

Amir Reza ASADI

*Leverhulme Early Career Fellow
Isaac Newton Trust Fellow*

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Research Interests

- Machine Learning
- Information Theory
- Differential Privacy
- High-Dimensional Probability and Statistics

Education

- 2017–2021 **Ph.D. in Electrical and Computer Engineering**, *Princeton University*, Princeton, New Jersey, United States.
Dissertation: “*Neural Network Learning: A Multiscale-Entropy and Self-Similarity Approach*”
Advisor: Prof. Emmanuel Abbe
- 2015–2017 **M.A. in Electrical Engineering**, *Princeton University*, Princeton, New Jersey, United States.
Advisors: Prof. Emmanuel Abbe and Prof. Sergio Verdú
- 2010–2015 **B.Sc. in Mathematics**, *Sharif University of Technology*, Tehran, Iran.
- 2010–2015 **B.Sc. in Electrical Engineering (Communications)**, *Sharif University of Technology*, Tehran, Iran.
Cumulative GPA: 18.48/20.00 (calculated across both Mathematics and Electrical Engineering degrees)
Project: Some Schemes for File Dissemination in Networks Employing Linear Network Coding
Project Advisor: Dr. Amin A. Gohari

Academic Positions

- 2023–Present **Leverhulme Trust Early Career Fellow**, *Statistical Laboratory, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge*, Cambridge, United Kingdom.
- Fellow of the Isaac Newton Trust, Cambridge, United Kingdom
 - PI of the “Hierarchical Approaches to Statistical Learning and Private Data Generation” project
- 2021–2023 **Postdoctoral Research Associate**, *Statistical Laboratory, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge*, Cambridge, United Kingdom.
Mentors: Prof. Po-Ling Loh and Prof. Varun Jog

Academic Affiliation

2022–Present **Postdoctoral Affiliate**, Trinity College, Cambridge, United Kingdom.

Publications

- **A. R. Asadi**, A. Davoodi, R. Javadi & F. Parvaresh. (2025) Exact Recovery in the Data Block Model. (*In Preparation.*)
- **A. R. Asadi**. (2025) Hierarchical Maximum Entropy via the Renormalization Group. *arXiv preprint arXiv:2509.01424 (Submitted)*.
- G. Aminian, **A. R. Asadi**, I. Shenfeld & Y. Mroueh. (2025) Theoretical Analysis of KL-regularized RLHF with Multiple Reference Models. To appear in *Advances in Neural Information Processing Systems (NeurIPS) 2025*.
- G. Aminian, I. Shenfeld, **A. R. Asadi**, A. Beirami & Y. Mroueh. (2025) Best-of-N through the Smoothing Lens: KL Divergence and Regret Analysis. *Efficient Systems for Foundation Models Workshop at the International Conference on Machine Learning (ICML) 2025*.
- G. Aminian, **A. R. Asadi**, T. Li, A. Beirami, G. Reinert & S. N. Cohen (2025) Generalization and Robustness of the Tilted Empirical Risk. *International Conference on Machine Learning (ICML) 2025*.
- A. Pensia, **A. R. Asadi**, V. Jog & P. Loh. (2024) Simple Binary Hypothesis Testing under Local Differential Privacy and Communication Constraints. *IEEE Transactions on Information Theory*. vol. 71, no. 1, pp. 592-617.
- **A. R. Asadi**. (2024) An Entropy-Based Model for Hierarchical Learning. *Journal of Machine Learning Research*, 25(187), pp. 1-45.
- **A. R. Asadi** & P. Loh (2024) Entropic Regularization of Neural Networks: Self-Similar Approximations. *Journal of Statistical Planning and Inference*, Vol. 233.
- **A. R. Asadi** & P. Loh (2023) On the Gibbs Exponential Mechanism and Private Data Generation. *IEEE International Symposium on Information Theory (ISIT) 2023*. pp. 2213-2218
- A. Pensia, **A. R. Asadi**, V. Jog & P. Loh. (2023) Simple Binary Hypothesis Testing under Local Differential Privacy and Communication Constraints. *Conference on Learning Theory (COLT)*.
- **A. R. Asadi** & E. Abbe. (2020) Chaining Meets Chain Rule: Multilevel Entropic Regularization and Training of Neural Networks. *Journal of Machine Learning Research*, 21(139), pp. 1-32.
- **A. R. Asadi**, E. Abbe, & S. Verdú. (2018) Chaining Mutual Information and Tightening Generalization Bounds. *Advances in Neural Information Processing Systems (NeurIPS)*, pp. 7245-7254.
- **A. R. Asadi**, E. Abbe, & S. Verdú, (2017) Compressing Data on Graphs with Clusters. *IEEE International Symposium on Information Theory (ISIT)*, pp. 1583-1587.
- M. Asadi, & **A. R. Asadi**. (2014) On the Failure Probability of Used Coherent Systems. *Communications in Statistics, Theory and Methods*, Vol. 43, pp. 2468-2475.
- **A. R. Asadi** (2013). Problem 96.J with solution, *The Mathematical Gazette*, Vol. 97, No. 539, pp. 345-346, United Kingdom. (Available at [JSTOR](#).)

