

Sophia Pietsch

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Education

University of Waterloo

GPA: 96.41% / Major GPA: 97.22%

CANDIDATE FOR BACHELOR OF COMPUTER SCIENCE

September 2018 - June 2023

- **Computer Science:** Machine Learning, Artificial Intelligence, Computer Vision, Operating Systems, Algorithm Design and Analysis, Computer Security and Privacy, Distributed Computing, Graphics, Databases
- **Mathematics:** Advanced-Level Calculus, Advanced-Level Algebra, Advanced-Level Linear Algebra, Combinatorics, Optimization, Advanced-Level Probability, Advanced-Level Statistics

Research Interests

Reinforcement Learning, Multi-Task Learning, Meta Learning, Few-Shot Learning, Unsupervised Learning

Research Experience

Waabi Innovation Inc.

Toronto

ADVISORS: RAQUEL URTASUN AND SERGIO CASAS

May 2022 - August 2022

- Developed and optimized trajectory prediction models to give the best predictions for vehicles that are important to the planning module of Waabi's self-driving software, improving prediction metrics for these vehicles by 10%
- Presented a paper at an internal conference, reviewed other submissions for the conference and participated in discussions about presented topics

Cryptography, Security, and Privacy Lab, University of Waterloo

Remote

ADVISORS: FLORIAN KERSCHBAUM AND EHSAN AMJADIAN

September 2021 - April 2022

- Created a novel distributed anomaly detection system for PDF documents by clustering encrypted confidential data, allowing multiple parties to share early warnings about potential malware
- Designed a custom PyTorch autoencoder to convert extracted features to a format suitable for inner product encryption, allowing distance computation between encrypted feature vectors without exposing other information
- Made architecture resilient against adversarial attacks by training autoencoder to be robust against small changes in PDFs, decreasing the number of misclassifications caused by such modifications by 50%
- Designed custom clustering algorithm to identify classes of similar PDFs based on distances between feature vectors, correctly grouping 94% of similar PDFs together and identifying 89% of existing classes

Cryptography, Security, and Privacy Lab, University of Waterloo

Remote

ADVISOR: FLORIAN KERSCHBAUM

May 2021 - August 2021

- Created and implemented a new algorithm that reduces inequality comparisons over homomorphically encrypted data to a linear number of equality comparisons
- Significantly increased number of calculations possible over homomorphically encrypted data by reducing the amount of consecutive multiplications to a desired level while increasing the number of overall multiplications

Research Projects

Inequality Comparisons over Homomorphically Encrypted Data

University of Waterloo

COURSE: ALGORITHM DESIGN AND ANALYSIS

2021

- Proved correctness and runtime for the inequality comparison algorithm developed at the Cryptography, Security, and Privacy lab
- Researched previous work in the area, wrote a paper contrasting the new approach with a prevalent algorithm and presented the paper to the course

Training Connect 4 Agents Against an Optimal Agent

University of Waterloo

COURSE: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

2020

- Trained Connect 4 agents using Temporal Difference Learning, beating an optimal agent over 80% of the time
- Modified the reward function to allow agents to train against an existing optimal agent
- Documented methodology and results in a paper as a group and presented the project to the course

Industry Experience

Bloomberg

New York

SOFTWARE ENGINEERING INTERN

August 2022 - December 2022

- Investigated algorithms and methods for the detection of performance regressions in a system processing real-time financial data, ensuring the availability of a system used by major financial corporations
- Chose an anomaly detection algorithm suitable for the type of metric data available by evaluating the precision and recall of methods on sample data from the system
- Designed and implemented an application which uses the proposed algorithm to detect performance regressions, resolving issues before they impact clients

Side Effects Software, Inc.

Remote

3D SOFTWARE DEVELOPER

January 2021 - April 2021

- Created prototypes for a new editing tool in the Houdini 3D modeling and special effects software using C++, allowing users to reduce the stretching or contraction of texture maps
- Computed optimal shapes of triangles in mesh and used Least Squares Conformal Mapping algorithm with these shapes to obtain a modified texture map whose stretching and contraction is automatically reduced
- Allowed redistribution of stretching and contraction of texture maps through user-defined weights by using a harmonic map

Skills

Deep Learning PyTorch, TensorFlow, Keras

Programming Python, C++, C, Java, C#, Scala, TypeScript/JavaScript, SQL

Technologies Hadoop, Spark, PostgreSQL, Linux

Scholarships and Awards

Women in Mathematics Scholarship

2022

UNIVERSITY OF WATERLOO

President's Research Award

2021

UNIVERSITY OF WATERLOO

Hack the North Finalist

2021

HACK THE NORTH

Karen Padham Taylor Scholarship for Women in Computer Science

2020

UNIVERSITY OF WATERLOO

John Hin Chung Tsang Memorial Scholarship

2019

UNIVERSITY OF WATERLOO

Personal Interests

Cooking, Video Games, Reading, Cosmology, Swimming, Sculpting, Skiing, Drawing, Painting, Quantum Mechanics