

# Guillaume Rabusseau

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## Current Position

2018-present Since September 2018 I am an assistant professor at *Université de Montréal* and at the *Mila* research institute. Since March 2019, I am the holder of a CIFAR AI research chair.

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## Education

- 2016-2018 **IVADO post-doctoral scholar**, *McGill University, School of Computer Science*, Reasoning and Learning Lab (working with Professors Joelle Pineau, Doina Precup and Prakash Panangaden).
- 2013-2016 **PhD in Computer Science**, *Aix-Marseille Université, Laboratoire d'Informatique Fondamentale*, Qarma team (Machine Learning and Multimedia).
- Title: *A Tensor Perspective on Weighted Automata, Low-Rank Regression and Algebraic Mixtures*.
  - Main contributions: introduction of a new computational model on graphs generalizing weighted automata over strings and trees; design and theoretical analysis of an algorithm for approximate minimization of weighted tree automata; design and theoretical analysis of a novel algorithm for regression with tensor-structured outputs under multilinear rank constraints; extension of the tensor method of moments to algebraic mixtures (mixtures of distributions with negative weights).
  - Supervisors: François Denis and Hachem Kadri.
  - Defense date: October 20, 2016.
- 2012-2013 **MSc in Theoretical Computer Science**, *Aix-Marseille Université*, (grade: 18.4/20, rank: 1/13). Master Thesis: *Using a Linear Representation of Trees in the context of Structured Data Learning: A First Approach* (published in the international conference ICGI 2014)
- 2011-2012 **MSc in Computer Science, 1st year**, *Université de Franche-Comté*, (grade: 17.2/20, rank: 1/103).
- 2008-2011 **BSc in Computer Science**, *Université de Provence*, (grade: 17.3/20).
- 2003-2005 **DEM of Classical Guitar**, *ENMD de Châtellerauld*.
- 2000-2005 **MSc in Musicology**, *UFR de Tours*, (grade: 16.9/20). Master Thesis: *Conlon Nancarrow's Language: Compositional Method and Structure of Study #2a for Player Piano*

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## Teaching and Professional Experience

- 2018-2019 **Matrix and Tensor Factorization for Machine Learning**, *grad seminar course*.
- 2018-2019 **Foundations of Machine Learning**, *undergrad course*.
- 2018 **IVADO summer school**, *Introduction to machine learning*, first day of the summer school.  
*Lecturer at McGill University*
- 2017 **COMP-652/ECSE-608: Machine Learning course for graduate students**, *co-teaching with Prof. Doina Precup in Winter 2017 and with Riashat Islam (PhD student) in Fall 2017*.  
*Teaching Assistant at École Centrale Marseille (graduate school of engineering)*
- 2013-2016
- Big Data and Data Science, Lecturer (3rd year students, 40h)
  - Databases, Teaching Assistant (2nd year students, 65h)
  - Algorithmic, Teaching Assistant (1st year students, 85h)

## Professional Experience

- 2002-2010 **Experimental Music Performer**, based in Tours (FR) from 2002 to 2005 - Brussels (BE) from 2005 to 2008 - Berlin (GE) from 2008 to 2010.  
My work focused on developing a live-oriented computer interface (with the programming environment Pure Data) to incorporate sound synthesis in free improvisation.
- 2000-2010 **Guitar and Music Theory Teacher**.

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## Publications

### Articles in Peer-Reviewed Journals

Borja Balle and Guillaume Rabusseau. Approximate minimization of weighted tree automata. *Information and Computation*, 282:104654, 2022.

Tianyu Li, Doina Precup, and Guillaume Rabusseau. Connecting weighted automata, tensor networks and recurrent neural networks through spectral learning. *Machine Learning*, 2022.

Bogdan Mazouze, Thang Doan, Tianyu Li, Vladimir Makarenkov, Joelle Pineau, Doina Precup, and Guillaume Rabusseau. Low-rank representation of reinforcement learning policies. *Journal of Artificial Intelligence Research*, 2022.

Vladimir Makarenkov, Bogdan Mazouze, Guillaume Rabusseau, and Pierre Legendre. Horizontal gene transfer and recombination analysis of sars-cov-2 genes helps discover its close relatives and shed light on its origin. *BMC Ecology and Evolution*, 21(1):1–18, 2021.

Raphaël Bailly, Guillaume Rabusseau, and François Denis. Recognizable series on graphs and hypergraphs. *Journal of Computer and System Sciences*, 104:58 – 81, 2019.

