

# Moka (Mokhwa) Lee

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## EDUCATION

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- **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

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

## WORK EXPERIENCE

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- **Utopia Compression Corporation** Los Angeles, California  
*Research and Development (R&D) Engineer* Jan. 2023 - 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

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- **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

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- **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

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- **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

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- **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

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- Machine Learning, Artificial Intelligence, 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.