Anatoly Zavyalov

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## **Research Interests**

Differential Privacy, Sublinear Algorithms

## Education

#### **Boston University**

Ph.D. Student in Computer Science

#### University of Toronto

H.B.Sc. Applied Mathematics 3.95 cGPA

September 2024 - June 2029 (expected)

September 2020 - June 2024

February 2025

March 2023

November 2022

### **Honors and Awards**

#### Chair's Graduate Fellowship - \$10,000 USD

Awarded on admission to Boston University

Wasteneys Chancellor's Scholarship - \$500 CADNovember 2023Awarded for high academic achievement in the 2022-2023 academic session by the<br/>Trinity College at the University of Toronto.

#### **Dean's List Scholar**

June 2021, June 2022, June 2023

Awarded to a small group of the University of Toronto's Faculty of Arts & Science students who have a cumulative GPA of 3.50 or higher after completing 6 credits.

NSERC Undergraduate Student Research Award - \$7,500 CAD

OFFERED BY THE UNIVERSITY OF TORONTO'S DEPARTMENT OF COMPUTER SCIENCE FOR THE PROJECT "COMMUTATIVITY IN PROGRAM VERIFICATION".

### Ashbaugh Chancellor's Scholarship - \$500 CAD

Awarded for high academic achievement in the 2021-2022 academic session by the Trinity College at the University of Toronto.

**NSERC Undergraduate Student Research Award (Declined the offer) - \$7,500 CAD** March 2022 OFFERED BY THE UNIVERSITY OF TORONTO'S DEPARTMENT OF COMPUTER SCIENCE FOR THE PROJECT "ONLINE AND OTHER MYOPIC ALGORITHMS". I DECLINED THE OFFER.

Fields Undergraduate Summer Research Program (Declined the offer)March 2022OFFERED BY THE FIELDS INSTITUTE FOR THE PROJECT "EXTENDING TRACE THEORY FOR<br/>CONCURRENT PROGRAM ANALYSIS". I DECLINED THE OFFER.March 2022

AWARDED FOR HIGH ACADEMIC ACHIEVEMENT IN THE 2020-2021 ACADEMIC SESSION BY THE TRINITY COLLEGE AT THE UNIVERSITY OF TORONTO.

Summer Undergraduate Research Program (SURP) Fellowship - \$9,595 CAD May 2021 AWARDED BY THE DAVID A. DUNLAP DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS AT THE UNIVERSITY OF TORONTO.

# University of Toronto Excellence Award (UTEA) - \$7,500 CAD

AWARDED TO SUPPLEMENT FUNDING FOR SURP RESEARCH.

# **Publications**

- Jeffrey Shallit, Anatoly Zavyalov, "Transduction of Automatic Sequences and 2023 Applications", In: Nagy, B. (eds) Implementation and Application of Automata. CIAA 2023. Lecture Notes in Computer Science, vol 14151. Springer, Cham. (10 August 2023); https://doi.org/10.1007/978-3-031-40247-0 20
- 2022 Adam D. Hincks, Anatoly Zavyalov, and Dhananjhay Bansal, "A graph database solution for tracking the deployment and layout of a large radio interferometer", Proc. SPIE 12189, Software and Cyberinfrastructure for Astronomy VII, 1218909 (29 August 2022); https://doi.org/10.1117/12.2627960

Devin Crichton, et al., "The Hydrogen Intensity and Real-time Analysis eXperiment: 256-Element Array Status and Overview." J. Astron. Telesc. Instrum. Syst. 8 (1), 011019 (12 January 2022); https://doi.org/10.1117/1.JATIS.8.1.011019

# Talks

- 2023 27th International Conference on Implementation and Application of Automata (CIAA) 2023): "Transduction of Automatic Sequences and Applications". (September 22, 2023, 30min) (Slides)
  - SigmaCamp 2023: "Automata Theory: The Foundations of Computer Science". (August 14, 2023, 1hr) (Slides)
  - Canadian Undergraduate Math Conference (CUMC) 2023: "Automatic Sequences". (June 21, 2023, 30min) (Slides)
  - UTSC CMS Undergraduate Seminar: "Automatic Sequences". (January 19, 2023, 1hr) (Slides) (Recording)

# **Undergraduate Research Experience**

## **UNIVERSITY OF WATERLOO** | RESEARCH ASSISTANT

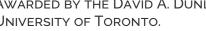
DAVID R. CHERITON SCHOOL OF COMPUTER SCIENCE

- Researching and implementing algorithms into **Walnut**, a theorem proving software for automatic sequences written in Java, under the supervision of Professor Jeffrey Shallit.
- Research culminated in a publication and presentation at the 27th International Conference on Implementation and Application of Automata (CIAA 2023).