Vincent François-Lavet, Guillaume Rabusseau, Joelle Pineau, Damien Ernst, and Raphael Fonteneau. On overfitting and asymptotic bias in batch reinforcement learning with partial observability. *Journal of Artificial Intelligence Research*, 65:1–30, 2019.

### Articles in Peer-Reviewed International Conferences

Shenyang Huang, Jacob Danovitch, Guillaume Rabusseau, and Reihaneh Rabbany. Fast and attributed change detection on dynamic graphs with density of states. In *PAKDD*, 2023.

Shenyang Huang, Farimah Poursafaei, Jacob Danovitch, Matthias Fey, Weihua Hu, Emanuele Rossi, Jure Leskovec, Michael Bronstein, Guillaume Rabusseau, and Reihaneh Rabbany. Temporal graph benchmark for machine learning on temporal graphs. In *NeurIPS*, 2023.

Chenqing Hua, Guillaume Rabusseau, and Jian Tang. High-order pooling for graph neural networks with tensor decomposition. In *NeurIPS*, 2022.

Borja Balle, Clara Lacroce, Prakash Panangaden, Doina Precup, and Guillaume Rabusseau. Optimal spectral-norm approximate minimization of weighted finite automata. In *ICALP*, 2021.

Thang Doan, Mehdi Bennani, Bogdan Mazouze, Guillaume Rabusseau, and Pierre Alquier. A theoretical analysis of catastrophic forgetting through the NTK overlap matrix. In *AISTATS*, 2021.

Shenyang Huang, Vincent François-Lavet, and Guillaume Rabusseau. Understanding capacity saturation in incremental learning. In *34th Canadian Conference on Artificial Intelligence*, 2021.

Behnoush Khavari and Guillaume Rabusseau. Lower and upper bounds on the pseudo-dimension of tensor network models. In *NeurIPS*, 2021.

Clara Lacroce, Prakash Panangaden, and Guillaume Rabusseau. Extracting weighted automata for approximate minimization in language modelling. In *ICGI*, 2021.

Jacob Miller, Guillaume Rabusseau, and John Terilla. Tensor networks for probabilistic sequence modeling. In *AISTATS*, 2021.

Siddarth Srinivasan, Sandesh Adhikary, Jacob Miller, Guillaume Rabusseau, and Byron Boots. Quantum tensor networks, stochastic processes, and weighted automata. In *AISTATS*, 2021.

Shenyang Huang, Yasmeen Hitti, Guillaume Rabusseau, and Reihaneh Rabbany. Laplacian change point detection for dynamic graphs. In *KDD*, 2020.

Tianyu Li, Bogdan Mazouze, Doina Precup, and Guillaume Rabusseau. Efficient planning under partial observability with unnormalized Q functions and spectral learning. *AISTATS*, 2020.

Beheshteh Rakhshan and Guillaume Rabusseau. Tensorized random projections. *AISTATS*, 2020.

Guillaume Rabusseau, Tianyu Li, and Doina Precup. Connecting weighted automata and recurrent neural networks through spectral learning. In *AISTATS*, 2019.

Philip Amortila and Guillaume Rabusseau. Learning graph weighted models on pictures. In *ICGI*, 2018.

Tianyu Li, Guillaume Rabusseau, and Doina Precup. Nonlinear weighted finite automata. In *AISTATS*. 2018.

Guillaume Rabusseau. Minimization of graph weighted models over circular strings. In *FoSSaCS*. 2018.

Guillaume Rabusseau, Borja Balle, and Joelle Pineau. Multitask spectral learning of weighted automata. In *NeurIPS*. 2017.

Matteo Ruffini, Guillaume Rabusseau, and Borja Balle. Hierarchical methods of moments. In *NeurIPS*. 2017.

Guillaume Rabusseau, Borja Balle, and Shay B. Cohen. Low-Rank Approximation of Weighted Tree Automata. In *AISTATS*, 2016.

Guillaume Rabusseau and Hachem Kadri. Low-rank regression with tensor responses. In *NeurIPS*. 2016.

Raphaël Bailly, François Denis, and Guillaume Rabusseau. Recognizable Series on Hypergraphs. In *LATA*, 2015.

Guillaume Rabusseau and François Denis. Maximizing a Tree Series in the Representation Space. In *ICGI*, 2014.

### Technical Reports / Preprints

Meraj Hashemizadeh, Michelle Liu, Jacob Miller, and Guillaume Rabusseau. Adaptive tensor learning with tensor networks. *arXiv preprint arXiv:2008.05437*, 2020.

