

ARNAB BHATTACHARYYA

Tenure-Track Assistant Professor
Computer Science, School of Computing, National University of Singapore
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AREAS OF INTEREST

Foundations of Data Science; more specifically: algorithms for data analytics, probability, statistics, property testing, complexity theory, coding theory, interaction between computation and physical systems.

EDUCATION & TRAINING

Massachusetts Institute of Technology	
Ph.D. in Computer Science (Advisor: Ronitt Rubinfeld)	2012, June
M.Eng. in Computer Science (Advisor: G.J. Sussman)	2006
S.B. in Computer Science and Physics, minor in Mathematics	2005
CCI Postdoctoral fellow at Princeton University (Mentor: B. Chazelle)	2011-12
DIMACS Postdoctoral associate at Rutgers University (Mentor: S. Muthukrishnan)	2012-13

RELATED EXPERIENCE

Long-term visitor at the Simons Institute for the Theory of Computing	2017, Spring
Simons visitor at National Centre for Biological Sciences, India	2014 – 2016
Assistant Professor (with tenure) Computer Science & Automation, Indian Institute of Science, Bangalore.	2013--2018

AWARDS

National Research Foundation Fellowship in AI	2020
Amazon Faculty Research Award	2019
Ramanujan Fellow	2014 – 2019
Krell Institute Computational Science Graduate Fellow	2006 – 2010

ADVISING

Vipul Arora (Ph.D.)	2019 – Present
Suprovat Ghoshal (Ph.D., coadvised with Prof. Siddharth Barman)	2015 – Present
Palash Dey (Ph.D. → IIT Kharagpur, coadvised with Prof. Y. Narahari)	2013 – 2017
Indranil Bhattacharya (M.Sc. → Amazon)	2015 – 2017
Anurita Mathur (M.Sc. → Microsoft)	2015 – 2017
Kirankumar Shiragur (M.Sc. → Microsoft Research India → Stanford University)	2013 – 2015
Ameet Gadekar (M.Sc. → Citrix → Aalto University)	2013 – 2015
Chetan Gupta (M.Sc. → Samsung)	2013 – 2016

TEACHING EXPERIENCE

National University of Singapore Lecturer – Randomized Algorithms	Spring 2020
National University of Singapore Lecturer – Property Testing	Fall 2019
National University of Singapore Lecturer – Design and Analysis of Algorithms	Spring 2019
Indian Institute of Science Lecturer – Probability & Statistics in High Dimensions	Fall 2017

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Indian Institute of Science Lecturer – Randomized Algorithms	Spring 2016
Indian Institute of Science Lecturer – Approximation Algorithms	Spring 2015
Indian Institute of Science Lecturer – Design and Analysis of Algorithms	Fall 2013-17
Indian Institute of Science Lecturer – Expander Graphs and Applications	Spring 2014
Massachusetts Institute of Technology Teaching Assistant for various undergraduate and graduate classes	2005-2010

FUNDING OBTAINED

- NRF Fellowship in AI (Principal PI, 2020 – present)
- MOE Tier II Grant (Principal PI, 2020 – present)
- Amazon Faculty Award (Principal PI, 2019 – present)
- NUS Startup Grant ACF Tier I (Principal PI, 2018 – present)
- Indo-US Joint Centre for Research on Pseudorandomness in Computer Science (Principal PI, 2017-19)
- DRDO-IISc Programme to Advance the Frontiers of Communications, Control, Signal Processing and Computation (co-PI, 2016-18)
- Robert Bosch Centre for Cyberphysical Systems project “Autonomous Coordinated Navigation of Drones” (co-PI, 2016-17)
- Ramanujan Fellowship (2015-19)

PROFESSIONAL ACTIVITIES

- Steering committee member of the NMI Thematic Program on Complexity and Cryptography (2016-17)
- Organizer for FSTTCS 2015 workshop, “FOURIER”
- Co-organizer for the Indo-US Symposium on Learning, Algorithms and Complexity, 2015
- Co-organizer for FOCS 2014 workshop, “Higher-order Fourier Analysis”
- Co-founder of the Big Data Initiative at CSA, IISc.
- Program Committee member: *XRCI Open 2015, FSTTCS 2013, SODA 2016, KDD 2016, AAMAS 2017, RANDOM 2017, FSTTCS 2017, WINE 2017, AAAI 2019, IJCAI 2020.*
- Reviewer for conferences and journals such as: *IEEE Foundations of Computer Science, ACM Symposium on Theory of Computing, SLAM Symposium on Discrete Algorithms, Conference on Computational Complexity, European Symposium on Algorithms, SLAM Journal on Computing, IEEE Transactions on Information Theory*, etc.
- Invited speaker at: *IBM I-CARE Conference, Simons Institute for Theory of Computing, International Centre for Theoretical Sciences, Indo-Swiss School on Algorithms and Complexity, Bertinoro International Center for Informatics, Young Investigator Meeting at Boston, Microsoft Research Silicon Valley, Stanford University, Technion, Chinese University of Hong Kong, Institute for Advanced Study, Haifa University, INFORMS Annual Meeting, Dagstuhl Center for Informatics, IIT Kanpur, IBM T.J. Watson Research Center*, etc.

