

# Amine Mohamed Aboussalah

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<http://ama-website.github.io>

## RESEARCH INTERESTS

Artificial Intelligence, Reinforcement Learning, Information Geometry, Dynamical Systems, Operations Research

## ACADEMIC APPOINTMENTS

**New York University**, New York, NY, USA 2022-Present

Industry Assistant Professor - Tandon School of Engineering, Finance & Risk Engineering

- Research – Developing new machine learning and control algorithms for real-world applications.
- Teaching – Machine learning in financial engineering (graduate course).

## EDUCATION

**University of Toronto**, Toronto, Canada 2017-2022

- Ph.D. in Operations Research, GPA: 4.0/4.0
- Thesis: Exploiting Structure to Mitigate Risk in Real-World Financial Control Problems.
- Committee: Prof. Chi-Guhn Lee, Prof. Douglas Tweed, Prof. Roy H. Kwon.
- Improve reinforcement learning by exploiting topological properties of dynamical systems and time series.
- Diploma in Operational Research from the Canadian Operational Research Society (2021).

**Polytechnique Montréal**, Montreal, Canada 2016-2017

- Started M.S. in Applied Mathematics & Data Science, GPA: 3.91/4.0. Transferred to Ph.D. program at University of Toronto.
- Canada Excellence Research Chair in Data Science for Real-Time Decision-Making.

**HEC Paris**, Paris, France 2013

- Postgraduate Diploma, Innovation Management in Aviation & Aerospace, GPA: 4.0/4.0
- Thesis: Can the problems faced by the Boeing 787 “Dreamliner” be explained by Boeing’s innovative supply chain strategy?

**ISAE-SUPAERO**, Toulouse, France and **Polytechnique Montréal**, Montreal, Canada 2008-2013

- Integrated Bachelor and Master in Engineering Physics, Aerospace Engineering, Astrophysics and Applied Mathematics.
- Thesis: Revealing the nature of a new black hole “Swift J1745-26” in outburst.
- Mention d’Excellence.

## RESEARCH EXPERIENCE

**World Bank Group**, Washington DC, USA 8/2021-6/2022

- Consultant – Sentiment analysis on social networks to probe the impact of COVID-19 on Morocco’s new economic model.

**Fujitsu Co-Creation Research Laboratory at the University of Toronto**, Toronto, Canada 8/2019-9/2020

- Research assistant – Solving complex combinatorial optimization problems using quantum-inspired computing.

**Mechanical and Industrial Engineering at the University of Toronto**, Toronto, Canada 9/2017-present

- FRQNT and NSERC Research fellowships – Improve reinforcement learning by exploiting topological properties of dynamical systems and time series with application to portfolio management.

**Canada Excellence Research Chair in Data Science for Real-Time Decision Making**, Montreal, Canada 1/2016-8/2017

- Research assistant – Development of RNNs for estimation and prediction of time series with missing data.

**Cancer University Institute of Toulouse Oncopole**, Toulouse, France 9/2014-8/2015

- Research assistant – Algorithm development for automatic organ delineation in adaptive radiation therapy.

**French Alternative Energies and Atomic Energy Commission (CEA-Saclay)**, Paris, France 6/2013-12/2013

- Research assistant – Photometric and Spectroscopic analysis of a black hole candidate in outburst (Swift J1745-26).

- Research assistant – Study of the transport of electric charges and spin dynamics in materials and magneto-devices.

- Research assistant – Modeling thin film growth and evaluating the emissivity of thermochromic materials.

