

Milad SEFIDGARAN

Email: milad.sefidgaran@gmail.com — Paris, France
[Google Scholar](#) — [LinkedIn](#) — miladsefidgaran.github.io

Professional Summary

Research scientist with extensive experience in **machine learning theory, generalization, and LLM representation learning**. First-author publications in top-tier venues including **NeurIPS Oral, ICLR Spotlight, ICML, and COLT**. Expertise in **theoretical foundations of modern AI systems**, with applied contributions to **LLM capability verification, reinforcement learning, and distributed learning**.

Core Expertise

- **Learning Theory:** generalization bounds, rate-distortion methods, information-theoretic analysis, statistical learning theory
- **Representation Learning:** information-theoretic data-dependent priors, latent space structure and geometry, multi-view learning, generalization guarantees for learned representations
- **Large Language Models:** representation space analysis, capability verification and task-readiness assessment, generalization of next-token prediction
- **Reinforcement Learning:** diversity-aware zero-shot RL, post-training for tool selection
- **Distributed Learning:** federated learning, communication-efficient algorithms, generalization under distribution shift
- **Programming:** Python (PyTorch); prior experience in MATLAB, C/C++, SQL

Professional Experience

Principal Machine Learning Research Scientist	2025–Present
Senior Machine Learning Research Scientist	2022–2025
Paris Fourier Research Center (Huawei), Paris, France	

- Lead a small research group on the foundations of AI at the Paris Fourier Research Center (Huawei), defining the research agenda across generalization theory, representation learning, LLM capability assessment, post-training methods, and diversity-aware zero-shot reinforcement learning.
- Designed novel **representation space-based algorithms for LLM capability verification**, assessing task-readiness prior to fine-tuning across models from 1.5B to 70B parameters, achieving up to 16% accuracy improvements on downstream benchmarks.
- Led research and development of **distributed attention fusion mechanisms in transformers** for dynamic inference using multimodal data, improving system throughput by 9% in multi-device deployments.
- Inventor on **28 patents** related to LLM inference, verification, transformer architecture optimization, and communication-efficient distributed learning.

Postdoctoral Researcher – Machine Learning	2021
INRIA & Télécom Paris (Institut Polytechnique de Paris), Paris, France	

- Developed **data-dependent generalization bounds** for deep learning, forming the basis of later work on MDL- and rate-distortion-based guarantees and published in **NeurIPS 2021** and **COLT 2022**.

Postdoctoral Researcher – Information Theory 2013-2015 & 2019-2020
Télécom Paris (Institut Polytechnique de Paris) & Sharif University

- Analyzed **capacity limits** of nonlinear communication channels using random matrix theory
- Advanced **distributed function computation** theory.

Data Analyst & Cellular Network Optimizer 2016–2019
IOID Human Resource Company, Tehran, Iran

Selected First-Author Publications Summary

- **NeurIPS Oral 2025:** Role of Projection and Quantization in Model Compression and Generalization (Top 0.36% of 21,575 submissions)
- **ICLR Spotlight 2025:** Robust Representation Learning via Gaussian Mixture Approximation of the Representation Space (Top 1.6% of 11,500 submissions)
- **ICML 2024:** Robust and Communication-Efficient Federated Learning
- **NeurIPS 2023:** Representation Learning by Structuring the Latent Space
- **NeurIPS 2022:** Generalization Guarantees for Distributed Machine Learning
- **COLT 2022:** Rate-Distortion Theory for Generalization in Stochastic Learning
- **NeurIPS 2021:** Emergence of Heavy Tails in SGD Explains the Generalization of Overparameterized Neural Networks

Awards & Recognition

- Silver Contribution Award at the corporate level for the **6G AI Core (A-Core)** (2024)
- **Best Theoretical Contribution Award**, Huawei Paris Research Center (2022, 2023)
- **Top 10% Reviewer** – NeurIPS 2023, ICML 2024
- Top 5 runners-up of the best **“Futur et ruptures” thesis** at Télécom Paris (2013)
- Silver Medal – Iranian **Mathematics Olympiad** (2002)

Education

Ph.D., Information Theory – Télécom Paris (Institut Polytechnique de Paris) 2009–2013
M.Sc., Telecommunication – Sharif University of Technology, Iran 2007–2009
B.Sc., Electrical Engineering – University of Tehran, Iran 2003–2007

Publications

- [1] R. Chor, **M. Sefidgaran**, and A. Zaidi, “On the effect of clients-server communication on the generalization error of federated learning,” *IEEE Transactions on Information Theory*, 2026.

