# Alex Kazachek

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## Education

**Western University**
*Sep 2019 – Apr 2023 (Projected)*

Honours BSc in Mathematics & Data Science.

GPA of 3.92.

## Awards

**RBC Data Science Scholarship**
*2021 School Year*

Recognized as a prospective student in data science and machine learning.

**Albert O. Jeffery Scholarship**
*2021 School Year*

Achieved the top average in third-year mathematics.

**Cecil G. Gracey Scholarship**
*2020 School Year*

Achieved the top average in second-year mathematics.

**Borwein Memorial Prize**
*2020 School Year*

Earned the highest grade in Real Analysis I (Math 2122B).

## Skills

**Programming**
Python (NumPy, SciPy, PyTorch, Pandas), R, C, Java, MATLAB, Mathematica, JavaScript (React.js)

**Tools**
Jupyter, LaTeX, Beamer, Excel, GitHub

**Areas**
Mathematics, Statistics, Machine Learning, Data Science

## Work Experience

**Western University | NSERC Research Assistant**
*May 2022 – Present*

Working in quantum information, specifically on the entanglement of coherent states in the Segal-Bargmann space.

**Western University | Teaching Assistant**
*Sep 2021 – Apr 2022*

Marked and proctored assessments for Math 2155F, AM 1201B, and Calc 1000B.

Topics include mathematical proofs, linear algebra and probability with applications to biology, and calculus.

**Western University | NSERC Research Assistant**
*May 2021 – Aug 2021*

Connected Kähler geometry with quantum information, publishing an inequality pertaining to the entanglement of formation of disjoint Kähler submanifolds.

## Projects

**American Option Pricing Techniques**
*Aug 2022*

Read a paper on a method to price American options, then wrote about and implemented it for calls. Parametres for the optimal exercise strategy are estimated by optimizing with SciPy. Monte-Carlo simulations then use them to compute low- and high-bias estimators of the option value.

**Physics-Informed Neural Network Optimization**
*Jan 2022 – May 2022*

Worked on a project on physics-informed neural networks (PINNs). Helped developed the theory for why certain optimizers, namely SGDM and Adam, mitigate spectral bias, the tendency for PINNs to learn lower frequencies of the target function first.

**Domain Adaptation with Neural Networks**
*Nov 2021*

Implemented a domain-adversarial neural network by hand, using NumPy to carry out the optimization procedure described in the paper. Processed both the MNIST and MNIST-M datasets, then trained the network using the former as the source domain and the latter as the target.

**2021 Canadian Undergraduate Mathematics Conference**
*Jan 2021 – Aug 2021*

Helped organize the conference, scouting professors and industry professionals for panels, workshops, and plenary lectures. Also designed and built the website using React.js, including mobile support and language localization.

## Clubs

**Math Club at Western (MaCAW) | Vice President**
*Sep 2021 – Present*

Started running biweekly math contests, helping write and grade them. Also introduced student seminars, events for undergraduates to deliver lectures on their research and thesis projects.

## Publications

G. Farhani, A. Kazachek, and B. Wang. "Momentum diminishes the effect of spectral bias in physics-informed neural networks." arXiv:2206.14862.

T. Barron and A. Kazachek. "Entanglement of mixed states in Kähler quantization." Lie Theory and Its Applications in Physics, Springer Proc. Math. Stat., 2021.

## Interests

Beat Saber (top 50 in Canada).

Speedcubing (personal best of 12.55 seconds).

Math contests (top Putnam score in the math department).

Callisthenics, rock climbing, and bouldering.