

Thomas Allard

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Dr. Thomas Allard
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Sequoia Hall 116
390 Jane Stanford Way
Stanford, California 94305

Citizenship: France
Birthdate: Sep. 05, 1995

Research: 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
• <i>Mathematics of Information</i> (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	
• <i>Mathematics of Information</i> (Master's course)	2020 – 2022
• <i>Numerical Analysis II</i> (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, <u>Thomas Allard</u> , Helmut Bölcskei, <i>Applied and Computational Harmonic Analysis</i> , Vol. 77, no. 101762.	Jun. 2025
Metric Entropy of Ellipsoids with Applications to Machine Learning, <u>Thomas Allard</u> , <i>ETH Research Collection</i> , Doctoral Thesis.	May 2025

Preprints

Metric Entropy and Minimax Risk of Ellipsoids with an Application to Pinsker's Theorem, <u>Thomas Allard</u> , Submitted to <i>The Annals of Statistics</i> . https://arxiv.org/abs/2510.22441	Oct. 2025
Metric Entropy of Ellipsoids in Banach Spaces: Techniques and Precise Asymptotics, <u>Thomas Allard</u> , Helmut Bölcskei, Submitted to <i>Journal of Functional Analysis</i> . https://arxiv.org/abs/2504.18321	May 2025
Ellipsoid Methods for Metric Entropy Computation, <u>Thomas Allard</u> , Helmut Bölcskei, Submitted to <i>Constructive Approximation</i> . https://arxiv.org/abs/2405.11066	May 2024

In Preparation

Entropy of Pseudodifferential Operators and Underspread Systems, <u>Thomas Allard</u> , Helmut Bölcskei.	Exp. Jan. 2026
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Criterion for Optimal Learning with Neural Networks,
Thomas Allard, Helmut Bölcskei.

Exp. 2026

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, Rayen Ayari, ETH Zurich.	2021
Random Perturbations Theory for Stochastic Gradient Descent, Konstantin Häberle, ETH Zurich.	2020
On Parameters of the Expressivity of Neural Networks, Jacob Clarysse, ETH Zurich.	2020

Bachelor Theses

SGD Learns Over-parametrized Networks that Provably Generalize on Linearly Separable Data, Afroditi Iliadis, ETH Zurich.	2021
Stability of Simple Neural Network Architectures, Pablo Lahmann, ETH Zurich.	2020

Bachelor Projects

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

- Accounting and budget management (CHF 15k-20k yearly budget), search for sponsors, organization of events Jun. 2021 – May 2023

Producer, NX Télévision

- Video production, event coverage, organization of weekly events Sep. 2015 – Sep. 2017

About Me

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