May 2022 - July 2023

April 2021

November 2021



Elizabeth Kingstone Scholarship - \$500

#### **UNIVERSITY OF TORONTO** | RESEARCH ASSISTANT

DEPARTMENT OF COMPUTER SCIENCE

- Researched algebraic methods for concurrent program verification and race condition detection.
- Created a **Python** program for detecting race conditions in models of multithreaded programs.
- Research done as part of the CS Undergraduate Research Summer Program at the University of Toronto, supported by an NSERC Undergraduate Student Research Award.

#### **UNIVERSITY OF TORONTO** | RESEARCH FELLOW

May 2021 – April 2022

DAVID A. DUNLAP DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS

- Developed **Padloper**, a full-stack graph database solution for tracking deployment and layout of a large radio interferometer, using JanusGraph, Flask and React, under the supervision of Professor Adam Hincks.
- Benchmarked ways to represent properties, connections, and changes to components in a JanusGraph graph database for efficient and intuitive querying.
- Research done in part during the **Summer Undergraduate Research Program (SURP)** in the DADDAA, conducted in the summer of 2021.
- Research culminated in a publication in SPIE Astronomical Telescopes + Instrumentation 2022 and proceedings at SPIE's Software and Cyberinfrastructure for Astronomy VII conference.
- Padloper is to be used for the Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX) and at the **Simons Observatory**.

# **Teaching Experience**

#### **UNIVERSITY OF TORONTO** | TEACHING ASSISTANT

- Teaching Assistant for CSC363: Computational Complexity and Computability (January 2024 - Present)
- Lead Teaching Assistant for CSC373H5: Algorithm Design and Analysis (September 2023 -December 2023)
  - Authoring problems for course assignments, supervising a team of five teaching assistants.
- Teaching Assistant for CSC240H1: Enriched Introduction to the Theory of Computation (February 2022 - May 2022)
  - Graded assignments and tests for 90+ students, ran tutorials on automata theory and correctness of algorithms.

## **UNIVERSITY OF TORONTO** | SUMMER CAMP ASSISTANT

#### MATHEMATICS OUTREACH OFFICE, DEPARTMENT OF MATHEMATICS

- Supervised online camp sessions, tracked student attendance, and solved technical problems.
- Helped students during problem-solving sessions to turn their ideas into proper solutions.

### WESTON LEARNING CENTRE | TEACHING ASSISTANT

- Instructed accelerated Grade 12 Physics (SPH4U) and Grade 11 Functions (MHF3U) curricula.
- Led a course on computer fluency and introduction to programming using Scratch and Python.

### **PRIVATE TUTOR**

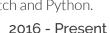
- Working with dozens of clients over several years, solidifying students' understanding of material, exposing them to new topics, and preparing them for tests, examinations and contests.
- Teaching mathematics, physics, computer science and programming in Python and Java.

February 2022 – Present

July 2021 - August 2021

March 2018 - August 2020

# May 2023 – August 2023



# **Other Experience/Volunteering**

## **SIGMACAMP** | Administrator & Counselor

- Leading the "Problem of the Month" contest, providing an opportunity for continuous learning and problem-solving.
- Teaching Assistant for "Surprises in Probability" semilab instructed by Professor Sofya Raskhodnikova; prepared hands-on activities involving counterintuitive topics in probability.
- Gave lectures on automata theory, graph algorithms, and Python basics.

# Projects

SUPREM.IO

## REACT, JAVASCRIPT, HTML, CSS, PIXIJS, NODE.JS, COLYSEUS

An online multiplayer battle arena platformer game with tons of weapons and enthralling, high-pace gameplay.

- SUPREM.IO achieved more than 200,000 page views in March 2023.
- Created and fostered a community of 650+ players around the game.
- Singlehandedly created and developed the game, including all game assets and graphics, gameplay, game logic and server-side infrastructure.
- Used the PixiJS rendering library for rendering the game, and used React, JavaScript, HTML and CSS for the front-end interface.
- Used NodeJS, Colyseus, and Nginx for the backend.

# DIFFMUSE 🖸

A diffusion model for generating classical piano music.

- Implemented quantitative metrics for model evaluation in **PyTorch**.
- Created an algorithm for cleaning datasets of piano performances to remove short notes in **PyTorch**, which was used to assemble the model's training set.

## VESSEL CLASH

A space-themed endless arcade shooter with thrilling powerups, unique enemies, and epic bosses.

# OGYGIUS 🗹

A top-down Minecraft-esque survival game, with crafting, animals, building, and procedurally generating biomes.

# Skills

- Languages: English (fluent), Russian (fluent), German (intermediate)
- Programming Languages: C++, Java, Python, JavaScript, TypeScript
- Web & Backend: React, HTML, CSS, Flask, PostgreSQL, JanusGraph, Colyseus
- Other: NumPy, Pandas, PixiJS, SFML, &TEX, Git

# **Professional Development**

Linear Regression with NumPy and Python (Coursera)  $\square$ 

Database Design and Basic SQL in PostgreSQL (Coursera)  $\square$ 

## C++, SFML

PYTORCH, NUMPY

#### C++, SFML

AUGUST 2022

**JUNE 2022** 

2022 - Present