allanwei67@gmail.ca allanwei.com github.com/timeolord

ALLAN WEI

Languages: English, Mandarin, C++, Java, Haskell, Python, Julia

EXPERIENCE

Perepichka Group — *Computational Chemistry*

September 2019

- Performed small molecule DFT and periodic DFT, using Gaussian, Quantum Espresso, and ADF.
- Ran DFT calculations on ComputeCanada clusters using Slurm.
- 3D Modelling and creation of novel compounds using Materials Studios.
- Organized and updated an online lab notebook and Github repository for the documentation of lab procedures.
- Organized, collected, and sorted collections of chemical data, to add to a database to train a graph neural net, for predicting fluorescence and other light-based properties.

Perepichka Group — *Organic Synthesis*

September 2019

- Synthesis of sensitive organic compounds, including in nitrogen atmosphere and dry conditions, primarily Suzuki coupling and lithiation reactions.
- Purification of organic compounds using vacuum sublimation, column chromatography, preparative chromatography.
- Organized and updated an online lab notebook and Github repository for the documentation of lab procedures.

McMedHacks 2021 Mentor

August 2021

- Mentored for McMedHacks specifically relating to neural networks in regards to medical imaging.
- Helped teams in several challenges including, medical image pre-processing, integration of GANs, and AlphaTau's seed detection of real clinical data.

C++ Development

April 2021

- Experience developing with C++ and working with BLAS and Eigen in scientific computing contexts.
- Currently creating a custom deep learning library in C++ as a passion project.
- Familiar with C++ workflows with both GCC and MSVC.
- Experience with optimizing and profiling computationally expensive code, e.g Monte Carlo Search Trees used frequently in the AlphaZero model.

Deep Reinforcement Learning

April 2021

- Created a local cluster for distributed computing using Ray and bash scripts to train the reinforcement agents I've created.

- Wrote a custom OpenAI gym environment to simulate the stock market using real data from web scraped from Yahoo Finance.
- Wrote another custom OpenAI gym environment to wrap over the game Hotline Miami 2. I decompiled and reverse engineered the game to find specific pointer paths to data that is inaccessible normally, i.e raw position values.
- Modified an existing implementation of the MuZero algorithm to work on my custom environment, specifically I implemented a multithreading saver that transfers trained model data onto the head node, as the original implementation was not designed to be run on clusters.

Motion Graphics

- Ran a fiverr account which created custom motion graphic videos of the clients request.
- Proficient in Adobe Illustrator, After Effects, and Premiere.

PROJECTS

ExperiNet

A custom neural network model from scratch in C++ using only Eigen as the linear algebra library. This was built to better understand the underlying mechanics of neural networks and to learn how to optimize computationally expensive software. Currently only supports feedforward networks, but future plans include support for other architectures such as recursive networks.

Reinforcement Learning Stock Trader

A reinforcement learning model that learns how to trade stocks using a modified version of MuZero written in Python. This project had to manage and organize a large database, along with reward shaping to optimize trading profits. A major challenge was modifying the MuZero implementation for distributed training, with the use of Ray. Ultimately performance of the reinforcement agent only matched passive growth, most likely due to lack of training data, as MuZero is very data inefficient, and thus would not make riskier trades that could increase overall profits.

RL Game Agents

A reinforcement learning project written in Python which focused on creating OpenAI gym environments from pre-existing games. Stable baselines was used to train the agent as the focus was on the reverse engineering of the games to create the environment. x64dbg was used to analyze the runtime of Hotline Miami 2, to find key variables needed for training, such as player position, death state, and pointer counter. Furthermore to send the inputs without delay, the win32 apis were used to write directly to the input buffer. Issues were encountered with attempting to vectorize the environment, Brawlhalla did not support multiple game instances, while with Hotline Miami 2 action input became an issue as only the active window would receive the agent's input. Future plans include a total rewrite, and switching to Julia which would make integration with the x64dbg data easier.

Sorting Algorithms Benchmark

A collection of sorting algorithms written in Java, with a generic multithreaded benchmark. This project was made to better understand multithreading, generics, and functional programming in Java.

Fire Alarm

A project made for McHacks 2020, the premise is to use Fourier transforms on the incoming audio of the phone to detect the sounds of a fire alarm to aid deaf or hard of hearing users. This was written in Java for Android devices.

Coffee Break

A project made for uOttaHack 3, the idea is a messaging app for co-workers to talk to each other while working from home, during breaks. People are matched to other co-workers with similar interests. Written in Java for Android devices. Additionally a promotional video was also created.

C++ Pong

A terminal only implementation of Pong written in C++.

EDUCATION

McGill University, Montreal — *B.Sc.*

Expected Graduation in 2023

Blyth Academy, Ottawa — *High School Diploma*

Graduated 2018 followed by a gap year.