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25 years old (born August 11th, 1997)

Clémence Prévost

Post-doctoral fellow

Summary

I obtained my PhD in signal processing in Oct. 2021 with applications in remote sensing. In the first part, I designed tensor-based algorithms for data fusion, assorted with theoretical reconstruction guarantees. In the second part, I conducted performance analysis for coupled tensor models using Cramér-Rao bounds. Since November 2021, I am a post-doctoral fellow in University of Lille. The goal of my post-doc is to design and study statistical tensor models for inverse problems. These models find applications in medical imaging, remote sensing and radio-astronomy.

Education and research

2021–present **Post-doctoral fellow**, Centre de Recherche en Informatique, Signal et Automatique de Lille, CNRS UMR 9189.

- **Topic:** "*Bayesian tensor approaches for inverse problems*".
- **Supervisors:** Pierre Chainais, Professeur des Universités, Université de Lille; Rémy Boyer, Professeur des Universités, Université de Lille.

2018–2021 **PhD in Signal Processing**, Centre de Recherche en Automatique de Nancy, CNRS UMR 7039.

- **PhD topic:** "*Multimodal data fusion by low-rank tensor approximations*";
- **Funding:** Doctoral contract;
- **Defense:** October 22nd 2021, Faculté des Sciences de Nancy;
- **Supervisors:** David Brie, Professeur des Universités, Université de Lorraine; Konstantin Usevich, Research Fellow CNRS, Université de Lorraine.
- **Referrees:** Tülay Adali, Distinguished University Professor, University of Maryland, Baltimore County;
  Rémy Boyer, Professeur des Universités, Université de Lille.
- **Attendees:** Mariya Ishteva, Assistant Professor, KU Leuven;
  Alain Richard, Professeur des Universités, Université de Lorraine;
  Jean-Yves Tourneret, Professeur des Universités, Université de Toulouse.

- **Guest members:** Pierre Comon, Directeur de recherche CNRS, Université Grenoble-Alpes;
  Cédric Richard, Professeur des Universités, Université Côte d'Azur;
  Eric Chaumette, Professeur des Universités, ISAE-Supaéro.
- **Class:** EC Machine Learning (Ecole des Mines de Nancy). *Theoretical and practical course (21h) on machine learning, deep neural networks and probabilistic models.*
- **Summer school:** 2019 Peyresq summer school. *Theoretical course and talks (21h) information geometry and its applications to signal processing.*

2017–2018 **M.Sc. in System engineering**, *Université de Lorraine, Nancy, France.*

- **M.Sc. thesis:** "*Low-rank structured matrix completion and its application to MRI reconstruction*," under the supervision of David Brie and Konstantin Usevich.

2015–2018 **Mechanical and Electrical engineer**, *École Nationale Supérieure d'Electricité et de Mécanique (ENSEM), Nancy, France*, Digital system engineering (ISN).

2013–2015 **CPGE PCSI - PSI*, Lycée César Baggio, Lille.**, *Preparatory class to French engineering schools. Two years theoretical and practical course with a major in mathematics, physics and engineering.*

2013 **French Baccalaureate, Lycée Denis Diderot, Langres, France**, *With honors and a major in mathematics, physics and biology*.

Teaching

2022–2023 **Teaching assistant**, Ecole Centrale de Lille, Lille, France.

- **Practical course in "Signal Processing"** : 13h lectures and lab sessions in 2022–2023. *Fourier series, DFT, adaptive filtering.*

2021–2023 **Teaching assistant**, IMT Lille Douai, Lille, France.

- **Practical course in "Regression" (UV SDATA)** : 6h lab sessions in 2021–2022. *Linear and polynomial regression using Python and Numpy.*
- **Practical course in "Particle filtering" (UV SDATA)** : 3h lab sessions in 2022–2023. *An introduction to Bayesian sampling using particle filtering, using Python and Numpy.*

2018–2021 **Doctoral teaching assistant**, IUT Nancy-Brabois, Department of Networks and Telecommunications (R&T), Nancy, France.

- **Practical course in "Principle of radio transmission" (M2107)** : 16h lab sessions in 2018–2019.
- **Practical course in "Principle of signal measurements" (M1107)** : 176h lab sessions in total.

Publications

I currently have **15 publications in total**, reaching a total of **121 citations** with an **h-index of 5**.

International journals

- "Constrained Cramér-Rao lower bounds for reconstruction problems formulated as coupled canonical polyadic decompositions", **Prévost, C.**, Usevich, K., Haardt, M., Comon, P. et Brie, D. *Elsevier Signal Processing, vol. 198 (2022), 108573* .
- "Hyperspectral super-resolution accounting for spectral variability: coupled tensor LL1-based recovery and blind unmixing of the unknown super-resolution image", **Prévost, C.**, Borsoi R. A., Usevich, K., Brie, D., Bermudez, J .M. et Richard, C. *SIAM Journal on Imaging Sciences vol. 15.1 (2022), 110-138.*
- "Coupled Tensor Decomposition for Hyperspectral and Multispectral Image Fusion with Inter-image Variability", Borsoi R. A., **Prévost, C.**, Usevich, K., Brie, D., Bermudez, J .M. et Richard, C. *IEEE Journal of Selected Topics in Signal Processing, vol. 15(3), 702-717.*
- "Hyperspectral super-resolution with coupled Tucker approximation: Identifiability and SVD-based algorithms", **Prévost, C.**, Usevich, K., Brie, D. et Comon, P. *IEEE Transactions on Signal Processing, vol. 68, p.931-946.*

