Moka (Mokhwa) Lee

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Education

- **Stony Brook University** — Stony Brook, NY
  PhD candidate in Applied Mathematics and Statistics (AMS), Operations Research Track — *Aug. 2019 – July. 2025*
  Advanced Certificate : Data and Computational Science
- **Ewha Womans University** — Seoul, Korea
  MS in Mathematics — *Mar. 2017 - Aug. 2019*
- **Ewha Womans University** — Seoul, Korea
  BS in Mathematics and Computational Science — *Mar. 2012 - Feb. 2017*

Programming Skills

- **Languages**: Python, MATLAB, R, C++ **Technologies**: Github, Postman, API

Work Experience

- **Utopia Compression Corporation** — Los Angeles, California
  Research and Development (R&D) Engineer — *Jan. 2023 - Aug. 2023, June. 2024 - Aug. 2024*
  - **Mathematical Modeling and Software Engineering**
    - Utilized Mixed Integer Programming (MIP) with branch-and-bound algorithm to solve a constrained minimization problem, using Python Ortool package and the MOSEK optimization solver.
    - Enhanced an e-commerce marketplace bid matching algorithm/model and provided end-to-end solutions.
    - The algorithm finds the best integer solution that minimizes total order cost using supply and demand data.
    - Integrated the optimizer into the BigCommerce API, automating the communication between front-end and back-end via GitHub version control (full-stack).
- **AlphaCrest Capital Management LLC** — New York, Manhattan
  Quantitative Researcher — *Aug. 2020 - June. 2021*
  - **Convex Optimization in Portfolio and Risk Management**
    - Aimed to obtain a sparse coefficient solution to address the non-convex feature selection problem.
    - Implemented the Relaxed Lasso method (linear regression) in Python and R (glmnet package).
    - Applied L1 regularization to select relevant columns in the predictor matrix and minimize prediction error.
    - Used the Polyphase Filter Bank technique on alpha data to compute the frequency spectrum of the signal.
    - Preprocessed and trained on mid-frequency time series data from 2011 to 2018.

Research

- **PhD in the OptiML (Optimization and Machine Learning) Lab** — Stony Brook University, NY
  Advisor : Yifan Sun (CS) and Joseph Mitchell (AMS) — *Oct. 2020 - Present*
  - **Publications**
    - Journal of Optimization Theory and Applications (JOTA)
      - "Advancing Multi-Secant Quasi-Newton Methods for General Convex Functions."
    - IEEE 2024 58th Asilomar Conference on Signals, Systems, and Computers
      – "Almost Multisecant BFGS Quasi-Newton Method."
    - NeurIPS OPT2023 (Workshop on Optimization for Machine Learning)
      - "Almost Multisecant Quasi-Newton Method."
    - Selected Conference Presentations
      - CMS (Canadian Mathematical Society) and MOPTA (Modeling and Optimization Theory and Applications)

- **Second order approximation for machine learning problems**
  - Solved convex problems using Quasi-Newton methods with efficient curvature approximations.
  - Developed a robust update scheme using past iterates to ensure descent direction in supervised learning tasks.
  - Extended multisecant BFGS to a limited memory version for scalable machine learning applications like logistic regression and neural networks.
  - Proved the superlinear convergence rate and integrated the method into a PyTorch extension.

Other Projects

- **Kim's Numerical Analysis Research Lab** — Ewha W. University, South Korea
  Master's Thesis in Mathematics (Advisor: Prof. Sunyoung Kim) — *Jan. 2017 - Aug. 2019*
  - **Solving Nonconvex Quadratic Constrained Quadratic Problems (QCQP) with Hollow Matrices**
    - Developed a computational method to solve QCQP efficiently by leveraging matrix sparsity.
    - Evaluated performance on nonconvex quadratic optimization using relaxation techniques, including Linear Programming (LP), Semidefinite Programming (SDP), and Second-Order Cone Programming (SOCP)
    - Used SeDuMi (Self-Dual-Minimization) software 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 relaxations.
- **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 (ML), Artificial Intelligence (AI), Linear Programming, Operations Research : Stochastic Models, Network flows, Probability, Numerical Analysis, Linear Regression, Numerical Differential Equations (Finite Difference, Finite Element method), and many more Applied Math and Statistics & Computer Science courses.