Vincent Roulet

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Positions

2022 - now	**Research Scientist**, *Google*, Google Brain, Seattle.
2021 - 2022	**Acting Assistant Professor**, *University of Washington*, Department of Statistics, Seattle.
2021 - 2022	**Acting Assistant Professor**, *University of Washington*, Department of Statistics, Seattle.
2020 - 2021	**Acting Instructor**, *University of Washington*, Department of Statistics, Seattle.
2018- 2020	**Research Associate (Postdoc)**, *University of Washington*, Department of Statistics, Seattle.

Education

2014 – 2017	**Doctorate in Applied Mathematics**, *Paris Sciences et Lettres Research University*, Paris. Equivalent of PhD in Optimization and Machine Learning. <u>Title</u>: *On the geometry of optimization problems and their structure.* <u>Advisor</u>: Alexandre d'Aspremont. <u>Location</u>: Department of Computer Science of the École Normale Supérieure.
2013 – 2014	**Master in Applied Mathematics**, *Télécom Paris*, Paris. Specialty in Mathematics, Vision, Learning at École Normale Supérieure Paris-Saclay. *Obtained with high honors.*
2010 – 2014	**Master and Engineering degree**, *École Polytechnique*, Paris. Specialty Electrical Engineering Equivalent of Master in Applied Mathematics, Physics, Computer Science. *Top ranked French university, admission through competitive national exams.*
2008 – 2010	**Classes Préparatoires**, *Lycée Louis-le-Grand*, Paris. Equivalent to Bachelor in Mathematics and Physics.

Papers

I have made several contributions to *optimization* and *machine learning*. Those have been published in peer-reviewed international journals (SIAM Journal on Optimization, Information and Inference) and main international conferences in machine learning (Conference on Neural Information Processing Systems, International Conference on Machine Learning). These conferences are very selective with an acceptance rate in general below 25%, and their proceedings play a role which is as important as international journals.

Published

Stochastic Optimization for Spectral Risk Measures, Ronak Mehta, Vincent Roulet, Krishna Pillutla, Lang Liu, Zaid Harchaoui, to appear in *Proceedings of the 26th International Conference on Artificial Intelligence and Statistics*, 2023.

Target Propagation via Regularized Inversion for Recurrent Neural Networks, Vincent Roulet, Zaid Harchaoui, *Transactions in Machine Learning Research*, 2023.

Revisiting Convolutional Neural Networks from the Viewpoint of Kernel-Based Methods, Corinne Jones, Vincent Roulet, Zaid Harchaoui, *Journal of Computational and Graphical Statistics*, 2022.

A Representation-Focused Training Algorithm for Deep Networks, Vincent Roulet, Corinne Jones, Zaid Harchaoui, *Proceedings of the 2022 IEEE Data Science and Learning Workshop (IEEEDSLW)*, 2022.

Differentiable Programming à la Moreau, Vincent Roulet, Zaid Harchaoui, *Proceedings of the International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022.

Discriminative Clustering with Representation Learning with any Ratio of Labeled to Unlabeled Data, Corinne Jones, Vincent Roulet, Zaid Harchaoui, *Statistics and Computing*, 2022.

On the Smoothing of Deep Networks, Vincent Roulet, Zaid Harchaoui, *2021 55th Annual Conference on Information Sciences and Systems (CISS)*, 2021.

On the Convergence to Stationary Points of the Iterative Linear Exponential Quadratic Gaussian Algorithm, Vincent Roulet, Maryam Fazel, Siddhartha Srinivasa, Zaid Harchaoui, in *Proceedings of the 2020 American Control Conference (ACC)*, 2020.

End-to-end Learning, with or without Labels., Corinne Jones, Vincent Roulet, Zaid Harchaoui, in *Proceedings of Joint Statistical Meetings, Winner of the 2020 ASA Computing/Graphics Student Paper Award*, 2020.

An Elementary Approach to Convergence Guarantees of Optimization Algorithms for Deep Networks, Vincent Roulet, Zaid Harchaoui, in *Proceedings of the 57th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, 2019.

Sharpness, Restart and Acceleration, *(Journal version),* Vincent Roulet, Alexandre d'Aspremont, in *SIAM Journal on Optimization (SIOPT)*, 2019.

Iterative Linearized Control: Stable Algorithms and Complexity Guarantees, Vincent Roulet, Siddhartha Srinivasa, Dmitriy Drusvyatskiy, Zaid Harchaoui, in *Proceedings of the 36th International Conference on Machine Learning (ICML)*, 2019.

