Lexiao Lai

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EDUCATION

Columbia University in the City of New York — New York, U.S.
Doctor of Philosophy in Operations Research — Sept. 2019 - June 2024 (expected)

The University of Hong Kong — Hong Kong
Bachelor of Science Major in Mathematics, Minor in Finance — Sept. 2015 - June 2019
cGPA: **3.87 /4.3**; Major GPA: **4.19/4.3**

University of Toronto — Toronto, Canada
HKUWW Undergraduate Student Exchange Programme
GPA: **4.0/4.0** — Sept. - Dec. 2017

RESEARCH INTERESTS

Optimization, Optimal Control, Operations Research.

RESEARCH EXPERIENCE

Title: *Time-dependent Surveillance-Evasion Game (Paper accepted by* CDC2019*)* June - Oct. 2018
Sponsored by Overseas Research Fellowship from Faculty of Science, HKU — Cornell University
Supervisor: Prof. Alexander Vladimirsky — Center of Applied Mathematics
Objectives:

- Find Nash Equilibrium in a time-dependent adversarial path-planning problem.

Achievements:

- Developed efficient algorithm to approximate Nash Equilibrium by scalarization-based method and nonsmooth convex optimization techniques.
- Implemented upwind scheme to solve time-dependent Hamilton-Jacobi-Bellman equation, and improved the accuracy with 8-pt stencil.
- Implemented fast algorithms for computation of visibility function and 3D interpolation.
- Designed and implemented the computation for multi-evader and anisotropic-observer extension.

Title: *Convergence Estimates for Value Iterations in Piecewise Deterministic Settings* June 2018 -
Sponsored by Overseas Research Fellowship from Faculty of Science, HKU — Cornell University
Supervisor: Prof. Alexander Vladimirsky — Center of Applied Mathematics
Objectives:

- Provide upper bounds for performance degradation due to early stopping in value iteration process when solving piecewise deterministic Hamilton-Jacobi-Bellman Equation.

Achievements:

- Provided an upper bound for convergence rate in value iteration process.

Title: *Gradient Schemes in Convex Optimization: Adaptive Restart Improvements and Applications*
Jan. - May 2018
Supervisor: Dr. Zheng Qu — Department of Mathematics, HKU
Objectives:

- Analyze the convergence with adaptive restart first-order schemes in convex optimization.
- Test Adaptive Restart Schemes in nonsmooth optimization problems.

Achievements:

- Estimated the convergence rate when applying Nesterov's accelerated gradient descent schemes with adaptive restart improvement to optimize convex quadratic functions.
- Tested the improvement of adaptive restart for generalized gradient methods (FISTA) through numerical experiments.

Title: *Assessing Portfolios Containing Various Assets in the World Market* June - July 2017
Sponsored by Summer Research Fellowship at Faculty of Science, HKU
Supervisor: Dr. Siu Pang Yung — Department of Mathematics, HKU
Objectives:

- Test on different active management strategies.

- Investigate the effect of diversification in stock investments, with computer simulations based on stocks in Hong Kong and U.S. stock Market.

Achievements:

- Discovered from the simulations of investment strategies that active management can be beneficial in stock investments.
- Justified the positive effects of diversification based on Hong Kong and U.S. stocks.

AWARDS & HONOURS

- **Outstanding Winner** of *Mathematical Contest in Modelling* 2017
  (Top 13 winners out of 8843 teams)
  Organized by COMAP Inc.
- Ranked **134** out of 4638 in *78th William Putnam Mathematical Competition* 2017
  Organized by *Mathematical Association of America*
- Walter Brown Memorial Prizes in Mathematics 2019
  The best student in Mathematics, on the recommendation of the Head of Mathematics, among those completing the BSc final year.
- Doris Chen Undergraduate Project Prize 2018
  Awarded by *Department of Mathematics, The University of Hong Kong*
  To recognise research outputs and excellent performance in project courses in Mathematics by undergraduate students majoring in Mathematics.
- Liu Ming-Chit Prize in Mathematics 2018
  Awarded by *Department of Mathematics, The University of Hong Kong*
  A student in Mathematics who has completed his/her 2nd or 3rd year of study, on the recommendation of the Head of Mathematics
- Alan John Allis Prize in Mathematics 2016,2017
  Awarded by *Department of Mathematics, The University of Hong Kong*
  to not more than *five* undergraduates who have just completed their 1st or 2nd year of study
- Dean's Honours List 2016,2017,2019
  Awarded by *Faculty of Science, The University of Hong Kong*
- HKSAR Government Scholarship 2015-2019
- B.Sc. Class of 1971 Prize 2018
- Talent Development Scholarship 2018
- HKUAA Ontario Student Exchange Scholarships 2017

COMPUTER SKILLS

Programming Languages: Python, MATLAB, C++, LaTeX.

MAJOR COURSES

Category	Course	Grade
Analysis	Introduction to Mathematical Analysis	A+
	Analysis I	A-
	Introduction in Topology	A+
	Functional Analysis	A+
	Real Analysis (Graduate Course)	A+
Calculus	University Mathematics I	A+
	Multivariable Calculus	A
	Functions of Complex Variables (at U of Toronto)	A+
Algebra	Linear Algebra I	A+
	Linear Algebra II	A+
	Algebra I (Abstract Algebra)	A
Differential Equations	(Ordinary) Differential Equations	A
	Introduction to Partial Differential Equations	A+
Applied Mathematics	Discrete Mathematics	A
	Applied Linear Programming (at U of Toronto)	A+
	Algorithmetic Game Theory (at U of Toronto)	A+
	Introduction to Optimization	A
	Topics in Math Programming and Optimization	A+
Probability and Statistics	Probability and Statistics I	A
	Probability I (at U of Toronto)	A+
	Stochastic Processes	A+
Economics and Finance	Introductory Microeconomics	A+
	Introductory Econometrics	A
	Corporate Finance	A
	Financial Derivatives	A
	Mathematical Finance	A