

Tianyi Liu | Dr.-Ing.

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📄 Tianyi-Liu-3 • 📄 SAJ8bL8AAAAJ

Nationality: Chinese (eligible to work in EU – EU permanent residence issued by Germany)

Education

Technical University of Darmstadt

Dr.-Ing. in Elect. Eng. and Inform. Technol., with distinction

Thesis: *A parallel successive convex approximation framework with smoothing majorization for phase retrieval*

Advisor: Prof. Marius Pesavento

Co-referee: Prof. Stefan Ulbrich

Darmstadt, Germany

Oct. 2018 – Sept. 2024

Technical University of Darmstadt

M.Sc. in Elect. Eng. and Inform. Technol., with distinction

Recipient of the Best Master Student Award from the Dept. ETIT

Erasmus Double Degree Program between Technical University of Darmstadt and Politecnico di Torino

Thesis: *A scalable graph-based mixed-integer linear programming approach for the examination timetabling problem*

Darmstadt, Germany

Oct. 2016 – July 2018

Politecnico di Torino

M.Sc. in Communications and Computer Networks Eng., cum laude

Turin, Italy
Sept. 2015 – July 2018

Politecnico di Torino

B.Sc. in Telecommunications Engineering

Double Degree Program PoliTong between Politecnico di Torino and Tongji University

Turin, Italy
Sept. 2014 – July 2015

Tongji University

B.Eng. in Electronics and Information Engineering

Shanghai, China
Sept. 2011 – June 2015

Research Experience

Communication Systems Group, TU Darmstadt

Research Associate

Darmstadt, Germany

2018 – present

Politecnico di Torino

Research Assistant

Developed a heuristic algorithm for optimizing the constellation in satellite communication

Turin, Italy

Mar. 2015 – July 2015

Research Interests

- Sparse signal processing
- Parallel optimization methods: Focusing on nonconvex and nonsmooth problems
- Sensor array signal processing: Direction-of-Arrival estimation
- Game theory: Generalized Nash equilibrium
- Graph signal processing: Graph topology inference

Honors and Awards

Finalist of the IEEE SAM 2024 Best Student Paper Contest

2024

IEEE SPS Student Travel Grant for the IEEE CAMSAP 2019

2019

Finalist of the EUSIPCO 2019 Best Student Paper Contest

2019

Participated Projects

- German Research Foundation (DFG), “The Partial relaxation method in direction-of-arrival estimation: Design and analysis”, PI: Prof. Marius Pesavento, €300K, 2019–2025
- DFG priority program on Compressed Sensing in Information Processing (CoSIP), “Exploiting structure in compressed sensing using side constraints: From analysis to system design – Funding phase II”, PI: Prof. Martin Haardt, Prof. Marc Pfetsch, Prof. Marius Pesavento, €300K for each group, 2018–2021

Research Skills

Programming: MATLAB, Python, C/C++, Julia, Linux, Bash/Zsh, Git, CUDA

Optimization Tools: CVX, MOSEK, Gurobi, SCIP/SCIP-SDP, CPLEX

Writing and Note Management: Markdown, LaTeX, Obsidian, Zotero, PARA method, Neovim

Professional Skills Training

Attendance at the IEEE-SPS/EURASIP Summer School on Network- and Data-Driven Learning 2019

Academic Service

Reviewer for IEEE Signal Processing Letters 2024

Reviewer for Elsevier Signal Processing 2023

Teaching Experience

Teaching Assistant at TU Darmstadt.....

18-pe-2080 Graph Signal Processing, Learning and Optimization

Instructor: Prof. Marius Pesavento WS 2020/21 – WS 2024/25

18-pe-2070 Matrix Analysis and Computations

Instructor: Prof. Marius Pesavento SS 2019 – SS 2024

18-pe-2050 Project Seminar: Procedures for Massive MIMO and 5G

Instructor: Prof. Marius Pesavento SS 2020

18-pe-2030 MIMO Communication and Space-Time Coding

Instructor: Prof. Marius Pesavento WS 2018/19 – WS 2019/20

Supervised Student Projects

- [1] A. Ahmad, “Distributed nonlinear polynomial graph filter and its output graph spectrum,” Project seminar, Technische Universität Darmstadt, Darmstadt, Dec. 2022.
- [2] A. Sorg, “Direction of arrival estimation in the multiple measurement model using sparse reconstruction,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Nov. 2022.
- [3] Y. Zhang, “Advanced optimization methods for direction-of-arrival estimation with correlated sources,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Mar. 2022.
- [4] S. Rajurkar, “Resource allocation in wireless networks using graph convolutional neural networks,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Nov. 2021.

- [5] H. S. Saka, “Sparse graph Laplacian learning with real-world data,” Bachelor thesis, Technische Universität Darmstadt, Darmstadt, Apr. 2021.
- [6] Y. Zhang, “Sparse graph Laplacian learning with real-world data,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, May 2021.
- [7] S. Ben Abid, “Parallel optimization methods for graph topology learning and tracking,” Bachelor thesis, Technische Universität Darmstadt, Darmstadt, Mar. 2020.
- [8] F. Bonakdar, “Sparse reconstruction and prediction of mobility patterns in traffic networks,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Jun. 2020.
- [9] M. Grytz, “Implementation of a block coordinate descent graph learning algorithm and its application to real-world problems,” Studienarbeit, Technische Universität Darmstadt, Darmstadt, Oct. 2020.
- [10] H. S. Saka, “Optimization algorithms for graph Laplacian estimation via ADMM and MM,” Project seminar, Technische Universität Darmstadt, Darmstadt, Sep. 2020.
- [11] D. Jaoua, “Parallel optimization methods for sparse signal recovery from non linear mixtures,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, 2019.
- [12] S. U. Rehman, “Implementation of a parallel algorithm for sparse optimization on a graphical processing unit,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Jul. 2019.
- [13] X. Wang, “Implementation of parallel optimization for nondifferentiable nonconvex problems on GPU architecture,” M.S. thesis, Technische Universität Darmstadt, Darmstadt, Sep. 2019.

