

Jean-Yves Franceschi

Curriculum Vitae

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Research

January 2022 **Researcher**, *Criteo*, Paris, France

Member of the Criteo AI Lab (<https://ailab.criteo.com/>). I am developing my research around deep generative modeling [2] and (spatio-)temporal modeling [1], in line with the topics I tackled during my Ph.D.

September 2018 – February 2022 **Ph.D. Student**, *Sorbonne Université, LIP6 / Institut Systèmes Intelligents et de Robotique, team MLIA*, Paris, France, supervised by Sylvain Lamprier and Patrick Gallinari

I worked on dynamical systems for representation learning and deep generative modeling; cf. <https://jyfranceschi.fr/phd/> for more resources.

One of the main directions of this work was to investigate the role of differential equations for the modeling and prediction of spatiotemporal data. Inspired by the connections between differential equations and neural networks, I designed with colleagues a novel temporal model based on residual connections instead of recurrent neural networks that lead to state-of-the-art results for stochastic video prediction. This work was accepted to ICML 2020 [4]. We also leveraged a resolution technique for partial differential equations, the functional separation of variables, to propose a novel interpretation of spatiotemporal disentanglement, leading to a simple but performant disentangled predictive model. This work was accepted to ICLR 2021 [3].

Furthermore, we used dynamical systems describing the temporal evolution of neural networks during training in order to better understand the training dynamics of generative models. In particular, leveraging the neural tangent kernel theory, we proposed a novel theoretical framework for the understanding of generative adversarial networks [2, accepted at ICML 2022] based on modeling the training of the discriminator as a neural network thanks to a differential equation, gaining novel insights on this popular generative model.

Finally, I was during this time a teacher assistant at Sorbonne Université in Computer Science and participated in organizing a reading group about spatiotemporal machine learning.

March 2017 – July 2018 **Research Internship**, *Ecole Polytechnique Fédérale de Lausanne, Machine Learning and Optimization Laboratory*, Lausanne, Switzerland, 19 weeks, supervised by Martin Jaggi

I worked on unsupervised scalable representation learning for time series. We designed a method combining an encoder based on causal dilated convolutions with a novel triplet loss employing time-based negative sampling, obtaining general-purpose representations for variable-length and multivariate time series in a scalable manner. This work was accepted to NeurIPS 2019 [5].

- September 2017 – February 2018 **Research Internship**, *Ecole Normale Supérieure de Lyon, Laboratoire de l'Informatique et du Parallélisme, team MC2*, Lyon, France, 25 weeks, supervised by Omar Fawzi
 I worked on theoretical aspects of machine learning, such as adversarial examples and convex optimization.
 We bounded the ratio between the amplitude of adversarial perturbations (imperceptible perturbations altering the classification of an image) and classifiers robustness to random perturbations for linear classifiers, extended the result to more general classifiers, and experimentally verified it on state-of-the-art neural networks. This work was accepted to AISTATS 2018 [6].
 Our work on convex optimization consisted in studying the precise query complexity of convex optimization problems (existing algorithms and lower bounds) and formalizing query complexity for convex optimization in the quantum setting.
- February – June 2017 **Research Internship**, *Inria Antenne Lyon - La Doua, team Privatics*, Lyon, France, 20 weeks, supervised by Daniel Le Métayer
 I worked on the emerging field of accountability of decision algorithms, more particularly on decision explanation (why did a classifier output a given result?) and fairness (how to detect and design fair classifiers?), with an emphasis on learning procedures. We produced a first attempt of a state-of-the-art review of the field.
- May – July 2016 **Research Internship**, *University of Konstanz, Computer Graphics and Media Informatics working group*, Konstanz, Germany, 11 weeks, supervised by Abdalla Gaafar Ahmed and Oliver Deussen
 I worked on blue-noise sampling in computer graphics. After a review of the topic and of the standard and state-of-the-art techniques, I worked on an in-development sampling method, studied it and proposed a variant improving its blue-noise properties. A paper related to this topic was published in IEEE TVCG [7].
- June & July 2015 **Research Internship**, *Inria Sophia Antipolis, team Marelle*, Valbonne, France, 6 weeks, supervised by Yves Bertot
 I worked on the integration of the “differential dynamic logic” – a logical system aiming to prove properties about physical systems – in the higher order proof system Coq. We managed to implement its basis and start a reflexion about how to modify this logic for a potential implementation to be convenient to write and use.

Publications

- [1] Y. Yin, M. Kirchmeyer, J.-Y. Franceschi, A. Rakotomamonjy, and P. Gallinari. “Continuous PDE Dynamics Forecasting with Implicit Neural Representations”. In: *International Conference on Learning Representations*. 2023.
- [2] J.-Y. Franceschi, E. de Bézenac, I. Ayed, M. Chen, S. Lamprier, and P. Gallinari. “A Neural Tangent Kernel Perspective of GANs”. In: *Proceedings of the 39th International Conference on Machine Learning*. Vol. 162. Proceedings of Machine Learning Research. Baltimore, MD, USA: PMLR, July 2022, pp. 6660–6704.
- [3] J. Donà, J.-Y. Franceschi, S. Lamprier, and P. Gallinari. “PDE-Driven Spatiotemporal Disentanglement”. In: *International Conference on Learning Representations*. 2021.
- [4] J.-Y. Franceschi, E. Delasalles, M. Chen, S. Lamprier, and P. Gallinari. “Stochastic Latent Residual Video Prediction”. In: *Proceedings of the 37th International*

Conference on Machine Learning. Vol. 119. Proceedings of Machine Learning Research. Virtual: PMLR, July 2020, pp. 3233–3246.