INDUSTRIAL COLLABORATION

- Consultant for the Computational Materials Science team at Shell Technology Center, 2015—2018.

JOURNAL PUBLICATIONS¹

Machine Learning Constrained with Dimensional Analysis and Scaling Laws: Simple, Transferable, and Interpretable Models of Materials from Small Datasets (with N. Kumar, P. Rajagopalan, P. Pankajakshan, S. Sanyal, J. Balachandran)
Chemistry of Materials, 2019.

Discovering vesicle traffic network constraints by model checking (with A. Shukla, L. Kuppusamy, M. Srivas, and M. Thattai)
PLOS ONE, 2017.

Machine Learning and Statistical Analysis for Materials Science: Stability and Transferability of Fingerprint Descriptors and Chemical Insights (with P. Pankajakshan, S. Sanyal, O.E. de Noord, **I. Bhattacharya** and U. Waghmare)
Chemistry of Materials, 2017.

Tight lower bounds for linear 2-query locally correctable codes over finite fields (with Z. Dvir, S. Saraf, A. Shpilka)
Combinatorica, 2016.

Preliminary version appeared in Proc. IEEE Foundations of Computer Science, 2011.

Optimal algorithms for heavy hitters in insertion streams and related problems (with **P. Dey** and D. Woodruff)
ACM Transactions on Algorithms, 2018 (to appear).

Preliminary version appeared in Proc. Principles of Database Systems, 2016.

Lower bounds for constant query affine-invariant LCC's and LTC's (with S. Gopi)

ACM Transactions on Computation Theory, 2017.

Preliminary version appeared in Proc. Computational Complexity Theory, 2016.

On Testing Affine-Invariant Properties

Invited column on ACM SIGACT News, vol. 44, no. 4, 2013.

A bipartite graph with non-unimodal independent set sequence (with J. Kahn)

Electronic Journal of Combinatorics, vol. 20, no. 4, 2013.

Testing Odd-Cycle Freeness in Boolean Functions (with E. Grigorescu, P. Raghavendra, A. Shapira)

Combinatorics, Probability & Computing, 2012.

Preliminary version appeared in Proc. SIAM Symposium on Discrete Algorithms, 2012.

Approximation algorithms for spanner problems and directed Steiner forest (with P. Berman, K. Makarychev, S. Raskhodnikova, G. Yaroslavtsev)

Special issue of Information and Computation, 2013.

Preliminary version appeared in Proc. Intl. Colloquium on Automata, Languages and Programming, 2011.

Every locally characterized affine-invariant property is testable (with E. Fischer, H. Hatami, P. Hatami, S. Lovett)

Submitted to SIAM Journal of Computing.

Preliminary version appeared in Proc. ACM Symposium on Theory of Computing, 2013.

Steiner transitive-closure spanners for low-dimensional posets (with P. Berman, E. Grigorescu, S. Raskhodnikova, D. Woodruff, G. Yaroslavtsev)

Combinatorica, 2014.

Preliminary version appeared in Proc. Intl. Colloquium on Automata, Languages and Programming, 2011.

A Unified Framework for Testing Linear-Invariant Properties (with E. Grigorescu, A. Shapira)

Random Structures & Algorithms, 2012.

Preliminary version appeared in Proc. Foundations of Computer Science, 2010.

Lower Bounds for Monotonicity Reconstruction from Transitive-Closure Spanners (with E. Grigorescu, M. Jha, K. Jung, S. Raskhodnikova, D. Woodruff)

SIAM Journal of Discrete Mathematics, 2012.

Preliminary version appeared in Proc. Intl. Workshop on Randomization and Computation, 2010.

¹ Names in blue were students under my supervision during co-authorship.

Testing Linear-Invariant Non-linear Properties (with V. Chen, M. Sudan, N. Xie)
Theory of Computing, 2011.
Preliminary version appeared in Proc. Symposium on Theoretical Aspects of Computer Science, 2009.

Transitive Closure Spanners (with E. Grigorescu, K. Jung, S. Raskhodnikova, D. Woodruff)
SIAM Journal of Computing, 2012.
Preliminary version appeared in Proc. SIAM Symposium on Discrete Algorithms, 2009.

CONFERENCE PUBLICATIONS¹

Combinatorial Lower Bounds for 3-query LDC's (with **S. Ghoshal** and S. Chandran)
Proc. Innovations in Theoretical Computer Science, 2020.

Minimum Intervention Cover of a Causal Graph (with **S. Kandasamy** and V. Honavar)
Proc. Association of Artificial Intelligence, 2019.

Learning and Testing Causal Models with Interventions (with J. Acharya, C. Daskalakis, and **S. Kandasamy**)
Proc. Neural Information Processing Systems, 2018.

