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Aleksei G. Sorokin

Skills

Math Interests Probabilistic Numerics, Quasi-Monte Carlo, Gaussian Processes, Machine Learning
Softwares GitHub Actions, Docker, Amazon EC2, LaTeX
Languages Python, Julia, C, MATLAB, R
Python Libraries numpy, scipy, matplotlib, pandas, pytorch, gpytorch

Education

2021 - 2025 **Ph.D. in Applied Mathematics.** Illinois Institute of Technology (IIT).
2017 - 2021 **Master of Data Science.** IIT. Summa cum laude.
2017 - 2021 **B.S. in Applied Mathematics, Minor in Computer Science.** IIT. Summa cum laude.

Experiences

Summer 2023 **Graduate Intern** at **Los Alamos National Laboratory.** I modeled the solution processes of PDEs with random coefficients using efficient and error aware Gaussian processes. Resulted in publication of *Computationally Efficient and Error Aware Surrogate Construction for Numerical Solutions of Subsurface Flow Through Porous Media*.

Summer 2022 **Givens Associate** at **Argonne National Laboratory**. I researched methods to efficiently estimate failure probability using Monte Carlo with non-parametric importance sampling. Resulted in publication of "Adaptive Probabiliy of Failure Estimation with Gaussian Processes".

Summer 2021 **Machine Learning Intern** at **SigOpt, an Intel Company**. I developed novel meta-learning techniques for model-aware hyperparameter optimization. Resulted in publication of "SigOpt Mulch: An intelligent system for AutoML of gradient boosted trees".

Fall 2021 - Present **Teaching assistant** at **IIT**. Includes leading review sessions for Ph.D. qualifying exams.

Projects

Fast Gaussian Processes with Derivatives The cost of Gaussian process regression can be reduced from $\mathcal{O}(n^3)$ to $\mathcal{O}(n \log n)$ when one has control over the design of experiments. This is achieved by pairing quasi-random sampling sequences with matching kernels to induce structure in the kernel matrix. My Ph.D. research studies generalizations for quickly incorporating derivative information into the Gaussian process model and applications in building surrogates for PDEs solutions.

QMCPy I have led development of QMCPy, a Quasi-Monte Carlo Python Library, since 2018. This package provides researchers and practitioners with high quality sequence generators, automatic variable transformations, adaptive stopping criteria algorithms, and diverse use cases. Publications include "Quasi-Monte Carlo Software", "On Bounding and Approximating Functions of Multiple Expectations using Quasi-Monte Carlo", *Challenges in Developing Great Quasi-Monte Carlo Software*. See *qmcpy.org* for details.

Argonne: AI on Supercomputers I participated in an elective course on *AI Driven Science on Supercomputers* through *Argonne National Laboratory*. Included instruction on handling large scale data pipelines and parallel training for neural networks. Coursework at *github.com/alegresor/ai-science-training-series*.

Awards

2023 **Outstanding Mathematics Poster**, Los Alamos National Laboratory.
2021 **Best Manuscript**, IIT Undergraduate Research Journal.
2020 **Karl Menger Student Award for Exceptional Scholarship**, IIT.