# Xavier **Bouthillier**

Computer Science · Machine Learning Researcher

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## Summary

I am a sixth-year PhD student in computer science at Mila, Université de Montréal. I am studying under the supervision of Pascal Vincent, specializing in machine learning, specifically deep learning. I am strongly interested in both research and software development.

During my Master's and PhD, I have done research on a wide array of subjects ranging from NLP, computer vision, and optimization to theoretical deep learning. I am now concentrating on studying the methodology for deep learning research, designing methods to improve reproducibility.

Beside research, I have been an important contributor to tools developed at LISA/Mila such as Theano and Pylearn2 and a mentor for students contributing to these projects. I am now the lead developer of the project Oríon, a platform for hyper-parameter optimization, supported by the Mila IDT team and for which we are currently signing collaboration agreements with the industry.

## Education

### Mila, Université de Montréal

PhD in Computer Science, Machine Learning — *2014 - 2020*

Master in Computer Science, Machine Learning — *2013 - 2014*

Bachelor in Computer Science — *2009 - 2012*

### Freiburg Albert-Ludwigs Universität (Germany)

Exchange program during Bachelor's degree — *2011-2012*

### CÉGEP Saint-Laurent

Natural Science — *2008 - 2009*

Music, Composition Profile — *2005 - 2008*

## Experience

### Mila, Université de Montréal — *Montréal, Canada*

Research Developer — *Oct. 2017 - Present*

- Lead developer of Oríon (See description for Oríon in Open Source Projects)

### Nuance Communications — *Montréal, Canada*

Research Intern — *Sep. 2016 - Dec. 2016*

- Improved the attention mechanism in the paper Hierarchical Attention Networks for Document Classification

### Nuance Communications — *Montréal, Canada*

Research Intern — *May. 2016 - Aug. 2016*

- Developed an algorithm to generate fake examples based on large medical documents.
- Reproduced the paper Hierarchical Attention Networks for Document Classification.
- Implemented a pipeline to convert large medical documents in deep hierarchical structures.

### Nuance Communications — *Montréal, Canada*

Research Intern — *Sep. 2014 - Jan. 2015*

- Applied deep learning models to a classification problem in natural language processing.
- Developed a new convolutional model inspired by n-grams using PyLearn2.

### LISA (Mila), Université de Montréal — *Montreal, Canada*

Research Assistant — *2010 - 2012*

- Learned website development from scratch.
- Implemented jQuery plugins.
- Maintained website and applied modifications on request.

## Teaching Experience

**IFT6390** Foundations of machine learning, *Teaching Assistant, Université de Montréal* — *Fall 2014*

**IFT6390** Foundations of machine learning, *Teaching Assistant, Université de Montréal* — *Fall 2013*

# Publications

## Journal Articles

Emonets: Multimodal Deep Learning Approaches for Emotion Recognition in Video
Samira Ebrahimi Kahou, Xavier Bouthillier, Pascal Lamblin, Caglar Gulcehre, Vincent Michalski, Kishore Konda, Sébastien Jean, Pierre Froumenty, Yann Dauphin, Nicolas Boulanger-Lewandowski
*Journal on Multimodal User Interfaces* 10.2 (2016) pp. 99–111. Springer, 2016

## Conference Proceedings

Accounting for variance in machine learning benchmarks
Xavier Bouthillier, Pierre Delaunay, Mirko Bronzi, Assya Trofimov, Brennan Nichyporuk, Justin Szeto, Nazanin Mohammadi Sepahvand, Edward Raff, Kanika Madan, Vikram Voleti, Samira Ebrahimi Kahou, Vincent Michalski, Tal Arbel, Chris Pal, Gael Varoquaux, Pascal Vincent
*Proceedings of Machine Learning and Systems* 3 (2021). 2021

Unreproducible Research is Reproducible
Xavier Bouthillier, César Laurent, Pascal Vincent
*International Conference on Machine Learning*, 2019

Fast Approximate Natural Gradient Descent in a Kronecker Factored Eigenbasis
Thomas George, César Laurent, Xavier Bouthillier, Nicolas Ballas, Pascal Vincent
*Advances in Neural Information Processing Systems*, 2018