Publications

Theses

- [T1] T. Liu, “A parallel successive convex approximation framework with smoothing majorization for phase retrieval,” Ph.D. dissertation, Technische Universität Darmstadt, Darmstadt, Oct. 2024. DOI: 10.26083/tuprints-00028201.
- [T2] T. Liu, “A scalable graph-based mixed-integer linear programming approach for the examination timetabling problem,” M.S. thesis, Politecnico di Torino, Turin, Jul. 2018.

Book Chapters

- [B1] K. Ardah, M. Haardt, T. Liu, F. Matter, M. Pesavento, and M. E. Pfetsch, “Recovery under side constraints,” in *Compressed sensing in information processing*, G. Kutyniok, H. Rauhut, and R. J. Kunsch, Eds., Cham: Springer International Publishing, 2022, pp. 213–246, ISBN: 978-3-031-09745-4.

Preprints

- [P1] T. Liu, S. P. Deram, K. Ardah, M. Haardt, M. E. Pfetsch, and M. Pesavento, *Gridless parameter estimation in partly calibrated rectangular arrays*, Jun. 2024. DOI: 10.48550/arXiv.2406.16041. arXiv: 2406.16041 [eess].
- [P2] T. Liu, F. Matter, A. Sorg, M. E. Pfetsch, M. Haardt, and M. Pesavento, *Maximum a posteriori direction-of-arrival estimation via mixed-integer semidefinite programming*, Oct. 2024. DOI: 10.48550/arXiv.2311.03501. arXiv: 2311.03501.

Journal Articles

- [J1] R. Müller, G. Allevato, M. Rutsch, C. Haugwitz, T. Liu, M. Kupnik, and M. Pesavento, “A tensor model for the calibration of air-coupled ultrasonic sensor arrays in 3D imaging,” *Signal Processing*, p. 109 812, Nov. 2024, ISSN: 0165-1684. DOI: 10.1016/j.sigpro.2024.109812.
- [J2] T. Liu, A. M. Tillmann, Y. Yang, Y. C. Eldar, and M. Pesavento, “Extended successive convex approximation for phase retrieval with dictionary learning,” *IEEE Transactions on Signal Processing*, vol. 70, pp. 6300–6315, 2022, ISSN: 1941-0476. DOI: 10.1109/TSP.2022.3233253.

Conference Proceedings.....

- [C1] T. Liu, S. P. Deram, K. Ardah, M. Haardt, M. E. Pfetsch, and M. Pesavento, "Gridless parameter estimation in partly calibrated rectangular arrays," in *ICASSP 2024 - 2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Apr. 2024, pp. 8796–8800. DOI: 10.1109/ICASSP48485.2024.10446959.
- [C2] T. Liu and M. Pesavento, "Blind phase-offset estimation in sparse partly calibrated arrays," in *2024 IEEE 13rd Sensor Array and Multichannel Signal Processing Workshop (SAM)*, Jul. 2024, pp. 1–5. DOI: 10.1109/SAM60225.2024.10636507.
- [C3] T. Liu, F. Matter, A. Sorg, M. E. Pfetsch, M. Haardt, and M. Pesavento, "Joint sparse estimation with cardinality constraint via mixed-integer semidefinite programming," in *2023 IEEE 9th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, Herradura, Costa Rica, Dec. 2023, pp. 106–110. DOI: 10.1109/CAMSAP58249.2023.10403415.
- [C4] Y. Zhang, T. Liu, and M. Pesavento, "Direction-of-arrival estimation for correlated sources and low sample size," in *2023 31st European Signal Processing Conference (EUSIPCO)*, Sep. 2023, pp. 1559–1563. DOI: 10.23919/EUSIPCO58844.2023.10290019.
- [C5] T. Liu, A. M. Tillmann, Y. Yang, Y. C. Eldar, and M. Pesavento, "A parallel algorithm for phase retrieval with dictionary learning," in *IEEE International Conference on Acoustics, Speech and Signal Processing*, Jun. 2021, pp. 5619–5623. DOI: 10.1109/ICASSP39728.2021.9413991.
- [C6] X. Wang, T. Liu, M. Trinh-Hoang, and M. Pesavento, "GPU-accelerated parallel optimization for sparse regularization," in *2020 IEEE 11th Sensor Array and Multichannel Signal Processing Workshop (SAM)*, Jun. 2020, pp. 1–5. DOI: 10.1109/SAM48682.2020.9104328.
- [C7] T. Liu, M. Trinh-Hoang, Y. Yang, and M. Pesavento, "A block coordinate descent algorithm for sparse Gaussian graphical model inference with laplacian constraints," in *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing*, Dec. 2019, pp. 236–240. DOI: 10.1109/CAMSAP45676.2019.9022643.
- [C8] T. Liu, M. Trinh-Hoang, Y. Yang, and M. Pesavento, "A parallel optimization approach on the infinity norm minimization problem," in *2019 27th European Signal Processing Conference (EUSIPCO)*, A Coruna, Spain: IEEE, Sep. 2019, pp. 1–5, ISBN: 978-90-827970-3-9. DOI: 10.23919/EUSIPCO.2019.8902548.

Languages

Chinese: Mother tongue

English: Fluent

Italian: Intermediate

German: Intermediate

Referees

Prof. Marius Pesavento: Communication Systems Group, TU Darmstadt, Germany

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Prof. Martin Haardt: Communications Research Laboratory, TU Ilmenau, Germany

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