Shahab Asoodeh

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Appointments

- **Vector Institute** — **Toronto, ON**
  Faculty Affiliate — *2023–present*
- **McMaster University** — **Hamilton, ON**
  Assistant Professor, Department of Computing and Software — *2021–present*
- **Meta** — **Menlo Park, CA**
  Visiting Research Scientist, Statistics & Privacy Team — *2021–2022*
- **Harvard University** — **Cambridge, MA**
  Postdoctoral Fellow, School of Engineering and Applied Science — *2019–2021*
- **The University of Chicago** — **Chicago, IL**
  Postdoctoral Scholar, Computation Inst. and Inst. of Genetics and System Biology — *2017–2019*

Education

- **Queen's University** — **Kingston, ON**
  Ph.D. in Applied Mathematics — *2017*
- **Queen's University** — **Kingston, ON**
  M.Sc. in Applied Mathematics — *2012*
- **ETH Zürich and TU Delft** — **Switzerland and Netherlands**
  M.Sc. in Electrical Engineering — *2011*
- **Beheshti University** — **Tehran, Iran**
  B.Sc. in Electrical Engineering — *2008*

Sponsored Research

- 2022-2027: **NSERC Discovery Grant**: "Foundations of Differential Privacy Watchdog: From Theory to Practice"
- 2022: **NSERC Discovery Launch Supplements**
- 2020: **Oracle Labs**: Private Federated Learning: From Theory to Practice. (Together with Flavio Calmon, Harvard)

Tutorials and Short Courses

- **2023: Local Differential Privacy and Contraction of Markov Kernels:** Contributed session taught at Latin American Congress of Probability and Mathematical Statistics (CLAPEM), São Paulo, Brazil.
- **2022: Foundations of Differential Privacy:** Course taught to grad students at Canadian Society of Information Theory.
- **2022: Information-Theoretic Tools for Responsible Machine Learning:** Tutorial taught at International Symposium on Information Theory, Helsinki, Finland.

Professional Services

- **Diversity and Inclusion Committee Member (2025-present):** IEEE Information Theory Society
- **Technical Program Committee Member:** 2024, 2025 IEEE International Symposium of Information Theory (ISIT)
- **Organizing Committee Member:** 2024 IEEE North American School of Information Theory
- **Organizing Committee Member:** 1st Workshop on Information-Theoretic Methods for Trustworthy Machine Learning
- **Editorial Board Member (2023-present):** ACM Transactions on Probabilistic Machine Learning

Current Group Members and Research Advisees

- **McMaster University:**
  - Hrad Ghoukasian (Research Associate since Winter 2025)
  - Narges Rahimi Shahmirzadi (M.Eng. since Fall 2024)
  - Behnoosh Zamanlooy (Ph.D. since Fall 2022)
  - Alireza Daeijavad (Ph.D. since Fall 2022)
- **Harvard University:**
  - Benjamin Levy (M.Sc. in IACS, 2020-2021)
  - Zihao Xu (M.Sc. in IACS, 2020-2021)
  - Liyang Zhao (M.Sc. in IACS, 2020-2021)
  - Shuying Ni (M.Sc. in IACS, 2020-2021)
  - Qiang Fei (M.Sc. in IACS, 2020-2021)
  - Yingsi Jian (M.Sc. in IACS, 2020-2021)
  - Mingyue Wei (M.Sc. in IACS, 2020-2021)
  - Shuyuan Xiao (M.Sc. in IACS, 2020-2021)

Past Group Members

- Hrad Ghoukasian (M.Sc. graduated in Fall 2024): Currently Research Associate at McMaster
- Alireza Fathollah Pour (Research Associate Feb - Aug 2023, co-supervised with Hassan Ashtiani): Currently Ph.D. at University of Waterloo
- Hyun-Young Park (Visiting PhD student from KAIST, Winter 2023)
- Anish Das (Mitacs intern, Summer 2023)
- Nihal Azavedo (Undergrad, 2021-2022): Currently Ph.D. at NYU

Thesis Committee

- Saber Malekmohammadi, Ph.D. at University of Waterloo (external examiner, 2025)
- Monica Welfert, Ph.D. at Arizona State University (2024 - present)
- Naima Tasnim, Ph.D. at Arizona State University (2024 - present)
- Yuanming Cao, Ph.D. at McMaster University (2024 - present)
- Zheheng Zhao, Ph.D. at McMaster University (2024 - present)
- Mohammad Afzali Kharkouei, M.Sc. at McMaster University (2022 - 2024)

Publication

Clarification on authorship: I publish and collaborate across areas. Each field has its own conventions for ordering authors. Authorship lists can be alphabetical, represent the order of contribution (usually with students first), have senior PIs ordered by contribution, or have a single lead senior PI as last author. Below, asterisk refers to a trainee under my supervision.

