Jivan Waber

MSc in Applied Mathematics in Machine Learning
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Education

ETH ZURICH, SWITZERLAND *September 2020 - February 2024*
MSc Applied Mathematics, application in Machine Learning Grade: 5.23/6

DURHAM UNIVERSITY, UK *September 2019 - June 2020*
Erasmus+ international mobility program, Mathematics (3rd year of BSc Mathematics) Grade: 74% (First)

UNIVERSITY OF NEUCHATEL, SWITZERLAND *September 2017 - July 2020*
BSc Mathematics Grade: 4.86/6

Projects

Areas of Interest: Machine Learning, Generalization, Sampling, Theoretical Foundations of AI

Research Internship in AI, Vector Institute *April 2024 - present*
Fundamental Limits of Learning Single-Index Models under Structured Data supervisor: **Prof. Dr. Murat A. Erdogdu**

- **Preparing first author conference submission**, preprint will be available at https://jivanwaber.github.io/personal-website/sim-algorithmic-bounds/.
- **Workshop submission to ICML HiLD 2025:** Jivan Waber, Alireza Mousavi-Hosseini, Murat A. Erdogdu. "Fundamental Limits of Learning Single-Index Models under Structured Data."
- I investigated the number of samples needed for different algorithms such as SGD to achieve recovery guarantees of the single-index model in high dimensions under structured data. This involved the construction of computational bounds (e.g. CSQ, SQ) and analysis of algorithms.

Applied Internship in AI, MeteoSwiss *October 2023 - March 2024*
Development of ML model for thunderstorm predictions for Swiss aviation sector supervisor: **Dr. Roman Attinger**

- This work was **presented at the European Meteorological Society Annual Meeting** held in September 2024: https://meetingorganizer.copernicus.org/EMS2024/EMS2024-451.html
- I successfully provided an ML-based approach to predict thunderstorms over Switzerland that performed considerably better (e.g. in terms of F-scores) than previous solutions. This is a hard problem as thunderstorms are unpredictable for long lead times and suffer from heavy class imbalance. The approach will be operational in 2025 and used as part of a service for an air navigation service provider.
- I evaluated the performances of preexisting prediction services, i.e. unstructured data from human forecasters, and operational model outputs. I set up a large part of the ML pipeline and used UNet and FCN50 architectures to output spatial probabilistic grids of thunderstorm occurrences for different lead times. I trained on GPUs on a high-performance computer with Slurm, and used Git.

Master's Thesis, ETH Zurich *February 2023 - August 2023*
Interactions between Benign Overfitting and Regularization supervisor: **Prof. Dr. Sara van de Geer**

- I investigated overfitting that does not hurt generalization in overparametrized linear and ridge regression, by studying the minimum-norm solutions with respect to l^2-norm, with tools from high-dimensional probability and statistics. I also made progress to extend it to general minimum l^p-norm solutions. This problem setting is motivated by deep learning algorithms that perfectly fit their training data and still generalize well.

Semester Paper, ETH Zurich *September 2022 - January 2023*
Metric Entropy of Pseudodifferential Operators supervisor: **Prof. Dr. Helmut Bölcskei**

- I examined techniques from microlocal analysis to approximate the metric entropy (a complexity measure) of classes of functions with a view towards understanding the expressiveness of deep neural networks.

Professional Experience

Vector Institute *April 2024 - December 2024*
Research Intern in AI: theoretical foundations of ML, statistical learning theory Toronto, Canada

Federal Office of Meteorology and Climate MeteoSwiss *October 2023 - March 2024*
Mandatory Swiss civil service: Weather forecasting using Machine Learning Zürich

ETH Zurich *September 2022 - December 2022*
Teaching Assistant in Linear Algebra for BSc students in mathematics and physics Zürich

Swiss Military Service *July 2020 - November 2020*
Mandatory Swiss military service: Infantry

Technical Skills

Python: Pytorch, Scikit-learn, Pandas, Numpy, NetCDF for ML projects
R: Computational statistics course
C# & Java: Basic knowledge
Coursework: Machine Learning, Probability Theory, Statistics, Mathematics of Information, Probabilistic AI, Graph Algorithms, Convex Optimization, Random Matrices
Languages: English: Fluent, French: Mother tongue, German: Conversational

Extracurricular Activities

Centaur AI Institute: Neuro-Symbolic AI Summer School *September 2024*

ETH Zurich: ETH Week, week-long interdisciplinary team project on the topic of health *September 2021*

University of Neuchatel: Representative at the Institute of Mathematics *Sept. 2018 - Sept. 2019*

Grants and Scholarships

Conference on Learning Theory (COLT) Travel Grant *1500 CAD (Canadian Dollars)*
2024

Vector Institute Research Grant *15000 CAD (Canadian Dollars)*
2024

Swiss-European Mobility Programme Scholarship *3200 CHF (Swiss Francs)*
2019

Hobbies

Rock Climbing

Drawing