

Education

- 2025-2026 **IASD, MSc. in Artificial Intelligence**, PSL, Dauphine - ENS - Mines Paris
Learning Theory, Large Language Models, Mathematics of Deep Learning, Reinforcement Learning, Computer Vision, Manifold Learning, Non-convex Optimization, XAI.
- 2020-2022 **MSc. in Mathematics**, ETH Zürich, Switzerland
Analysis, Algebra, Probability, Geometry, Topology, Combinatorics, Graphs, Group Actions, Neural Network Theory. Master's thesis in Category Theory applied to Quantum Information.
- 2017-2020 **BSc. in Mathematics**, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland
Analysis, Linear Algebra, Algebraic Structures, Probability, Statistics, Combinatorics, Theoretical Computer Science, Physics, OO Programming in C++, Climate, Philosophy of Science.
- 2019-2020 **Year Abroad**, University of Bristol, UK
Algebra, Number Theory, Set Theory, Logic. Bachelor's Thesis supervised by Dr. Scott Harper in Group Theory: *The Mathieu Groups*.
- 2017 **French Baccalauréat**, Lycée Vieljeux, La Rochelle, France
French high school Diploma in Science. Highest honors.

Work Experience

- 2026 **Research Associate**, Universität des Saarlandes, Saarbrücken, Germany
Fixed term research position: April-August, working alongside Prof. Michael Hahn within the Language, Computation and Cognition Lab (LaCoCo). Exploring limits of LLMs, in particular looking at Fixed-Precision Transformers with a focus on Length Generalization capabilities, employing both theoretical and empirical approaches.
- 2024 **Data Scientist**, Shift Technology, Paris, France
Data Scientist role at the French unicorn Shift Technology. Great emphasis on Data Engineering. Extract, Transform and Load processes (ETL), in order to link clients' data to the company database. Build fraud detection scenarios according to clients' needs, making use of machine learning models for fraud classification. C#, SQL, Python, Scikit-Learn, Agile methodology, Octopus Deploy, Git.
- 2024 - 2025 **Mathematics Expert - Proofreader**, Outlier AI, Remote
Correction and formatting. LLM fine-tuning for mathematical and reasoning abilities.
- 2023-2025 **Waiter**, Paris, France
- 2022 **Visiting Researcher**, University of Cambridge, UK
Position held at the University of Cambridge, during the completion of my Master's thesis. Work on algebraic structures - 2-categorical 'biunitary quantum structures' - representing quantum logic gates and quantum measurements. My stay was supervised by Prof. Jamie Vicary from the University of Cambridge and co-supervised by Prof. Thomas Willwacher from ETH Zürich.
- 2018-2021 **Academic Teaching Assistant**, EPFL & ETH Zürich, Switzerland
Linear Algebra: exercises sessions for EPFL first year students.
Partial Differential Equations: teaching, exercises and corrections for ETHZ second year students.
- 2020 **Lecturer**, Institut Privé Voltaire (INPV), Switzerland
Two months of lectures and assistantship for a class of future EPFL students in Analysis, Linear Algebra and Physics.

Publications

[1] P. W. Claeys, M. Henry, J. Vicary, and A. Lamacraft, *Exact dynamics in dual-unitary quantum circuits with projective measurements.*, *Physical Review Research*, 4(4), 043212 (2022).

Description: This paper introduces a specific type of projective measurement, applied to dual-unitary quantum circuits, that preserves the exact traceability of correlation and entanglement between quantum systems (e.g. qubits).

Code Projects

Robustness of a CIFAR-10 classifier

Building a robust image classifier on the CIFAR-10 dataset to withstand adversarial attacks. Basic convolutional neural network on which is applied adversarial training (from FGSM and PGD). Attempts to improve robustness with randomized networks and Lipschitz regularization.

Mechanistic Interpretability: Circuit Analysis on GPT-2

Implementation of parts of the circuit analysis provided by the paper *Interpretability in the Wild: A Circuit for Indirect Object Identification in GPT-2 Small*. Focus on attention heads' roles identification and circuit metrics computation, such as minimality and completeness.

MNIST digit generation with GANs

Development of Generative Adversarial Networks for synthetic MNIST digit image generation. Improvement of the generator's performance and output diversity by modelling the latent space input using a *Gaussian Mixture Model*. Models evaluations based on built metrics.

GPT from Scratch

Implementation of a Generative Pre-trained Transformer architecture: data preprocessing, custom tokenization, Word2Vec embeddings, transformer structure implementation including masked multi-head attention layers finally leading to an autoregressive generation model.

Collaborative Filtering with Matrix Factorization

Collaborative Filtering system using Matrix Factorization. Alternating Least Squares based methods like *UserReg*. Enhanced performance by integrating *Heterogeneous Information Networks* to embed and fuse contextual movie data (title, genre, release date) into the model.

Automatic Playlist Generation from Text Inputs

Generation of Spotify playlists based on a natural language prompt. For each track, construction of a descriptive sentence combining metadata and audio attributes. The sentences are converted into semantic embeddings using a pre-trained BERT-type model. Identifying the closest vectors to the prompt in the latent space to generate the playlist.

Forecasting Gas Use in the French Electricity Energy Mix

Prediction of electricity production from gas combustion in France using historical RTE energy time series and weather data. Conventional steps of a prediction pipeline from data cleaning to model evaluation. Emphasis on seasonal analysis.

Interests

Academic Interests

LLMs, Learning Theory, Interpretability, Deep Learning, AI Safety, Combinatorics, Compositionality

Other Interests

Music, Sustainability, Literature, Politics, Hiking, Football, Philosophy.