# **Shuyu Dong** · Curriculum Vitae

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## Education

**Université catholique de Louvain** **Louvain-la-Neuve, Belgium**
*PhD in sciences de l'ingénieur at INMA, ICTEAM* *2016–2021*

**PhD Thesis:** *Low-rank matrix and tensor completion using graph-based regularization*
**Advisors:** P.-A. Absil, Kyle A. Gallivan
**Jury members:**
*Roland Keunings,* Jury president, Professor, Université catholique de Louvain
*Jean-Charles Delvenne,* Reporter and Examiner, Professor, Université catholique de Louvain
*François Glineur,* Examiner, Professor, Université catholique de Louvain
*Yurii Nesterov,* Examiner, Professor, Université catholique de Louvain
*Lieven De Lauthauwer,* Examiner, Professor, Katholieke Universiteit Leuven
*Wen Huang,* Examiner, Professor, Xiamen University

**Ecole Polytechnique** **Palaiseau, France**
*Ingénieur Polytechnicien and MSc in Mathematics, Vision, Learning (MVA)* *2011–2016*
Ecole polytechnique *2011-2014*
*Ingénieur diplômé de l'Ecole Polytechnique*
Télécom ParisTech & ENS Cachan (4th-year program) *2014-2015*
*Ingénieur dimplômé de l'Ecole Polytechnique et le grade de master*

**Université Paris VI** **Paris, France**
*Licence in Mathematics* (Equivalent to Bachelor's degree) *2009-2011*
*Licence 1, Université Paris XIII, Villetaneuse* *2008-2009*

## Professional Experiences

**Postdoctoral Researcher** **Palaiseau, France**
*L2S, CentraleSupélec, Université Paris-Saclay* *2024–present*

Currently postdoctoral researcher at Laboratoire des Signaux et Systèmes (L2S) of Université Paris-Saclay, in collaboration with Mohammed Nabil El-Korso, Arthur Tenenhaus et Laurent Le Brusquet.
**Research topics:** Graphical models, Optimization, Low-rank plus sparse matrix decomposition, Causal structure learning in the presence of latent variables, Latent variable causal models

*INRIA TAU team, LISN, Université Paris-Saclay* *2021–2024*

Postdoctoral researcher with the INRIA TAU team in collaboration with Michèle Sebag.
**Research topics:** Causal structure learning, Directed acyclic graphes (DAGs), Sparse matrix decomposition, Optimization, Integer linear programmation (ILP)

- Contribution under the INRIA-Fujitsu collaborations: LoRAM [4], ICID [8].

- Contribution under the French national research project Causali-T-AI of PEPR-IA: DCILP [3].

**PhD** **Louvain-la-Neuve, Belgium**
*INMA, ICTEAM, Université catholique de Louvain* *2016–2021*

PhD thesis on new methods for Riemannian optimization, low-rank matrix and tensor decomposition, graph learning, and matrix and tensor completion with applications to recommendation systems and inverse problems.

**Research topics:** Optimization on Riemannian manifolds, Low-rank matrix and tensor models, matrix and tensor completion, graph Laplacian-based regularization

**Contributions :**

- Publications [6, 5, 2, 10, 1, 9].
- Contribution to MATLAB tools à GRMC [2], TC-Precon [1], TC-Reg [10].
- Teaching assistant for Master's and Bachelor's courses.

**Research intern** (Master's thesis) **Lausanne, Switzerland**
*Télécom ParisTech and Ecole polytechnique fédérale de Lausanne* *2015–2016*

Research Internship of the Engineering and Master's program at Télécom ParisTech conducted at LTS4 of Ecole polytechnique fédérale de Lausanne (EPFL) in Switzerland.

**Research topics**: Graph learning and dictionary learning for signals representation on graphs

**Contributions :** publication [7]; development of new algorithms for graph learning.

**Internship** (Master 1) **Issy-les-Moulineaux, France**
*Invoxia* *2014*

Research and development on real-time speaker diarization using information geometric methods for

- Speaker change detection
- Unsupervised speaker segmentation and clustering; adaptation to real-time application; supervised speaker identification.

