Thibaut GERMAIN

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Paris, France

Research Interests

My research interests lie at the intersection of machine learning, geometry, and dynamical systems. More specifically, I focus on developing machine learning methods tailored to dynamical systems and time series, with a particular emphasis on the interpretability, comparison, and transport of dynamic behaviors.

Education

2021 - 2025 **PhD**, **Centre Borelli, Ecole Normale Supérieure Paris-Saclay, France**. Thesis on detection and statistical analysis of pattern in physiological time series. Link thèses.fr : https://theses.fr/s298010. Thesis co-supervised by Laurent OUDRE and Charles TRUONG. Thesis started on 01/10/2021 for a duration of 37 months. Thesis defended on 06/12/2024 before a jury composed of:

- President of the jury :
  - Alain TROUVE (Professor, ENS Paris-Saclay)
- Jury members :
  - Jessica LIN (Associate Professor, George Mason University)
  - Romain TAVENARD (Professor, Université Rennes 2)
  - Laurent YOUNES (Professor, Johns Hopkins University)
  - Guillermo SAPIRO (Professor, Princeton University)

2020 **Master of Science**, **Ecole Normale Supérieure Paris-saclay, France**. Master Mathématiques Vision et Apprentissage (MVA), highest honors.

2017 **Master of Science**, **Université Lyon 1, France**. Master Operational Research and Supply Chain.

2017 **Master's degree**, **Ecole des Mines de Saint-Etienne, France**. Master in supply chain engineering.

Position

2025 - auj. **Postdoctorat**, **Centre de Mathématiques Appliquées de Polytechnique (CMAP), Palaiseau, France**. Postdoctoral research on problems regarding statistical analysis and domain adaptation of stochastic dynamical systems through the transport of spectral decompositions of their transfer operators (Koopman operator). Project started 01/03/2025, co-supervised by Karim LOUNICI and Rémi FLAMARY.

2024 **Visiting researcher**, **Duke University, Durham, NC (USA)**. Contribution to developing video-based tools for analyzing the therapeutic evolution of eating disorders. Focused on analyzing facial emotions, combining signal processing and pattern analysis approaches. This exchange lasted a month.

2020 **Research volunteer**, **Centre Borelli, France**. Assisted Argyris KALOGERATOS for simulating COVID-19 dynamical propagation within a hospital department. Four months volunteering.

2017 - 2019 **Supply chain engineer**, **Tempest Tech Corp., Fresno, CA (USA)**. Standardizing and optimizing operational activities. Overseeing research and development activities. Management support: supervising the production team, training, and hiring.

2017 **Supply chain intern**, **Airbus Helicopters, Marignane, France**. Modeling and optimizing the supply chain of the H160 during its research and development phase. Evaluating the supply chain robustness through a sensitivity analysis.

Teaching

2021 - 2024 **Teaching assistant (TD/TP)**, **Ecole Normale Supérieur Paris-saclay, France**.

• Mathematical statistics and machine learning, (Graduate course).

• Statistics for the French exam "Agrégation de mathématiques", (Graduate course).

2022 **Teaching assistant (TD/TP)**, **Ecole Normale Supérieur Paris-saclay, France**.

• Introduction to measure theory, integration, and probability, (Undergraduate course).

Students

PhD

• Valerio GUERRINI, 2024 - , co-supervised with Charles TRUONG and Laurent OUDRE, on "Unsupervised approaches for constructing semantic summaries from physiological signals. Application to behavioral study".

Graduate

- Valerio GUERRINI, M2 MVA, April-September 2024, co-supervised with Charles TRUONG and Laurent OUDRE, on "Benchmark for motif discovery in time series".
- Lucas HAUBERT, M2 MVA, April-September 2024, co-supervised with Chrysoula KOSMA and Laurent OUDRE, on "Toward shape-based losses for deep learning on time series".

Undergraduate

- Romain DELAUNAY and Hugo GAIBLE, L3 ENS Paris Saclay, April-June 2023, co-supervised with Alexandre BOIS and Laurent OUDRE, on "Convolutional dictionnay learning".
- William RAMOS and Oussama ZEKRI, L3 ENS Paris Saclay, April-June 2022, co-supervised with Laurent OUDRE, on "Optimal transport and elastic measures on time series".