Pre-prints

[P1]. H. Ghoukasian*, B. Lee* and **S. Asoodeh**, "Locally private sampling: Beyond global minimax", 2025.

[P2]. B. Lee* and **S. Asoodeh**, "Locally private multi-sampling", Submitted 2025.

[P3]. M. Diaz and **S. Asoodeh**, "Privacy loss of noisy stochastic gradient descent might converge even for non-convex losses", Submitted, 2025.

Journals and Full CS Conference Papers

[J1]. A. Gilani, J. F. Gomez, **S. Asoodeh**, F. Calmon, O. Kosut, and L. Sankar, "Optimizing noise distributions for differential privacy", *International Conference on Machine Learning (ICML)*, 2025.

[J2]. B. Zamanlooy*, M. Diaz and **S. Asoodeh**, "Locally private sampling with public data", *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2025.

[J3]. H-Y. Park*, **S. Asoodeh**, and S-H. Lee, "Exactly minimax-optimal locally differentially private sampling", *Neural Information Processing Systems (NeurIPS)*, 2024.

[J4]. A. Fathollah Pour*, H. Ashtiani, and **S. Asoodeh**, "Sample-optimal locally private hypothesis selection and the provable benefits of interactivity", *Conference on Learning Theory (COLT)*, 4240-4275, 2024.

[J5]. W. Alghamdi, **S. Asoodeh**, F. Calmon, F. Gomez, O. Kosut, and L. Sankar, "The saddle-point accountant for differential privacy", *International Conference on Machine Learning* (ICML), 2023.

[J6]. W. Alghamdi, H. Hsu, H. Jeong, H. Wang, **S. Asoodeh**, and F. Calmon, "Beyond Adult and COMPAS: Fairness in multi-class prediction", *Neural Information Processing Systems (NeurIPS)*, 2022. **[Selected as Oral Presentation]**

[J7]. **S. Asoodeh** and H. Zheng, "Contraction of locally differentially private mechanisms with applications", *Accepted in IEEE Journal on Selected Areas in Information Theory (Special Issue on Information-Theoretic Methods for Trustworthy and Reliable Machine Learning)*, 2024. [arXiv]

[J8]. **S. Asoodeh**, J. Liao, F. Calmon, O. Kosut, L. Sankar, "Three variants of differential privacy: lossless conversion and applications", *IEEE Journal on Selected Areas in Information Theory*, vol. 2(1), pp. 208-222, 2021.

[J9]. N. Yadati, T. Gao, **S. Asoodeh**, P. Talukdar, and A. Louis, "Graph neural networks for soft semi-supervised learning on hypergraphs", *Pacific-Asia Conf. Knowledge Discovery and Data Mining (PA-KDD),* 2021.

[J10]. H. Hsu, **S. Asoodeh**, and F. Calmon, "Information obfuscation via information density estimation", in *Int. Conf. on Artificial Intelligence and Statistics (AISTATS),* 2020.

[J11]. **S. Asoodeh**, and F. Calmon, "Bottleneck problems: Information and estimation-theoretic view", *Entropy Special Issue on Information-Theoretic Methods for Deep Learning*, 2020. **[Invited Paper]**

[J12]. **S. Asoodeh**, M. Diaz, F. Alajaji and T. Linder, "Estimation efficiency under privacy constraints", *IEEE Transaction on Information Theory,* vol. 65 (3), pp. 1512-1534, March 2019.

[J13]. **S. Asoodeh**, M. Diaz, F. Alajaji and T. Linder, "Information extraction under privacy constraint", *Information*, 2016.

Peer-Reviewed Conference Papers

[C1]. A. Daeijavad* and **S. Asoodeh**, "Exponential convergence of projected Langevin Monte Carlo with non-convex potentials", *Submitted*, 2025.

