Jake Tuero

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Research Interests

My research goal is focused on creating agents which can solve complex tasks with sparse rewards, that requires a well thought out sequence of high level actions to solve. Specifically, environments in which high level plans may be correct, but the implementation of each step impacts whether the rest of the plan is still achievable. My research area involves combining reinforcement learning with traditional tree search methods. Coming from a background in math, I am particularly interested in finding ways to make predictions and solve difficult problems using rigorous tools from statistics.

Education

University of Alberta — Edmonton, Alberta
Ph.D. in Computer Science, Advisors: Michael Buro, Levi Lelis — 2018 – Current

- Given exceptional status to transfer directly into Ph.D. from M.Sc.
- Research focuses on combining tree search methods for efficient reinforcement learning

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

Research Experience

University of Alberta — Edmonton, Alberta
Department of Computer Science — Graduate Research Assistant — 2018 – Current

- Extended algorithm runtime distribution prediction models into the Bayesian setting [1]

Wilfrid Laurier University — Waterloo, Ontario
Department of Mathematics — Undergraduate Research Assistant — Winter 2018

- Investigated how the sentiment of news affects prices in the stock market

Wilfrid Laurier University — Waterloo, Ontario
Department of Computer Science — NSERC Undergraduate Research Assistant — Summer 2017

- Worked on an open conjecture in chromatic symmetric functions
- Solved the e-positivity conjecture for a subclass of claw-free graphs [2]

Academic Teaching Positions

University of Alberta — Edmonton, Alberta
Principal Instructor — Fall 2022

- 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
- Introduction to the Foundations of Computation II; Practical Programming Methodology in C; Advanced Game Programming in C++; Computational Cryptography; Search Knowledge and Simulations

Wilfrid Laurier University Waterloo, Ontario
Undergraduate Teaching Assistant 2017 – 2018

- Responsible for facilitating and carrying out labs, course material, exams, and assignments
- Data Structures I; Introduction to Microprocessors; Algorithm Design and Analysis I

Publications

[1] **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.

[2] 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.

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.

Programming Languages and Frameworks

- **Programming Languages:** C, C++ 14/17, Python, Java, 8600 Assembly
- **Frameworks:** PyTorch, Cuda

Projects & Open Source Contributions

See full list of projects on `github.com/tuero`

- 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 game Stones n Gems for the Open Spiel framework by DeepMind. Stones n Gems is a simplified version of a mixture of common stone and gem games, such as Boulder Dash and Emerald Mines.
- Rocks n Diamonds (C++)
  A wrapper for the Rocks'n'Diamonds open source C arcade style game (based off Boulder Dash, Emerald Mines, Supapplex, and Sokoban). The project extends Rocks'n'Diamonds by letting users add their own AI controllers, providing a host of library functions to easily access the internal state of the engine, replay functionality, and logging.

Work Experience

AI4Good Lab — Edmonton, Alberta
Teaching Assistant — Summers 2021-2023

- AI4Good lab is a 7-week training program for women across Canada, which composes of lectures, workshops, and a self-directed team project
- Prepared teaching and lab material for students across many topics, including machine learning, recurrent and convolutional neural networks, reinforcement learning, and best practices
- Paired with 2 groups of students to help mentor and facilitate their projects

CGI — Markham, Ontario
Technical Analyst — Java Developer — Summer 2018

- Worked on a Java Spring Boot dashboard for financial institutions
- Increased test coverage from 20 to 80 percent
- Investigated and presented to project managers how machine learning can be leveraged to further improve the application

Intact Financial — Toronto, Ontario
Summer Student — IT Department — Summer 2016

- Created a dashboard to show agile metrics of the software developer terms' productivity for upper management

Intact Financial — Toronto, Ontario
Summer Student — Taxation — Summer 2015

- Completed income tax returns for multiple companies under the intact umbrella
- Automated deposit recovery reconciliation using Excel macros

Sun Life Financial — Waterloo, Ontario
Junior Process Consultant — Process & Productivity Improvement — Winter 2015

- Supported a metrics framework for upper management to track operational efficiency
- Managed the implementation by planning and delivering multiple requirements while collaborating with the clients

Scholarships and Awards

- NSERC Undergraduate Research Award — 2017
- Faculty of Science Dean's Honour Roll — 2017
- Faculty of Science Dean's Honour Roll — 2016

Extracurricular Activities

- Ice Hockey — 2003 – Current
  Newmarket Minor Hockey Association, Laurier Intramural Ice Hockey
- Scouts Canada — 2000 – 2016
  Volunteered at youth camps, teaching survival skills. Helped with various fundraisers and community events, including the Scout Tree program.
- MedVents — 2008 – 2010
  Further developed First Aid and survival skills alongside trained paramedics. Provided First Aid for various camps and community events.