- [5] **J.-Y. Franceschi**, A. Dieuleveut, and M. Jaggi. “Unsupervised Scalable Representation Learning for Multivariate Time Series”. In: *Advances in Neural Information Processing Systems 32*. Curran Associates, Inc., 2019, pp. 4650–4661.
- [6] **J.-Y. Franceschi**, A. Fawzi, and O. Fawzi. “Robustness of classifiers to uniform ℓ_p and Gaussian noise”. In: *Proceedings of the Twenty-First International Conference on Artificial Intelligence and Statistics (AISTATS)*. Vol. 84. Proceedings of Machine Learning Research. Playa Blanca, Lanzarote, Canary Islands: PMLR, Apr. 2018, pp. 1280–1288.
- [7] A. G. M. Ahmed, J. Guo, D. M. Yan, **J.-Y. Franceschi**, X. Zhang, and O. Deussen. “A Simple Push-Pull Algorithm for Blue-Noise Sampling”. In: *IEEE Transactions on Visualization and Computer Graphics* 23.12 (Dec. 2017), pp. 2496–2508.

Reviewing

- 2023 **ICLR (three papers)**.
- 2022 **ICLR (three papers), ICML (one paper), NeurIPS (4 papers), TMLR (2 papers)**.
Top reviewer at NeurIPS.
- 2021 **ICML (one paper), NeurIPS (7 papers)**.
Outstanding reviewer at NeurIPS.

Teaching

- September 2018 – August 2021 **Teaching Assistant**, *Computer Science*, Sorbonne Université, Paris, France
- 2020:
 - **Algorithmique I** (38.5h), 2nd year of Bachelor: tutorials covering algorithmics foundations (halting, correctness, complexity, trees, and graphs).
 - **Projet (application)** (38.5h), 2nd year of Bachelor: supervizing around 15 group projects to build an artificial intelligence for two-player games (Awele, Othello) in Python.
 - **Statistiques et informatique** (14h), 3rd year of Bachelor: supervizing around 30 group projects to design and analyze probabilistic strategies for the Battleship game, as an application of a statistics course.
 - **Programmation fonctionnelle** (21h), 2nd year of Bachelor: functional programming and OCaml practical works.
 - 2019:
 - **Introduction à la programmation Objet** (19.25h), 2nd year of Bachelor: object-oriented programming and Java practical works.
 - **Projet (application)** (38.5h), 2nd year of Bachelor: supervizing around 15 group projects to build an artificial intelligence for two-player games (Awele, Othello) in Python.
 - 2018:
 - **Introduction à la programmation Objet** (19.25h), 2nd year of Bachelor: object-oriented programming and Java practical works.

Education

- 2022 **Ph.D., Computer Science**, *Sorbonne Université*, Paris, France
Ph.D. (doctorat) defended on February 14th, 2022; cf. <https://jyfranceschi.fr/phd/> for related resources.
- 2018 **Ecole Normale Supérieure de Lyon Diploma**, *Ecole Normale Supérieure de Lyon*, Lyon, France
- 2017 **Master of Science, Foundations of Computer Science**, *Ecole Normale Supérieure de Lyon*, Lyon, France, *GPA: 4.00*
Obtained with highest honors.¹
- 2015 **Bachelor of Science, Foundations of Computer Science**, *Ecole Normale Supérieure de Lyon*, Lyon, France, *GPA: 4.00*
Main and mandatory bachelor (*licence*), obtained with highest honors.¹
- 2015 **Bachelor of Science, Mathematics and Applications**, *Université Claude Bernard Lyon I*, Villeurbanne, France, *GPA: 3.50*
Bachelor (*licence*) followed under the scope of a double degree, obtained with highest honors.¹
- 2014 **Admission to the Ecole Normale Supérieure de Lyon over a competitive exam**
The Ecole Normale Supérieure de Lyon is a French “Grande Ecole”, *i.e.* a leading institution of higher education entrance to which is based on a competitive examination. It provides a four-year training designed for future researchers and scientists.
- 2012–2014 **Scientific Classes préparatoires MPSI/MP**, *Centre International de Valbonne*, Valbonne, France
“Classes préparatoires” are a two-year intensive course preparing for the competitive entrance examinations to French “Grandes Ecoles”. They provide a high-level scientific formation based on Mathematics (14 hours a week), Physics (10 hours a week), Computer Science (5 hours a week), English (3 hours a week) and Philosophy (2 hours a week), and require a consequent investment and a lot of personal work.
- 2012 **Baccalauréat scientifique**, Ajaccio, France
High-school diploma with a scientific major, obtained with highest honors.

Accomplishments

- 2015 Ranked 10th as a member of the ENSL1 team (Simon Mauras, Timothée Pécatte and myself) at the Southwestern Europe Regional Contest (SWERC) 2015 of the ACM-ICPC contest.
- 2017 Ranked 12th as a member of the ENSL2 team (Simon Mauras, Raphaël Monat and myself) at the Southwestern Europe Regional Contest (SWERC) 2017 of the ACM-ICPC contest.

¹GPA computed thanks to the following conversion tool: <https://www.scholaro.com/gpa-calculator>.

Languages

French	Mother tongue	
English	Proficient	(B2 level) ¹
German	Intermediate	(B1 level) ¹

Computer Skills

Programming Languages

Intermediate	Java
Proficient	C, C++, Python, OCaml

Miscellaneous

Basic	SageMath, Maple, Mathematica, SQL
Intermediate	MPI, Qt, Coq Proof Assistant, Tensorflow
Proficient	LaTeX, PyTorch, JAX

¹See https://en.wikipedia.org/wiki/Common_European_Framework_of_Reference_for_Languages.