

# Xavier Bouthillier

MACHINE LEARNING RESEARCHER · RESEARCH DEVELOPER

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## Summary

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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

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### Mila, Université de Montréal

PhD in Computer Science, Machine Learning

2014 - 2021

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

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### 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

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**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

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## 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, Çağlar 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

*CI ML 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

### Orion: 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

## Presentations

18 Nov 2021	<b>Reliability of benchmarks and why HPO is important</b>	<a href="https://youtu.be/ZRQF72IXiDc">youtu.be/ZRQF72IXiDc</a>	AutoML Seminar, remote
21 Sep 2021	<b>Accounting for Variance and HPO in ML Benchmarks</b>	<a href="https://tinyurl.com/m5t26u35">tinyurl.com/m5t26u35</a>	Microsoft Research, remote
14 Jul 2021	<b>Practical approaches for efficient HPO with Oríon</b>	<a href="https://youtu.be/H1jQBQIbQmA">youtu.be/H1jQBQIbQmA</a>	SciPy 2021, remote
9 Jun 2021	<b>Oríon - Librarie pour l'optimisation d'hyperparamètres</b>	<a href="https://tinyurl.com/ycku5vhv">tinyurl.com/ycku5vhv</a>	Mila, remote
19 May 2021	<b>Black-Box Optimization using Dask with Oríon</b>	<a href="https://youtu.be/W5oWdRiSSr8">youtu.be/W5oWdRiSSr8</a>	Dask Summit 2021, remote
7 Apr 2021	<b>Accounting for Variance in Machine Learning Benchmarks</b>	<a href="https://youtu.be/-bukIBTKQiM">youtu.be/-bukIBTKQiM</a>	MLSys 2021, remote
16 Mar 2021	<b>Practical Approaches for Efficient Hyperparameter Optimization</b>	<a href="https://youtu.be/QQ69vxF3LTI">youtu.be/QQ69vxF3LTI</a>	AICamp, remote
12 Jan 2021	<b>Oríon - A framework for distributed hyperparameter optimisation</b>	<a href="https://tinyurl.com/yuy5w6ta">tinyurl.com/yuy5w6ta</a>	Mila & Vector, remote
12 Jan 2021	<b>On a quest for more trustworthy scientific conclusions in ML</b>	<a href="https://tinyurl.com/2hv27p5m">tinyurl.com/2hv27p5m</a>	Parietal, INRIA, remote
5 Nov 2020	<b>L'intelligence artificielle dans les bibliothèques</b>	Table ronde	CBPQ, remote
17 Feb 2020	<b>Reproducibility &amp; Hyperparameter Optimization with Oríon</b>	<a href="https://tinyurl.com/43zt5wej">tinyurl.com/43zt5wej</a>	Ai4Sim, Atos, remote
4 Dec 2019	<b>Unreproducible Research is Reproducible</b>	<a href="https://tinyurl.com/t7rpaaa">tinyurl.com/t7rpaaa</a>	CHAI, Berkeley, USA
28 Nov 2019	<b>Oríon: A Framework for Distributed Hyperparameter Optimisation</b>	<a href="https://tinyurl.com/t4ubtb4">tinyurl.com/t4ubtb4</a>	Mila, Montreal, Canada
21 Nov 2019	<b>Reproducibility in ML, or why benchmarks are lotteries</b>	<a href="https://tinyurl.com/u54a7o6">tinyurl.com/u54a7o6</a>	Mila, Montreal, Canada
21 Nov 2019	<b>Oríon: A Framework for Distributed Hyperparameter Optimisation</b>	<a href="https://tinyurl.com/scxq63b">tinyurl.com/scxq63b</a>	Mila, Montreal, Canada
15 Nov 2019	<b>Unreproducible Research is Reproducible</b>	<a href="https://tinyurl.com/rkgp55k">tinyurl.com/rkgp55k</a>	Mila, Montreal, Canada
31 Jul 2019	<b>Reproducibility in AI</b>	<a href="https://tinyurl.com/roue8js">tinyurl.com/roue8js</a>	Stradigi AI, Montreal, Canada
13 Jun 2019	<b>Unreproducible Research is Reproducible</b>	<a href="https://tinyurl.com/w52vjjs">tinyurl.com/w52vjjs</a>	ICML, Long Beach, USA
10 Apr 2019	<b>Introduction à l'intelligence artificielle</b>	For a specialized school for gifted children	UdeM, Montreal, Canada
14 Nov 2018	<b>Intelligence artificielle: Une fabrique à outils</b>	<a href="https://tinyurl.com/yx6thyjd">tinyurl.com/yx6thyjd</a>	CPI, Montreal, Canada
12 Nov 2018	<b>Introduction à l'intelligence artificielle</b>	For high school <i>Forum des jeunes en science</i>	CEGEP Montmo., Laval, Canada
30 Aug 2018	<b>Tutorial on Oríon</b>	<a href="https://tinyurl.com/u4pjkjy">tinyurl.com/u4pjkjy</a>	Mila, Montreal, Canada
14 Jul 2018	<b>Oríon: Experiment Version Control for Efficient Hyperparameter Optimization</b>		ICML, Stockholm, Sweden
26 Apr 2014	<b>Introduction au langage de programmation Python</b>		Google, Montreal, Canada

## Open Source Projects

### Oríon ([github.com/Epistimio/orion](https://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](https://bouthilx.github.io/projects/2-mahler))

Developer - Prototype stage

2019-2020

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](https://bouthilx.github.io/projects/4-kleio))

Developer - Prototype stage

2018-2019

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](https://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

# Extracurricular Activity

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## Reviewer

NeurIPS, ICML, ICLR, AISTATS, MLSys, Neural Computation, AutoML Workshop,  
NAS Workshop, Reproducibility Challenges, MLSys'20 Artifact Evaluation,  
Rethinking ML Papers workshop @ ICLR 2021

2015 - Present

## Workshop Organizer

Retrospectives Workshop  
Setting up ML Evaluation Standards to Accelerate Progress

Dec. 2019

Apr. 2022

## 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.