## **PUBLICATIONS**

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- **Aboussalah, A.M.**, Kwon, M-J, Patel, R.G., Chi, C., Lee, C-G. Recursive Time Series Data Augmentation. The International Conference on Learning Representations (ICLR 2023).
- Abdul Reda, A., **Aboussalah, A.M.**, Sinanoğlu, S. Out of Sight, Out of Mind: The Impact of Lockdown Measures on Sentiment Towards Refugees. Journal of Information Technology & Politics (2023).
- Chi, C., **Aboussalah, A.M.**, Khalil, E. A Deep Reinforcement Learning Framework for Column Generation. The Annual Conference on Neural Information Processing Systems (NeurIPS 2022).
- **Aboussalah, A.M.**, Xu, Z., Lee, C-G. What is the Value of the Cross-Sectional Approach to Deep Reinforcement Learning? Quantitative Finance, p.1-21, ISSN: 1469-7688 (2021).
- Abdul Reda, A., **Aboussalah, A.M.**, Sinanoğlu, S. Curbing Xenophobia? Assessing the Impact of COVID-19 Lockdown Measures on Anti-Refugee Sentiment in Turkey. American Political Science Association (APSA) Conference (2021).
- **Aboussalah, A.M.**, Lee, C-G. Continuous Control Deep Dynamic Recurrent Reinforcement Learning for Portfolio Optimization. Expert Systems With Applications (ESWA-112891) (2020).
- Taib, B., **Aboussalah, A.M.**, Moniruzzaman, M., Chen, S., Haughey, N.J., Kim, S.F., Ahima, R. S. Lipid Accumulation and Oxidation in Glioblastoma Multiforme. Scientific Reports - Nature, volume 9, Article number: 19593 (2019).
- **Aboussalah, A.M.**, Neal, C. Forecasting Local Warming: Missing Data Generation and Future Temperature Prediction. Cahiers du GERAD. G-2016-76, ISSN: 0711-2440 (2016).
- Lopez-Oramas, A., Chaty, S., Coleiro, A., **Aboussalah, A.M.** Infrared and Optical Observations of the Black Hole X-Ray Transient Swift J1745-26. Submitted to Mon. Not. R. Astron. Soc. 1-6, ISSN: 1365-2966 (2015).
- **Aboussalah, A.M.**, De Pommereau, T., Leyder, R., Wagon, J., Watinne, T. Can the Problems Faced by the Boeing 787 be Explained by Boeing's Innovative Supply Chain Strategy? HEC Paris thesis (2013).

## **SUBMITTED PAPERS**

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- **Aboussalah, A.M.**, Chi, C., Lee, C-G. Quantum Computing Reduces Systemic Risk in Financial Networks. Submitted to Scientific Reports - Nature (2022). Available at SSRN.

## **WORKING PAPERS**

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- **Aboussalah, A.M.**, Zerouali, A.J., Lee, C-G. Topological Phase Space Reconstruction for Augmented Real-World Reinforcement Learning. In preparation for INFORMS-Mathematics of Operations Research (2022). Available at SSRN.
- **Aboussalah, A.M.**, Beyond Black-Scholes: A Reinforcement Learning Approach for Option Pricing.
- **Aboussalah, A.M.**, Akrouit, M. Finding Optimal Post-COVID High-Stakes Policies Using Deep Reinforcement Learning.
- **Aboussalah, A.M.**, Chi, C., Orban, D. An Optimal Control Based Approach for Simulating Interstellar Wormholes.
- **Aboussalah, A.M.**, Building Financial Baskets with Quantum Computing.

## **SEMINARS AND PRESENTATIONS**

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- Exploiting Structure in Reinforcement Learning to Mitigate Risk in Real-World Financial Control Problems. Peter Carr Brooklyn Quant Experience (BQE) Seminar Series, New York University (2023).
- A Deep Reinforcement Learning Framework for Column Generation. Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting (Cluster: Reinforcement Learning for Decision Making in Networks and Combinatorial Spaces), Indianapolis (2022).
- Quantum Graph Partitioning Delays Cascade Failure Phase Transition in Financial Networks. Workshop on Quantum Computing and Operations Research, The Fields Institute, Toronto (2022).
- Exploiting Symmetry in Real-World Reinforcement Learning. 62nd Canadian Operational Research Society (CORS) Annual Conference (Cluster: Artificial Intelligence and Machine Learning), Toronto (2021).
- High-Dimensional Continuous Reinforcement Learning For Finance. 62nd Canadian Operational Research Society (CORS) Annual Conference (Cluster: Finance and Risk Management), Toronto (2021).

- High-Dimensional Reinforcement Learning for Finance. Bank of Montreal (BMO) Capital Markets AI Labs, Toronto, Canada (2021).
- High-Dimensional Reinforcement Learning for Portfolio Management. Canadian Imperial Bank of Commerce (CIBC Capital Markets), Toronto, Canada (2020).
- Continuous Control with Deep Dynamic Recurrent Reinforcement Learning for Portfolio Optimization. 4th Industrial-Academic Workshop on Optimization and Artificial Intelligence in Finance, The Fields Institute, Toronto (2018).
- Optimization-Based Approach for Simulating Interstellar's Wormhole. Institute for Data Valorization (IVADO), Montreal, Canada (2017).
- Forecasting Local Warming: Missing Data Generation and Future Temperature Prediction. CERC-Data Science, Montreal, Canada (2016).
- Can the Problems Faced by the Boeing 787 be Explained by Boeing's Innovative Supply Chain Strategy? Paris Air Show (Salon du Bourget), Paris, France (2013).