Efficient Exact Gradient Update for Training Deep Networks with Very Large Sparse Targets
Pascal Vincent, Alexandre De Brébisson, Xavier Bouthillier
*Advances in Neural Information Processing Systems*, 2015

Combining Modality Specific Deep Neural Networks for Emotion Recognition in Video
Samira Ebrahimi Kahou, Christopher Pal, Xavier Bouthillier, Pierre Froumenty, Çaglar Gülçehre, Roland Memisevic, Pascal Vincent, Aaron Courville, Yoshua Bengio, Raul Chandias Ferrari
*Proceedings of the 15th ACM on International conference on multimodal interaction*, 2013

## Workshops

Improving Reproducibility of Benchmarks
Xavier Bouthillier
*CiML Workshop at Advances in Neural Information Processing Systems*, 2019

An Evaluation of Fisher Approximations Beyond Kronecker Factorization
César Laurent, Thomas George, Xavier Bouthillier, Nicolas Ballas, Pascal Vincent
*Workshop at International Conference on Learning Representations*, 2018

Oríon: Experiment Version Control for Efficient Hyperparameter Optimization
Christos Tsirigotis, Xavier Bouthillier, François Corneau-Tremblay, Peter Henderson, Reyhane Askari, Samuel Lavoie-Marchildon, Tristan Deleu, Dendi Suhubdy, Michael Noukhovitch, Frédéric Bastien
*AutoML Workshop at the International Conference on Machine Learning*, 2018

## Reports

Survey of machine-learning experimental methods at NeurIPS2019 and ICLR2020
Xavier Bouthillier, Gaël Varoquaux
Research Report hal-02447823, 2020

Theano: A Python Framework for Fast Computation of Mathematical Expressions
The Theano Development Team, Rami Al-Rfou, Guillaume Alain, Amjad Almahairi, Christof Angermueller, Dzmitry Bahdanau, Nicolas Ballas, Frédéric Bastien, Justin Bayer, Anatoly Belikov, ...
*arXiv preprint arXiv:1605.02688* (2016). 2016

Exact Gradient Updates in Time Independent of Output Size for the Spherical Loss Family
Pascal Vincent, Alexandre Brébisson, Xavier Bouthillier
*arXiv preprint arXiv:1606.08061* (2016). 2016

Dropout as Data Augmentation
Xavier Bouthillier, Kishore Konda, Pascal Vincent, Roland Memisevic
*arXiv preprint arXiv:1506.08700* (2015). 2015

# Open Source Projects

### Oríon (github.com/Epistimio/orion)

*Lead developer* *2017-Present*

Oríon is an open-source framework developed at Mila for distributed black-box optimization.

- Lead project directions and main goals
- Design architecture of the framework
- Recruit and interview potential candidates for Mila IDT team
- Mentor interns for software engineering
- Mentor students for research projects
- Design governance rules
- Provide support to users
- Give presentations and tutorials
- Write extensive documentation in reStructuredText
- Setup and maintain CI with Travis, github-actions and codecov
- Implemented an experiment version control system

### Mahler (bouthilx.github.io/projects/2-mahler)

*Developer - Prototype stage* *2019-Present*

Mahler is a framework to provide more control over workflow, better resiliency and better automation in HPC

- Implemented an automated remote installations using Fabrik for multi-cluster setups.
- Implemented a singularity-based workflow to easily deploy experiments on different clusters.
- Implemented a Dispatcher that monitors GPU usage and oversubscribe them with additional workers if possible.
- Implemented a dashboard using Dash to provide visualization and control over the pool of workers and registered tasks.

### Kleió (bouthilx.github.io/projects/4-kleio)

*Developer - Prototype stage* *2018-Present*

Kleió is an experiment manager that provides full traceability.

- Implemented a new data architecture based on the concept of events sourcing.
- Implemented remote commands (cat, tail, head, ...) for logs of experiments.

