Nemo Fournier

Curriculum vitæ

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Education

2021 – 2024 **PhD Student at the Paris Brain Institute**.

2017 – 2021 **Élève de l'École Normale Supérieure de Lyon**.

2018 – 2020 **Master Degree in Computer Science**, *ENS de Lyon*, *with highest honours*.

2017 – 2018 **Bachelor Degree in Computer Science**, *ENS de Lyon*, *with honours*.

2015 – 2017 **Classe Préparatoire Scientifique (C.P.G.E)**, Toulouse.

2015 **Baccalauréat Scientifique**.

Internships

March 2021 – July 2021 **5 Months Research Internship**, *Aramis Lab*, Paris Brain Institute, supervised by Stanley Durrleman.
Longitudinal Analysis for the Discovery of Neurodegenerative Diseases Subtypes

September 2020 – February 2021 **5 Months Research Internship**, *IMAGES team*, Telecom Paris, supervised by Pietro Gori, joint work with Jean Feydy and Pierre Roussillon.
Tractogram Segmentation using Geometry Induced Metrics and Optimal Transport

January – June 2020 **5 Months Research Internship**, *Empenn*, Inria Rennes, co-supervised by Pierre Maurel and Julie Coloigner.
Graph-based Methods for Brain Structural Connectivity Analysis

May – July 2019 **3 Months Research Internship**, *University of Edinburgh*, supervised by Kartic Subr, joint work with Tatiana Lopez-Guevara.
Reinforcement Learning of Parameters in Complex Physical Systems

June – July 2018 **6 Weeks Research Internship**, *IXXI*, Lyon, co-supervised by Paulo Gonçalves and Patrick Flandrin.
Geometry and Statistics of the Time-Frequency Signature of *High-Frequency Oscillations* in EEG

Responsabilities

2022 - Present ***Communication* for the Young Researchers of the Paris Brain Institute**.
Responsible for the communication (mailing-lists, website, social-media, connection with institutions) in *Les Ajités* association, which organize multiple scientific and social activities aimed at young researchers of the neuroscience community.

2018 - 2020 **Head of the *Hardware* team for the Symbolibre project**.
Working on the conception of the first prototypes of the Symbolibre graphic calculator, from hardware selection and design to building the actual physical prototype.

Winter 2017-2018 **Organiser of a *sport-study* conference week**.
Logistic and scientific organisation of a week of conferences about current research topics in computer science, aimed at computer science students of the ENS de Lyon

Teaching

September - December 2022 **Apprentissage par la Recherche**, *Institut de Psychologie de Paris*.
Semester of transversal courses on *Science and Research* for 1st year Bachelor Students in Psychologie. Introduction to what constitutes a *science*, how hypothesis are formulated and tested, how to search for, read and synthetize research articles (48h — APR 1)

January - February 2022 **Statistics & Linear Models**, *Telecom ParisTech*.
Practicals and Exercise Sessions (TPs / TDs) covering linear models with a statistical approach, deriving hypothesis testing frameworks and generalization (dimensionality reduction, regularization paradigms, etc) (SD-TSIA204)

January 2022 **Longitudinal Data Analysis**, *AI4Health Winter School*.
Practicals introducing mixed-effects models for the analysis of longitudinal data to a broad audience (from clinicians to data-scientists). Covered topics included cohort analysis, data simulation, non linear models, modeling of ordinal data.

Published Work

Journal Articles

[1] Rémi Flamary, Nicolas Courty, Alexandre Gramfort, Mokhtar Z Alaya, Aurélie Boisbunon, Stanislas Chambon, Laetitia Chapel, Adrien Corenflos, Kilian Fatras, **Nemo Fournier**, et al. Pot: Python optimal transport. *Journal of Machine Learning Research*, 22(78):1–8, 2021.

Conference Papers

[2] **Nemo Fournier** and Stanley Durrleman. A multimodal disease progression model for genetic associations with disease dynamics. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pages 601–610. Springer, 2023.