Shenyang Huang, Vincent François-Lavet, and Guillaume Rabusseau. Neural architecture search for class-incremental learning. *arXiv preprint arXiv:1909.06686*, 2019.

Xingwei Cao and Guillaume Rabusseau. Tensor regression networks with various low-rank tensor approximations. *arXiv preprint arXiv:1712.09520*, 2017.

Guillaume Rabusseau and François Denis. Learning Negative Mixture Models by Tensor Decompositions. *CoRR*, abs/1403.4224, 2014.

### Workshop Contributions

Marawan Gamal and Guillaume Rabusseau. Rosa: Random orthogonal subspace adaptation. In *Workshop on Efficient Systems for Foundation Models@ ICML2023*, 2023.

Farzaneh Heidari, Perouz Taslakian, and Guillaume Rabusseau. Explaining graph neural networks using interpretable local surrogates. In *Topological, Algebraic and Geometric Learning Workshops 2023*, pages 146–155. PMLR, 2023.

Kaiwein Hou and Guillaume Rabusseau. Spectral regularization: an inductive bias for sequence modeling. *LearnAut workshop at ICALP 2022*, 2022.

Clara Lacroce, Prakash Panangaden, and Guillaume Rabusseau. Towards an aak theory approach to approximate minimization in the multi-letter case. *LearnAut workshop at ICALP 2022*, 2022.

Tianyu Li, Bogdan Mazoure, and Guillaume Rabusseau. Sequential density estimation via ncwfas sequential density estimation via nonlinear continuous weighted finite automata. *LearnAut workshop at ICALP 2022*, 2022.

Maude Lizaïre, Simon Verret, and Guillaume Rabusseau. Spectral initialization of recurrent neural networks: Proof of concept. *LearnAut workshop at ICALP 2022*, 2022.

Andy Huang, Kuan-Chieh Wang, Guillaume Rabusseau, and Alireza Makhzani. Few shot image generation via implicit autoencoding of support sets. In *Fifth Workshop on Meta-Learning at the Conference on Neural Information Processing Systems*, 2021.

Beheshteh T Rakhshan and Guillaume Rabusseau. Rademacher random projections with tensor networks. In *Second Workshop on Quantum Tensor Networks in Machine Learning In conjunction with NeurIPS*, 2021.

Siddarth Srinivasan, Sandesh Adhikary, Jacob Miller, Bibek Pokharel, Guillaume Rabusseau, and Byron Boots. Towards a trace-preserving tensor network representation of quantum channels. In *Second Workshop on Quantum Tensor Networks in Machine Learning In conjunction with NeurIPS*, 2021.

Philip Amortila and Guillaume Rabusseau. Learning graph weighted models on pictures. *2nd workshop on Learning and Automata (LearnAut at FLoC 2018)*, 2018.

Shenyang Huang, Vincent François-Lavet, Guillaume Rabusseau, and Joelle Pineau. Exploring continual learning using incremental architecture search. *NeurIPS 2018 Workshop on Continual Learning*, 2018.

Di Wu, Guillaume Rabusseau, Vincent François-lavet, Doina Precup, and Benoit Boulet. Optimizing home energy management and electric vehicle charging with reinforcement learning. *Adaptive Learning Agents (ALA) workshop at the Federated AI Meeting*, 2018.

Tianyu Li, Guillaume Rabusseau, and Doina Precup. Neural network based nonlinear weighted finite automata. *LICS workshop on Learning and Automata*, 2017.

Guillaume Rabusseau and Joelle Pineau. Multitask spectral learning of weighted automata. *LICS workshop on Learning and Automata*, 2017.

Raphaël Bailly and Guillaume Rabusseau. Graph learning as a tensor factorization problem. *NIPS workshop on Learning with Tensors*, 2016.

Guillaume Rabusseau and François Denis. Learning Negative Mixture Models by Tensor Decompositions. *Workshop on Method of Moments and Spectral Learning (ICML 2014)*, 2014.

## Thesis

Guillaume Rabusseau. *A Tensor Perspective on Weighted Automata, Low-Rank Regression and Algebraic Mixtures*. PhD thesis, Aix-Marseille Université, 2016.

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## Invited Talks

### Tensor Network Models for Structured Data.

December 2020 *NeurIPS 2020 Workshop on Quantum Tensor Networks in Machine Learning*.

### Adaptive Tensor Learning with Tensor Networks.

November 2020 *Huawei Montreal Research Centre, Montreal*.

### **Tensor Networks for Machine Learning.**

January 2021 *Séminaire Signal et Apprentissage, groupe ALEA*, Marseille.

