# Sina Rezazadeh Baghal

AL & ML | Research Engineer LinkedIn Website Github

#### Work Experience

# TD (Data Scientist III)

Jul 23 - Present

Email: siinabaghal@gmail.com Phone: 226-972-8891, Toronto

Current position

Developed models to analyze customer behavior across the full banking portfolio to detect fraudulent activity. Supported stakeholders with ad-hoc requests by applying problem-solving and programming expertise.

 Tags:
 Python
 PySpark
 SQL
 SAS
 Problem Solving
 Modeling
 Data Science

# CIBC (Quantitative Analyst)

Aug 22 - Jul 23

Developed Python packages and designed methodologies to meet risk management mandates. Implemented OOP with parallel processing to handle large datasets and leveraged bash scripting to ensure maintainability.

 Tags:
 Mathematical Finance
 FRTB
 Python
 Performance Optimization
 Parallel Processing
 OOP

#### Huawei Noah's Ark Lab (Machine Learning Researcher)

Feb 22 - Aug 22

Accelerated neural networks' SoftMax layer in PyTorch for both training and inference. Achieved baseline accuracy using only the optimal number of bits for classification, i.e.,  $\lceil \log_2 c \rceil$  where c is the number of classes.

 Tags:
 Deep Learning
 Transformers
 Quantization
 Research
 Weight Distributions
 Pytorch

# University of Waterloo (Postdoc (CS), Grad (C&O))

May 16 - Feb 22

Conducted research in stochastic optimization and graph neural networks. Served as a teaching assistant for graduate and undergraduate courses.

 Tags:
 Numerical Analysis
 Integer Programming
 Optimization
 Statistics
 Machine Learning
 Python
 CPU/GPU
 C++

 MATLAB
 Parallel Processing
 Dask
 Spark
 Code Performance Optimization
 OOP

# Young Scholars Club (Seasonal Mathematical Olympiad Coach (Iran))

Sep 06 - May 16

Taught courses in Advanced Mathematics. Led challenging problem-solving sessions (e.g., Putnam) to develop students' mathematical skills and contributed to the problem-design committee.

 Tags:
 Problem Solving
 Mathematical Olympiad
 Problem Design

#### Development Projects

### • Solving Pasur Using GPU-Accelerated Counterfactual Regret Minimization (arXiv Preprint)

Developed a CUDA-accelerated computational framework with optimized memory management to simulate a fishing card game, enabling the creation of an AI agent to play the game using Reinforcement Learning.

 Tags:
 Reinforcement Learning
 Generative AI
 Artificial Intelligence
 Counterfactual Regret Minimization
 Efficient Computing

 PyTorch
 CUDA
 Game Theory
 GPU Optimization
 Memory Management
 Nash Equilibrium

# • Generative Modeling of Heston Volatility Surfaces Via Variational Autoencoders (Project Page, Code)

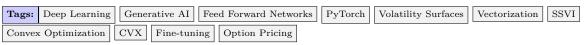
Trained a Variational Autoencoder (VAE) on Heston stochastic volatility models to generate volatility surfaces for use in option pricing and financial applications.

 Tags:
 Deep Learning
 Generative AI
 Variational Autoencoder
 PyTorch
 Heston Model
 Volatility Surfaces
 Vectorization

 Monte Carlo Simulation
 Numerical Analysis
 Optimization
 Option Pricing

# • Implementing Deep Smoothing for Implied Volatility Surfaces (Project Page, Code)

Implemented in Python the methodologies from Deep Smoothing of the Implied Volatility Surface (Ackerer et al.), with independently developed approaches to neural network training, convergence, and implementation details.



#### EDUCATION

#### University of Waterloo

May 16 - Apr 21

• PhD in Mathematical Optimization at the department of Combinatorics & Optimization

### Sharif University of Technology

Sep 06 - Jul 12

#### ACADEMIC PROJECTS

• Solution Manual to Stochastic Calculus for Finance II (Manuscript)

Authored a complete solution manual for Stochastic Calculus for Finance II, covering all exercises.

 Tags:
 Mathematics
 Stochastic Calculus
 Option Pricing
 Finance
 Probability Theory

• A Matrix Concentration Inequality for Products (arXiv Preprint)

Provided a non-asymptotic bound on the product of random positive semidefinite matrices, which can be used to analyze the convergence behavior of stochastic gradient descent in machine learning.

 Tags:
 Mathematics
 High Dimensional Statistics
 Probability Theory

• A Termination Criterion for Stochastic Gradient Descent for Binary Classification (arXiv Preprint)

Developed a computationally efficient early stopping criterion for machine learning, supported by theoretical guarantees, showing strong predictability on unseen data. Presented at the NeurIPS and the Fields Institute.

 Tags:
 Stochastic Gradient Descent
 Mixture of Gaussians
 Machine Learning
 Early Stopping
 Markov Chains
 Stochastic Stability

#### Selected Honors and Awards

International Scientific Olympiad in Mathematics (Silver Medal, 2010). Iranian Math. Olympiad (Silver Medal, 2005)<sup>1</sup>

<sup>&</sup>lt;sup>1</sup>Olympiad medals are awarded annually to 40 out of 320,000 competing students