Complexity versus Statistical Performance on Sparse Recovery Problems, Vincent Roulet, Nicolas Boumal, Alexandre d'Aspremont, *Information and Inference: a Journal of the IMA*, 2019.

A Smoother Way to Train Structured Prediction Models, Krishna Pillutla, Vincent Roulet, Sham Kakade, Zaid Harchaoui, in *Advances in Neural Information Processing Systems 31 (NeurIPS)*, 2018.

Sharpness, Restart and Acceleration, *(Conference version),* Vincent Roulet, Alexandre d'Aspremont, in *Advances in Neural Information Processing Systems 30 (NeurIPS)*, 2017.

Integration Methods and Accelerated Optimization Algorithms, Damien Scieur, Vincent Roulet, Francis Bach, Alexandre d'Aspremont, in *Advances in Neural Information Processing Systems 30 (NeurIPS)*, 2017.

Working papers

Modified Gauss-Newton Algorithms under Noise, Krishna Pillutla, Vincent Roulet, Sham Kakade, Zaid Harchaoui, *Manuscript submitted*, 2022.

Complexity Bounds of Iterative Linear Quadratic Optimization Algorithms for Discrete Time Nonlinear Control, Vincent Roulet, Siddhartha Srinivasa, Maryam Fazel, Zaid Harchaoui, *Manuscript under review*, 2022.

Iterative Linear Quadratic Optimization for Nonlinear Control: Differentiable Programming Algorithmic Templates, Vincent Roulet, Siddhartha Srinivasa, Maryam Fazel, Zaid Harchaoui, *Manuscript under review*, 2022.

Software

2019-now **ilqc**, Main contributor, `https://github.com/vroulet/ilqc`.
Software library for analyzing non-linear control algorithms from an optimization perspective. Implementation of classical nonlinear algorithms: gradient, Gauss-Newton, Newton, Differentiable Dynamic Programming approach with quadratic or linear-quadratic approximations. Oracles implemented in a differentiable programming framework, various line-searches tested for all algorithms. Diverse environments available with animations: pendulum, pendulum on a cart, simple model of a car, bicycle model of a cart. Model Predictive Controller implemented for a contouring objective of a track racing task with a complex track.

2021 **tpri**, Main Contributor, `https://github.com/vroulet/tpri`.
Implementation of Target Propagation oracles for recurrent neural networks using the analytical formulation of the inverses.

2021 **xsdc**, Contributor, `https://github.com/cjones6/xsdc`.
Implementation of semi-supervised learning methods with deep network feature representations (X-Supervised Discriminative Clustering). Implemented the comparisons with baselines.

2019 **casimir**, Contributor, `https://github.com/krishnap25/casimir`.
Software library for structured prediction problems. Implemented accelerated prox-linear algorithms by extrapolation.

Awards

2022 Best Poster Award at the 7th International Conference on Continuous Optimization

2019 University of Washington Data Science Postdoctoral Fellowship

2018, 2019, 2020 Outstanding reviewer for the Neural Information processing Systems Conference, granted to 10% of the reviewers.

2016 Start-up prize *Be the Future of Sound* organized by Société d'Accélération du Transfert de Technologies Lutech, received 70 000€ for the project Bloom.

2014 Outstanding investment award *"Outstanding student who has distinguished himself through his behavior, dedication and commitment to the student body"*, granted to 10% of the students of Ecole Polytechnique.

Teaching

Teacher

2020 **STAT 538 Statistical Learning**, *University of Washington*, Seattle.
Reviews optimization and convex optimization in its relation to statistics. Covers the basics of unconstrained and constrained convex optimization, basics of clustering and classification, entropy, KL divergence and exponential family models, duality, modern learning algorithms like boosting, support vector machines, and variational approximations in inference.
Graduate course, approx. 20 students, co-taught with Z. Harchaoui in Winter 2020.

2021-2022 **STAT 394 Probability I**, *University of Washington*, Seattle.
Axiomatic definitions of probability; conditional probability, independence, Bayes' theorem; classical discrete and continuous random variables; expectation, variance, quantiles; transformations of a single random variable; Markov and Chebyshev's inequality; weak law of large numbers.
Undergraduate course, approx. 120 students, taught in Winter 2021, Autumn 2021.

2020-2022 **STAT 395 Probability II**, *University of Washington*, Seattle.
Joint distributions; exchangeability; moment generating function; covariance, correlation; central limit theorem; conditional distributions.
Undergraduate course, approx. 70 students, taught in Spring 2020, 2021, Winter 2022.

