Aleksandar Armacki

Personal Data

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Research Interests

I am interested in the learning guarantees of centralized, as well as large-scale distributed systems, both federated and decentralized. I study the behaviour of such systems under the presence of various notions of heterogeneity, e.g., statistical heterogeneity between different users, or system heterogeneity, such as varying communication or computation capabilities of different users. I am also interested in studying learning guarantees under phenomena such as heavy-tailed noise.

Experience

Aug 2020 - Present | Research Assistant at Carnegie Mellon University, Pittsburgh, PA
Electrical and Computer Engineering | Advisor: Prof. **Soummya Kar**
Studying learning guarantees in the presence of heavy-tailed noise [1, 2, 3]; designing algorithms for distributed learning that are communication efficient [4, 5] and provide personalization for users [5, 6]. Also developed a clustering framework [7], applicable to a wide array of clustering problems, with strong theoretical guarantees.

Nov 2018 - Jun 2020 | Junior Researcher at Faculty of Sciences, Novi Sad
Numerical Analysis Group | Advisor: Prof. **Dusan Jakovetic**
Designed an algorithm for distributed optimization, using the trust-region method [8].

Sep 2019 - Dec 2019 | Visiting Researcher at University of Pennsylvania, Philadelphia, PA
Electrical and Systems Engineering | Advisor: Prof. **Alejandro Ribeiro**
Worked on theoretical analysis of an algorithm for distributed optimization.

July 2018 - Oct 2018 | Junior Researcher at BioSense Institute, Novi Sad
Developed an automated method for selecting hiqh-quality pollen samples to be used for predicting pollen concentration in the atmosphere.

Feb 2018 - July 2018 | Visiting Researcher at Faculty of Computer and Information Science, Ljubljana
Bioinformatics Lab | Advisor: Prof. **Blaz Zupan**
Developed a deep-learning model for dimensionality reduction of single-cell data, resulting in my master's thesis. The work was recognized by the **Mathematical Institute of the Serbian Academy of Sciences and Arts**, as the thesis entered the final selection for the Annual Award in the field of computing for M.Sc. students.

Education

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: "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

[1] **Armacki, A.**, S. Yu, D. Bajovic, D. Jakovetic, and S. Kar. *Large Deviations and Improved Mean-squared Error Rates of Nonlinear SGD: Heavy-tailed Noise and Power of Symmetry*. In *arXiv Preprint*, 2024. [Under review].

[2] **Armacki, A.**, S. Yu, P. Sharma, J. Gauri, D. Bajovic, D. Jakovetic, and S. Kar. *Nonlinear Stochastic Gradient Descent and Heavy-tailed Noise: A Unified Framework and High-probability Guarantees*. In *arXiv Preprint*, 2024. [Under review].

[3] **Armacki, A.**, P. Sharma, J. Gauri, D. Bajovic, D. Jakovetic, and S. Kar. *High-probability Convergence Bounds for Nonlinear Stochastic Gradient Descent Under Heavy-tailed Noise*. In *arXiv Preprint*, 2023.

[4] **Armacki, A.**, N. Milosevic, D. Bajovic, S. Kar, D. Jakovetic, A. Bakhtiarnia, L. Esterle, A. Muscat, and T. Festi. *Communication Efficient Model-aware Federated Learning for Visual Crowd Counting and Density Estimation in Smart Cities*. In *EUSIPCO 2023 31st European Signal Processing Conference*, 2023.

[5] **Armacki, A.**, D. Bajovic, D. Jakovetic, and S. Kar. *A One-shot Framework for Distributed Clustered Learning in Heterogeneous Environments*. *IEEE Transactions on Signal Processing*, 72:636–651, 2024.

[6] **Armacki, A.**, D. Bajovic, D. Jakovetic, and S. Kar. *Personalized Federated Learning via Convex Clustering*. In *2022 IEEE International Smart Cities Conference (ISC2)*, pages 1–7, 2022.

[7] **Armacki, A.**, D. Bajovic, D. Jakovetic, and S. Kar. *Gradient Based Clustering*. In *Proceedings of the 39th International Conference on Machine Learning*, volume 162 of *Proceedings of Machine Learning Research*, pages 929–947. PMLR, 17–23 July 2022.

[8] **Armacki, A.**, D. Jakovetic, N. Krejic, and N. K. Jerinkic. *Distributed Trust-Region Method With First Order Models*. In *IEEE EUROCON 2019-18th International Conference on Smart Technologies*, pages 1–6, 2019.

Awards

2023	IBM PhD Fellowship - Finalist. One of three nominees by the Electrical and Computer Engineering Department, Carnegie Mellon University
2020	Dean's Fellowship at the department of Electrical and Computer Engineering, 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
2012-18	Various government awards and fellowships for students with stellar academic record

Academic Service

- *Conference reviewer.*
  - AISTATS: 2023, 2024, 2025
  - IEEE ISIT: 2024
- *Journal reviewer.*
  - IEEE TSP: 2024
- *Student supervision.* Helped supervise student intern Himkant Sharma during his summer visit at prof. Soummya Kar's group in 2024.
- *Student council for faculty hiring.* Served in the Electrical and Computer Engineering's student council for faculty hiring at Carnegie Mellon in 2023. Participated in interviewing faculty candidates, with the goal of evaluating the candidates' potential to advise graduate students.

Conferences and Workshops

2023 *31st European Signal Processing Conference*, Helsinki, Finland
Presented the work [4] in a talk

2022 *39th International Conference on Machine Learning*, Baltimore, USA
Presented the work [7] in a spotlight talk and poster session

2019 *EUROCON 2019*, IEEE, Novi Sad, Serbia
Presented the work [8] in a short talk

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