November 2020 *Tea Talk*, Mila, Montreal.

### **Connecting Weighted Automata and Recurrent Neural Networks through Spectral Learning.**

August 2020 *ICGI conference*, New-York, USA.

April 2019 *IACS Seminar*, Stony Brook University, New-York, USA.

### **Multitask Spectral Learning of Weighted Automata.**

July 2018 *MAGNET team seminar*, INRIA Lille, France.

### **Machine Learning with Tensors for Structured Data.**

June 2018 *RIKEN Center for Advanced Intelligence Project*, AIP, Japan.

March 2018 *Séminaires de doctorat en informatique cognitive*, UQAM, Canada.

Feb. 2018 *Colloque du DIRO*, Université de Montréal, Canada.

### **Higher-Order Low-Rank Regression.**

May 2016 *Mathematics and Statistics Seminar*, Lancaster University, UK.

Nov. 2015 *Workshop on Tensor Decompositions and Covariance Matrix Estimation*, Aix-Marseille University, France.

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## Grants

2020 **CIFAR COVID-19 CATALYST grant**, Modeling the transmission of SARS-CoV-2 between zoonotic sources on a gene level.

2019-2024 **Canada CIFAR AI (CCAI) research chair**.

2019-2024 **NSERC Discovery grant**, Machine Learning with Tensor Networks.

April 2017 **IVADO postdoctoral fellowship**, two year funding for a postdoctoral position at McGill.

2017 **NVIDIA GPU grant**, donation of one NVIDIA TITAN Xp GPU.

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## Other Research Activities

- Supervision
- Current students: Jacob Miller (postdoc), Tianyu Li (PhD, co-supervised with Doina Precup), Behnoush Khavari (MSc), Meraj Hashemizadeh (MSc), Andy Huang (PhD, co-supervised with Reihane Rabbany), Beheshteh Tolouei Rakhshan (PhD), Maude Lizaire (PhD), Ali Parviz (PhD intern)
  - Past students at UdeM: Lionel Tondji (intern, summer 2019), Andy Huang (MSc, co-supervised with Reihane Rabbany), Marie-Ève Malette-Campeau (MSc, co-supervised with Georges Dionne and Fabian Bastin), Maude Lizaire (PhD intern, co-supervised with Simon Verret), Beheshteh Tolouei Rakhshan (PhD intern), Vincent Létourneau (postdoc, co-supervised with Maia Fraser)
  - I worked with the following students at the Reasoning and Learning Lab (2016-2018): Philip Amortila (MSc), Xingwei Cao (BSc), Eric Crawford (PhD), Andy Huang (BSc), Tianyu Li (PhD) and Di Wu (PhD)
  - Co-supervisor of 2nd year student Claire Béhue's internship on *Artificial Intelligence for the Game of Gomoku* (LIF, 2014).
  - Co-supervisor of 1st year student Yoan Chaillan's internship on *Computer Vision for Gender Recognition* (LIF, 2013).

- Organization
- Co-organizer of the ACL 2019 workshop *Deep Learning and Formal Languages: Building Bridges*.
  - Co-organizer of two editions of the *Learning and Automata workshop* at FLoC 2018 and at LICS 2019.
  - Co-organizer of the UAI 2018 workshop on *Safety, Risk and Uncertainty in Reinforcement Learning*.
  - Co-organizer of the *Hackday* (24 hours machine learning hackathon) for the machine learning french conference CAP 2016.
- Reviewer
- Conferences: area chair for NIPS 2019, senior PC member for IJCAI 2020, reviewer for ICLR 2019, AISTATS 2019-2020, ICML 2019, UAI 2019, NIPS 2018, ALT 2018, IJCAI 2018
  - Journals: Machine Learning, IEEE Access, IEEE transactions
  - Grants: Mitacs Accelerate research project (2), NSERC discovery grant (1)

## Responsibilities

- 2018- **Steering committee of the International Conference on Grammatical Inference**, *Committee Member*.
- 2018- **Comité d'éthique de la recherche en sciences et en santé - CERSES (ethics committee for research in healthcare)**, *Committee Member*, Université de Montréal.
- 2018,2019 **Jury de bourse d'excellence en sciences humaines et sociales (Excellence Award in Human and Social Sciences)**, *Committee Member*, Université de Montréal.
- 2014-2016 **Doctoral School Counsel**, *Elected representative of LIF PhD students*.

## Languages

French	mother tongue
English	fluent
Spanish/German	notions