[C2]. W. Alghamdi, **S. Asoodeh**, F. P. Calmon, O. Kosut, and L Sankar, "Differential privacy-capacity", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2024.

[C3]. B. Zamanlooy*, S. **Asoodeh**, M. Diaz, and F. Calmon, "E_γ-Mixing time", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2024.

[C4]. H. Ghoukasian* and S. **Asoodeh**, "Differentially private fair classification", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2024.

[C5]. S. **Asoodeh**, and M. Diaz,"On the privacy guarantees of differentially private stochastic gradient descent", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2024.

[C6]. W. Alghamdi, **S. Asoodeh**, F. Calmon, O. Kosut, and L. Sankar, "Optimal multidimensional differentially private mechanisms in the large-composition regime", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2023.

[C7]. W. Alghamdi, **S. Asoodeh**, F. Calmon, O. Kosut, and L. Sankar, "Schrödinger mechanisms: Optimal differential privacy mechanisms for small sensitivity", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2023.

[C8]. B. Zamanlooy*, and **S. Asoodeh**, "Strong data processing inequalities for locally differentially private mechanisms", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2023.

[C9]. E. Benger, **S. Asoodeh**, and J. Chen, "The cardinality bound on the information bottleneck representations is tight", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2023.

[C10]. **S. Asoodeh**,"Distribution simulation under local differential privacy", *Canadian Workshop on Information Theory*, 2022.

[C11]. W. Alghamdi, **S. Asoodeh**, F. Calmon, O. Kosut, L. Sankar, and F. Wei, "The Cactus mechanism: Optimal privacy mechanisms in the large-composition regime", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2022.

[C12]. **S. Asoodeh**, W. Chen, F. Calmon, and A. Özgür, "Differentially private federated learning: An information-theoretic perspective", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2021.

[C13]. **S. Asoodeh**, M. Aliakbarpour, and F. Calmon, "Local differential privacy is equivalent to contraction of E_γ-divergence", *IEEE Int. Symp. on Inf. Theory (ISIT)*, 2021.

[C14]. W. Alghamdi, **S. Asoodeh**, H. Wang, F. Calmon, D. Wei and K. N. Ramamurthy, "Model projection: theory and applications to fair machine learning", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2020.

[C15]. **S. Asoodeh**, J. Liao, F. Calmon, O. Kosut, and L. Sankar, "A Better bound gives a hundred rounds: Enhanced privacy guarantees via f-divergences", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2020.

[C16]. **S. Asoodeh**, Mario Diaz, and F. Calmon, "Privacy amplification of iterative algorithms via contraction coefficient", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2020.

[C17]. T. Gao, **S. Asoodeh**, Y. Huang, and J. Evans, "Wasserstein soft label propagation on hypergraphs: algorithm and generalization error bounds", in *Proc. 33rd AAAI Conf. on Artificial Intelligence (AAAI)*, 2019.

[C18]. H. Hsu, **S. Asoodeh**, and F. Calmon, "Information-theoretic privacy watchdogs", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2019.

[C19]. H. Hsu, **S. Asoodeh**, S. Salamatian and F. Calmon, "Generalizing bottleneck problems", *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2018.

[C20]. **S. Asoodeh**, Y. Huang and I. Chattopadhyay, "Tamper-free communication over deletion channels", in *Proc. IEEE Conference on Decision and Control (CDC)*, 2018.

[C21]. **S. Asoodeh**, T. Gao, and J. A. Evans, "Curvature of hypergraphs via multi-marginal optimal transport", in *Proc. IEEE Conference on Decision and Control (CDC)*, 2018.

[C22]. **S. Asoodeh**, M. Diaz, F. Alajaji and T. Linder, "Privacy-aware guessing efficiency", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2017.

[C23]. **S. Asoodeh**, F. Alajaji and T. Linder, "Almost perfect privacy over additive Gaussian channel", in *Proc. Int. Conference on Information Theoretic Security*, 2016.

[C24]. **S. Asoodeh**, F. Alajaji and T. Linder, "Privacy-aware MMSE estimation", in *Proc. IEEE Int. Symp. on Inf. Theory (ISIT)*, 2016.

[C25]. **S. Asoodeh**, F. Alajaji and T. Linder, "Lossless secure source coding: Yamamoto's setting", in *Proc. 53rd Annual Allerton Conference on Communication, Control, and Computing*, 2015.

