

# Nabil Abubaker

Parallel Computing Researcher | Software Engineer

Postdoctoral Fellow at SPCL Lab, ETH Zürich, Switzerland

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## PROFILE

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I work in Parallel Computing research. Specifically, I investigate and design combinatorial algorithms and methods for reducing communication overhead of parallel scientific and machine learning applications running on HPC systems. Experienced in dealing with sparse data at scale as well as graph/hypergraph partitioning.

## EDUCATION

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- Ph.D. in Computer Engineering @Bilkent University** 2022  
Thesis: Novel Algorithms and Models for Scaling Parallel Sparse Tensor and Matrix Factorizations. Advisor: Prof. Cevdet Aykanat
- M.Sc. in Computer Engineering @Bilkent University** 2016  
Thesis: Reordering Methods for Exploiting Spatial and Temporal Localities in Parallel Matrix-Vector Multiplication
- B.Sc. in Computer Engineering (*summa cum laude*) @An-Najah National Univeristy** 2014

## EXPERIENCE

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- Postdoctoral Fellow @ETH Zürich** May 2023-Now  
SNSF Swiss Postdoctoral Fellowship, Scalable Parallel Computing Laboratory Advisor: Prof. Torsten Hoefler
- Postdoctoral Researcher @Bilkent University** Sept. 2022-April 2023
- Research & Teaching Assistant @Bilkent University** 2016-2022
- Research: Full-stack researcher (motivate, design, implement, experiment, document) for several funded projects focusing on parallel sparse computations.
  - Teaching: Assistant for several courses, mainly Algorithms I (design and analysis), Digital Design, Fundamentals of Data Structures and Algorithms, Software Verification and Validation, and OO programming courses using JAVA.
- Instructor @An-Najah National University** Jan 2021 - May 2021  
I taught the course "Computer Architecture II" for senior undergrad students.
- Full-Stack Engineer @Etgi Grup, Ankara, Turkey** 2017 - 2018
- Main duties: Investigating and implementing new features for the company's e-learning platform: [Vedubox](#), integrating external services through RESTful API, SQL queries optimization, back-end services optimization.
- Software Engineer @Sina Research Institute, Birzeit University** May 2014- Aug 2014
- Software Engineering Intern @Exalt Technologies, Ramallah, Palestine** June 2013 - Aug 2013

## RESEARCH PROJECTS

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- Efficient Training of Hypergraph NNs Through Comm-Efficient Sparse Tensor Operations** 2023-2025  
Funded Project
- Store-And-Forward Communication Models For Scaling Latency-Bound Parallel Applications** 2021-2024  
Funded Project, Principal Investigator: Cevdet Aykanat | My role: Senior Researcher and sub-task leader
- Parallel Stochastic Gradient Descent Algorithms for Large-Scale Recommendation Systems** 2019-2021  
Funded Project, Principal Investigator: Cevdet Aykanat | My role: PhD Researcher and sub-task leader
- High Performance Tensor Methods for Distributed and Shared Memory Parallel Systems** 2017-2019  
Funded Project, Principal Investigator: Cevdet Aykanat | My role: PhD Researcher and sub-task leader

## TECHNICAL SKILLS

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### As an HPC Researcher:

- **Writing the code:** C, C++, MPI, openMP
- **Dev environment:** Vim, tmux, Linux
- **Experimentation setup:** Bash scripts, slurm
- **Data collection & wrangling:** Bash, awk, sed
- **Data analysis & reporting:** R, Pandas, PGFPlots
- **Preparing articles & figures:** L<sup>A</sup>T<sub>E</sub>X, TikZ, Inkscape

### As a Software Engineer:

C#, Java, SQL, Python, Julia, Git, EntityFramework, RESTful API, Goolg App Engine, Matlab, JavaScript, AngularJS, VHDL, Verilog.

## PUBLICATIONS

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**Arrow Matrix Decomposition: A Novel Approach for Communication-Efficient SpMM** 2024

Lukas Gianinazzi et. al. In *PPoPP '24*

**Minimizing Staleness and Comm. Overhead in Dist. SGD for Collaborative Filtering** 2023

Nabil Abubaker, Orhun Caglayan, M. Ozan Karsavuran, Cevdet Aykanat. In *IEEE Transactions on Computers*

**Scaling Stratified Stochastic Gradient Descent for Distributed Matrix Completion.** 2023

Nabil Abubaker, M. Ozan Karsavuran, Cevdet Aykanat. In *IEEE Transactions on Knowledge and Data Engineering*

**Scalable Unsupervised ML: Latency Hiding in Distributed Sparse Tensor Decomposition.** 2022

Nabil Abubaker, M. Ozan Karsavuran, Cevdet Aykanat. In *IEEE Transactions on Parallel and Distributed Systems*

**True Load Balancing for Matricized Tensor Times Khatri-Rao Product.** 2021

Nabil Abubaker, Seher Acer, Cevdet Aykanat. In *IEEE Transactions on Parallel and Distributed Systems*

**Spatiotemporal Graph and Hypergraph Part. Models for SpMV on Many-Core Architectures.** 2019

Nabil Abubaker, Kadir Akbudak, Cevdet Aykanat. In *IEEE Transactions on Parallel and Distributed Systems*

**Privacy-Preserving Fog Computing Paradigm.** 2017

Nabil Abubaker, Leonard Dervishi, Erman Ayday. *IEEE CNS'17*

## TALKS

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**Combinatorial Opportunities for Scalability of CP Tensor Decomposition** 2023

University of Texas at Austin

Austin, TX, USA

**Combinatorial Opportunities for Large-Scale Tensor and Matrix Factorizations** 2022

Lawrence Berkeley National Labs

Berkeley, CA, USA

**Novel Algorithms and Models for Scaling Parallel Sparse Tensor and Matrix Factorizations.** 2022

PhD Dissertation Talk at Bilkent University.

**Sparse Tensor Partitioning for Scalable Distributed CPD-ALS.** 2022

SIAM Conference on Parallel Processing for Scientific Computing (PP22).

Seattle, WA, USA

## AWARDS & HONORS

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- SNSF Swiss Postdoctoral Fellowship.
- Recipient of the “Bilkent University best journal article by a PhD student” award two years in a row.
- UYBT incentive award by the The Scientific and Technological Research Institution of Turkey (TÜBİTAK).
- Bilkent University tuition waiver & full support scholarship for MSc and PhD studies.
- The CocaCola - Injaz exchange program scholarship award - 2012/2013
- Ranked 1st in province and 7th country-wide in nation-wide high school diploma exams - industrial stream. Honored by the mayor.

## MISCELLANEOUS

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### Professional Society Membership

- Association for Computing Machinery (ACM)
- Society of Industrial and Applied Mathematics (SIAM)
- The Institute of Electrical and Electronic Engineers (IEEE)

### Academic Review Service

- International Journal of High Performance Computing Applications.
- IEEE Transactions on Big Data.
- International Parallel & Distributed Processing Symposium (IPDPS) - 2018

### Languages

- Arabic: Native
- English: Fluent
- Turkish: Intermediate

## LEADERSHIP / EXTRACURRICULAR

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- Board Member of the Association of Scientific Staff at Computer Science department (VMI) of ETH Zurich.
- Served as vice-chair for the university's IEEE Student Branch in 2011-2012.
- Co-founded and co-organized the first Palestine Programming Olympiad event (PPO), a 24-hours programming contest for students and young professionals.
- Participated in IEEEExtreme 24h programming competition 5.0, 6.0, 7.0 and 8.0 (2011,2012, 2013, 2014). *Our team won the 2<sup>nd</sup> place country-wise in 2013.*