Le Quoc-Tung

Post-doctorant, Toulouse School of Economics, France

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Research interests

I am broadly interested in optimization problems for **machine learning**. During my PhD, I worked on the training problem of **sparse deep neural networks** and one of its simplified (but already involved) version - **sparse matrix factorization**. My postdoctoral research continues this theme but it engages with a broader set of problems such as **bi-level optimization** and **algorithmic differentiation**. My primary research interests are:

- Optimization algorithms for **sparse and/or low-rank** models in machine learning, with provable guarantee.
- **Mathematical frameworks** for current challenges in **deep learning optimization** such as **automatic differentiation** for complex deep-learning modules, **implicit bias** of training algorithms and the effects of **over-parameterization**.

Education

Sep 2020 – Dec 2023	**Ph.D. Student**, *Computer Science Laboratory, ENS de Lyon*, Lyon, France Supervisors: **Rémi Gribonval** and **Elisa Riccietti** Subject: **Algorithmic and theoretical aspects of sparse deep neural networks** ○ Algorithmic and mathematical aspects of the sparse matrix factorization problem. ○ Connection between sparse matrix factorization and sparse deep neural networks. **Link to the manuscript:** `https://inria.hal.science/tel-04329531`
Sep 2017 – Aug 2020	**License 3 - Master 2**, *ENS de Paris*, Paris, France ○ **License 3**: Program L3 Computer Science **ENS de Paris** ○ **Master 1**: Parisian Master of Research in Computer Science **ENS de Paris** ○ **Master 2**: Master Mathematics, Vision and Machine Learning **ENS Paris Scalay**
Sep 2014 – Aug 2017	**Undergraduate**, *Hanoi University of Science and Technology*, Hanoi, Vietnam Program: **Talented Engineering of Information and Technology**

Research Internship/Experience

Jan 2024 – Present	**Post-doctoral on optimization and its applications to machine learning**, *Toulouse School of Economics*, Toulouse Supervisor: **Jérôme Bolte** and **Edouard Pauwels** ○ Geometrical and computational complexity of bi-level optimization. ○ Automatic differentiation for bilevel optimization.
Apr 2020 – Aug 2020	**Multi-layer sparse matrix factorization**, *Team DANTE, ENS de Lyon*, Lyon Supervisor: Rémi Gribonval - You can find my internship report here
Feb 2019 – Jun 2019	**Domain Adaptation and Transfer Learning**, *Team MLIA, LIP6*, Paris Supervisor: Mathieu Cord - LIP6, Sorbone University

Jun 2018 – Aug 2018	**Quantum computing and optimization**, *Team MC2, ENS de Lyon*, Lyon Supervisor: Omar Fawzi - LIP, ENS de Lyon.
Feb 2016 – May 2017	**Evolutionary Algorithms and applications in Wireless Sensor Network**, *MSO Laboratory, School of Information and Communication Technology*, Hanoi Supervisor: Huynh Thi Thanh Binh - SoICT, Hanoi University of Science and Technology.

Publications

[-] Y-M, Chee, **Q-T., Le**, H., Ta, **On the Asymptotic Nonnegative Rank of Matrices and its Applications in Information Theory**, *IEEE International Symposium on Information Theory , July 2024, Athens, Greece*

[-] **Q-T., Le**, E., Riccietti, R., Grivonval, **Does a sparse ReLU network training problem always admit an optimum?**, *Thirty-seventh Conference on Neural Information Processing Systems, Dec 2023, New Orleans (Lousiane), United States, 2023*

[-] A., Gonon, L., Zheng, C., Lalanne, **Q-T., Le**, G., Lauga, C., Poulinquen, **Sparsity can improve privacy of neural networks**, *GRETSI, Grenoble, France, 2023*

[-] H., Vu, **Q-T., Le**, D-H., Ta, and R. Hildebrant, **Towards Better Bounds for Finding Quasi-Identifiers**, *ACM SIGMOD/PODS International Conference on Management of Data, Seatle, WA, USA, 2023*

[-] **Q-T.,Le**, E., Riccietti, R., Grivonval, **Spurious Valleys, NP-hardness, and Tractability of Sparse Matrix Factorization With Fixed Support**, *SIAM Journal on Matrix Analysis and Applications, 2022*

[-] **Q-T.,Le**, L., Zheng, E., Riccietti, R., Grivonval, **Fast learning of fast transforms, with guarantees**, *ICASSP 2022 - IEEE International Conference on Acoustics, Speech and Signal Processing, Singapore, Singapore, May 2022*

[-] **Q-T., Le** and R., Gribonval, **Structured Support Exploration for Multi-layer Sparse Matrix Factorization**, *ICASSP 2021 - IEEE International Conference on Acoustics, Speech and Signal Processing, Toronto, Ontario, Canada, June 2021*

[-] T-H., Nguyen, T-H., Nguyen, T-T-B., Huynh, E., Kurniawan and **Q-T., Le**, **Connectivity optimization problem in vehicular mobile Wireless Sensor Networks**, *2016 International Conference on Computational Intelligence and Cybernetics, Makassar, Indonesia, Nov 2016*

Talks and Presentations

July 2024	**Nonconvexity in bilevel optimization is very hard**, *25th International Symposium on Mathematical Programming*, Montreal, Canada
May 2024	**Sparse matrix factorization from an optimization viewpoint**, *SPOT Seminar*, Toulouse, France
June 2023	**Existence of optima in sparse matrix factorization and sparse ReLU networks training**, *Research visit at Université de Mons*, Mons, Belgium
May-June 2023	**Sparse Matrix Factorization from an Optimization Point of View**, *SIAM Conference on Optimization (OP23)*, Seattle, Washington, U.S.

Sep 2022	**Sparse Matrix Factorization and Beyond**, *Workshop MIA-MIVA*, Sophia-Antipolis, France
Jun 2022	**From hardness to efficiency in sparse deep network training**, *SNN Workshop*, virtual
May 2022	**NP-hardness, Tractability and Landscape of Fixed Support Matrix Factorization**, *Journée SMAI-MODE*, Limoges, France
Apr 2022	**Fixed support matrix factorization**, *Seminar ARIC*, ENS de Lyon, Lyon, France
June 2021	**Fixed support matrix factorization is NP hard**, *GdR ISIS thematic day: Theory of deep learning*, virtual

Honor and awards

2012-2013	**Third Prize in Vietnamese Mathematics Olympiads**
2013-2014	**First Prize in Vietnamese Mathematics Olympiads**
2014	**Le Van Thiem Award** This prize is annually given to two or four students and teachers to recognize their achievements in teaching and studying of mathematics by Vietnamese Mathematical Society.
2014-2015	**Special Prize in Vietnamese Mathematics Olympiads for Undergraduate** Special Prize is only given to students who obtain two First Prizes or achieve the highest score in Algebra and Analytics Section.
Nov 2016	**Consolation Prize in Samsung Software Challenges**

Other skills

Programming	**C, C++, Python, Java, Ocaml**
Language	**Vietnamese** (Mother tongue), **English** (6.5 IELTS), **French** (B1 - B2 TCF)
Operating System	**Windows, MacOS, Ubuntu, Debian**