

# Adarsh Barik

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## Research Interests

- Statistical Machine Learning
  - High-Dimensional Data Analysis
  - Optimization
  - Information Theory
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## Academic Journey

- **National University of Singapore** **Singapore**  
*Institute of Data Science* 2023 – now
    - Program: Research Fellow, Host: Professor Vincent Y. F. Tan
    - Developing online learning algorithms for convex and nonconvex loss functions
  - **Purdue University** **West Lafayette, USA**  
*Department of Computer Science* 2017 – 2023
    - Program: Ph.D., Advisor: Professor Jean Honorio, GPA: 4.0/4.0
    - Developed novel continuous relaxations for combinatorial problems - extended beyond convexity
    - Provided sufficient and necessary theoretical bounds on the sample and computational complexity
  - **Indian Institute of Technology Madras** **Chennai, India**  
*Department of Aerospace Engineering* 2008 – 2013
    - Program: B.Tech and M.Tech, Advisor: Professor M Ramakrishna, GPA: 8.49/10
    - Developed mathematical and computational model of flow inside a flexible tube
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## Publications and Preprints

1. **An SDP Formulation for Minimizing p-th Order Controversy with Unknown Initial Opinions**  
*Meher Chaitanya, Adarsh Barik, Jean Honorio* *Conference on Complex Networks and Their Applications, 2024*
2. **Exact Support Recovery in Federated Regression with One-shot Communication**  
*Adarsh Barik, Jean Honorio* *Transactions on Machine Learning Research (TMLR), 2023*
3. **Provable Computational and Statistical Guarantees for Efficient Learning of Continuous-Action Graphical Games**  
*Adarsh Barik, Jean Honorio* *International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2023*
4. **Sparse Mixed Linear Regression with Guarantees: Taming an Intractable Problem with Invex Relaxation**  
*Adarsh Barik, Jean Honorio* *International Conference on Machine Learning (ICML), 2022*  
Acceptance rate < 20%
5. **A Simple Unified Framework for High Dimensional Bandit Problems**  
*Wenjie Li, Adarsh Barik, Jean Honorio* *International Conference on Machine Learning (ICML), 2022*  
Acceptance rate < 20%
6. **Provable Sample Complexity Guarantees for Learning of Continuous-Action Graphical Games With Non-parametric Utilities**  
*Adarsh Barik, Jean Honorio* *International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022*
7. **Information Theoretic Limits for Standard and One-Bit Compressed Sensing with Graph-Structured Sparsity**  
*Adarsh Barik, Jean Honorio* *International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022*
8. **Fair Sparse Regression with Clustering: An Invex Relaxation for a Combinatorial Problem**  
*Adarsh Barik, Jean Honorio* *Neural Information Processing Systems (NeurIPS), 2021*  
**Spotlight**, Acceptance rate < 3%

9. **Information-Theoretic Bounds for Integral Estimation**  
Donald Q. Adams, Adarsh Barik, Jean Honorio *IEEE International Symposium on Information Theory (ISIT)*, 2021
  10. **Learning Discrete Bayesian Networks in Polynomial Time and Sample Complexity**  
Adarsh Barik, Jean Honorio *IEEE International Symposium on Information Theory (ISIT)*, 2020
  11. **Learning Bayesian Networks with Low Rank Conditional Probability Tables**  
Adarsh Barik, Jean Honorio *Neural Information Processing Systems (NeurIPS)*, 2019  
Acceptance rate < 22%
  12. **Information Theoretic Limits for Linear Prediction with Graph-Structured Sparsity**  
Adarsh Barik, Jean Honorio, Mohit Tawarmalani *IEEE International Symposium on Information Theory (ISIT)*, 2017
  13. **Invex programs - First Order Algorithms and Their Convergence**  
Adarsh Barik, Suwit Sra, Jean Honorio *Preprint*
  14. **On exact solutions of the inner optimization problem of adversarial robustness**  
Deepak Maurya, Adarsh Barik, Jean Honorio *Preprint*
  15. **Minimizing Polarization in Social Networks: Modifying Network Topology with Fully and Partially Observed Initial Opinions**  
Meher Chaitanya, Adarsh Barik, Mansi Rankawat, Jean Honorio *Preprint*
  16. **LEARN: An Invex Loss for Outlier Oblivious Robust Online Optimization**  
Adarsh Barik, Anand Krishna, Vincent Y. F. Tan *Preprint*
  17. **A Sample Efficient Alternating Minimization-based Algorithm For Robust Phase Retrieval**  
Adarsh Barik, Anand Krishna, Vincent Y. F. Tan *Preprint*
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## Talks