## FUNDED RESEARCH GRANTS

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- Chi-Guhn Lee, Amine Mohamed Aboussalah, LG Sciencepark Research Proposal – \$525,000 (2019).  
Transfer learning in a changing environment.  
*Conceived project, wrote proposal, supervised MS student.*
- Chi-Guhn Lee, Amine Mohamed Aboussalah, Huawei-UoT Joint Lab Research Proposal - \$161,000 (2019).  
Transfer learning approaches to the graph-structured data.  
*Conceived project, wrote proposal.*
- Chi-Guhn Lee, Amine Mohamed Aboussalah, Fujitsu Co-Creation Research Laboratory – \$100,000 (2019).  
Deep reinforcement learning and quantum annealing on DAU.  
*Conceived project, wrote proposal, conducted research.*

## TEACHING EXPERIENCE

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**Assistant Professor**, New York University, NYC, United States 9/2022-present

- FRE-GY7773 – Machine Learning in Financial Engineering. Teaching, office hours.
- VIP-GY 5000 BD – Active Portfolio Management with Machine Learning and Time Series Forecasting. Teaching, office hours.
- VIP-GY 5000 BE – Merger & Acquisition Outcome Prediction. Teaching, office hours.

**Teaching Assistant**, University of Toronto, Toronto, Canada 9/2018-5/2022

- MIE567 – Dynamic and Distributed Decision Making (5 semesters). Teaching, lab, grading, office hours.
- MIE367 – Cases in Operations Research (3 semesters). Lab, grading, office hours.
- MIE364 – Quality Control and Improvement (3 semesters). Teaching, lab, grading, office hours.
- MIE1615 – Markov Decision Processes (1 semester). Lab, grading, office hours.
- Faculty of Applied Science and Engineering (FASE) TA Training course (2 semesters). Office hours.

**Volunteer High School Tutor**, OSE ISAE-SUPAERO diversity program, Toulouse, France 9/2012-12/2014

- Physics I – Motion, Mechanics, Electricity and Magnetism (6 hours a week).

## MENTORING ACTIVITIES

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- Student mentor at HEC Montréal. Number of mentees: 1. 2017
- Student mentor at Polytechnique Montréal. Number of mentees: 3. 2016-2017
- Student mentor at University of Toronto. Number of mentees: 8.

## SCHOLARSHIPS AND AWARDS

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- Diploma in Operational Research from the Canadian Operational Research Society (2021).
- Ontario Graduate Scholarship Award (OGS) – \$15,000 (2021).
- U of T COVID-19 Student Engagement Award – \$3,000 (2021).
- MIE Group Teaching Assistant Award – Department of Industrial Engineering (University of Toronto) – \$300 (2021).
- NSERC Research Michael Smith Foreign Study Supplements (MSFSS) Award to support work at the Institute for Data, Systems, and Society (IDSS) at Massachusetts Institute of Technology (MIT) (deferred due to COVID) – \$6,000 (2021).

- Alexander Graham Bell Canada Graduate Fellowship (CGS D) – Ranked 7th Nationwide – \$70,000 (2019-2021).
- Fonds de Recherche du Québec – Nature et Technologies (FRQNT) – \$42,000 (2017-2019).
- Barbara and Frank Milligan Graduate Fellowship – \$5,460 (2017).
- CAE-R. Fraser Elliott Scholarship – \$2,000 (2017).
- Polytechnique Montréal Graduate Scholarship Award – \$20,000 (2016).
- Award of Excellence of the Director General of Polytechnique Montréal (2014).
- International Profile Award of Polytechnique Montréal (2014).
- Pegasus Award in Engineering (2014).
- Selected for the Québec Lieutenant Governor's Medal (2013).
- Exchange Student Mobility Scholarship – \$10,000 (2011-2013).
- Roasters Foundation Distinction Scholarship – \$2,500 (2011).
- Unit Participation and Initiation Research Scholarship – \$1,500 (2011).
- Arthur Yelon and John Brebner Low Award – \$4,800 (2011).
- Québec Advanced Materials Group Award (RQMP) – \$5,000 (2010).
- National Merit Scholarship by the Moroccan Ministry of Higher Education and Scientific Research – \$28,000 (2008-2011).

## **MEDIA**

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- The problems of education in the 21<sup>st</sup> century. CreativeLab: The New School of Creativity (Montreal, 2016).
- YopiCar première plateforme de covoiturage au Maroc. Radio Maroc MedinaFM (Rabat, 2016).
- Aboussalah, A.M., A la découverte d'un génie oublié. Les Cahiers de l'Imaginaire (2016).