- [2] M. Kavian, R. Chor, A. Zaidi, and **M. Sefidgaran**, “Generalization analysis of next-token prediction learning algorithms,” in *2026 IEEE International Symposium on Information Theory (ISIT)*, 2026.
- [3] M. Kavian, R. Chor, **M. Sefidgaran**, and A. Zaidi, “Impact of data heterogeneity on the generalization error of distributed learning algorithms,” in *2026 IEEE International Symposium on Information Theory (ISIT)*, 2026.
- [4] **M. Sefidgaran**, K. Nadjahi, and A. Zaidi, “Tighter CMI-based generalization bounds via projection and quantization,” in *Thirty-ninth Conference on Neural Information Processing Systems (NeurIPS)*. **Accepted as an Oral Paper (top 0.36% of all submissions: 77 orals out of 21575 submissions and 5290 accepted papers.)**, 2025.
- [5] **M. Sefidgaran**, A. Zaidi, and P. Krasnowski, “Generalization guarantees for representation learning via data-dependent gaussian mixture priors,” in *Thirteenth International Conference on Learning Representations (ICLR)*. **Accepted as a Spotlight Paper (top 1.6% of all submissions: 188 spotlights out of 11500 submissions and 3680 accepted papers.)**, 2025.
- [6] **M. Sefidgaran** and A. Zaidi, “Multi-view representation learning regularizer with gaussian-product mixture prior,” in *2025 IEEE International Symposium on Information Theory (ISIT)*, 2025.
- [7] **M. Sefidgaran**, R. Chor, A. Zaidi, and Y. Wan, “Lessons from generalization error analysis of federated learning: You may communicate less often!” in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
- [8] **M. Sefidgaran** and A. Zaidi, “Data-dependent generalization bounds via variable-size compressibility,” *IEEE Transactions on Information Theory* (earlier versions appeared at *ISIT 2024* and *IZS 2024*), 2024.
- [9] **M. Sefidgaran**, A. Zaidi, and P. Krasnowski, “Minimal communication-cost statistical learning,” in *2024 IEEE International Symposium on Information Theory (ISIT)*, 2024.
- [10] **M. Sefidgaran**, A. Zaidi, and P. Krasnowski, “Minimum description length and generalization guarantees for representation learning,” in *Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS)*, 2023.
- [11] R. Chor, **M. Sefidgaran**, and A. Zaidi, “More communication does not result in smaller generalization error in federated learning,” in *2023 IEEE International Symposium on Information Theory (ISIT)*, 2023, pp. 48–53.
- [12] **M. Sefidgaran**, R. Chor, and A. Zaidi, “Rate-distortion theoretic bounds on generalization error for distributed learning,” *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS)*, 2022.
- [13] **M. Sefidgaran**, A. Gohari, G. Richard, and U. Şimşekli, “Rate-distortion theoretic generalization bounds for stochastic learning algorithms,” in *Proceedings of Thirty Fifth Conference on Learning Theory (COLT)*, ser. Proceedings of Machine Learning Research, P.-L. Loh and M. Raginsky, Eds., vol. 178. PMLR, 02–05 Jul 2022, pp. 4416–4463.
- [14] **M. Sefidgaran***, M. Barsbey*, M. A. Erdogdu, G. Richard, and U. Şimşekli, “Heavy tails in sgd and compressibility of overparametrized neural networks,” *Thirty-fifth Conference on Neural Information Processing Systems (NeurIPS)*, vol. 34, pp. 29 364–29 378, 2021.
- [15] **M. Sefidgaran** and M. Yousefi, “Lower bound on the capacity of the continuous-space ssfm model of optical fiber,” *IEEE Transactions on Information Theory*, 2021.

- [16] **M. Sefidgaran** and A. Tchamkerten, “Zero-error sum modulo two with a common observation,” in *IEEE Information Theory Workshop (ITW)*, 2021.
- [17] **M. Sefidgaran** and M. Yousefi, “On the capacity of the continuous-space ssfm model of optical fiber,” in *IEEE Information Theory Workshop (ITW)*, 2021.
- [18] M. Sefidgaran and A. Tchamkerten, “Distributed function computation over a rooted directed tree,” *IEEE Transactions on Information Theory*, vol. 62, no. 12, 2016.
- [19] M. Sefidgaran, A. Gohari, and M. R. Aref, “On körner-marton’s sum modulo two problem,” in *2015 Iran Workshop on Communication and Information Theory (IWCIT)*, 2015.
- [20] M. Sefidgaran and A. Tchamkerten, “On cooperation in multi-terminal computation and rate distortion,” 2015.
- [21] M. Sefidgaran, “Computing a function of correlated sources,” Ph.D. dissertation, Télécom Paris, France, Apr. 2013.
- [22] M. Sefidgaran and A. Tchamkerten, “Distributed function computation over a tree network,” in *2013 IEEE Information Theory Workshop (ITW)*, 2013.
- [23] M. Sefidgaran and A. Tchamkerten, “On function computation over a cascade network,” in *2012 IEEE Information Theory Workshop (ITW)*, 2012.
- [24] M. Sefidgaran and A. Tchamkerten, “On cooperation in multi-terminal computation and rate distortion,” in *2012 IEEE International Symposium on Information Theory Proceedings (ISIT)*, 2012.
- [25] M. Sefidgaran and A. Tchamkerten, “Computing a function of correlated sources: A rate region,” in *2011 IEEE International Symposium on Information Theory Proceedings (ISIT)*, 2011.
- [26] M. Sefidgaran, B. Akhbari, Y. Mohsenzadeh, and M. R. Aref, “Reliable source transmission over relay networks with side information,” in *2009 IEEE International Symposium on Information Theory (ISIT)*, 2009.

* *equal contribution*