Jake Tuero

Website: tuero.github.io
Email: tuero@ualberta.ca
GitHub: github.com/tuero

Summary

Ph.D. candidate in Computer Science at the University of Alberta (expected 2025), looking for industry research/engineer positions. My research focuses on sample-efficient methods for learning policies for tree search and reinforcement learning algorithms; enabling learning where it would be infeasible for other methods due to computation overhead. My work has been published at several top conferences and journals, including AAAI and ICML. I have a passion for writing performant research algorithms and models in C++.

Education

University of Alberta — Edmonton, Alberta
Ph.D. in Computer Science, Advisors: Michael Buro, Levi Lelis — 2018 – Current
- **Research Area**: Learning policies for tree search and reinforcement learning methods under sparse rewards
- Awarded exceptional status to transfer directly into Ph.D. from M.Sc.

Wilfrid Laurier University — Waterloo, Ontario
B.S. in Computer Science & Mathematics (Double Major), GPA: 3.7/4.00 — 2013 – 2017

Work Experience

AI4Good Lab — Edmonton, Alberta
Teaching Assistant, Mentor — Summers 2021-2025
- AI4Good lab is a 7-week machine learning training program for women and gender diverse people across Canada
- Prepared teaching and lab material for students across many topics, including machine learning, recurrent and convolutional neural networks, reinforcement learning, and best practices
- Mentored groups which have won the *Accelerator Award*, which grants groups extended funding and resources

University of Alberta — Edmonton, Alberta
Principal Instructor — Advanced Games Programming — Fall 2022/2024
- Responsible for creating and delivering teaching material for an upper year undergraduate course
- Topics include C++ programming, AI for games, and RTS game engine internals

University of Alberta — Edmonton, Alberta
Graduate Teaching Assistant — 2018 – Current
- Responsible for facilitating and carrying out labs, course material, exams, and assignments
- Practical Programming Methodology in C; Advanced Game Programming in C++; Search Knowledge and Simulations

CGI — Markham, Ontario
Technical Analyst — Java Developer — Summer 2018
- Backend development on a Java Spring Boot dashboard for financial institutions
- Increased test coverage from 20 to 80 percent
- Led early research into how machine learning models can be leveraged to improve user experience

Research Experience

University of Alberta — Edmonton, Alberta
Department of Computer Science — Graduate Research Assistant — 2022 – 2025
- Developed a novel method for learning subgoal-based policies for policy tree search algorithms [1]
- Our method's sample efficiency enables policies to be learned on complex environment domains in which the existing state-of-the-art approaches fail to make progress due to the computation costs
- Accepted to ICML-25

University of Alberta — Edmonton, Alberta
Department of Computer Science — Graduate Research Assistant — 2018 – 2021
- Developed Bayesian models for algorithm runtime distribution prediction [3]
- Outperformed the current state-of-the-art models in the low-data setting and in handling censored observations
- Accepted to AAAI-21

Wilfrid Laurier University — Waterloo, Ontario
Department of Mathematics — Undergraduate Research Assistant — Winter 2018
- Combined statistical methods with financial news sentiment analysis to predict price changes in the stock market [2]
- During validation backtesting, our models consistently outperformed the market
- Accepted to the AIMS Journal of Data Science in Finance and Economics

Wilfrid Laurier University — Waterloo, Ontario
Department of Computer Science — NSERC Undergraduate Research Assistant — Summer 2017
- Solved the e-positivity chromatic symmetric function conjecture, an open problem in graph and representation theory, for a subclass of claw-free graphs [4]
- Accepted to the Springer Journal of Graphs and Combinatorics

Technical Skills

- **Programming Languages:** C, C++11/14/17/20, Python, Java
- **Frameworks:** PyTorch (Python), Libtorch (C++), CUDA
- **Research:** Tree Search Algorithms, Reinforcement Learning, Vector Quantized-Variational Autoencoders (VQ-VAEs), Bayesian Neural Networks, Convolution Neural Networks

Publications

[1] **J. Tuero**, M. Buro, and L. Lelis, "Subgoal-guided policy heuristic search with learned subgoals", in *Forty-second International Conference on Machine Learning*, Accepted – 2025.

[2] J. He, R. N. Makarov, **J. Tuero**, and Z. Wang, "Performance evaluation metric for statistical learning trading strategies", *Data Science in Finance and Economics*, vol. 4, no. 4, pp. 570–600, 2024.

[3] **J. Tuero** and M. Buro, "Bayes distnet - a robust neural network for algorithm runtime distribution predictions", *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 35, no. 14, pp. 12 418–12 426, May 2021.

[4] A. M. Hamel, C. T. Hoàng, and **J. Tuero**, "Chromatic symmetric functions and h-free graphs", *Graphs and Combinatorics*, vol. 35, no. 4, pp. 815–825, 2019.

Projects & Open Source Contributions

tinytensor (C++)
- A multi-dimensional array and automatic differentiation library with CUDA acceleration
- Efficient implementations of neural network layers and optimizers
- Goal was to learn the performance pain points that need to be considered when using these libraries

muzero-cpp (C++)
- A pure C++ implementation of the MuZero algorithm, using libtorch C++
- Features multi-threaded async actor inference, complex action representation, efficient batched GPU inference

Stones n Gems — Open Spiel Framework (C++)
- Author of the Stones n Gems environment for the Open Spiel framework by DeepMind
- Stones n Gems is a complex environment used for reinforcement learning research

Invited Talks

1. "Learning to Generate Optimal Paths using Search-Aware Models", *AIIDE-21 Workshop on Artificial Intelligence for Strategy Games*, Edmonton, Canada, Oct 11 2021.

2. "INSYN: Recommendation Models for Syntactically Incorrect Source Code", *ATB Financial*, Edmonton, Canada, Jan 31 2019.