

# Xavier Bouthillier

COMPUTER SCIENCE · MACHINE LEARNING RESEARCHER

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## Summary

I am a fifth-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. I am concurrently developing an automation tool called Mahler, which enables large-scale experimentation for improved reproducibility using statistical tests.

## 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

Research Developer

Montréal, Canada

Oct. 2017 - Present

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

### Nuance Communications

Research Intern

Montréal, Canada

Sep. 2016 - Dec. 2016

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

### Nuance Communications

Research Intern

Montréal, Canada

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

Research Intern

Montréal, Canada

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

Research Assistant

Montreal, Canada

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

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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

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

*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

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**Mahler** ([bouthilx.github.io/projects/2-mahler](https://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.

## 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
- Design governance rules
- Provide support to users
- Give presentations and tutorials
- Write extensive documentation in reStructuredText
- Setup and maintain CI with Travis and codecov
- Implemented an experiment version control system

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

Developer - Prototype stage

2018-Present

Kleiô 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

## Presentations

4 Dec 2019	<b>Unreproducible Research is Reproducible</b>	<a href="https://tinyurl.com/w6kmn2d">tinyurl.com/w6kmn2d</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 machine learning, 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/w52vjys">tinyurl.com/w52vjys</a>	ICML, Long Beach, USA
10 Apr 2019	<b>Introduction à l'intelligence artificielle</b>		UdeM, Montreal, Canada
	Presentation to children in a special educational program for intellectual giftedness		
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>		Collège Montmorency, Laval, Canada
	Presentation to high school students for the <i>Forum des jeunes en science</i>		
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

## Extracurricular Activity

### Reviewer

NeurIPS, ICML, ICLR, Neural Computation, AutoML Workshop,

NAS Workshop, Reproducibility Challenge, MLSys'20 (Artifact Evaluation)

2015 - Present

### 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.