

SURIYA GUNASEKAR

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Current position

2019–Present **Senior Researcher.**
Microsoft Research, Redmond, USA.

Past positions

2016–2019 **Research Assistant Professor.**
Toyota Technological Institute at Chicago, USA.
Mentor: Nathan Srebro.
Primary research topics: (a) inductive bias from optimization in learning and (b) supervised learning of *non-discriminatory* predictors in the context of algorithmic fairness.

Summer 2019 **Long term visitor.**
Simons Institute for the Theory of Computing, University of California, Berkeley.
Special program on Foundations of Deep Learning..

Education

2010–2016 **MS–PhD in Electrical and Computer Engineering.**
The University of Texas at Austin, USA.
Advisor: Prof. Joydeep Ghosh.
PhD Thesis: Mining Structured Matrices in High Dimensions

2006–2010 **B. Tech in Electronics and Communication Engineering.**
National Institute of Technology, Warangal, India.

Grants

2018 Senior Research Personnel on National Science Foundation award AF: RI: Medium: Collaborative Research: *Understanding and Improving Optimization for Deep and Recurrent Networks.*

Teaching

2018 **Co-instructor.** *Introduction to Machine Learning Summer School* jointly organized by TTI Chicago and the University of Chicago as part of an NSF Research and Training Grant.

- Two week intensive course on basics of machine learning primarily aimed at graduate students from outside of computer science departments.
- Covered all topics of a full-term ML course. Teaching material at <http://www.ttic.edu/intromlss2018>.

2017–2018 **Guest Lectures at TTI Japan** on *Introduction to Machine Learning*.

- Taught 4 lectures in the remote course jointly offered by multiple TTI Chicago faculty (Spring '17, '18).
- Topics: Classification, AdaBoost, generative models, mixture models, Expectation-Maximization (EM).

2016–2017 **Guest lectures at TTI Chicago** on *Introduction to Statistical Machine Learning*.

- Total of 4 lectures during Fall '16, '17 (Instructor: Dr. Greg Shakhnarovich).
- Topics: Regularization, gradient descent, logistic regression, support vector machines, kernels.

2006–2010 **Teaching Assistant, UT Austin.**

Data Mining, Spring '13 (Instructor: Dr. Joydeep Ghosh).

Digital Logic Design, Fall '10 – Fall '11 (Instructors: Dr. Adnan Aziz, Dr. Lizy John).

Publications

Peer-reviewed full length conference publications

1. Lexicographic and Depth-Sensitive Margins in Homogeneous and Non-Homogeneous Deep Models. M. S. Nacson, S. Gunasekar, J. Lee, N. Srebro, D. Soudry. *In 36th International Conference on Machine Learning (ICML) 2019.*
2. Convergence of gradient descent on separable data. M. S. Nacson, J. Lee, S. Gunasekar, P. Savarese, N. Srebro, D. Soudry. *In 22nd International Conference on Artificial Intelligence and Statistics (AISTATS) 2019.*
3. Implicit bias of gradient descent on linear convolutional networks. S. Gunasekar, J. Lee, D. Soudry, N. Srebro. *In 32nd Conference on Neural Information Processing Systems (NeurIPS, previously NIPS) 2018.*
4. On preserving non-discrimination when combining expert advice. A. Blum, S. Gunasekar, T. Lykouris, N. Srebro. *In 32nd Conference on Neural Information Processing Systems (NeurIPS, previously NIPS) 2018.*
5. Characterizing implicit bias in terms of optimization geometry. S. Gunasekar, J. Lee, D. Soudry, N. Srebro. *In 35th International Conference on Machine Learning (ICML) 2018.*
6. Implicit regularization in matrix factorization. S. Gunasekar, B. Woodworth, S. Bhojanapalli, B. Neyshabur, N. Srebro. *In 31st Conference on Neural Information Processing Systems (NIPS) 2017. (spotlight presentation)*
7. Learning non-discriminatory predictors. B. Woodworth, S. Gunasekar, M. Ohannessian, N. Srebro. *In 30th Conference on Learning Theory (COLT) 2017.*
8. Preference completion from partial rankings. S. Gunasekar, O. Koyejo, J. Ghosh. *In 30th Conference on Neural Information Processing Systems (NIPS) 2016.*
9. Identifiable phenotyping using constrained non-negative matrix factorization. S. Joshi, S. Gunasekar, D. Sontag, J. Ghosh. *In 1st Machine Learning for Healthcare Conference (MLHC) 2016.*
10. Unified view of matrix completion under general structural constraints. S. Gunasekar, A. Banerjee, J. Ghosh. *In 29th Conference on Neural Information Processing Systems (NIPS) 2015.*
11. Consistent collective matrix completion under joint low rank structure. S. Gunasekar, M. Yamada, D. Yin, Y. Chang. *In 18th International Conference on Artificial Intelligence and Statistics 2015.*
12. Face detection on distorted images using perceptual quality-aware features. S. Gunasekar, J. Ghosh, A. Bovik. *In 14th IS&T/SPIE Human Vision and Electronic Imaging Conference 2014.*
13. Exponential family matrix completion under structural constraints. S. Gunasekar, P. Ravikumar, J. Ghosh. *In 31st International Conference on Machine Learning (ICML) 2014.*
14. Noisy matrix completion using alternating minimization. S. Gunasekar, A. Acharya, N. Gaur, J. Ghosh. *In Machine Learning and Knowledge Discovery in Databases (ECML/PKDD) 2013.*
15. Review quality aware collaborative filtering. S. Raghavan, S. Gunasekar, J. Ghosh. *In 6th ACM Conference on Recommender Systems (RecSys) 2012.*

