Aleksandar Armacki

Personal Data

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google scholar:	https://scholar.google.com/citations?user=21d_U30AAAAJ

Research Interests

I study learning guarantees of centralized and large-scale multi-agent systems, both distributed (a.k.a. federated) and fully decentralized. In particular, I work on establishing guarantees in the presence of phenomena such as heavy-tailed noise and various notions of heterogeneity across users, e.g., statistical heterogeneity between users' data, or system heterogeneity, like varying communication and computation capabilities. The goal of my work is to provide a comprehensive characterization of the performance of learning algorithms under these settings, both in terms of training/convergence and generalization/statistical guarantees, with the aim of informing the practical design and implementation of algorithms in real-world applications, e.g., when training deep learning models. To that end, I draw upon tools from areas such as optimization and large deviations theory, concentration inequalities, as well as multi-agent and consensus theory.

Experience

Sep 2025 - Present	Post-doctoral researcher at EPFL, Lausanne, Switzerland *Adaptive Systems Laboratory* | Advisor: Prof. **Ali H. Sayed**
Aug 2020 - Jun 2025	Research assistant at Carnegie Mellon University, Pittsburgh, PA *Electrical and Computer Engineering* | Advisor: Prof. **Soummya Kar**
Sep 2019 - Dec 2019	Visiting researcher at University of Pennsylvania, Philadelphia, PA *Electrical and Systems Engineering* | Advisor: Prof. **Alejandro Ribeiro**
Nov 2018 - Jun 2020	Junior researcher at Faculty of Sciences, Novi Sad, Serbia *Numerical Analysis Group* | Advisor: Prof. **Dusan Jakovetic**
Jul 2018 - Oct 2018	Junior researcher at BioSense Institute, Novi Sad, Serbia
Feb 2018 - Jul 2018	Visiting researcher at FRI, Ljubljana, Slovenia *Bioinformatics Lab* | Advisor: Prof. **Blaz Zupan**

Education

Aug 2020 - Jun 2025	Doctor of Philosophy in Electrical and Computer Engineering College of Engineering, Carnegie Mellon University Thesis: "High-probability and Large Deviations Techniques for Design and Analysis of Large-scale and Distributed Learning Systems"
Oct 2016 - Oct 2018	Master of Science in Applied Mathematics Faculty of Sciences, University of Novi Sad Thesis: "Application of Autoencoders on Single-cell Data"
Sep 2012 - July 2016	Bachelor of Science in Applied Mathematics Faculty of Sciences, University of Novi Sad

Publications (in chronological order, * = equal contribution)

[1] **Armacki, A.**, Bajovic, D., Jakovetic, D., Kar, S. (2025). *Optimal High-probability Convergence of Nonlinear SGD under Heavy-tailed Noise through Symmetrization*. Under peer review in IEEE Transactions on Information Theory (1st round). Available online: https://arxiv.org/abs/2507.09093

[2] **Armacki, A.**, Kar, S. (2025). *Toward Understanding the Improved Robustness to Initialization in Distributed Clustering*. To appear in 33rd European Signal Processing Conference. Available online: https://github.com/aarmacki/aarmacki.github.io/blob/master/publications/dist_clust_init.pdf

[3] **Armacki, A.**, Yu, S., Sharma, P., Gauri, J., Bajovic, D., Jakovetic, D., Kar, S. (2025). *High-probability Convergence Bounds for Online Nonlinear Stochastic Gradient Descent under Heavy-tailed Noise*. In 28th International Conference on Artificial Intelligence and Statistics. Available online: https://proceedings.mlr.press/v258/armacki25a.html

[4] **Armacki, A.**, Bajovic, D., Jakovetic, D., Kar, S. (2025). *Distributed Center-Based Clustering: A Unified Framework*. In IEEE Transactions on Signal Processing, 73:903-918. Available online: https://ieeexplore.ieee.org/abstract/document/10847582