**Internship** **Paris, France**
*SDESS, Banque de France* *2013*

Internship at the SDESS department of Banque de France on parallel computing.

- Development of large-scale linear system solvers using parallel computing
- Transformation of gradient descent and conjugate gradient methods under CUDA; Benchmark with cuSparse et cuBlas.

## Languages

**English** : Bilingual **French** : Bilingual **Chinese** : Native speaker

## Software

| Language | Remark | Language | Remark | Language | Remark |
|---|---|---|---|---|---|
| Python | Daily usage | Bash | Daily usage | C++ | Intermediate |
| MATLAB | Daily usage | LaTeX | Daily usage | CUDA | Intermediate |
| R | Intermediate | SLURM | Daily usage | | |
| Java | Intermediate | Docker | Basic knowledge | | |

## Publications

### Journals:

[1] **Shuyu Dong**, Bin Gao, Yu Guan, and François Glineur. New Riemannian preconditioned algorithms for tensor completion via polyadic decomposition. *SIAM Journal on Matrix Analysis and Applications*, 840–866, 2022. URL https://doi.org/10.1137/21M1394734. DOI: 10.1137/21M1394734.

[2] **Shuyu Dong**, P.-A. Absil, and Kyle A. Gallivan. Riemannian gradient descent methods for graph-regularized matrix completion. *Linear Algebra and its Applications*, 2021. URL https://doi.org/10.1016/j.laa.2020.06.010. DOI: 10.1016/j.laa.2020.06.010

### International conferences:

[3] **Shuyu Dong**, Michèle Sebag, Kento Uemura, Akito Fujii, Shuang Chang, Yusuke Koyanagi, Koji Maruhashi. DCILP: A distributed learning method for large-scale causal structure learning, 2025. URL https://arxiv.org/pdf/2406.10481.pdf.
To appear in *the 39th Annual AAAI Conference on Artificial Intelligence* (AAAI-25).

[4] **Shuyu Dong** and Michèle Sebag. From graphs to DAGs: a low-complexity model and a scalable algorithm. In *Machine Learning and Knowledge Discovery in Databases: European Conference, ECML-PKDD 2022, Proceedings, Part V*, pages 107–122, 2022, Springer-Verlag. URL https://doi.org/10.1007/978-3-031-26419-1_7. DOI: 10.1007/978-3-031-26419-1_7

[5] **Shuyu Dong**, P.-A. Absil, and Kyle A. Gallivan. Preconditioned Conjugate Gradient Algorithms for Graph Regularized Matrix Completion. In *Proceedings of the 27th European Symposium on Artificial Neural Networks (ESANN 2019)*, pages 239–244, 2019. ISBN 978-287-587-065-0. URL https://www.esann.org/sites/default/files/proceedings/legacy/es2019-133.pdf

[6] **Shuyu Dong**, P.-A. Absil, and Kyle A. Gallivan. Graph learning for regularized low rank matrix completion. *Proceedings of the 23rd International Symposium on Mathematical Theory of Networks and Systems (MTNS 2018)*, pages 460–467, 2018. URL https://mtns2018.hkust.edu.hk/media/files/0153.pdf

[7] **Shuyu Dong**, Dorina Thanou, P.-A. Absil, and Pascal Frossard. Learning sparse models of diffusive graph signals. In *Proceedings of the 25th European Symposium on Artificial Neural Networks (ESANN 2017)*, pages 251–256, 2017. ISBN 978-287587039-1. URL https://www.esann.org/sites/default/files/proceedings/legacy/es2017-116.pdf

### Preprints in preparation for submission:

[8] **Shuyu Dong**, Kento Uemura, Akito Fujii, Shuang Chang, Yusuke Koyanagi, Koji Maruhashi, and Michèle Sebag. Learning large causal structures from inverse covariance matrix via matrix decompo-

sition. *arXiv preprint arXiv:2211.14221*, 2024. URL `https://arxiv.org/pdf/2211.14221.pdf`. Article in preparation for submission.