Journal publications

16. The implicit bias of gradient descent on separable data. D. Soudry, E. Hoffer, M. S. Nacson, S. Gunasekar, N. Srebro. *In Journal of Machine Learning Research 2018.*
17. Face detection on distorted images augmented by perceptual quality-aware features. S. Gunasekar, J. Ghosh, A. Bovik. *In IEEE Transactions on Information Forensics and Security 2014.*

Preprints/Theses

- Mirrorless Mirror Descent: A More Natural Discretization of Riemannian Gradient Flow. S. Gunasekar, B. Woodworth, N. Srebro. *In Arxiv 2020*.
- Kernel and Deep Regimes in Overparametrized Models. B. Woodworth, S. Gunasekar, P. Savarese, E. Moroshko, I. Golan, J. Lee, D. Soudry, N. Srebro. *In Arxiv 2019*.
- Implicit Regularization of Normalization Methods. X. Wu, E. Dobriban, T. Ren, S. Wu, Z. Li, S. Gunasekar, R. Ward, Q. Liu. *In Arxiv 2019*
- Phenotyping using structured collective matrix factorization of multi-source EHR data. S. Gunasekar, J. Ho, J. Ghosh, S. Kreml, A. N. Kho, J. C. Denny, B. A. Malin, J. Sun. *In Arxiv 2016*.

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| Dissertation | Mining structured matrices in high dimensions. Advised by Prof. Joydeep Ghosh. <i>In UT Electronic Theses and Dissertations, 2016</i> . |
| Master's Report | A survey on using side information in recommendation systems. Advised by Prof. Joydeep Ghosh. <i>In UT Electronic Theses and Dissertations, 2012</i> . |

Invited talks/seminars

- 2020 *Algorithmic Regularization* at Theory of Deep Learning workshop in Bellairs Institute, Barbados.
- 2020 *Kernel and Rich Regimes in Overparameterized Linear Models* at Information Theory and Applications (ITA) workshop.
- 2019 *Optimization Bias of Gradient Descent in Linear Regression* in the Theory of Machine Learning Seminar at Harvard University.
- 2019 *Kernel and Rich Regimes in Overparameterized Learning* at the workshop on Frontiers of Deep Learning at the Simons Institute, University of California, Berkeley.
- 2019 *Characterizing Optimization Bias in terms of Optimization Geometry* at
 - Data Science through a Geometric Lens workshop, Symposium of Theory of Computing (STOC),
 - AI Institute at Microsoft Research, Redmond.
- 2019 *Rethinking the Role of Optimization in Learning* at
 - University of British Columbia (UBC), Canada,
 - University of Illinois Urbana-Champaign (UIUC),
 - University of Washington at Seattle (UW),
 - University of California at San Diego (UCSD),
 - New York University (NYU),
 - McGill University, Canada,
 - Ecole polytechnique federale de Lausanne (EPFL), Switzerland,
 - ETH Zurich, Switzerland,
 - Duke University,
 - University of Wisconsin Madison (UW Madison),
 - University of Massachusetts at Amherst,
 - Johns Hopkins University,
 - University of Michigan at Ann Arbor,
 - Columbia University,
 - Princeton University,
 - Georgia Institute of Technology,
 - Microsoft Research, Redmond,
 - Northwestern University.

