

# Aleksandar ARMACKI

## PERSONAL DATA

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## RESEARCH INTERESTS

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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

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AUG 2020 - PRESENT	Research Assistant at CARNEGIE MELLON UNIVERSITY, Pittsburgh, PA <i>Electrical and Computer Engineering</i>   Advisor: Prof. <b>Soumya Kar</b>
SEP 2019 - DEC 2019	Visiting Researcher at UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA <i>Electrical and Systems Engineering</i>   Advisor: Prof. <b>Alejandro Ribeiro</b>
NOV 2018 - JUN 2020	Junior Researcher at FACULTY OF SCIENCES, Novi Sad <i>Numerical Analysis Group</i>   Advisor: Prof. <b>Dusan Jakovetic</b>
JULY 2018 - OCT 2018	Junior Researcher at BIOSENSE INSTITUTE, Novi Sad
FEB 2018 - JULY 2018	Guest Researcher at FACULTY OF COMPUTER AND INFORMATION SCIENCE, Ljubljana <i>Bioinformatics Lab</i>   Advisor: Prof. <b>Blaz Zupan</b>

## EDUCATION

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AUG 2020 - PRESENT	Doctor of Philosophy in ELECTRICAL AND COMPUTER ENGINEERING College of Engineering, Carnegie Mellon University
OCT 2016 - OCT 2018	Master of Science in APPLIED MATHEMATICS Faculty of Sciences, University of Novi Sad Thesis: " <a href="#">Application of Autoencoders on Single-cell Data</a> "
SEP 2012 - JULY 2016	Bachelor of Science in APPLIED MATHEMATICS Faculty of Sciences, University of Novi Sad

## PUBLICATIONS (IN CHRONOLOGICAL ORDER, \* = EQUAL CONTRIBUTION)

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- [1] **Armacki, A., Bajovic, D., Jakovetic, D., Kar, S. (2025).** *Optimal High-probability Rates for Non-convex Optimization under Heavy-tailed Noise through Symmetrization.* Under peer review.
- [2] **Armacki, A., Kar, S. (2025).** *Toward Understanding the Improved Robustness to Initialization in Distributed Clustering.* Under peer review. Available online: [https://github.com/aarmacki/aarmacki.github.io/blob/master/publications/dist\\_clust\\_init.pdf](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.* To appear in 28th International Conference on Artificial Intelligence and Statistics. Available online: <https://arxiv.org/abs/2410.13954>
- [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

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- 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

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- *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

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| 2025 | <i>28th International Conference on Artificial Intelligence and Statistics</i> , Mai Khao, Thailand<br>Will present the work [3] in a poster session |
| 2024 | <i>58th Asilomar Conference on Signals, Systems, and Computers</i> , Asilomar, USA<br>Presented the work [5] in a talk                               |
| 2023 | <i>31st European Signal Processing Conference</i> , Helsinki, Finland<br>Presented the work [8] in a talk  |
| 2022 | <i>39th International Conference on Machine Learning</i> , Baltimore, USA<br>Presented the work [10] in a talk and poster session                    |
| 2019 | <i>EUROCON 2019</i> , IEEE, Novi Sad, Serbia<br>Presented the work [11] in a talk  |
| 2018 | <i>US-Serbia &amp; West Balkan Data Science Workshop</i> , NSF Serbia, Belgrade, Serbia<br>Presented results from master's thesis in poster session  |