

# Jesse Sun

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## WORK EXPERIENCE

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### Machine Learning Engineer

May. 2023 – Present

*BetterUp*

*Remote*

- Drove end-to-end development of a LLM-based personalized message templating tool, scaling A/B tests and conducting quantitative utilization analysis - now a tool that 20% of coaches use weekly.
- Led a group of 4 engineers in a system health initiative, directly optimizing Ruby on Rails code for high-traffic web app endpoints, slashing p95 latency by up to 40%.
- Engineered a prototype AI assistant using OpenAI Assistants API and RAG pipeline LLM, integrating it with a scalable OpenSearch vector database.

### Research Assistant

Jan. 2023 – June 2023

*University of Waterloo — Advised by David Saunders & Mario Ghossoub*

*Waterloo, Ontario*

- Developed a Python package using numpy & CVXPY to empirically study and test bounds on the minimum composition norms of Choquet capacities on product spaces.
- Devised efficient algorithms for simulating stochastic marginal capacities within set constraints, and adeptly constructed and solved complex nonlinear programs.
- Applications in uncertainty estimation and cooperative game theory.

### Machine Learning Engineer Intern

Jan. 2022 – Aug. 2022

*BetterUp — Recommendation Systems Team*

*Remote*

- Drove R&D for a feature store platform, expertly integrating Feast, Snowflake, Redis, and AWS for robust solutions.
- Directed the development of a multi-objective ranking system, enhancing the capabilities of the recommendation engine API used in core business logic.
- Optimized the recommendation engine through modularizing and scaling up the AWS infrastructure, reducing memory usage by 33% and deployment time by more than 50%.

### Undergraduate Research Fellow

May 2021 – Aug. 2021

*University of Waterloo — Advised by Yaoliang Yu*

*Waterloo, Ontario*

- Researched generative multivariate quantile neural models using optimal transport for probabilistic forecasting, out-of-distribution/anomaly detection, and uncertainty/risk quantification.
- Workshop paper accepted to ICLR 2022 DGM4HSD workshop.

### Research Intern

Sept. 2020 – Dec. 2020

*University Health Network — Advised by Bo Wang*

*Toronto, Ontario*

- Proposed novel self-supervised pre-training method for 3D point clouds in PyTorch via persistent homology.
- Improved classification accuracy of PointNet and Dynamic Graph CNN (DGCNN) models on the ModelNet40 dataset by up to 2% relative to fully supervised counterpart.
- Contributed in data collection, pre-processing, and developing a temporal convolutional network (TCN) for daily forecasting of COVID-19 cases in regions from tabular data for the global XPRIZE Pandemic Response Challenge.

### Research Intern

Jan. 2020 – Apr. 2020

*University Health Network — Advised by Bo Wang*

*Toronto, Ontario*

- Built and migrated novel image segmentation framework for automatic scar quantification.
- Automated pre-processing pipeline to clean and generate ground truth masks for scars in hypertrophic cardiomyopathy patients' MR images based on manual pixel intensity heuristic used by clinicians.

### Research Intern

May 2019 – Aug. 2019

*University Health Network — Advised by Bo Wang*

*Toronto, Ontario*

- Spearheaded research in deep segmentation models for automatic ventricular segmentation from MR image using PyTorch & CUDA.
- Improved state-of-the-art on ventricular segmentation datasets SUN09 and AC17 by up to 3% in Dice score coefficient.

## TECHNICAL SKILLS

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**Languages:** Python, Rust, C++, R, Ruby, Javascript

**Frameworks:** Ruby on Rails, Ember

**Tools:** PyTorch, numpy, TensorFlow, Docker, JAX, CVXPY, GluonTS, pandas, scikit-learn, Slurm, Haystack

**Technologies:** AWS, Hugging Face, Feast Feature Store, Redis, Snowflake, Terraform, Datadog, Amplitude

## EDUCATION

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### University of Waterloo

Waterloo, ON

*Bachelor of Computer Science, Honours, Co-op. cGPA: 3.84, Faculty GPA: 3.92*

*Sept. 2018 – Apr. 2023*

- *Graduate Courses:* Optimization for Data Science (CS794), Continuous Optimization (CO466/666), Stochastic Processes II (STAT433/833), Intro. to Machine Learning (CS480/680), Algorithm Design and Analysis (CS466/666), Convex Optimization and Analysis (CO463/663)
- *Undergraduate Courses:* Advanced Probability (STAT240), Stochastic Processes I (STAT333), Algorithms (CS341), Game Theory (CO456), Financial Modelling (CS476), Operating Systems (CS350)

## PUBLICATIONS & WORKSHOP PAPERS (\* DENOTES EQUAL CONTRIBUTION)

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### 3. Conditional Generative Quantile Networks via Optimal Transport

Jesse Sun, Dihong Jiang, Yaoliang Yu.