- 2018 *Implicit Bias of Optimization in Learning* at
 - INFORMS Annual Meeting,
 - Center for Applied Mathematics (CAM) colloquium, Cornell University,
 - International Symposium on Mathematical Programming (ISMP),
 - Microsoft Research, Redmond.
- 2018 *Optimization Geometry and Implicit Regularization* at SILO Seminar, UW Madison.
- 2017 *Implicit Regularization in Matrix Factorization* at
 - Statistics colloquium, Indiana University Bloomington,
 - RIKEN Center for Advanced Intelligent Project (AIP), Japan,
 - Information Theory and Applications (ITA) workshop.
- 2017 *Regularization in non-convex Optimization* at CSL/SINE Seminar, UIUC.
- 2016 *Mining Structured Matrices in High Dimensions* at
 - Toyota Technological Institute at Chicago,
 - Google Research, New York.

Professional activities

Organization/Committees

- 2019-2020 **Publications Chair** for *Conference on Learning Theory (COLT) 2020*.
- 2019 **Organizer** of *Workshop on Theory of Deep Learning: Where next?* at Institute of Advanced Study (IAS). Website: <https://www.math.ias.edu/wtdl>.
- 2018 **Organizer and co-instructor** for the *Introduction to Machine Learning Summer School* jointly organized by TTIC and UChicago. Website: <http://ttic.edu/intromlss2018>
- 2018 **Organizing committee member** for the *2nd Midwest Machine Learning Symposium (MMLS)*. Website: <http://midwest-ml.org/2018/>
- 2018 **Committee member** on drafting of the *Policy on Discrimination, Harassment, and Abusive Behavior at TTIC*.
- 2016-2019 **Organizer** for *Machine Learning Seminar Series at TTIC*. Website: <http://www.ttic.edu/mls/>.

Journal reviewing

Journal of the ACM, Journal of Machine Learning Research, Journal of Neurocomputing, Mathematics of Operations Research, Journal of the Royal Statistical Society, IEEE Signal Processing Letters, IEEE Transactions on Image Processing, IEEE Transactions on Knowledge and Data Engineering, IEEE Transactions on Signal Processing.

Conference reviewing

International Conference on Machine Learning (ICML), Neural Information Processing Systems (NeurIPS, previously NIPS), International Conference on Learning Representations (ICLR), Uncertainty in Artificial Intelligence (UAI), Conference on Learning Theory (COLT), Algorithmic Learning Theory (ALT), Association for the Advancement of Artificial Intelligence Conference (AAAI), Conference on Data Sciences (CODS).

- Area chair for NeurIPS 2020.
- Program committee member for Conference on Algorithmic Learning Theory (ALT) 2020.
- Area chair for NeurIPS 2019.

Past employment

- 2016–2019 **Research Assistant Professor**. Toyota Technological Institute at Chicago, USA.

- 2010–2016 **Graduate Research Assistant.** The University of Texas Austin, USA.
Worked on research questions within multiple NSF funded projects.
Supervisors: Dr. Joydeep Ghosh and Dr. Alan C. Bovik.
- Listwise ranking in high dimensions using retargeting of preference feedback.
 - Interpretable phenotype extraction from patient electronic health records (EHRs).
 - Robust face detection models using image quality indicative features.
- Summer ‘14 **Research Intern.** Yahoo Labs, Sunnyvale, USA.
Worked on theoretical analysis and applications of collective matrix completion.
- Summer ‘12 **Research Intern.** SRI Labs, Princeton, USA.
Worked on models for personalized photo recommendation system.
- Summer ‘11 **Software Intern.** Apple Inc., Cupertino, USA.
Worked on data collection and preliminary data analysis prototypes for hardware testing.

References

1. **Joydeep Ghosh**, Professor, Department of ECE, ghosh@ece.utexas.edu
The University of Texas at Austin.
2. **Nathan Srebro**, Professor, nsrebro+suriya-letter@ttic.edu
Toyota Technological Institute at Chicago.
3. **Avrim Blum**, Professor and Chief Academic Officer, avrim@ttic.edu
Toyota Technological Institute at Chicago.
4. **Robert Nowak**, Professor, Department of ECE, rdnowak@wisc.edu
University of Wisconsin, Madison.