[C26]. **S. Asoodeh**, F. Alajaji and T. Linder, "On maximal correlation, mutual information and a data privacy problem", *Canadian Workshop on Information Theory*, 2015.

[C27]. **S. Asoodeh**, F. Alajaji and T. Linder, Notes on information theoretic privacy, in *Proc. 52nd Annual Allerton Conference on Communication, Control, and Computing*, 2014.

[C28]. **S. Asoodeh**, F. Alajaji and T. Linder, "An achievability proof for the lossy coding of Markov sources with feed-forward", *Proc. Canadian Workshop on Information Theory*, 2013.

[C29]. **S. Asoodeh**, "On the energy of a single-bit communication in the Poisson channel with feedback", *Queen's Biennial Symposium on Communications*, 2012.

[C30]. **S. Asoodeh**, A. Lapidoth and L. Wang,"It takes half the energy of a photon to send one bit reliably on the Poisson channel with feedback", *Joint Workshop on Coding and Communications*, 2010.

[C31]. **S. Asoodeh**, "A new stopping criterion for turbo decoder in the presence of SNR mismatch", in *Proc. IEEE Int. Congress on Ultra Modern Telecomm. and Control Systems (ICUMT)*, 2010.

[C32]. **S. Asoodeh**, H. Ramezani and H. Samimi, "Gaussian approximation for LDPC codes", in *Proc. IEEE Int. Conf. on Wireless Communications (WICOM)*, 2007.

[C33]. **S. Asoodeh** and H. Maddahi, "On PN code acquisition in direct sequence CDMA", in *Proc. IEEE Int. Conf. on Wireless Communications (WICOM)*, 2007.

[C34]. **S. Asoodeh** and A. R. Rezazade, "A novel algorithm for CFO estimation in OFDM-based systems", in *Proc. Int. Conf. on Communications and Inf. Tech. (CIIT)*, 2007.

[C35]. **S. Asoodeh** and A. R. Rezazade, "Design of optimal period interleaver in turbo codes", in *Proc. Canadian Workshop on Information Theory*, 2007.

[C36]. E. Afjei, **S. Asoodeh** and A. Dargahi, "Error analysis in finite difference solution of linear and non-linear cylindrical magnetostatic problems", in *Proc. IEEE ACEMP*, 2007.

Book Chapter

[B1]. **S. Asoodeh**, F. Alajaji and T. Linder, Almost perfect privacy for additive Gaussian privacy filters, *Springer-Verlag Lecture Notes in Computer Science: Information-Theoretic Security*, p. 259-278, 2016.

Workshop Papers

[W1]. A. Fathollah Pour*, H. Ashtiani, and **S. Asoodeh**, "Sample-optimal locally private hypothesis selection and the provable benefits of interactivity", *Theory and Practice of Differential Privacy (TPDP)*, 2024. **[Selected as Oral Presentation]**

[W2]. W. Alghamdi, **S. Asoodeh**, F. P. Calmon, O. Kosut, and L Sankar, "Differential privacy-capacity", *Theory and Practice of Differential Privacy (TPDP)*, 2024.

[W3]. A. Gilani, J. F. Gomez, **S. Asoodeh**, F. P. Calmon, O. Kosut, and L. Sankar, "Optimizing discrete noise distributions for Rényi differential privacy", *Theory and Practice of Differential Privacy (TPDP)*, 2024.

[W4]. W. Alghamdi, **S. Asoodeh**, F. Calmon, O. Kosut, and L. Sankar, "Schrödinger mechanisms: Optimal differential privacy mechanisms for small sensitivity", *Theory and Practice of Differential Privacy (TPDP)*, 2023.

[W5]. **S. Asoodeh** and M. Diaz, "Privacy loss of noisy stochastic gradient descent might converge even for non-convex losses", *Theory and Practice of Differential Privacy (TPDP)*, 2023.

[W6]. W. Alghamdi, **S. Asoodeh**, F. Calmon, O. Kosut, and L. Sankar, "Optimal multidimensional differentially private mechanisms in the large-composition regime", *Theory and Practice of Differential Privacy (TPDP)*, 2023.