2020 -2021 **STAT 516 Stochastic Modeling of Scientific Data I**, *University of Washington*, Seattle.
Markov chains; ergodic theorem; Monte Carlo Markov Chains; Hidden Markov Models; frequentist and Bayesian inference on Markov chains.
Graduate course, approx. 25 students, taught in Autumn 2021, 2022.

2021-2022 **STAT 517 Stochastic Modeling of Scientific Data II**, *University of Washington*, Seattle.
Gaussian processes; spatial linear regression; Gaussian Markov random fields; Poisson processes; Wiener processes.
Graduate course, approx. 15 students, taught in Winter 2021, 2022.

Teaching assistant

2014 – 2017   **Convex Optimization**, *Master Mathematics, Vision, Learning*, École Normale Supérieure Paris-Saclay, Paris.
Graduate course, approx. 90 students.

2013 – 2014   **Oral Interrogations in Mathematics**, *Classes Préparatoires in Mathematics and Physics*, Lycée Janson de Sailly, Paris.
Undergraduate course, approx. 30 students.

Tutorials

2019, 2020   **Automatic Differentiation**, *Statistical Machine Learning for Data Scientists*, University of Washington.
Lecture on automatic differentiation with code examples covering: how to compute gradients of a chain of computations, how to use automatic-differentiation software, how to use automatic-differentiation beyond gradient computations.

2018   **Optimization for Deep Learning**, *Summer School on Fundamentals of Data Analysis*, University of Wisconsin-Madison.
Interactive Jupyter Notebook for 30 attendees to understand the basics of optimization for deep learning: automatic-differentiation, convergence guarantees of SGD, illustration of the batch-normalization effect.

Academic service

Mentoring, committees

2018 – 2019   Mentored PhD student **Krishna Pillutla** on
- A Smoother Way to Train Structured Prediction Models.

2018 – 2019   Mentored PhD student **Corinne Jones** on
- Kernel-based Translations of Convolutional Networks,
- Learning Feature Representations for Discriminative Clustering with Limited Supervision.

2019–2020   Mentored 4 students for the Research Preliminary Exam at the Department of Statistics of the University of Washington.

2021   Examiner for the Research Preliminary Exam.

2021   Member of the MS Admission committee.

Scientific events

Fall 2019   Machine Learning and Optimization Reading Group at the University of Washington.

Oct. 2019   Session Chair for the Optimization and Deep Learning Session of the Annual Allerton Conference on Communication, Control, and Computing (Allerton) 2019.

Aug. 2019   Summer School on Foundations of Data Science, *University of Washington*, Seattle.
Supervised the conduct of the event each day, organized dinners for the speakers.

Reviewer

Conference Reviewer   Neural Information Processing Systems 2018-2020, 2022, International Conference on Machine Learning 2019, 2021, 2022, International Conference on Artificial Intelligence and Statistics 2021, Learning for Decision and Control 2021, American Control Conference 2022

Journal Reviewer   Journal of Machine Learning Research, Foundations of Computational Mathematics, Mathematics of Operation Research, SIAM Journal on Optimization, IEEE Transactions on Information Theory, IEEE Transactions on Image Processing, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Control Systems Letters,

Presentations

Jul 2022   Complexity Bounds of Iterative Linear Quadratic Optimization Algorithms for Discrete Time Nonlinear Control, *7th International Conference on Continuous Optimization (ICCOPT)*, Bethlehem, PA, USA, Talk, Poster *Best Poster Award.*