*International Conference on Learning Representations 2022 - Deep Generative Models for Highly Structured Data Workshop.*

### 2. Automated Left Ventricular Scar Quantification in Hypertrophic Cardiomyopathy Patients with an Interpretable Machine Learning Model

Zeinab Ghaziani\*, Jesse Sun\*, Raymond Chan, Kate Hanneman, Amna Al-Arnawoot, Harry Rakowski, Barry Maron, Bo Wang, Wendy Tsang

*Circulation (2020) & PLOS Digital Health (2023)*

### 1. SAUNet: Shape Attentive U-Net for Interpretable Medical Image Segmentation

Jesse Sun, Fatemeh Darbehani, Mark Zaidi, Bo Wang

*International Conference on Medical Image Computing and Computer Assisted Intervention 2020, MICCAI 2020.*

## OPEN SOURCE PROJECTS

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### RAG LLM in Rust

2024

Fast & scalable implementation of Retrieval Augmented Generation (RAG) to enrich LLM prompting. Uses LLM backbones to extract embeddings. Built in *Rust* with *qdrant* vector database.

### Minimum Choquet Capacities in Product Spaces Simulations

2023

Open source code for evaluating the minimum composition norm of the product capacity of randomized marginals. Built in *Python* using *numpy* and *CVXPY*.

### Anti-chess Bot (Game Theory Final Project)

2023

Bot that plays antichess using the alpha-beta pruning algorithm. Built in *Python*.

## AWARDS AND SCHOLARSHIPS

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Undergraduate Research Assistant (URA) Funding (\$2,000 CAD)

2022

President's Research Award (\$3,000 CAD)

2021

Cheriton School of Computer Science, Undergraduate Research Fellowship (\$15,000 CAD)

2021

Software Engineering Entrance Scholarship (\$4,000 CAD)

2018

Math Faculty Entrance Scholarship (\$10,000 CAD)

2018

University of Waterloo President's Scholarship of Distinction (\$2,000 CAD)

2018

## LEADERSHIP AND SERVICE

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**Reviewer:** ICML 2022, NeurIPS 2022

**Clubs:** University of Waterloo Data Science Club, University of Waterloo Poker Club.

## TALKS AND PRESENTATIONS

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### Workshop on Generative AI and LLMs

Nov. 2023

Presented at *Codebuds* Workshop (Organization for high school students interested in tech)

### Introduction to Deep Learning Workshop

Nov. 2021

Presented at *Dataverse 2021* datathon.

### Computer Vision Reading Group

Fall 2021

Presented at *University of Waterloo Data Science Club*.

<b>MICCAI 2020 Oral and Poster Sessions - Shape Attentive U-Net</b> Presented at <i>MICCAI 2020</i> .	Oct. 2020
<b>Self-Supervised Training of Graph Convolutional Networks</b> Presented at University Health Network.	Aug. 2020
<b>Graph Convolutional Networks and Applications for Drug Discovery Tasks</b> Presented at University Health Network.	Apr. 2020
<b>Shape Attentive U-Net</b> Presented at University Health Network.	Jan. 2020
<b>Neural State Machines: Learning by Abstractions</b> Presented at University of Waterloo Data Science Club.	Nov. 2019
<b>Intro to Neural Networks and Optimization</b> Presented at University of Waterloo Data Science Club.	Oct. 2019
<b>Sanity Checks in Computer Vision</b> Presented at University Health Network.	July 2019
<b>EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks</b> Presented at University Health Network.	June 2019

## INTERESTS AND FUN FACTS

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- I'm currently training for an Ironman 70.3 in Switzerland this year!
- Long distance runner! I've completed 2 marathons so far, and I am aiming to run sub 3 this fall.
- I love travelling! Had the wonderful opportunity to be a digital nomad in Asia as I visited 4 different regions for more than a month in 2023.