Haoyang Cao

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POSITION

Department of Applied Mathematics and Statistics, Johns Hopkins University *Starting from Jan 2024*
Tenure-track Assistant Professor

CMAP, École Polytechnique *Jan 2022 - Dec 2023*
Postdoctoral Researcher
Supervisor: Prof. Mathieu Rosenbaum

The Alan Turing Institute *Sep 2020 - Jan 2022*
Postdoc, Machine Learning in Finance
Supervisors: Prof. Samuel Cohen, Prof. Łukastz Szpruch

EDUCATION

University of California, Berkeley *2015 - 2020*
PhD in Industrial Engineering and Operations Research
Thesis: Connecting mean-field games and generative adversarial networks
Advisor: Prof. Xin Guo

The University of Hong Kong *2012 - 2015*
BSc in Mathematics with *First Class Honor*

RESEARCH INTERESTS

Applied Probability and Stochastic Analysis

- Stochastic control and modeling, N-player stochastic differential games and mean-field gamee, application in finance and operations research

Machine Learning

- Machine learning algorithms in dynamical system, applications in finance

RESEARCH

Haoyang Cao and Xin Guo. SDE approximations of GANs training and its long-run behavior. *Journal of Applied Probability*, First View, pp. 1–25, 2023.

Haoyang Cao, Jodi Dianetti, and Giorgio Ferrari. Stationary discounted and ergodic mean field games with singular controls. To appear, *Mathematics of Operations Research*, 2022.

Haoyang Cao, Xin Guo, and Joon Seok Lee. Approximation of N-player stochastic games with singular controls by mean field games. To appear, *Numerical Algebra, Control and Optimization*, 2022.

Haoyang Cao and Xin Guo. MFGs for partially reversible investment. *Stochastic Processes and their Applications*, Vol. 150, pp. 995–1014, August 2022.

Matteo Basei, Haoyang Cao, and Xin Guo. Nonzero-Sum Stochastic Games and Mean-Field Games with Impulse Controls. *Mathematics of Operations Research*, 47(1), February 2022.

Haoyang Cao, Samuel N. Cohen, and Lukasz Szpruch. Identifiability in inverse reinforcement learning. *Advances in Neural Information Processing Systems 34*, 2021

Haoyang Cao and Xin Guo. Generative Adversarial Networks: Some Analytical Perspective. Book chapter in *Machine Learning for Financial Markets: a guide to contemporary practices*, Cambridge University Press, Editors: Agostino Capponi and Charles-Albert Lehalle.

Haoyang Cao, Gaotian Gu, Xin Guo and Mathieu Rosenbaum. Risk of transfer learning and its applications in finance. Submitted, *Mathematical Finance*, 2023

Haoyang Cao, Xin Guo and Mathieu Laurière. Connecting GANs, MFGs and OT. In review, *SIAM Journal on Applied Mathematics*, 2023.

Haoyang Cao, Gaotian Gu, Xin Guo and Mathieu Rosenbaum. Feasibility and transferability of transfer learning: a mathematical framework. Preprint, 2023

Haoyang Cao, Xin Guo, and Guan Wang. Meta-learning with GANs for anomaly detection, with deployment in high-speed rail inspection system. Submitted, 2023.

Qinkai Chen, Mohamed El-Mennaoui, Antoine Fosset, Amine Rebei, Haoyang Cao, Philine Bouscasse, Christy Eóin O'Beirne, Sasha Shevchenko, and Mathieu Rosenbaum. Towards mapping the contemporary art world with ArtLM: an art-specific NLP model. Submitted, 2023.

INVITED TALKS

ICAIF'23 Workshop – Transfer Learning and its Applications in Finance, New York, NY (November 2023)

Paris Bachelier Seminar, Paris, France (November 2023)

2023 INFORMS Annual Meeting, Phoenix, AZ (October 2023)

ICAIM 2023, hybrid (August 2023)

IMSI Workshop – Machine Learning and Mean Field Games, hybrid (May 2022)

Conference in Stochastoc Control & Analysis and Applications, Hammamet, Tunisia (March 2022)

Paris Bachelier Seminar, Paris, France (February 2022)

Joint LSE Risk & Stochastics and Financial Mathematics Seminar, online (January 2022)

15th International Conference Computational and Financial Econometrics, London, UK (December 2021)

Workshop KCL-UP Mean-field Reinforcement learning, virtual (October 2021)

SIAM Minisymposium on Mathematics of Machine Learning in Finance, virtual (January 2021)

2020 INFORMS Annual Meeting, virtual (November 2020)

Oxford Data Science Seminar (November 2020)

2019 INFORMS Annual Meeting, Seattle, WA (October 2019)

Cornell ORIE Young Researchers Workshop, Cornell University, Ithaca, NY (October 2019)

Equilibria in Markets, Strategic Interactions, and Complex Systems, Bielefeld University, Bielefeld, Germany (July 2019)

9^{th} General AMaMeF Conference, Paris, France (June 2019)

2018 INFORMS Annual Meeting, Phoenix, AZ (November 2018)

TEACHING EXPERIENCE

Graduate Student Instructor

- PhD-level course:
  IEOR 263A Applied Stochastic Processes I, Fall 2016
  IEOR 263B Applied Stochastic Processes, Spring 2018/Spring 2019
- Master-level course:
  IEOR 241 Risk Modeling, Simulation, and Data Analysis, Fall 2017/Fall 2018
  IEOR 222 Financial Engineering Systems I, Spring 2020
- Undergraduate-level course:
  IEOR 173 Introduction to Stochastic Processes, Spring 2017

INDUSTRY EXPERIENCE

Quantitative Research Summer Associate — May 2018 - August 2018
J.P.Morgan & Chase, New York, NY

- Conducted research on LGD discount rate methodology which has been a haunting issue faced by the team, independently built, implemented and tested a CAPM-based model which will be adopted in future regulatory frameworks.
- Conducted research on Tobit models and implemented Type II Tobit model in Python to help the team convert from SAS to Python platform
- Conducted Research on Omitted Variable Biases problems, presented and documented related work to the team

HONOR & AWARD

Berkeley IEOR Summer Research Grant	2017, 2019
First Runner-up, TBSI Visiting Student Poster Contest	June 2017
Berkeley IEOR Graduate Student Group Award	May 2017
Berkeley IEOR First Year Fellowship	2015-2016
Y. M. Chen Memorial Prize in Mathematics	2014-2015
C. V. Starr Scholarships	2013-2014
Liu Ming-Chit Prize in Mathematics	2012-2013, 2013-2014
Dean's Honours List	2012-2013

TECHNICAL SKILLS

Programming: Python, Pandas, Mathematica, C++.
Optimization: CPLEX, AMPL

MISC. SKILLS & HOBBIES

Music: Piano and Clarinet Player, Singer.
Sports: Swimmer.