[5] **Armacki, A.***, Sharma, H.*, Bajovic, D., Jakovetic, D., Chakraborty, M., Kar, S. (2024). *Distributed Gradient Clustering: Convergence and the Effect of Initialization*. In 58th Asilomar Conference on Signals, Systems, and Computers, pp. 1461-1465. Available online: https://ieeexplore.ieee.org/document/10942834

[6] **Armacki, A.***, Yu, S.*, Bajovic, D., Jakovetic, D., Kar, S. (2024). *Large Deviations and Improved Mean-squared Error Rates of Nonlinear SGD: Heavy-tailed Noise and Power of Symmetry*. Under peer review in SIAM Journal on Optimization (2nd round). Available online: https://arxiv.org/abs/2410.15637

[7] **Armacki, A.**, Bajovic, D., Jakovetic, D., Kar, S. (2024). *A One-shot Framework for Distributed Clustered Learning in Heterogeneous Environments*. In IEEE Transactions on Signal Processing, 72:636-651. Available online: https://ieeexplore.ieee.org/abstract/document/10373766/

[8] **Armacki, A.**, Milosevic, N., Bajovic, D., Kar, S., Jakovetic, D., Bakhtiarnia, A., Esterle, L., Muscat, A., Festi, T. (2023). *Communication Efficient Model-aware Federated Learning for Visual Crowd Counting and Density Estimation in Smart Cities*. In 31st European Signal Processing Conference. Available online: https://ieeexplore.ieee.org/abstract/document/10289938/

[9] **Armacki, A.**, Bajovic, D., Jakovetic, D., Kar, S. (2022). *Personalized Federated Learning via Convex Clustering*. In IEEE International Smart Cities Conference (ISC2). Available online: https://ieeexplore.ieee.org/abstract/document/9921863

[10] **Armacki, A.**, Bajovic, D., Jakovetic, D., Kar, S. (2022). *Gradient Based Clustering*. In 39th International Conference on Machine Learning, PMLR, 162:929-947. Available online: https://proceedings.mlr.press/v162/armacki22a

[11] **Armacki, A.**, Jakovetic, D., Krejic, N., Jerinkic, N. K. (2019). *Distributed Trust-Region Method With First Order Models*. In IEEE EUROCON 18th International Conference on Smart Technologies. Available online: https://ieeexplore.ieee.org/abstract/document/8861739

Awards

2023 IBM PhD Fellowship - Finalist. One of three nominees by the Electrical and Computer Engineering Department, Carnegie Mellon University

2020 Dean's Fellowship from the Electrical and Computer Engineering Department, Carnegie Mellon University

2019 Annual Award of the Mathematical Institute of the Serbian Academy of Sciences and Arts in the field of computing for M.Sc. students - Finalist

Academic Service

- *Conference reviewer:* AISTATS, IEEE ISIT.
- *Journal reviewer:* IEEE TSP.
- *Student supervision:* Helped supervise Himkant Sharma during his internship in prof. Kar's group, in the summer of 2024. The supervision resulted in publication [5].
- *Teaching:* Served as teaching assistant for the course "Linear Systems" in Electrical and Computer Engineering Department, Carnegie Mellon University, in 2022 and 2023.
- *Student council for faculty hiring:* Served in the Electrical and Engineering Department's student council for faculty hiring in 2023. Participated in interviewing faculty candidates, with the goal of evaluating the candidates' potential to advise graduate students.

Conferences and Workshops

2025 *28th International Conference on Artificial Intelligence and Statistics*, Mai Khao, Thaliand
Presented the work [3] in a poster session

2024 *58th Asilomar Conference on Signals, Systems, and Computers*, Asilomar, USA
Presented the work [5] in a talk

2023 *31st European Signal Processing Conference*, Helsinki, Finland
Presented the work [8] in a talk

2022 *39th International Conference on Machine Learning*, Baltimore, USA
Presented the work [10] in a talk and poster session

2019 *EUROCON 2019*, IEEE, Novi Sad, Serbia
Presented the work [11] in a talk

2018 *US-Serbia & West Balkan Data Science Workshop*, NSF Serbia, Belgrade, Serbia
Presented results from master's thesis in poster session