Alexey Izmailov

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Education

Brown University RI, USA

B.Sc. Applied Math and Computer Science *Sep 2020 – May 2024 (Expected)*

Graduate coursework: Recent Applications of Probability and Statistics, Modern Algebra I, Numerical Solutions to Partial Differential Equations I (finite difference methods) & II (classical finite element methods) & III (finite elements for mixed/saddle point problems), Theory of Partial Differential Equations I

Independent Study: SciML for parametric PDE (Mark Ainsworth, 2022-2023), functional analysis (John Ahn, 2021)

Undergraduate coursework: Wavelets and Applications, Machine Learning, Design and Analysis of Algorithms, Applied Cryptography, Data Science, Blockchains and Cryptocurrencies, Data Structures and Algorithms, Applied Dynamical Systems, Statistical Inference, Topics in Abstract Algebra (Galois Theory)

Research Experience

Oden Institute, Center for Computational Visualization TX, USA

Moncrief Fellowship Research Assistant *Jun 2023 – Aug 2023*

- Working with Chandrajit Bajaj on automatic discovery of PDE Lie symmetries for augmenting SciML techniques

Flatiron Institute, Center for Computational Mathematics NY, USA

Undergraduate Research Assistant *Jun 2022 – Aug 2022*

- Developed *scikit-stan*, a novel open-source Python interface to Stan that matches the *scikit-learn* API and provides probabilistic programming models
- Implemented generalized regression models with high degree of customizability and modularity for priors, family-link combinations, and adherence to several visualization libraries
- Developed a rigorous test suite and developed multi-OS installation support

Computational Flow Group, Brown University RI, USA

Undergraduate Research Assistant *Feb 2022 – Present*

- Designing and implementing a novel Python package for demonstrating a forward-inverse workflow for acoustically-forced bubble cavitation problems and associated material characterization via PINNs
- Developed numerical simulations for bubble cavitation for supercomputer processing of three dimensions for viscoelastic-air and water-air simulations with biomedical applications to mitigate adverse health effects from ultrasounds as part of the Eulerian Multiphase Solver

Work Experience

Anailytica Inc. Remote

Full-Stack Software Engineering Contractor *May 2022 – Aug 2022*

- Containerized and optimized research code for particle-tracking velocimetry applications of physics-informed neural networks as a novel engineering product for industrial purposes
- Developed novel web application with user management, data operations on training data and neural network results, and an interactive visualization suite as the front end
- Created modularized endpoints for user management through SQL database and connectivity with compute cluster for GPU-optimized neural network computations based on user data and options

Everaise Academy Remote

Curriculum Developer and Instructor *May 2020 – Aug 2020*

- Developed curriculum advanced topics in math competitions at the high AIME and olympiad level
- Held office hours and provided detailed feedback on problem sets for 100+ students
- Co-wrote a 256 page text about problem solving and preparation for math competitions

Awards & Achievements

Meritorious Winner COMAP MCM 2023: Top 7% competitor in international math modelling competition consisting of $\sim$ 11,000 teams; top 200 on Problem A (continuous math)

Spring 2023 UTRA Grant: Amount: $ 1,200, awarded to select undergraduate researchers at Brown University for a project with Professor Kavita Ramanan

Winner of Brown Math Contest for Modelling 2022: Winning submission in weekend-long math modelling competition; awarded a modest cash prize and fees paid for ICM/MCM in 2023

Summer 2022 UTRA Grant: Amount: $ 2,500, awarded to select undergraduate researchers at Brown University for a project in the Rodriguez Flow Research Group

USA Math Talent Search Silver Medalist (2018), Bronze Medalist (2017, 2019)

USA National Chemistry Olympiad Semi-finalist (2017, 2018)

USA National Computing Olympiad Silver Medalist (2019)

Projects

Signatures for Hand Synergies | *GitHub* | *Technical Summary*

- An exploratory Python project applying the signature method to hand motion data from the NINAPRO database
- Implements several machine learning methods including Elastic Net, SVM, and MLP classifiers and associated statistical analysis (ANOVA, CV)

Brown University DRP Spring 2021 Write-up | *Summary*

- A 27 page report about my graduate functional analysis directed reading program covering reproducing kernel Hilbert spaces, representations and applications such as the Karhunen-Loeve transform

Numerical Methods for PDE | *GitHub*

- In-progress project regarding the implementation of various schemes for solving partial differential equations using FDM and FEM algorithms in Python, MATLAB, C++
- Implemented Crank-Nicolson, Forward and Backward Euler, Lax-Friedrichs, Lax-Wendroff and Method of Lines for Transport and Heat equations

BrunoCoin | *GitHub*

- Multi-threaded proof-of-concept cryptocurrency and blockchain from scratch featuring proof of work mining, full transaction capabilities, and ledgers that follows the Bitcoin whitepaper
- Uses a gRPC server with Google's Protobuf as a local simulation of network communication with 1000+ nodes and 200+ miners

Leadership

PyOpenScience Package Reviewer — Remote
Apr 2023 – Present

Teaching Assistant (PHP2561) — RI, USA
Jan 2022 – May 2022

- Elected as TA for graduate bioinformatics & data science course focusing on implementation of algorithms for biomedical research
- Demonstrated and graded assignments written in Julia as well as helping to debug faulty Julia code
- Advised technical aspects of a final research project, at the masters level, within a health/biomedical context

Lead Teaching Assistant (MATH1530) — RI, USA
Jun 2021 – Aug 2021

- Elected as lead TA for undergraduate abstract algebra sequence covering group, ring, and field theory
- Effectively provided weekly feedback (4.67/5.0 post hoc rating by students) on problem sets and held weekly office hours for 30+ students
- Coordinated with other TAs to ensure expedient grading and foster a welcoming environment

Skills

Programming: Python, Stan, MATLAB, C++, Julia, GoLang

Frameworks: JAX, PyTorch, GMesh, FEniCSx, Docker, Slurm, MPI, Plotly + Dash

Languages: English (native), Russian (native), Spanish (elementary)