TALKS

1. "Detection and statistical analysis of temporal pattern" (R&D cognition day, January 2025)
2. "Interactive discovery of temporal motifs, a web application" (ECML PKDD, September 2024).
3. "Shape analysis and machine learning for time series", (Duke University, July 2024).
4. "Persistence-based Motifs Discovery in Time Series", (Centre Borelli, June 2024).
5. "Linear-trend normalization for multivariate subsequence similarity search", (ICDE 2024, May 2024).
6. "Interpretable classification of ventilation behaviors based on machine learning", (Integrative Neuroscience and Cognitive Center (INCC), January 2023).
7. "Une méthode de regroupement des comportements respiratoires basée sur des distances DTW entre séries temporelle & Comment les nouveaux outils permettent de redécouvrir des données ?", (Maths & Medecine, December 2022).
8. "Unsupervised study of plethysmography signals through DTW clustering", (EMBC 2022, July 2022).

PUBLICATIONS

Journal papers:

1. Valerio Guerrini, Thibaut Germain, Charles Truong, Laurent Oudre, and Paul Boniol. "Time Series Motif Discovery: A Comprehensive Evaluation". In: *Proceedings of the VLDB Endowment* 18.7 (2025)
2. Thibaut Germain, Charles Truong, and Laurent Oudre. "Persistence-Based Motif Discovery in Time Series". In: *IEEE Transactions on Knowledge and Data Engineering (TKDE)* 36.11 (2024), pp. 6814–6827. DOI: 10.1109/TKDE.2024.3417303
3. Thibaut Germain, Charles Truong, Laurent Oudre, and Eric Krejci. "Unsupervised classification of plethysmography signals with advanced visual representations". In: *Frontiers in Physiology* 14 (2023). ISSN: 1664-042X. DOI: 10.3389/fphys.2023.1154328

International conference papers:

1. Thibaut Germain, Chrysoula Kosma, and Laurent Oudre. "Time Series Representations with Hard-Coded Invariances". In: *The Forty-second International Conference on machine Learning (ICML)*. 2025
2. Thibaut Germain, Samuel Gruffaz, Charles Truong, Alain Durmus, and Laurent Oudre. "Shape analysis for time series". In: *The Thirty-eighth Annual Conference on Neural Information Processing Systems (NeurIPS)*. 2024
3. Thibaut Germain, Charles Truong, and Laurent Oudre. "Interactive Motif Discovery in Time Series with Persistent Homology". In: *Machine Learning and Knowledge Discovery in Databases. Research Track and Demo Track (ECML PKDD)*. Cham: Springer Nature Switzerland, 2024, pp. 383–387. ISBN: 978-3-031-70371-3. DOI: 10.1007/978-3-031-70371-3_25
4. Thibaut Germain, Charles Truong, and Laurent Oudre. "Linear-trend normalization for multivariate subsequence similarity search". In: *2024 IEEE 40th International Conference on Data Engineering Workshops (ICDEW)*. IEEE. 2024, pp. 167–175. DOI: 10.1109/ICDEW61823.2024.00028
5. Thibaut Germain, Charles Truong, Laurent Oudre, and Eric Krejci. "Unsupervised study of plethysmography signals through DTW clustering". In: *2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*. IEEE. 2022, pp. 3396–3400. DOI: 10.1109/EMBC48229.2022.9870907

National conference papers:

1. Thibaut Germain, Alexandre Bois, Charles Truong, Brian Tervil, and Laurent Oudre. "Détection non supervisée de motifs sur séries temporelles". In: *2023 29ème Colloque Francophone de Traitement du Signal et des Images (GRETSI)*. 2023
2. Thibaut Germain, Charles Truong, Laurent Oudre, and Eric Krejci. "Approches non-supervisées et non-linéaires pour l'analyse de signaux de pléthysmographie". In: *2022 28ème Colloque Francophone de Traitement du Signal et des Images (GRETSI)*. 2022

PhD Thesis:

1. Thibaut Germain. "Pattern detection and shape analysis for physiological timeseries". PhD thesis. Université Paris-Saclay, 2024

RÉFÉRENTS

1. **Alain TROUVE**
   Professor
   Centre Borelli, Ecole Normale Supérieur Paris-Saclay
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2. **Alain DURMUS**
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3. **Eric KREJCI**
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4. **Laurent OUDRE**
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5. **Charles TRUONG**
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   Relation : PhD supervisor