[9] **Shuyu Dong**, Bin Gao, Wen Huang, and Kyle A. Gallivan. On the analysis of optimization with fixed-rank matrices: a quotient geometric view. *arXiv preprint arxiv:2203.06765*, 1–27, 2024. URL `https://arxiv.org/pdf/2203.06765.pdf`. Presented on 21 August 2024 at *The 26th International Symposium on Mathematical Theory of Networks and Systems (MTNS 2024)*, Cambridge, UK. Article in preparation for submission.

[10] Yu Guan, **Shuyu Dong**, Bin Gao, P.-A. Absil, and François Glineur. Alternating minimization algorithms for graph-regularized tensor completion. *arXiv preprint arXiv:2008.12876*, 1–22, 2023. URL `https://arxiv.org/pdf/2008.12876.pdf`. Article in preparation for submission.

### Seminars

1. Talk: *On the analysis of optimization with fixed-rank matrices* [9]. The 26th International Symposium on Mathematical Theory of Networks and Systems (MTNS 2024), Cambridge, UK, July 21–25, 2024.
2. Talk: *Sparse matrix decomposition for causal discovery* [8]. The 14th International Conference on Numerical Optimization and Numerical Linear Algebra (ICNONLA 2023), Taiyuan, China, August 15–18, 2023.
3. Talk: *Sparse matrix decomposition for causal discovery* [8]. Fundamental Challenges in Causality 2023, Université Grenoble Aples, France, May 9th–12th, 2023.
4. Poster presentation: *From graphs to DAGs: a low-complexity method for learning causal graphs* [4]. Spring School on Causality, Sorbonne Université, France, March 28th–31st, 2023.
5. Poster presentation: *Graph-regularized matrix completion* [2]. Winter School "Low-Rank Models 2020", Villars-sur-Ollon (VD), Suisse, January 12–17, 2020.
6. Talk: *Riemannian gradient descent methods for graph-regularized matrix completion* [2]. The 9th International Congress on Industrial and Applied Mathematics (ICIAM 2019), Valence, Espagne, July 15–19, 2019.
7. Talk: *Preconditioned Conjugate Gradient Algorithms for Graph Regularized Matrix Completion* [5]. The 27th European Symposium on Artificial Neural Networks (ESANN 2019).
8. Talk: *Graph-regularized matrix completion* [2]. The 23th International Symposium on Mathematical Theory of Networks and Systems (MTNS 2018), Hong Kong University of Science and Technology, Hong Kong, China, July 16–20, 2018.
9. Talk: *Learning sparse models of diffusive graph signals* [7]. The 25th European Symposium on Artificial Neural Networks (ESANN 2017).

## Codes

1. DCILP (causal discovery): `https://github.com/shuyu-d/dcilp-exp`
2. ICID (causal discovery): `https://github.com/shuyu-d/icid-exp`
3. LoRAM (DAG computation): `https://github.com/shuyu-d/loram-exp`
4. TC-Precon (tensor completion): `https://gitlab.com/shuyudong.x11/tcprecon`
5. GRMC (graph-regularized matrix completion): `https://github.com/shuyu-d/grmc`

## Professional services

**Supervision** Co-supervisor (with Professor P.-A Absil) of Anuj Diwan (IIT) in his Summer Internship 2019 at ICTEAM, Université catholique de Louvain.

**Referee for journals and conferences**

- IEEE Transactions of Signal Processing (IEEE TSP)
- Signal Processing
- EURASIP Journal on Advances in Signal Processing
- The European Signal Processing Conference (Conférence EUSIPCO)
- IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI)
- Computational Optimization and Applications (COAP)
- Applied Mathematical Modelling (AMMOD)
- Journal of Computational and Applied Mathematics
- Journal of Computational Science
- European Conference on Machine Learning and Data Mining (ECML-PKDD)
- Geometric Science of Information (GSI Conference)