Thomas Jiralerspong

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Website
Google Scholar
GitHub
LinkedIn
Videogames

Education

University of Montreal/Mila – Co-supervised by Prof. Yoshua Bengio & Prof. Doina Precup
Master's of Science Starting Sep 2023

McGill University
Bachelor of Science - Honours Computer Science Sep 2020 – Apr 2023 (expected)

- **GPA: 4.0/4.0**
- **Graduate-Level Coursework:** Representation Learning, Reinforcement Learning, Brain Inspired A.I., Honours Mathematics for Machine Learning, Network Science**,** Probabilistic Programming, Quantum Computing, Information Theory
- **Exchange semester at the National University of Singapore**

Research Experience

Waabi
Research Intern – Toronto, Ontario Jun 2023 – Present

- Developing a realistic traffic simulation using generative deep learning methods

Mila/McGill University – Supervised by Prof. Blake Richards
Undergraduate Researcher – Montreal, Quebec Sep 2022 – Present

Submitted publication: *Contrastive Introspection (ConSpec) to Rapidly Identify Invariant Steps for Success (NeurIPS 2023)*

- Adapted the ConSpec algorithm to be compatible with MuJoCo environments
- Developed a modified version of MuJoCo environments with sparse rewards
- Demonstrated that ConSpec performed better than several other algorithms on MuJoCo environments with sparse rewards
- Modified a **Unity** experimental framework to be usable on a computer cluster to allow experiments to be run faster

Mila/McGill University – Supervised by Prof. Doina Precup
Undergraduate Researcher – Montreal, Quebec Jan 2022 – Present

Ongoing project: Deep reinforcement learning with affordance aware tree-search planning using option models

- Contributed to developing the initial research proposal and methodology for the project
- Reproduced a baseline from a state-of-the-art model-based reinforcement learning paper (Director)
- Modified the baseline's code to add temporally extended models and tree-search planning to the algorithm
- Currently running experiments comparing the baseline's performance to our model's performance on various environments

Vector Institute for Artificial Intelligence
Machine Learning Research Intern – Toronto, Ontario Sep 2022 – Dec 2022

Accepted publication: *A Comparison of Classical and Deep Reinforcement Learning Methods for HVAC Control (UIC 2023)*

- Transformed the novel model-based Hyperspace Neighbor Penetration algorithm into a model-free algorithm that is compatible with an existing data center HVAC simulator
- Modified the algorithm so that it can handle discrete, continuous, and multi-dimensional observations
- Modularized the code for the algorithm to be adaptable to different HVAC configurations

Project X – Machine Learning Research Competition
Co-Leader of McGill's Team Jun 2021 – Feb 2022

Publication: *Towards Safe Mechanical Ventilation Treatment Using Deep Offline Reinforcement Learning (co-first author) (AAAI 2023)*

- Contributed to developing the initial research proposal and methodology for the project
- Preprocessed medical data for over **50 000 patients** from the MIMIC-III Clinical Database using **Pandas** and **SQL**
- Developed the entire training pipeline including a LSTM autoencoder to encode a patient's entire history into their current state
- Trained and evaluated hundreds of policies with different hyperparameters to find the best ones for the model

- Co-first authored the final paper which received the **highest overall score out of all 25 papers submitted to the competition**, winning in the Clinical Practice category
- Helped to prepare the paper for publication and modify it based on reviewers' comments, leading to acceptance for publication at IAAI 2023 and as a poster presentation at RLDM 2022

McGill University – Supervised by Prof. Christian Genest
Collegiate Researcher – Montreal, Quebec Jan 2020 – May 2020

Article: *Modelling the Evolution of Arctic Ice Extent (co-first author)*

- Used ARIMA models in **R** to model the evolution of arctic ice extent
- Co-first authored the final article detailing and interpreting the results and their potential impact on society

Publications

Conference Publications

Towards Safe Mechanical Ventilation Treatment Using Deep Offline Reinforcement Learning
F. Kondrup*, **T. Jiralerspong***, E. Lau*, N. de Lara, J. Shkrob, M.D. Tran, D. Precup, S. Basu
Proceedings of the 37th AAAI Conference on Artificial Intelligence (AAAI 2023) 2023
*Equal Contribution