International conferences

- "Fast fusion of hyperspectral and multispectral images: a Tucker approximation approach" - **Prévost C.**, Chainais P. and Boyer, R. *2022 IEEE International Conference on Image Processing (ICIP).*
- "Multi-frame super-resolution MRI using coupled low-rank Tucker approximation", **Prévost, C.** et Odille, F. *2022 IEEE European Signal Processing Conference (EUSIPCO).*
- "Coupled tensor models accounting for inter-image variability", Borsoi R. A., **Prévost, C.**, Usevich, K., Brie, D., Bermudez, J .M. et Richard, C. *2021 IEEE Asilomar Conference – Special session on advances in coupled matrix and tensor factorizations with applications to remote sensing.*
- "Cramér-Rao Lower Bounds with random equality constraints", **Prévost, C.**, Chaumette, E., Usevich, K., Brie, D. et Comon, P. *2020 IEEE ICASSP (International Conference on Acoustics, Speech and Signal Processing).*
- "Cramér-Rao Bounds in the framework of hyperspectral super-resolution", **Prévost, C.**, Usevich, K., Haardt, M., Brie, D. et Comon, P., *2019 IEEE CAMSAP (international workshop on Computational Advances in Multi-Sensor Adaptative Processing).*
- "Coupled tensor low-rank multilinear approximation for hyperspectral super-resolution", **Prévost, C.**, Usevich, K., Brie, D. et Comon, P. *2019 IEEE ICASSP (International Conference on Acoustics, Speech and Signal Processing).*

National conferences

- "Approches tensorielles couplées pour la fusion aveugle d'images multispectrale et hyperspectrale", **Prévost, C.**, Usevich, K., Brie, D. et Comon, P. *2019 GRETSI (Colloque francophone de traitement de signal et des images).*

- "Super-résolution multi-images en IRM par approximation de Tucker couplée", **Prévost, C.**, Odille, F. *2022 GRETSI (Colloque francophone de traitement de signal et des images)*
- "Approches tensorielles couplées pour la fusion aveugle d'images multispectrale et hyperspectrale", **Prévost, C.**, Usevich, K., Comon, P. and Brie, D. *2019 GRETSI (Colloque francophone de traitement de signal et des images)*.

Submitted and in preparation

- "Nonnegative block-term decomposition with the beta-divergence: joint data fusion and blind spectral unmixing", **Prévost, C.** and Leplat, V. Submitted to *2023 IEEE ICASSP* (preprint hal-03831661).
- "On the efficiency of blind and non-blind estimation for coupled LL1 tensor models using the randomly-constrained Cramér-Rao bound", **Prévost, C.**, Usevich, K., Chaumette E., Brie D. and Comon, P. Submitted to *IEEE TSP* (preprint hal-03504402).

Workshops and invited talks

I was invited to present my work in **13 workshops** in France and abroad. Hereafter is a list of selected talks, most representative of my work.

- **Nonnegative block-term decomposition with the beta-divergence: joint data fusion and blind spectral unmixing**. Interfacing Bayesian statistics, machine learning, applied analysis, and blind and semi-blind imaging inverse problems, Jan. 2023.
- **Tensor decompositions and how to use them: an introduction to tensor low-rank in inverse problems**. Winter edition of the Orion-B astrophysics consortium, Jan. 2023.
- **Hyperspectral super-resolution accounting for spectral variability: coupled tensor LL1-based recovery and blind unmixing of the unknown super-resolution image**. 3rd IMA Conference on Inverse Problems from Theory to Application, May 2022.
- **Multimodal data fusion by low-rank tensor approximations: applications in remote sensing**. S^3 Seminar, Laboratoire des signaux et systèmes, Feb. 2022.
- **Hyperspectral super-resolution accounting for spectral variability: coupled tensor LL1-based recovery and blind unmixing of the unknown super-resolution image**. GdR ISIS meeting on machine learning and data fusion, Jan. 2022.
- **Tensor approaches for hyperspectral super-resolution: an overview of methods**. Invited talk at Laboratoire des Sciences du Numérique de Nantes (LS2N), Feb. 2021.
- **Hyperspectral super-resolution via coupled Tucker decomposition**. Workshop on Low-Rank Models and Applications (LRMA), Sept. 2019.

Outreach

- **Dec.2022: Internship supervisor**. I was supervising a group of 10 middleschool female interns for a week, for the "Informatique au Féminin" event organized by organized by my laboratory at the University of Lille (CRIStAL).
- **Competitor in "Ma thèse en 180 secondes" for the Grand-Est region**. 2021–2022. See **Awards** section.
- **PhD presentation**. "Prétexte" gathering between PhD and M.Sc students in Phi-Sciences, May 2019.

Community work

- **2022–2023: Organizer of PhD Coffee**, a monthly scientific meeting among non-permanent researchers of my research team in CRIStAL.
- **ENBIS 2018**, Ecole des Mines de Nancy, September 2–6: reception desk, technical chair.
- **IEEE CAMSAP 2019**, Le Gosier, Guadeloupe, December 15–18: reception desk.
- **Reviewer** for: IEEE Transactions on Signal Processing, IEEE Transactions on Geoscience and Remote Sensing, IEEE Transactions on Image Processing, IEEE Journal of Selecting Topics in Signal Processing, Elsevier Signal Processing, Elsevier Digital Signal Processing, Taylor and Francis Geocarto International, IET Signal Processing, Optica Prism.

Awards

- Awarded **best thesis of doctoral school IAEM, University of Lorraine**. 2021–2022.
- **Awarded 3rd by the committee of the regional competition "Ma thèse en 180 secondes"**. 2021–2022.

Skills

IT	MATLAB and Simulink, LaTeX, Python, R.
Language	French (fluent), English (fluent, TOEIC: 950/990), Czech (A2/B1).