Felix Zhang

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Education

Honours Bachelor of Science, University of Toronto Sept. 2021 – May 2025
Specialist in Computer Science, Major in Mathematics *3.96/4.0 cGPA*

Experience

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
- Explored the use of reinforcement learning to train agents which imitate given real-world actions

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 Student 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.

Student Response Classifier Mar. 2023 – Apr. 2023

- Developed a 3-parameter logistic item response theory classifier in **PyTorch**, using alternating gradient descent for training, to predict the correctness of student answers to multiple-choice questions
- Obtained an accuracy of *72%* on the *NeurIPS 2020 Education Challenge* dataset (within 5% of the best solution)

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++, Java
Frameworks	PyTorch, TensorFlow, scikit-learn, NumPy, Pandas, SciPy, Matplotlib, MuJoCo, Eigen3
Tools	Git, Google Colab, Jupyter, Anaconda, Linux, shell, WSL, Slurm, CMake

Student Leadership

Director of Internal Relations Apr. 2023 – Present

Computer Science Student Union, University of Toronto

- Organized orientation for the ~500 undergraduate students entering the computer science (CMP1) stream
- Planned 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

Math Union, University of Toronto

- Facilitated discussions between 20 mentor-mentee pairs in the *First-Year Mentorship Program* by providing guidance to the upper-year mentors
- Organized "Coffee and Chat" events which allowed for informal discussions between students and math professors

Registered Study Group Leader Sept. 2021 – April 2022

Sidney Smith Commons, University of Toronto

- Led study groups for *Foundations of Computer Science I* and *Enriched Introduction to the Theory of Computation*
- Headed weekly meetings for first-years students that reviewed content covered in the previous week's lecture
- Developed 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
MAT327	Introduction to Topology	Summer 2023
CSC373	Algorithm Design, Analysis and Complexity	Winter 2023
CSC384	Introduction to Artificial Intelligence	Winter 2023
CSC463	Computational Complexity and Computability	Fall 2022
MAT344	Introduction to Combinatorics	Summer 2022

†Cross-listed graduate courses