Conference Abstracts

Deep Conservative Reinforcement Learning for Personalization of Mechanical Ventilation Treatment
F. Kondrup*, **T. Jiralerspong***, E. Lau*, N. de Lara, J. Shkrob, M.D. Tran, D. Precup, S. Basu
The Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM 2022) 2022
*Equal Contribution

Accepted for Publication

A Comparison of Classical and Deep Reinforcement Learning Methods for HVAC Control
M. Wang, J. Willes, **T. Jiralerspong**, M. Moezzi
Accepted to the 20th IEEE International Conference on Ubiquitous Intelligence and Computing (UIC 2023) 2023

Submitted for Publication

Contrastive Introspection (ConSpec) to Rapidly Identify Invariant Prototypes for Success in RL
C. Sun, W. Yang, B. Alsbury-Nealy, **T. Jiralerspong**, Y. Bengio, B. Richards
Submitted to the Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS 2023) 2023

Preprints

Network Analysis of the iNaturalist Citizen Science Community
Y. Liu* & **T. Jiralerspong***
Preprint 2022
*Equal Contribution

Modelling the Evolution of Arctic Sea Ice Extent
X. Fan*, **T. Jiralerspong***, K. Zhu*, B. Nasri, C. Genest
Preprint 2020
*Equal Contribution

Professional Experience

Amazon Web Services (AWS) – S3 Team
Software Development Engineer Intern – Vancouver, British Columbia May 2022 – Jul 2022

- Developed a **JavaScript/Python** tool to automate the Incremental Backup recovery system for AWS S3 (stores ~**14 trillion objects**)
- Reduced recovery time by **5h/week** and **received a full time return offer** upon finishing the internship

Square Enix
Software Development Intern – Montreal, Quebec May 2021 – Aug 2021

- Designed and implemented a localization system using **Unity/C#** to allow a MOBA game to be translated into over **10 languages**
- Created a system using **C#** to allow PlayFab push notifications to redirect users to specific views
- Implemented a haptic feedback mechanism using **C#** to alert players of important game events
- Developed a tool to allow the marketing team to create custom lootboxes and unlock specific items

Expedia Group
Software Development Intern – Montreal, Quebec Jun 2019 – Aug 2019

- Developed a **React/TypeScript** tool to identify which elements of a webpage are broken and conveniently display them to developers

- Final tool used by over **50 developers** to make their workflow faster and more efficient

Awards and Honours

NSERC Canada Graduate Scholarship – Master's (17 500$) 2023
University of Montreal Discovery Master's Recruitment Scholarship (5 000$) 2023
McGill Mobility Bursary for Exchanges (6 000$) 2022
Winner of Project X Machine Learning Research Competition (25 000$, highest overall score out of 25 papers) 2022
J.W. McConnell Major Entrance Scholarship (9 000$) 2020, 2021, 2022
CIBPA Foundation Bursary (1 000$, 2 500$) 2021, 2022
McGill Faculty of Science Scholarship (300$) 2021
Marianopolis College Valedictorian (Highest average out of ~1000 graduating students) 2020
Governor General of Canada's Academic Medal 2020

Invited Talks and Presentations

"Applying Reinforcement Learning to Improve Healthcare" – *Canadian Undergraduate Conference on AI (CUCAI)* 2022
"Personalizing Mechanical Ventilation Using Deep Conservative Reinforcement Learning" – *UofT A.I. Conference* 2022
"Personalizing Mechanical Ventilation Using Deep Conservative Reinforcement Learning" – *Poster Presentation, RLDM* 2022
"Applying Reinforcement Learning to Improve Healthcare" – *McGill A.I. Society Learnathon* 2022

Organized Workshops

"Introduction to deep learning with PyTorch" – *Montreal A.I. & Neuroscience Conference* 2022
"Integrating your ML model into a basic webapp" – *McGill A.I. Society* 2021

Press

The McGill Tribune. Shadick, M. (2022, March 15). *Six McGill Undergrads win UofT international artificial intelligence competition*
McGill Reporter. Deschamps, R. (2022, March 1). *Undergrad team uses machine learning to create a better hospital ventilator*

Teaching Experience

Accelerated Introduction to Machine Learning Bootcamp (MAIS 202) – McGill A.I. Society
Co-organizer/Teaching Assistant May 2021 – Present

