Jean Feydy

PhD student at the École Normale Supérieure de Paris/Cachan

12 allée Jacques Tati
Joinville-le-Pont, France, 94340
(+33) 6 32 54 65 63
jean.feydy@ens.fr
www.math.ens.fr/~feydy
Citizenship : French
Date of birth: June 4th, 1994

Education

2016–2019 **PhD in applied mathematics**, *École Normale Supérieure de Cachan*.
Focus on automatic differentiation and optimal transport for diffeomorphic shape registration, under the supervision of Alain Trouvé.

2015–2016 **Pre-doctoral internship**, *École Normale Supérieure de Cachan*.
Under the supervision of Alain Trouvé.

Ap.-Sep. 2015 **MVA internship**, *Siemens Healthcare, Princeton, NJ*, design of a real-time denoising pipeline using structure tensors and steerable wavelets.

2014–2015 **Student at the M2 MVA, "Mathematics, Vision, Learning"**, *École Normale Supérieure de Cachan*, graduated with highest honours and a 17.75/20 grade.

1st Semester Courses :
- Sub-pixel Image Processing
- Convex Optimization
- Object Recognition and Computer Vision
- Mathematical Methods for Neurosciences

2nd Semester Courses :
- Geometry and Shapes Spaces
- Advanced Medical Imaging
- Points Clouds and 3D Modelization
- Brain-Computer Interfaces

2012–2016 **Student at the École Normale Supérieure (Paris)**, *Major in Mathematics*.

1st Year Subjects included :
- Signal Processing
- Compilers
- Probability Theory

2nd Year Subjects included :
- Differential Geometry
- Functional Analysis
- Statistics

july 2012 **Accepted at the École Normale Supérieure (Paris)**, *in Mathematics, Physics and Computer Science*, Ranked 31^{st} (out of 1571) in a nationwide competitive exam.

2010–2012 **2-year intensive program preparing for the national competitive exam for entry to engineering schools**, *Lycée Marcelin Berthelot*, Saint-Maur-des-Fossés.

Publications

2018 **Interpolating between Optimal Transport and MMD using Sinkhorn divergences**, *submitted to AiStats 2019, ArXiv:1810.08278*, Jean Feydy, Thibault Séjourné, François-Xavier Vialard, Shun-ichi Amari, Alain Trouvé, Gabriel Peyré.

Global divergences between measures: from Hausdorff distance to Optimal Transport, *ShapeMI workshop (oral presentation), MICCAI 2018*, Jean Feydy, Alain Trouvé.

2017 **Optimal Transport for Diffeomorphic Registration**, *MICCAI 2017 (main track, oral presentation)*, Jean Feydy, Benjamin Charlier, F.-X. Vialard, Gabriel Peyré.

Distortion minimizing geodesic subspaces in shape spaces and computational anatomy, *VipImage 2017*, Benjamin Charlier, Jean Feydy, David W. Jacobs and Alain Trouvé.

Software

2018 **KeOps: Kernel Operations on the GPU, with autodiff, without memory overflows**, *CUDA/C++11 library with PyTorch, NumPy and Matlab bindings:* `www.kernel-operations.io`, Benjamin Charlier, Jean Feydy, Joan Glaunès.

Global divergences between measures, *PyTorch implementation of MMD/kernel norms, Hausdorff distances and Optimal Transport costs that scales up to 1,000,000 samples or vertices:* `github.com/jeanfeydy/global-divergences`.

2017 **Numerical tours on Machine Learning**, *tutorials on supervised ML, convolutional neural networks, generative model fitting and Riemannian shape analysis:* `www.math.ens.fr/~feydy/Teaching`, *to be uploaded on* `www.numerical-tours.com`.

Shapes toolbox, *efficient PyTorch implementation of standard LDDMM algorithms on meshes:* `plmlab.math.cnrs.fr/jeanfeydy/shapes_toolbox`.

Teaching

2016–2019 **Tutor and teaching assistant ("Caïman")**, *École Normale Supérieure (Paris)*.

- Introduction to Riemannian geometry through the study of shapes spaces – lectures and monitoring of a reading group.
- Mathematical Foundations of Data Sciences (wavelets, sparsity, CNNs and optimal transport) – workshop sessions, with lectures by Gabriel Peyré.
- Mathematical Culture: a journey from highschool to research, with applications – lectures targeted at non-mathematicians at the ENS.

Redaction of three ~150 pages long manuals – one for each class.

2012–2016 **Teaching assistant (mathematics) in preparatory classes, MPSI and MP***, *Lycée Marcelin Berthelot, Saint-Maur-des-Fossés and Lycée Louis-le-Grand, Paris.*

Small projects, Memoirs and Internships

Some Projects Fragment of C to MIPS assembly compiler.

Screened Poisson Surface Reconstruction: Theoretical study and implementation from scratch using a quad-tree structure on the 2D plane.

Gradients Line Drawing: Sub-pixel computation of a gradient flow, with theoretical analysis and implementation of a Matlab toolbox.

Memoirs ENS admission: Study of the asymptotic properties of hyperbolic Cayley graphs.

Licence's thesis: Statistical and theoretical study of discretized polynomial maps.

Master's thesis: Study and design of real-time medical imaging denoising algorithms, using structure tensors and steerable wavelets.

Internships One month long internship (summer 2014) at Tsinghua University, Beijing : Study of Gilbert Strang's *Introduction to Applied Mathematics.*

Five months long master's thesis (April to September 2015) at Siemens CT Healthcare in Princeton, NJ. Design of a denoising pipeline using steerable wavelets.