Mokhwa Lee

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EDUCATION

Stony Brook University — Stony Brook, NY
Ph.D candidate in Applied Mathematics and Statistics (AMS), Operations Research Track — *Aug. 2019 – Present*
Advanced Certificate : Data and Computational Science

Ewha Womans University — Seoul, Korea
MS of Mathematics — *Mar. 2017 - Aug. 2019*

Ewha Womans University — Seoul, Korea
BS in Mathematics and Computational Science — *Mar. 2012 - Feb. 2017*

RESEARCH

PhD in the OptiML Research Lab — Stony Brook University, NY
advisor : Yifan Sun (CS) and Joseph Mitchell (AMS) — *Oct. 2020 - Present*

- **Limited Memory Almost Multisecant quasi-Newton(QN) method (in progress)**
  Extended the L-BFGS method to the almost multisecant L-BFGS method to save memory and reduce the computational overhead. Targeted to solve optimization problems such as classification tasks and Neural Network.
  - SIAM Journal on Mathematics of Data Science : *"Almost Multisecant Limited Memory quasi-Newton method"*.

- **Almost Multisecant quasi-Newton(QN) method**
  Solved convex optimization problem with the **second-order quasi-Newton(QN)** methods, fast curvature approximating methods, with the extension of the BFGS algorithm. Suggested robust update scheme by interpolating past iterates to maintain descent direction for the minimization machine learning problem.
  - Conference paper (accepted, IEEE) : *"2024 58th Asilomar Conference on Signals, Systems, and Computers"* with the title *"Almost Multisecant BFGS quasi-Newton method"*.
  - Selected Conference Presentation : NeurIPS OPT2023 (Workshop on Optimization for Machine Learning), CMS (Canadian Mathematical Society), and MOPTA (Modeling and Optimization Theory and Applications).

Kim's Numerical Analysis Research Lab — Ewha W. University, South Korea
Master's Thesis in Mathematics (Advisor: Prof. Sunyoung Kim) — *Jan. 2017 - Aug. 2019*

- Title : *"Solving Nonconvex Quadratic Constrained Quadratic Problems (QCQP) with Hollow Matrices"*
  - Proposed a computational method to solve QCQP for improved computational efficiency using matrix sparsity.
  - Evaluated the performance on non-convex quadratic optimization, including: Linear Programming (LP), Semidefinite Programming (SDP), and Second-Order Cone Programming (SOCP) relaxation methods using SeDuMi package in MATLAB.
  - Proved mathematically that the optimal value of the SDP relaxation of the original QCQP is equivalent to that of the new LP, SDP and SOCP relaxation.

WORK EXPERIENCE

UtopiaCompression Corporation — Los Angeles, California
Research and Development(R&D) Engineer Intern — *Jan. 2023 - Aug. 2023, June. 2024 - Aug. 2024*

- **Mathematical Modeling and Software Engineering**
  Improved an existing e-commerce marketplace matching algorithm in a constrained optimization manner. Solved Mixed Integer Problem (MIP) with branch and bound algorithm to get the optimal integer solution to minimize the total cost. Delivered end-to-end solutions with the BigCommerce API and Github, and integrated the optimizer into the interface, making it applicable for both frontend and backend operations.

- **AlphaCrest Capital Management LLC** New York, Manhattan
  Research Intern in Quantitative Finance *Aug. 2020 - June. 2021*
  - Applied Convex Optimization in Portfolio and Risk Management to analyze low signal-to-noise ratio environments, extracting clear patterns from time series data using Relaxed Lasso, Signal Processing, and Polyphase Filter Bank techniques, developed in Python and R.

Other Projects

- **Time series modeling for the stock market** Stony Brook University, NY
  Research Assistant in Zhenhua's Lab *Aug. 2021 - Dec. 2021*
  - Analyzed 2018 and 2019 time series training data to build the portfolio by setting different parameters such as volatility, transaction fee and rolling mean to achieve the maximum profit for the test data.
- **Statistics with Generalized Linear Model** Ewha Womans University, South Korea
  Data Analysis *Sept. 2017 - Dec. 2017*
  - Used big data, bird strikes and airplane damage, from Kaggle to derive the interrelationships and statistical information using R. Interpreted data and distinguished the model by setting a statistical threshold.

Scholarship and Fellowship

- **IACS Junior Researcher Award** Stony Brook University, NY
  Institute for Advanced Computational Science (IACS) *Aug. 2023 - Aug. 2025*
- **New Coming Graduate Student Fellowship** Stony Brook University, NY
  Applied Mathematics and Statistics Department *Aug. 2019*

Teaching Experience

- **Teaching Instructor** Stony Brook University, NY
  Graph Theory : Managed 22 students including exams, projects, and office hours. *July. 2020 - Aug. 2020*
- **Teaching Assistant** Stony Brook University, NY
  Operations Research (Deterministic Models), Graph Theory *Aug. 2019 - June. 2020*
- **Teaching Assistant** Ewha Womans University, South Korea
  Calculus 1, Calculus 2, Mathematical Science and Information *Mar. 2017 - June 2018*

Course Work

- Machine Learning, Artificial Intelligence, Linear Programming, Operations Research : Stochastic Models, Network flows, Probability, Numerical Analysis, Calculus, Linear Regression, Numerical Differential Equations (Finite Difference, Finite Element method), and many more Applied Math and Statistics & Computer Science courses during my Masters and PhD

Programming Skills

- **Languages**: Python, MATLAB, R, (C, C++) **Technologies**: Github, API, LaTeX