May 2022	A Representation-Focused Training Algorithm for Deep Networks, *IEEE Data Science and Learning Workshop*, Singapore (online), Talk.
May 2022	Differentiable Programming à la Moreau, *47th International Conference on Acoustics, Speech and Signal Processing*, Singapore (online), Talk, Poster.
May 2022	Complexity Bounds of Iterative Linear Quadratic Optimization Algorithms for Discrete Time Nonlinear Control, *3rd Biennial Meeting of SIAM Pacific Northwest Section*, Vancouver, WA, USA, Talk.
Mar. 2022	Complexity Bounds of Iterative Linear Quadratic Optimization Algorithms for Discrete Time Nonlinear Control, *INFORMS Optimization Society Conference (IOS)*, Greenville, SC, USA, Talk.
Mar. 2022	Complexity Bounds of Iterative Linear Quadratic Optimization Algorithms for Discrete Time Nonlinear Control, *Machine Learning and Optimization Seminar at the University of Washington*, Seattle, WA, USA, Talk.
Mar. 2021	On the Smoothing of Deep Networks, *55th Annual Conference on Information Sciences and Systems (CISS)*, Baltimore, MA, USA, Poster online.
Feb. 2021	From Statistical Bounds to Optimization Complexity in Sparse Recovery Problems, Non-Linear Dynamical Problems from a Optimization Viewpoint, *Seminar of the Department of Statistics*, Seattle, WA, USA, Talk online.
Jul. 2020	Automatic Differentiation Friendly Complexity Guarantees, *Workshop Beyond first order methods in Machine Learning Systems at the International Conference on Machine Learning 2020*, Vienna, Austria, Poster Online.
Jul. 2020	On the Convergence to Stationary Points of the Iterative Linear Exponential Quadratic Gaussian Algorithm, *American Control Conference*, Denver, CO, USA, Talk, Poster Online.
Jun. 2020	Computational Complexity versus Statistical Performance on Sparse Recovery Problems, *Seminar of the Department of Statistics*, Seattle, WA, USA, Talk.
Mar. 2020	Optimization Oracles for Chains of Computations, *Optimization for Machine Learning Workshop*, Centre International de Rencontres Mathématiques, Luminy, France, Talk.
Oct. 2019	Iterative Linearized Control from an Optimization Viewpoint, *Annual meeting of the Institute for Operations Research and the Management Sciences (INFORMS)*, Seattle, WA, USA, Talk.
Oct. 2019	Risk-Sensitive Control via Iterative Linearizations, *2nd Biennial Meeting of the SIAM Pacific Northwest Section*, Seattle, WA, USA, Talk.
Sep. 2019	Restarts of Accelerated Gradient Methods: Generic Theoretical Speed-up, *West Coast Optimization Meeting*, Vancouver, Canada, Talk.
Sep. 2019	An Elementary Approach to Convergence Guarantees of Optimization Algorithms for Deep Networks, *57th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, Urbana-Champaign, IL, USA, Talk.
Jun. 2019	Iterative Linearized Control: Stable Algorithms and Complexity Guarantees, *36th International Conference on Machine Learning (ICML)*, Long Beach, CA, USA, Talk and Poster.
Dec. 2018	A Smoother Way to Train Structured Prediction Models, *32nd Conference on Neural Information Processing Systems (NeurIPS)*, Montreal, Canada, Poster.
Dec. 2017	On the Geometry of Optimization Problems and their Structure, *Institut National de Recherche en Informatique en Automatique (INRIA)*, Paris, Thesis Presentation.
Dec. 2017	Sharpness, Restart and Acceleration, *31st Conference on Neural Information Processing Systems (NeurIPS)*, Montreal, Canada, Poster.
Dec. 2017	Integration Methods and Accelerated Optimization Algorithms, *31st Conference on Neural Information Processing Systems (NeurIPS)*, Montreal, Canada, Poster.
Jun. 2017	Integration Methods and Accelerated Optimization Algorithms, *Institut de Recherche en Informatique de Toulouse (IRIT)*, Toulouse, France, Talk.

Jun. 2017	<u>Learning with Clustered Penalties</u>, *Institut de Recherche en Informatique de Toulouse (IRIT)*, Toulouse, France, Talk.
Apr. 2017	<u>Sharpness, Restart and Acceleration</u>, *Optimization and Statistical Learning Workshop*, Les Houches, France, Talk and Poster.
Dec. 2015	<u>Supervised Clustering in the Data Cube</u>, *Transfer and Multi-Task Learning Workshop at the Conference on Neural Information Processing Systems*, Montreal, Canada, Talk and Poster.

Work Experiences

Internships

Summer 2014	**Intern**, *INRIA*, Paris. Studied hierarchical feature learning with kernel methods for computer vision.
Summer 2013	**Intern**, *Imperial College*, London. Studied applications of *Knows What It Knows* paradigm to bandit problems for recommendation.
Summer 2012	**Intern**, *Astrium EADS*, Bremen. Developed the statistical analysis of the pneumatic tests on the Ariane 5.

Entrepreneurship

2015 – 2016	**Entrepreneur**, *Bloom*, Paris. Leaded the development of a high quality multi-usage pocket size speaker within a team of 4 engineers. Selected to present the project at Échappée Volée organized by TedX Paris.

Social work

2010 – 2011	**Educator**, *Fondation d'Auteuil*, Paris. Helped teenagers with social difficulties, e.g. young immigrants, orphans, to get an education and work. Lived in a social residence with 8 teenagers for seven months to help provide them with good living conditions.