Hardness of learning noisy halfspaces using polynomial thresholds (with **S. Ghoshal** and R. Saket)
Proc. Conference on Learning Theory, 2018.

Improved bounds for universal one-bit compressed sensing (with J. Acharya and P. Kamath)
Proc. IEEE International Symposium on Information Theory, 2017.

On the gap between outcomes of voting rules (with **A. Mathur**). Extended abstract.
Proc. Conference on Autonomous Agents & Multiagent Systems, 2017.

Higher-order Fourier Analysis over non-prime fields (with A. Bhowmick and **C. Gupta**)
Proc. International Workshop on Randomization and Computation, 2016.

On the hardness of learning sparse parities (with A. Gadekar, **S. Ghoshal** and R. Saket)
Proc. European Symposium on Algorithms, 2016.

Lower bounds for constant query affine-invariant LCC's and LTC's (with S. Gopi)
Proc. Computational Complexity Conference, 2016.

Optimal algorithms for heavy hitters in insertion streams and related problems (with **P. Dey** and D. Woodruff)
Proc. Principles of Database Systems, 2016.

How friends and non-determinism affect opinion dynamics (with **K. Shiragur**)
Proc. Conference on Decision and Control, 2015.

Sample Complexity for Winner Prediction in Elections (with **P. Dey**)
Proc. Conference on Autonomous Agents & Multiagent Systems, 2015.

Algorithmic Regularity for Polynomials and Applications (with P. Hatami and M. Tulsiani)
Proc. Symposium on Discrete Algorithms, 2015.

Polynomial decompositions in polynomial time
Proc. European Symposium on Algorithms, 2014.

Every locally characterized affine-invariant property is testable (with E. Fischer, H. Hatami, P. Hatami, S. Lovett)
Proc. ACM Symposium on Theory of Computing, 2013.

On the convergence of the Hegselmann-Krause system (with M. Braverman, B. Chazelle, H. Nguyen)
Proc. Innovations in Theoretical Computer Science, 2013.

An Algebraic Characterization of Testable CSPs (with Y. Yoshida)
Proc. International Colloquium on Automata, Languages and Programming, 2013.

Testing Low Complexity Affine-Invariant Properties (with E. Fischer, S. Lovett)
Proc. SIAM Symposium on Discrete Algorithms, 2013.

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Testing Permanent Oracles – Revisited (with S. Arora, R. Manokaran, S. Sachdeva)

Proc. Intl. Workshop on Randomization and Computation, 2012.

Testing Odd-Cycle Freeness in Boolean Functions (with E. Grigorescu, P. Raghavendra, A. Shapira)

Proc. SIAM Symposium on Discrete Algorithms, 2012.

Tight lower bounds for linear 2-query locally correctable codes over finite fields (with Z. Dvir, S. Saraf, A. Shpilka)

Proc. IEEE Foundations of Computer Science, 2011.

Approximation algorithms for spanner problems and directed Steiner forest (with P. Berman, K. Makarychev, S. Raskhodnikova, G. Yaroslavtsev)

Proc. Intl. Colloquium on Automata, Languages and Programming, 2011.

Steiner transitive-closure spanners for low-dimensional posets (with P. Berman, E. Grigorescu, S. Raskhodnikova, D. Woodruff, G. Yaroslavtsev)

Proc. Intl. Colloquium on Automata, Languages and Programming, 2011.

The Complexity of Linear Dependence Problems in Vector Spaces (with P. Indyk, D. Woodruff, N. Xie)

Proc. Innovations in Computer Science, 2011.

Testing Monotonicity of distributions over general partial orders (with E. Fischer, R. Rubinfeld, P. Valiant)

Proc. Innovations in Computer Science, 2011.

A Unified Framework for Testing Linear-Invariant Properties (with E. Grigorescu, A. Shapira)

Proc. Foundations of Computer Science, 2010.

Optimal Testing of Reed-Muller Codes (with S. Kopparty, G. Schoenebeck, M. Sudan, D. Zuckerman)

Proc. Foundations of Computer Science, 2010.

Lower Bounds for Monotonicity Reconstruction from Transitive-Closure Spanners (with E. Grigorescu, M. Jha, K. Jung, S. Raskhodnikova, D. Woodruff)

Proc. Intl. Workshop on Randomization and Computation, 2010.

Lower Bounds for Testing Triangle-freeness in Boolean Functions (with N. Xie)

Proc. SIAM Symposium on Discrete Algorithms, 2010.

Testing Linear-Invariant Non-linear Properties (with V. Chen, M. Sudan, N. Xie)

Proc. Symposium on Theoretical Aspects of Computer Science, 2009.

Transitive Closure Spanners (with E. Grigorescu, K. Jung, S. Raskhodnikova, D. Woodruff)

Proc. SIAM Symposium on Discrete Algorithms, 2009.

SIAM Journal of Computing, vol. 41, no. 6, 2012.

BOOKS

Property Testing (with Y. Yoshida)

In preparation, 2020.