[W7]. W. Alghamdi, **S. Asoodeh**, F. Calmon, F. Gomez, O. Kosut, and L. Sankar, "The saddle-point accountant for differential privacy", *Theory and Practice of Differential Privacy (TPDP)*, 2023.

[W8]. W. Alghamdi, H. Hsu, H. Jeong, H. Wang, **S. Asoodeh**, and F. Calmon, "Beyond Adult and COMPAS: Fairness in multi-class prediction", *ICML Responsible Decision Making in Dynamic Environments Workshop*, 2022.

[W9]. **S. Asoodeh**, J. Liao, F. Calmon, O. Kosut, L. Sankar, "A better bound gives a hundred rounds: Differential privacy through the lens of f-divergences", *Theory and Practice of Differential Privacy, ACM Conf. Computer and Communication Security (CCS)*, 2020.

[W10]. **S. Asoodeh** and F. Calmon, "Differentially-private federated learning: Information-theoretic view", *ICML Workshop on Federated Learning for User Privacy*, 2020.

[W11]. H. Hsu, **S. Asoodeh**, and F. Calmon, "Discovering information-leaking samples and features", in *NeurIPS Workshop on Privacy and Machine Learning*, 2019.

Talks and Workshops

- Locally private samplers: Beyond global minimax optimality
  - RIKEN Center for Advanced Intelligence Project, Tokyo, May 2025. **[Invited]**
  - National University of Singapore, May 2025. **[Invited]**
- Locally private samplers: Minimax optimality for general f-divergences,
  - Workshop on Machine Learning and Statistics: From Theory to Practic at the Banff International Research Station (BIRS) for mathematical innovation and discovery, Chennai, India, January 2025. **[Invited]**
  - Vector Institute, February 2025. **[Invited]**
- Contraction of Markov kernels and differential privacy, Workshop on Information-Theoretic Methods for Trustworthy Machine Learning at the Simons Institute for the Theory of Computing, Berkeley, California, May 2023. **[Invited]**
- Saddle-point accountant for differential privacy
  - Google Research, October 2022. **[Invited]**
  - Meta, October 2022. **[Invited]**
  - Workshop on Differential Privacy and Statistical Data Analysis, Fields Institute, July 2022.
- Optimal differential privacy mechanisms under long composition regime, Meta/Facebook, December 2021. **[Invited]**
- Trustworthy machine learning, Mac AI Society, November 2021. **[Keynote Speaker]**
- Information theory for responsible machine learning, 2021. **[Invited]**
  - Faculty of Information (iSchool), University of Toronto
  - Department of Computer Science, University of Vermont
  - School of Mathematical and Statistical Sciences, Clemson University
  - Mathematical Institute, Leiden University
- Privacy analysis of iterative algorithms via f-divergences, Google Research, 2021. **[Invited]**
- On the equivalence between local differential privacy and contraction of E_γ-divergence, Privacy Tools Meeting, Harvard University, 2021. **[Invited]**
- Three variants of differential privacy: Lossless conversion and applications, Theory and Practice of Differential Privacy (TPDP), 2020.
- Differentially private federated learning: An information-theoretic perspective, ICML Workshop on Federated Learning for User Privacy and Data Confidentiality (FL-ICML), 2020.
- Contraction coefficients of Markov kernels with applications in privacy amplification, Information Theory and Application (ITA), 2020. **[Invited]**
- Discovering information-leaking samples and feature, NeurIPS workshop on Privacy in Machine Learning, 2019.
- A better bound gives a hundred rounds: Enhanced privacy guarantees via f-divergences, Privacy Tools Meeting, Harvard University, 2019. **[Invited]**

Teaching

- **McMaster University:**
  - Introduction to Machine Learning (CS 4ML3), Fall 2025
  - Introduction to Computational Thinking (CS 1JC3), Fall 2024
  - Discrete Mathematics for Computer Science (CS 1DM3), Winter 2023, 2024
  - Data Privacy (CS 3DP3), Winter 2023, 2024, Fall 2024
  - Information-Theoretic Methods for Trustworthy Machine Learnin (CAS751), Fall 2022, 2023, 2024
  - Information Security (CS 3IS3), Winter 2022
- **Harvard University:** Capstone ML Project APCOMP 297R (Co-instructor), Fall 2020
- **Queen's University:**
  - Probability I, Fall 2015
  - Engineering Data Analysis, Winter 2015