### Theano (github.com/Theano/Theano)

*Supervisor* *2015-2017*

Theano is a Python library that allows you to define, optimize, and evaluate mathematical expressions efficiently

- Mentored students contributing for the Common-Code-Workflow

# Presentations

| | | |
|---|---|---|
| 14 Jul 2021 | **Practical approaches for efficient hyperparameter optimization with Oríon** | *SciPy 2021, remote* |
| 9 Jun 2021 | **Oríon - Librarie pour l'optimisation d'hyperparamètres** shorturl.at/elqF3 | *Mila, remote* |
| 19 May 2021 | **Black-Box Optimization using Dask with Oríon** shorturl.at/pszLU | *Dask Summit 2021, remote* |
| 7 Apr 2021 | **Accounting for Variance in Machine Learning Benchmarks** youtu.be/-bukIBTkQiM | *MLSys 2021, remote* |
| 16 Mar 2021 | **Practical Approaches for Efficient Hyperparameter Optimization** youtu.be/QQ69vxF3LTI | *Parietal, INRIA, remote* |
| 12 Jan 2021 | **Oríon - A framework for distributed hyperparameter optimisation** shorturl.at/eoCEO | *Parietal, INRIA, remote* |
| 12 Jan 2021 | **On a quest for more trustworthy scientific conclusions in ML** shorturl.at/clCS4 | *Parietal, INRIA, remote* |
| 5 Nov 2020 | **L'intelligence artificielle dans les bibliothèques** Table ronde | *CBPQ, remote* |
| 17 Feb 2020 | **Reproducibility & Hyperparameter Optimization with Oríon** shorturl.at/duGIM | *Ai4Sim, Atos, remote* |
| 4 Dec 2019 | **Unreproducible Research is Reproducible** tinyurl.com/w6kmn2d | *CHAI, Berkeley, USA* |
| 28 Nov 2019 | **Oríon: A Framework for Distributed Hyperparameter Optimisation** tinyurl.com/t4ubtb4 | *Mila, Montreal, Canada* |
| 21 Nov 2019 | **Reproducibility in ML, or why benchmarks are lotteries** tinyurl.com/u54a7o6 | *Mila, Montreal, Canada* |
| 21 Nov 2019 | **Oríon: A Framework for Distributed Hyperparameter Optimisation** tinyurl.com/scxq63b | *Mila, Montreal, Canada* |
| 15 Nov 2019 | **Unreproducible Research is Reproducible** tinyurl.com/rkgp55k | *Mila, Montreal, Canada* |
| 31 Jul 2019 | **Reproducibility in AI** tinyurl.com/roue8js | *Stradigi AI, Montreal, Canada* |
| 13 Jun 2019 | **Unreproducible Research is Reproducible** tinyurl.com/w52vjsy | *ICML, Long Beach, USA* |
| 10 Apr 2019 | **Introduction à l'intelligence artificielle** For a specialized school for gifted children | *UdeM, Montreal, Canada* |
| 14 Nov 2018 | **Intelligence artificielle: Une fabrique à outils** tinyurl.com/yx6thyjd | *CPI, Montreal, Canada* |
| 12 Nov 2018 | **Introduction à l'intelligence artificielle** For high school *Forum des jeunes en science* | *CEGEP Montmo., Laval, Canada* |
| 30 Aug 2018 | **Tutorial on Oríon** tinyurl.com/u4pjkjy | *Mila, Montreal, Canada* |
| 14 Jul 2018 | **Oríon: Experiment Version Control for Efficient Hyperparameter Optimization** | *ICML, Stockholm, Sweden* |
| 26 Apr 2014 | **Introduction au langage de programmation Python** | *Google, Montreal, Canada* |

# Extracurricular Activity

### Reviewer

NeurIPS, ICML, ICLR, Neural Computation, AutoML Workshop,
NAS Workshop, Reproducibility Challenge, MLSys'20 (Artifact Evaluation), *2015 - Present*
Rethinking ML Papers workshop @ ICLR 2021

### Workshop Organizer

Retrospectives Workshop *Dec. 2019*

### Streaming Designer and Organizer

Mila, Université de Montréal *Mar. 2018 - Oct. 2018*

- Designed from scratch the setup, procedure and guidelines for recording and streaming at Mila.
- Trained dozen of volunteers to record and stream about a dozen different reading groups at Mila.
- Recorded and streamed weekly talks and PhD defenses.
- ***** Received a price of 6000$ to reward the quality and importance of the initiative and the work done.