Thomas Allard

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Citizenship:	France	Email:	tallard@stanford.edu
Birthdate:	Sep. 05, 1995	Website:	www.thomas-allard.com

Research Interests
Analysis, Applied Mathematics, Approximation Theory, Statistical Learning, Machine Learning

Present Occupation

Stanford University, Postdoctoral Researcher — Jan. 2026 –

- Advisor: Prof. Dr. David L. Donoho

Past Occupation

ETH Zurich, Postdoctoral Researcher — Jan. 2025 – Dec. 2025

- Advisor: Prof. Dr. Helmut Bölcskei

ETH Zurich, Ph.D. in Applied Mathematics — Nov. 2019 – Dec. 2024

- Under the supervision of Prof. Dr. Helmut Bölcskei (D-ITET, D-MATH, D-INFK)
- Thesis title: *Metric Entropy of Ellipsoids with Applications to Machine Learning*
- Jury: Prof. Dr. Helmut Bölcskei, Prof. Dr. David L. Donoho

Education

ETH Zurich, M.Sc. in Applied Mathematics — Sep. 2017 – Aug. 2019

- Thesis title: *Theoretical Guarantees for Stochastic Gradient Descent*

CentraleSupélec, Diplôme d'Ingénieur — Sep. 2015 – Aug. 2019

- Multi-disciplinary engineering degree: mathematics, physics, computer science, industrial engineering, business, management, and related fields

Université Paris Sud, B.Sc. in Pure and Applied Mathematics — Sep. 2015 – Aug. 2016

Lycée Masséna, Preparatory Classes — Sep. 2013 – Aug. 2015

- Preparation for 'Grandes Ecoles' entrance exams in Mathematics, Physics, and Computer Science

Experience

Co-Lecturer, ETH Zurich — Spring 2025

- *Mathematics of Information* (Master's course)
- In-class teaching (20% of lectures)

Teaching Assistant, ETH Zurich

- Typesetting of lecture notes, animation of exercise sessions, preparation and correction of exams
- *Mathematics of Information* (Master's course) — 2020 – 2022
- *Numerical Analysis II* (Bachelor's course) — Spring 2018

NLP Engineer Internship, Telepathy Labs — Jun. 2018 – Dec. 2018

- Project on synonyms extraction for context-dependent noun phrases in Python

Research

Publications

Entropy of Compact Operators with Applications to Landau-Pollak-Slepian Theory and Sobolev Spaces, — Jun. 2025
Thomas Allard, Helmut Bölcskei,
Applied and Computational Harmonic Analysis, Vol. 77, no. 101762.

Metric Entropy of Ellipsoids with Applications to Machine Learning, — May 2025
Thomas Allard,
ETH Research Collection, Doctoral Thesis.

Preprints

Entropy and Minimax Risk of Hypoelliptic Pseudodifferential Operators, — Jan. 2026
Thomas Allard, Helmut Bölcskei.
Submitted to *Journal of Fourier Analysis and Applications*.

Metric Entropy and Minimax Risk of Ellipsoids with an Application to Pinsker's Theorem, — Oct. 2025
Thomas Allard,
Submitted to *The Annals of Statistics*. https://arxiv.org/abs/2510.22441

Metric Entropy of Ellipsoids in Banach Spaces: Techniques and Precise Asymptotics, — May 2025
Thomas Allard, Helmut Bölcskei,
Submitted to *Journal of Functional Analysis*. https://arxiv.org/abs/2504.18321

Ellipsoid Methods for Metric Entropy Computation, — May 2024
Thomas Allard, Helmut Bölcskei,
Submitted to *Constructive Approximation*. https://arxiv.org/abs/2405.11066

In Preparation

Criterion for Optimal Learning with Neural Networks, Exp. 2026
Thomas Allard, Helmut Bölcskei.

Talks

Entropy and Identifiability of LTV Systems, 2025
Workshop on Mathematical Signal Processing, RWTH Aachen University, Germany.

Metric Entropy Limits on Recurrent Neural Network Learning of Linear Dynamical Systems, 2022
Machine Learning Summer School, University Mohammed VI Polytechnic, Morocco.

Posters

Ellipsoids Methods for Metric Entropy Computations, 2024
SIAM Conference on Mathematics of Data Science, Atlanta, Georgia, U.S.

Ellipsoid Methods for Metric Entropy Rates Computations, 2023
Foundations of Computational Mathematics (FoCM), Paris, France.

Projects Supervision

Master Theses

Precise Metric Entropy Results for Compact Hypoelliptic Pseudo-Differential Operators, 2024
Anton Künzi, ETH Zurich.

Metric Entropy Optimality of Continuous-Time RNNs for Learning Dynamical Systems, 2023
Maximilian Schneiderbauer, ETH Zurich.

Learning Rate Scheduling for Stochastic Gradient Descent, 2021
Konstantin Häberle, ETH Zurich.

Master Projects

Metric Entropy of Hypoelliptic Operators, 2024
Bror Hultberg, ETH Zurich, co-supervised with Clemens Hutter.

On the Metric Entropy of Dynamical Systems, 2023
Maximilian Schneiderbauer, ETH Zurich.

Metric Entropy of Pseudodifferential Operators, 2022
Jivan Waber, ETH Zurich.

Approximation of Dynamical Systems by Recurrent Neural Networks, 2022
Hugo Druenne, ETH Zurich.

Noise in Stochastic Gradient Descent with respect to Expected Loss, 2021
Güney Tombak, ETH Zurich.

On the News Categorization, 2021
Rayen Ayari, ETH Zurich.

Random Perturbations Theory for Stochastic Gradient Descent, 2020
Konstantin Häberle, ETH Zurich.

On Parameters of the Expressivity of Neural Networks, 2020
Jacob Clarysse, ETH Zurich.

Bachelor Theses

SGD Learns Over-parametrized Networks that Provably Generalize on Linearly Separable Data, 2021
Afroditi Iliadis, ETH Zurich.

Stability of Simple Neural Network Architectures, 2020
Pablo Lahmann, ETH Zurich.

Bachelor Projects

Optimization and Regularization Methods for Neural Networks: A Literature Review, 2020
Afroditi Iliadis, Isabel Heidtmann, ETH Zurich.

Other Activities

Board Member, ETH Chess Club (SKETH)

- Co-founder (2021), creation of the 'ETH Chess Championship' and the in-person component of the 'Polychamps' (yearly chess match between ETHZ and EPFL)
- **President**, creation and development of the club Jun. 2021 – May 2023
- **Community Manager**, responsible for the club's communication Jun. 2023 – May 2024
- **Secretary**, administrative support and organizational coordination Jun. 2024 – May 2025

Treasurer, L'Association Francophone des Étudiants de Zürich (L'AFrEZ) Jun. 2021 – May 2023

- Accounting and budget management (CHF 15k-20k yearly budget), search for sponsors, organization of events

Producer, NX Télévision Sep. 2015 – Sep. 2017

- Video production, event coverage, organization of weekly events

About Me

- **Languages**: French (native), English (fluent), and German (professional, Goethe-Zertifikat C1 2025);
- I am an active chess player (FIDE Rating: 2098).