Anatoly Zavyalov

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Research Interests

Differential Privacy, Sublinear Algorithms

Education

Boston University September 2024 - June 2029 (expected)
Ph.D. Student in Computer Science

University of Toronto September 2020 - June 2024
H.B.Sc. Applied Mathematics
3.95 cGPA

Honors and Awards

Chair's Graduate Fellowship - $10,000 USD February 2025
Awarded on admission to Boston University

Wasteneys Chancellor's Scholarship - $500 CAD November 2023
Awarded for high academic achievement in the 2022-2023 academic session by the 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 March 2023
Offered by the University of Toronto's Department of Computer Science for the project "Commutativity in Program Verification".

Ashbaugh Chancellor's Scholarship - $500 CAD November 2022
Awarded for high academic achievement in the 2021-2022 academic session by the Trinity College at the University of Toronto.

University of Toronto Scholar - $1,500 $\times$ 2 August 2021, August 2022
Awarded for being one of the most outstanding students in my cohort after completing first and second years.

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 2022
Offered by the Fields Institute for the project "Extending Trace Theory for Concurrent Program Analysis". I declined the offer.

Elizabeth Kingstone Scholarship - $500 November 2021
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 April 2021
Awarded to supplement funding for SURP research.

Publications

2023 Jeffrey Shallit, **Anatoly Zavyalov**, " Transduction of Automatic Sequences and 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 May 2022 – July 2023
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).

UNIVERSITY OF TORONTO | Research Assistant May 2023 – August 2023

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 February 2022 – Present

- 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 July 2021 - August 2021

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 March 2018 - August 2020

- 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 2016 - Present

- 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.

Other Experience/Volunteering

SIGMACAMP | Administrator & Counselor 2022 - Present

- 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 PyTorch, NumPy

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 C++, SFML

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

OGYGIUS C++, SFML

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, LaTeX, Git

Professional Development

Linear Regression with NumPy and Python (Coursera) August 2022

Database Design and Basic SQL in PostgreSQL (Coursera) June 2022