




Felix Zhang

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EDUCATION

Honours Bachelor of Science, University of Toronto

Specialist in Computer Science, Major in Mathematics

Sept. 2021 – May 2025

3.96/4.0 cGPA

EXPERIENCE

Machine Learning Researcher

Mar 2024 – Present

KidneyOS, University of Toronto

- Worked under Prof. Jack Sun to implement a memory-safe kernel *KidneyOS* in **Rust** for an introductory operating systems course
- Investigated binding the host file system to enable direct program execution within the **QEMU** emulator

Machine Learning Researcher

July 2023 – Present

BMO Lab, University of Toronto

- Worked under Prof. David Rokeby to integrate motion-capture suits and diffusion models into live performances
- Applied forward dynamics in real-time on motion-capture data using **MuJoCo**, providing joint-level control of the model and the option to extract physical data using inverse dynamics
- Used spherical linear interpolation to smooth highly-stochastic positional data and estimate the velocity and acceleration of joints over time
- Trained agents imitate real-world actions using the actor-critic algorithm and proximal policy optimization

Research Assistant

May 2023 – Present

Biological Physics Group, University of Toronto

- Worked under Prof. Anton Zilman to model receptor signalling via soluble ligands with a high degree of cross-talk
- Implemented a data pre-processing pipeline that transforms highly-stochastic time series into a representative smooth spline and its integral
- Built a feed-forward network in **PyTorch** that predicts the cytokine dynamics of T-cells in response to antigens
- Showed two variables are sufficient to determine cytokine concentrations (as predicted by theoretical work) because the model predicted the correct outputs with an ℓ_2 error of 0.1% using two hidden variables in the final layer

Research Assistant

May 2022 – Sept. 2022

Physics Education Group, University of Toronto

- Worked with Prof. Carolyn Sealfon to develop suggestion extraction models for feedback from physics courses
- Produced a dataset of ~11 000 sentences from student feedback which labels whether they contain suggestions
- Compared the effectiveness of statistical and deep-learning classifiers at extracting suggestions using **scikit-learn** and **TensorFlow** respectively
- Trained the models using **TensorFlow** and **scikit-learn** with a Bayesian hyperparameter optimizer
- Demonstrated the efficacy of a BERT classifier at addressing this problem with it achieving an F_1 score of 0.823

PROJECTS

MNIST-to-EMNIST Domain Adaption

Sept. 2023 – Dec. 2023

- Worked with Joaquin Sanchez-Garcia on applying the theory of optimal transport to domain adaption within the context of image classification.
- Used **Python Optimal Transport** to compute various functions which transform the EMNIST dataset of handwritten digits such that its distribution and priors match those of the MNIST dataset.
- Found that the accuracy of a fully-connected feed-forward classifier trained on the MNIST dataset was improved from 17% to 73% on the EMNIST dataset, demonstrating its usefulness.

MNIST Classifier

Dec. 2022 – Jan. 2023

- Implemented the softmax classifier from “Understanding Machine Learning – from Theory to Algorithms” with stochastic gradient descent using **C++** and the linear algebra library **Eigen3**
- Achieved 92% accuracy on the MNIST dataset of handwritten digits (within 2% of the top classifier using SGD)
- Included the ability to save trained weights, perform batch training, and track the training error in real-time

Image Restoration with Convolutional Neural Networks

Sept. 2020 – June 2021

- Combined the models RIDNet and DeepDeblur using **PyTorch** to determine the ability of convolutional neural networks to deblur and denoise images
- Artificially generated a dataset of ~5 000 noisy, blurred images using a Poisson-Gaussian noise model
- Discovered that integrating the two models offers marginal improvements over their individual performance

TECHNICAL SKILLS

Languages	Python, C, C++, Rust, Java
Frameworks	PyTorch, TensorFlow, scikit-learn, NumPy, Pandas, SciPy, Matplotlib, MuJoCo, Eigen3
Tools	Git, shell, ssh, Unix, CMake, Anaconda, Google Colab, QEMU, Jupyter, WSL, Slurm

STUDENT LEADERSHIP

Director of Internal Relations	Apr. 2023 – Present
<i>Computer Science Student Union, University of Toronto</i>	
<ul style="list-style-type: none">Organized orientation for the ~500 undergraduate students entering the computer science (CMP1) streamPlanned 10+ events in collaboration with various partners in industry (such as AMD and Google) and student organizations (such as UTMIST ✉ and WiCS ✉)Hosted 3+ talks with professors in the Department of Computer Science at the University of Toronto	
First-Year Academic Officer	Sept. 2021 – Apr. 2022
<i>Math Union, University of Toronto</i>	
<ul style="list-style-type: none">Facilitated discussions between 20 mentor-mentee pairs in the <i>First-Year Mentorship Program</i> by providing guidance to the upper-year mentorsOrganized “Coffee and Chat” events which allowed for informal discussions between students and math professors	
Registered Study Group Leader	Sept. 2021 – April 2022
<i>Sidney Smith Commons, University of Toronto</i>	
<ul style="list-style-type: none">Led study groups for <i>Foundations of Computer Science I</i> and <i>Enriched Introduction to the Theory of Computation</i>Headed weekly meetings for first-years students that reviewed content covered in the previous week’s lectureDeveloped example problems to clarify and reinforce important concepts through group discussion	

AWARDS & SCHOLARSHIPS

Dean’s List Scholar , University of Toronto	Sept. 2021 – Present
Second Malcom Wallace Scholarship (\$4 500), University of Toronto	Sept. 2021 – Present
Louis Savlov Scholarships in Sciences And Humanities (\$500), University of Toronto	Nov. 2023
University of Toronto Scholar (\$7 500), University of Toronto	Sept. 2021
BC Achievement Scholarship (\$1 250), Government of British Columbia	Aug. 2021
District/Authority Scholarship (\$1 250), Government of British Columbia	Aug. 2021

SELECTED COURSEWORK

Code	Title	Term
CSC324	Principles of Programming Languages	Winter 2024
CSC412 [†]	Probabilistic Learning and Reasoning	Winter 2024
CSC413 [†]	Neural Networks and Deep Learning	Winter 2024
CSC473	Advanced Algorithm Design	Winter 2024
MAT357	Real Analysis I	Winter 2024
APM462	Nonlinear Optimization	Fall 2023
CSC369	Operating Systems	Fall 2023
CSC420	Introduction to Image Understanding	Fall 2023
MAT354	Complex Analysis I	Fall 2023
MAT377	Mathematical Probability	Fall 2023
CSC373	Algorithm Design, Analysis and Complexity	Winter 2023
CSC384	Introduction to Artificial Intelligence	Winter 2023
CSC463	Computational Complexity and Computability	Fall 2022

[†]Cross-listed graduate courses