- Creating and grading assignments related to various machine learning topics
- Developing and presenting workshops related to various machine learning topics
- Answering student questions related to the assignments and the course material during office hours
- Helping more than 10 students/semester to complete their final machine learning related project

Software Systems (COMP206) – McGill University
Teaching Assistant Aug 2021 – May 2022

- Demonstrated and explained concepts related to **Unix**, **Bash** and **C** programming in weekly tutorials
- Answered students' questions about assignments and the course material during weekly office hours
- Corrected assignments for more than 30 students (6 assignments/student/semester)

Theory of Machine Learning (MATH/COMP 562) – McGill University
Guest Lecturer Jan 2022

- Gave a guest lecture on developing intermediate rewards for reinforcement learning agents in sparse reward environments

Paper Tutoring
Tutor Aug 2020 – Mar 2021

- Tutored hundreds of students in computer science, calculus, physics, math, and English through an online platform

Freelance
Private Tutor Sep 2018 – Mar 2020

- Helped five students to excel in subjects such as math, physics, chemistry, English, and French through weekly tutoring sessions

Community Service

McGill Artificial Intelligence Society
Executive Member May 2021 – Present

- Helping to organize and setup A.I. related events such as the McGill A.I. Society Hackathon (MAISHacks), the McGill A.I. Society Learnathon and the McGill A.I. Society Accelerated Introduction to Machine Learning Bootcamp

McGill NeuroTech
Member – Software/Machine Learning Team May 2021 – May 2022

- Worked on a project to provide biofeedback therapy to people experiencing anxiety using HCI Equipment
- Developed a Flask/React webapp to gather data about which YouTube videos people find anxiety inducing

McGill Robotics
Member – Rover Team, Software Division Sep 2020 – Jun 2021

- Developed a ROS/Python node to transform distance data from a LIDAR sensor into a list of convex obstacles surrounding a rover
- Helped to develop a Unity simulation to test this node as well as other parts of the rover's software

Marianopolis Technological Team
Software Developer Sep 2019 – May 2020

- Developed a Flask/React Native app to help the Marianopolis Student Union transmit information to students

Marianopolis Orchestra
Co-Founder/Director of Communications Jan 2019 – May 2020

- Co-founded the orchestra and recruited more than 50 members through social media and in person
- Organized weekly rehearsals and events to raise money for the orchestra
- Communicated with members to inform them about club developments and rehearsals

Technical Skills

Programming: Python, Keras, PyTorch, NumPy, Pandas, SQL, Java, C#, C++, OCaml, C, Bash, R, JavaScript, HTML, CSS
Other: Jupyter Notebook, Slurm, Perforce, GitHub, Jira, Unix, Linux, Unity

Languages

Fluent: English, French
Advanced: Italian, Spanish

Projects

Machine Learning

Rainbow Q-Learning in Jelly-Bean World 2022

- Implemented the Deep Q-Networks algorithm using only **PyTorch**
- Adapted a version of the Rainbow Deep Q-Networks algorithm to be usable with the Jelly-Bean World environment
- Added a memory buffer to both algorithms to allow them to incorporate an agent's previous observations into its current state
- Trained the algorithms with many different hyperparameters to obtain the best results and reported the results in a final report

Multi-headed Self-Attention Block Implementation 2022

- Implemented a multi-headed self-attention block using only **NumPy** and **PyTorch** for use in a vision transformer trained on CIFAR-10

Generating Music Using a LSTM Network with Attention 2020

- Transformed musical data from MIDI files into numerical data using **NumPy** and **Pandas**
- Used **Keras** to develop and experiment with multiple different architectures containing LSTM and attention layers
- Integrated the model into a user-friendly **Flask** webapp that allows a user to generate an original piece of music of a specified length

Videogames

Lost in Space 2022

- Led a team of 6 to develop a **Unity/C#** 3D platformer about an astronaut dodging asteroids in space

Don't Overthink It 2021

- Led a team of 4 to develop a Unity/C# online multiplayer shoot'em up game
- Added networking functionality using Mirror Networking for Unity
- Integrated the game with Steam using FizzySteamworks

Fly 2020

- Developed a **Unity/C#** game about a bird dodging trash while flying through the sky to convince people to protect the environment