Miscellanous Translations

[3] Florian Besson. Fabrice Mouthon, Le Sourire de Prométhée. L'homme et la nature au Moyen Âge. *Lectures*, January 2021. Translated to English by **Fournier, Nemo** and Kaisla, Emma.

Languages

French	Fluent (*Mother Tongue*)	Spanish	B2 (*School*)
English	C1 (*CAE, 2018*)	Deutsch	A1 (*School*)

Computer skills

Programming C, C++, Python, Matlab / Octave, Torch, TensorFlow, MPI
Tools LaTeX, Git, UNIX systems

Courses Attended

September 2017 – January 2018 **First Semester of Bachelor**.

- **Algorithms 1.** Algorithm design, complexity, NP-completness, approximations
- **Architecture and System.** Computer architecture from ISA to VHDL
- **Computability.** Computation models, language theory, (in)decidability
- **Programming theory.** Semantics of languages, typing, lambda calculus
- **Project 1.** Programming class, with focus on good programming practices
- **Algebra.** Duality, bilinear algebra, quadratic forms, groups and representations

January 2018 – June 2018 **Second Semester of Bachelor**.

- **Algorithms 2.** Emphasis on data structures, graph theory, algorithms on words
- **System and Networks.** Operating system design, communication networks
- **Logic.** Set theory, first-order logic, model theory, Peano's axioms, Gödel's theorems
- **Probability.** Probability theory, Markov chains, randomized algorithms, statistics
- **Preparation for ACM.** Training in the effective resolution of algorithmic problems
- **Signal Processing.** Processes, spectral estimation, sampling, filtering, transforms
- **Physics, Information and Computation.** Feyman's rules, quantum computations and algorithms and information theoretic approach, IBM Q

September 2018 – January 2019 **First Semester of Master**.

- **Performance Evaluation and Networks.** Random processes, queuing theory
- **Compilers and Program Analysis.** Writing a compiler, static analysis of programs
- **Information Theory.** Entropy, compression, Shannon's theorems, correcting codes
- **Parallel and Distributed Algorithms.** PRAMs, ring and grids, MPI
- **Optimisation, Approximation.** Linear programs, SDP, non-linear optimization

January 2019 – May 2019 **Second Semester of Master**.

- **Computational Geometry and Digital Images.** Image and shape representation and processing, computational geometry, data structures for geometry, rendering
- **Computer Algebra.** Arithmetic of polynomials, structured and fast linear algebra
- **Cryptography and Security.** Symmetric and asymmetric crypto, security proofs
- **Machine Learning.** Standard methods, bounds and guaranties, boosting theory, non-parametric methods, metric learning, optimal transport
- **Data Bases and Data Mining.** Relational model, functional relations, Armstrong's system, normalisation, data mining, clustering

September 2019 – January 2020 **Third Semester of Master**.

- **Machine Learning.** Theoretic machine learning, project on anomaly detection.
- **Numerical Methods for Computer Graphics.** Tools for image processing (Poisson processing, Monte-Carlo Methods, Optimal Transport, Manifold Frameworks)
- **Numerical Mechanics.** Theoretical and practical tools for simulation (Lagrangian mechanics, elasticity, inverse problems, slender structures, frictionnal contacts)
- **Hidden Markov models for time series classification and filtering.** Markov models for the analysis of time series data, focus on Bayesian decision and filtering.
- **Selected Topics in Information Theory.** Information theory, concentration inequalities, detection and estimation, hypothesis testing, decision-making processes, data compression, transmission and analysis.
- **Quantum Information and Computation.** Quantum information (quantum circuits, Shor's algorithm, Grover's algorithm) to geometry of entangled states
- **Modern Algorithms for Symbolic Summation and Integration.** Solving the problem "*[50] Develop computer programs for simplifying sums that involve binomial coefficients.*" from Knuth's Art of Computer Programming Book

September 2020 – Present **Extra courses followed as an *auditeur libre* or *self-study***.

- **IMA 204** at Telecom Paris, overview of medical image modalities and processing
- **Foundations of Distributed and Large Scale Computing Optimization** at Centrale Paris, non-differentiable optimization theory and numerical schemes
- **Differential and Riemannian Geometry** (self-study)