- **Outlier Oblivious Robust Online Optimization**  
*IIT Kanpur, India and TIFR, India, 2024*
  - **Sparse Mixed Linear Regression with Guarantees: Taming an Intractable Problem with Invex Relaxation**  
*Spotlight International Conference on Machine Learning (ICML), 2022*
  - **A Simple Unified Framework for High Dimensional Bandit Problems**  
*Spotlight International Conference on Machine Learning (ICML), 2022*
  - **Provable Sample Complexity Guarantees for Learning of Continuous-Action Graphical Games With Non-parametric Utilities**  
*International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022*
  - **Information Theoretic Limits for Standard and One-Bit Compressed Sensing with Graph-Structured Sparsity**  
*International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022*
  - **Fair Sparse Regression with Clustering: An Invex Relaxation for a Combinatorial Problem**  
*Spotlight Neural Information Processing Systems (NeurIPS), 2021*
  - **Learning Discrete Bayesian Networks in Polynomial Time and Sample Complexity**  
*IEEE International Symposium on Information Theory (ISIT), 2020*
  - **Learning Bayesian Networks with Low Rank Conditional Probability Tables**  
*Neural Information Processing Systems (NeurIPS), 2019*
  - **Information Theoretic Limits for Linear Prediction with Graph-Structured Sparsity**  
*IEEE International Symposium on Information Theory (ISIT), 2017*
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## Teaching

- **Instructor**, Purdue University
  - **Business Statistics**, MGMT305, Summer 2017 - **Outstanding Instructor Award**
- **Teaching Assistant**, Purdue University

- **Statistical Machine Learning**, CS578, Fall 2017, Spring 2018, Spring 2020, Spring 2023
  - **Computational Methods in Optimization**, CS520, Spring 2021
  - **Numerical Methods**, CS314, Fall 2020, Fall 2021
  - **Foundation of Computer Science**, CS182, Summer 2020, Summer 2021
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## Service

- **PC Member (Reviewer)**: NeurIPS 2023, AISTATS 2023, NeurIPS 2022, ICML 2022, AISTATS 2022, AISTATS 2021
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## Professional Experience

- **Associate Software Developer, FlexTrade Systems, India** 2013-2015
    - Worked on high-performance execution management and order management systems for equities, foreign exchange, options, futures, and fixed income
  - **Project Trainee, Honeywell Technology Solutions, India** 2011
    - Studied various modeling techniques for squeeze film dampers and damping simulation on bolted flange joints under high-loading conditions
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## Other Projects

- **IITMSAT Satellite Project** **Indian Institute of Technology Madras**
    - Founding member of the first student satellite project of IIT Madras
    - Leader of the structures subsystem and was responsible for the vibrational and structural robustness of the satellite structure
  - **Minimum Area Polygon Problem** **Indian Institute of Technology Madras**
    - Used Genetic algorithm to provide a novel greedy algorithm for finding a simple polygon with minimum enclosed area for a given number of data points
    - Formulated the algorithm and implemented using MATLAB®
  - **ASTROSAT Project** **Tata Institute of Fundamental Research**
    - Worked on structural analysis of CZT (Calcium-Zinc-Telluride) Imager of ASTROSAT satellite for an improved vibrational and thermal performance
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## Relevant Courses

Grade A or better

- Statistical Machine Learning
  - Artificial Intelligence
  - Hands-on Learning Theory
  - High-Dimensional Data Analysis
  - Algorithm Design and Analysis
  - Computational Methods in Optimization
  - Randomized Algorithm
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## Relevant Programming Experience

**Core technical skills:** Python, C++, C, MATLAB®, shell script, L<sup>A</sup>T<sub>E</sub>X

- **Classroom projects** - <https://github.com/Adarsh-Barik>
  - **Python**, Implemented a multiclass support vector machine classifier to recognize characters using Chars 74K data set (English characters) which contained code for feature extraction, model generation, hyperparameter estimation and cross-validation
  - **Python**, Implemented Sequential Minimization Optimization algorithm from scratch to solve soft margin problem in support vector machines
  - **Python**, Implemented two-phase Simplex algorithm from scratch to solve linear programs

- **Python**, Implemented a basic peer-to-peer chat application from scratch with no centralized server
  - **Master's project**
    - **Python**, Designed a three-dimensional mathematical model using Navier-Stokes equations and membrane equation to study flow-structure interaction and implemented it using MacCormack's finite-difference scheme
  - **Professional Software Developer**
    - **C++**, Designed and implemented custom trading strategies and customizable click-and-trade front-end applications as a professional software developer for 2 years
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## References

1. Vincent Y. F. Tan
  - Professor, Department of Mathematics and Department of Electrical and Computer Engineering, National University of Singapore
  - Email: [vtan@nus.edu.sg](mailto:vtan@nus.edu.sg)
2. Jean Honorio
  - Senior Lecturer, School of Computing and Information Systems, The University of Melbourne
  - Adjunct Professor, Department of Computer Science and Department of Statistics, Purdue University
  - Email: [jhonorio@unimelb.edu.au](mailto:jhonorio@unimelb.edu.au), [jhonorio@purdue.edu](mailto:jhonorio@purdue.edu)
3. Petros Drineas
  - Professor and Associate Head, Department of Computer Science, Purdue University
  - Email: [pdrineas@purdue.edu](mailto:pdrineas@purdue.edu)