtual]*  
*TOC Colloquium at MIT [virtual]*  
*SILO Seminar at UW-Madison [virtual]*  
*Statistics Seminar at Stanford University [virtual]*

**Learning Ising and Potts Models with Latent Variables** 2020  
*International Conference on Artificial Intelligence and Statistics (AISTATS) [virtual]*

**Approximation Schemes for ReLU Regression** 2020  
*Conference on Learning Theory (COLT) [virtual]*  
*Deep Learning Program Reunion at Simons Institute [virtual]*

**Provably Efficient Algorithms for Learning Neural Networks** 2020  
*Microsoft Research New York*  
*Microsoft Research New England*  
*Microsoft Research Redmond*

<b>Time/Accuracy Tradeoffs for Learning a ReLU wrt Gaussian Marginals</b> <i>Spotlight Talk at Neural Information Processing Systems (NeurIPS) 2019</i>	2019
<b>Exploring Surrogate Losses for Learning Neural Networks</b> <i>TTIC Young Researcher Seminar Series</i>	2019
<b>Efficiently Learning Simple Neural Networks</b> <i>Rising Star in ML Talk at University of Maryland Institute for Advanced Computer Studies</i>	2019
<b>Learning Ising Models with Independent Failures</b> <i>Conference on Learning Theory (COLT)</i> <i>Research Fellows Talk at Simons Institute</i>	2019
<b>Learning Neural Networks with Two Nonlinear Layers in Polynomial Time</b> <i>Conference on Learning Theory (COLT)</i>	2019
<b>Efficiently Learning Simple Convolutional Networks</b> <i>China Theory Week</i>	2018
<b>Learning One Convolutional Layer with Overlapping Patches</b> <i>Google Research Theory Reading Group</i> <i>International Conference on Machine Learning (ICML)</i>	2018
<b>Reliably Learning the ReLU in Polynomial Time</b> <i>Oral at OPT-ML Workshop at Neural Information Processing Systems (NeurIPS)</i>	2016-17

## INTERNSHIPS

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<b>Google, Mountain View CA</b> <i>Research Intern</i>	May - August 2018 <i>Supervisor: Rina Panigrahy</i>
<b>Dell, Round Rock TX</b> <i>Research Intern</i>	June - August 2017
<b>Google, New York, NY</b> <i>Research Intern</i>	May - August 2016 <i>Supervisor: Natalia Ponomareva</i>
<b>Google, Mountain View CA</b> <i>Software Engineering Intern</i>	May - August 2014 <i>Supervisor: Neha Jha</i>
<b>University of Michigan, Ann Arbor MI</b> <i>Research Scholar</i>	May - July 2013 <i>Supervisor: Atul Prakash</i>

## TEACHING EXPERIENCE

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<b>University of Texas at Austin</b> <i>Course: Distributed Computing (Hons.)</i>	Spring 2016 <i>Teaching Assistant</i>
<b>University of Texas at Austin</b> <i>Course: Data Structures</i>	Fall 2015 <i>Teaching Assistant</i>
<b>Indian Institute of Technology Delhi</b> <i>Course: Data Structures</i>	Spring 2015 <i>Teaching Assistant</i>

## OUTREACH

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<b>Co-founder</b> <i>Learning Theory Alliance (LeT-All)</i>	2020-Present
Co-organizing the <a href="#">Graduate Applications Support Program</a>	
Co-organized the <a href="#">COLT 2021 Mentoring Workshop</a>	
Co-organized the <a href="#">ALT 2021 Mentoring Workshop</a>	
<b>Mentor</b> <i>Women in Machine Learning Theory (WiML-T) Mentoring Program</i>	2021-Present
<b>Panelist</b> <i>VMware Nirman for Women in Tech</i>	2021
<b>Mentor</b> <i>UT Austin's Women in CS (GWC-WiCS) Mentoring Program</i>	2018-19

## SERVICE ROLES

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<b>Virtual Experience Chair</b> <i>Conference on Learning Theory (COLT)</i>	2021
Co-organized the virtual part of the hybrid conference, including the 2-day virtual-only program	
<b>Co-organizer</b> <i>One World Machine Learning Seminar Series</i>	2020-Present
<b>Treasurer</b> <i>Graduate Representative Association of Computer Sciences (GRACS)</i>	2016-17
<b>Program Committee</b> <i>International Conference on Algorithmic Learning Theory (ALT) 2021/22</i> <i>Conference on Learning Theory (COLT) 2021</i>	
<b>Reviewing</b> <i>Journal of Machine Learning Research 2021</i> <i>Symposium on Theory of Computing (STOC) 2019/20/21</i> <i>Neural Information Processing Systems (NeurIPS) (top 30%) 2018/20/21</i> <i>Conference on Learning Theory (COLT) 2018/19/20</i> <i>International Conference on Learning Representations (ICLR) 2019/20</i> <i>IEEE Transactions on Information Theory 2020</i> <i>Symposium on Discrete Algorithms (SODA) 2020</i> <i>Foundations of Computer Science (FOCS) 2020</i> <i>International Conference on Machine Learning (ICML) 2019 (top 5%)</i>	