Invited Talks

- June 2025 **“Differential Privacy: A Stability-Based Perspective”**, UK Crypto Day, University of Sheffield, Sheffield, United Kingdom
- January 2025 **“Hierarchical Learning: An Entropy-Based Approach”**, Chennai Mathematical Institute, Chennai, India

- May 2023 **“An Entropy-Based Model for Hierarchical Learning”**, Department of Mathematical Sciences, Durham University, Durham, United Kingdom
- February 2023 **“An Entropy-Based Model for Hierarchical Learning”**, Statistical Laboratory, University of Cambridge, Cambridge, United Kingdom
- February 2021 **“Neural Networks and Multiscale Entropies”**, Department of Computer Science, ETH Zürich, Zürich, Switzerland
- December 2020 **“Neural Networks and Multiscale Entropies”**, Department of EECS, Massachusetts Institute of Technology, Cambridge, Massachusetts, United States
- December 2020 **“Neural Networks and Multiscale Entropies”**, NSF-Simons Collaboration on the Theoretical Foundations of Deep Learning
- June 2020 **“Neural Networks and Multiscale Entropies”**, Center for Data Science, New York University, New York, United States
- May 2020 **“Neural Networks and Multiscale Entropies”**, Laboratoire de Physique, École Normale Supérieure, Paris, France
- April 2020 **“Neural Networks and Multiscale Entropies”**, Department of Statistical Sciences, University of Toronto, Toronto, Canada
- March 2020 **“Neural Networks and Multiscale Entropies”**, Department of Engineering, University of Cambridge, Cambridge, United Kingdom
- October 2019 **“Chaining Meets Chain Rule”**, Institute for Advanced Study, Princeton, New Jersey, United States. (Available at [YouTube](#).)
- September 2019 **“Chaining Meets Chain Rule”**, Microsoft Research AI, Redmond, Washington, United States

Awards and Honors

- 2023–present Leverhulme Early Career Fellowship, the Leverhulme Trust and the Isaac Newton Trust
- 2019 Teaching Assistant Award, Department of Electrical and Computer Engineering, Princeton University
- 2016 Anthony Ephremides Fellowship, Princeton University
- 2009 Bronze Medal, Iranian Mathematical Olympiad
- 2009 Diploma of Mathematics, Tournament of Towns Contest, Russian Academy of Sciences
- 2009–present Member of Iran’s National Elite Foundation

Research Visits

- September 2019 **Visiting Ph.D. Student**, *Microsoft Research AI*, Redmond, Washington, United States, **Host:** Prof. Sebastien Bubeck.
- Summer 2014 **Research Intern**, *Institute of Network Coding*, The Chinese University of Hong Kong, Hong Kong, **Host:** Prof. Raymond Yeung.
Working on linear network coding

Professional Services

- 2024–present Co-organizer of the Information Theory Seminar, University of Cambridge
- 14–16 May 2025 Co-organizer, 8th London Symposium on Information Theory
- 10 May 2024 Co-organizer, 2nd Cambridge Information Theory Colloquium
- 21 April 2023 Co-organizer, 1st Cambridge Information Theory Colloquium

Reviewer for:

- Journal of Machine Learning Research
- IEEE Transactions on Information Theory
- Journal of Statistical Planning and Inference
- Journal of Selected Areas on Information Theory
- Conference on Neural Information Processing Systems (NeurIPS)
- Conference on Learning Theory (COLT)
- International Symposium on Information Theory (ISIT)
- International Conference on Machine Learning (ICML)
- International Conference on Learning Representations (ICLR)
- Information Theory Workshop (ITW)
- Conference on Information Sciences and Systems (CISS)
- Notices of the American Mathematical Society
- Conference on Uncertainty in Artificial Intelligence (UAI)

Teaching Experience

- 2024–2025 **Supervisor for *Information Theory and Coding***, Department of Engineering, University of Cambridge, Cambridge, United Kingdom.
Supervised third year undergraduate students.
- 2023–2025 **Supervisor for *Probability***, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, Cambridge, United Kingdom.
Supervised first year undergraduate students.
- 2023–2025 **Supervisor for *Principles of Statistics***, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, Cambridge, United Kingdom.
Supervised third year undergraduate students.
- 2022 **Examples Class Instructor for *Information Theory***, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, Cambridge, United Kingdom.
Instructed Master's students.
- 2018–2019 **Teaching Assistant for *Probability in High Dimension***, Program in Applied and Computational Mathematics, Princeton University, Princeton, New Jersey, United States.
Graded problem sets for Prof. Ramon van Handel's course.
- 2017–2018 **Teaching Assistant for *Transmission and Compression of Information***, Department of Electrical and Computer Engineering, Princeton University, Princeton, New Jersey, United States.
Devised and graded problem sets, midterm and final exams in collaboration with Prof. Emmanuel Abbe.
Recipient of the Department of Electrical and Computer Engineering Teaching Assistant Award.

Coursework (Princeton University)

Course Title	Instructor(s)	Grade
Information Theory	Sergio Verdú	A ⁺
Lossless Data Compression	Sergio Verdú	A ⁺
Coding Theory and Random Graphs	Emmanuel Abbe	A ⁺
Theoretical Machine Learning	Elad Hazan	A
Probability in High Dimension	Ramon van Handel	A
Probability Theory	Ovidiu Calin	A

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Course Title	Instructor(s)	Grade
Theory of Detection and Estimation	Paul Cuff	A
Random Graphs and Networks	Emmanuel Abbe	A
Sparsity, Structure and Inference	Yuxin Chen	A
Theory of Algorithms	Robert Tarjan	A
Random Processes in Information Systems	Sergio Verdú	A ⁻
New Directions in Theoretical Machine Learning	Sanjeev Arora	AUD
The Probabilistic Method	Noga Alon	AUD
Theory of Detection and Estimation	Sergio Verdú	AUD
Introduction to Statistical Mechanics	Salvatore Torquato & Roberto Car	AUD

Programming Languages

- MATLAB
- Python
- C++