Yufei Zhang

CONTACT INFORMATION

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RESEARCH INTERESTS

Stochastic Control and Games, Mathematical and Computational Finance, Theory and Applications of Machine Learning, particularly Deep Learning and Reinforcement Learning

ACADEMIC APPOINTMENTS

Imperial College London, United Kingdom

Senior Lecturer at Department of Mathematics — Sep. 2023-present

London School of Economics, United Kingdom

Assistant Professor at Department of Statistics — Sep. 2021-Aug. 2023

EDUCATION

University of Oxford, United Kingdom

D.Phil., Mathematics — Oct. 2017-June 2021

The Chinese University of Hong Kong, Hong Kong

M.Phil., Mathematics — Aug. 2015-July 2017

M.Sc., Mathematics — Aug. 2013-June 2015

B.B.A., Insurance, Financial and Actuarial Analysis — Aug. 2008-June 2013

JOURNAL PUBLICATIONS

[1] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *A fast iterative PDE-based algorithm for feedback controls of nonsmooth mean-field control problems*, SIAM Journal on Scientific Computing, 46 (2024), pp. A2737-A2773. [Preprint version.]

[2] Lukasz Szpruch, Tanut Treetanthiploet, and Yufei Zhang, *Exploration-exploitation trade-off for continuous-time episodic reinforcement learning with linear-convex models*, The Annals of Applied Probability, forthcoming. [Preprint version.]

[3] Michael Giegrich, Christoph Reisinger, and Yufei Zhang, *Convergence of policy gradient methods for finite-horizon exploratory linear-quadratic control problems*, SIAM Journal on Control and Optimization, 62 (2024), pp. 1060-1092. [Preprint version.]

[4] Lukasz Szpruch, Tanut Treetanthiploet, and Yufei Zhang, *Optimal scheduling of entropy regulariser for continuous-time linear-quadratic reinforcement learning*, SIAM Journal on Control and Optimization, 62 (2024), pp. 135-166. [Preprint version.]

[5] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Linear convergence of a policy gradient method for some finite horizon continuous time control problems*, SIAM Journal on Control and Optimization, 61 (2023), pp. 3526-3558. [Preprint version.]

[6] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *A posteriori error estimates for fully coupled McKean-Vlasov forward-backward SDEs*, IMA Journal of Numerical Analysis, 44 (2024), pp. 2323-2369. [Preprint version.]

[7] Xin Guo, Anran Hu and Yufei Zhang, *Reinforcement learning for linear-convex models with jumps via stability analysis of feedback controls*, SIAM Journal on Control and Optimization, 61 (2023), pp. 755-787. [Preprint version.]

[8] Matteo Basei, Xin Guo, Anran Hu and Yufei Zhang, *Logarithmic regret for episodic continuous-time linear-quadratic reinforcement learning over a finite-time horizon*, Journal of Machine Learning Research, 23 (2022), pp. 1–34. [Preprint version.]

[9] Christoph Reisinger and Yufei Zhang, *Regularity and stability of feedback relaxed controls*, SIAM Journal on Control and Optimization, 59 (2021), pp. 3118–3151. [Preprint version.]

[10] Kazufumi Ito, Christoph Reisinger, and Yufei Zhang, *A neural network based policy iteration algorithm with global H^2-superlinear convergence for stochastic games on domains*, Foundations of Computational Mathematics, 21 (2021), pp. 331–374. [Preprint version.]

[11] Christoph Reisinger and Yufei Zhang, *A penalty scheme and policy iteration for nonlocal HJB variational inequalities with monotone drivers*, Computers and Mathematics with Applications, 93 (2021), pp. 199-213. [Preprint version.]

[12] Roxana Dumitrescu, Christoph Reisinger, and Yufei Zhang, *Approximation schemes for mixed optimal stopping and control problems with nonlinear expectations and jumps*, Applied Mathematics & Optimization, 83 (2021), pp. 1387-1429.

[13] Christoph Reisinger and Yufei Zhang, *Rectified deep neural networks overcome the curse of dimensionality for nonsmooth value functions in zero-sum games of nonlinear stiff systems*, Analysis and Applications, 18 (2020), pp. 951-999. [Preprint version.]

[14] Christoph Reisinger and Yufei Zhang, *Error estimates of penalty schemes for quasi-variational inequalities arising from impulse control problems*, SIAM Journal on Control and Optimization, 58 (2020), pp. 243–276. [Preprint version.]

[15] Christoph Reisinger and Yufei Zhang, *A penalty scheme for monotone systems with interconnected obstacles: convergence and error estimates*, SIAM Journal of Numerical Analysis, 57 (2019), pp. 1625–1648. [Preprint version.]

CONFERENCE PUBLICATIONS

[1] Xinshi Chen, Yufei Zhang, Christoph Reisinger, and Le Song, *Understanding deep architectures with reasoning layer*, Advances in Neural Information Processing Systems (NeurIPS 2020), 33 (2020), pp. 1240–1252. [Preprint version.]

PREPRINTS

[1] Lukasz Szpruch, Marc Sabaté Vidales, Tanut Treetanthiploet, Yufei Zhang, *Pricing and hedging of decentralised lending contracts*, Submitted, arXiv:2409.04233,2024.

[2] Christoph Knochenhauer, Alexander Merkel, and Yufei Zhang, *Continuous-time dynamic decision making with costly information*, Submitted, arXiv:2408.09693, 2024.

[3] Deven Sethi, David Šiška, and Yufei Zhang, *Entropy annealing for policy mirror descent in continuous time and space*, Submitted, arXiv:2405.20250, 2024.

[4] Tanut Treetanthiploet, Łukasz Szpruch, and Yufei Zhang, *ϵ-policy gradient for online pricing* , Submitted, arXiv:2405.03624, 2024.

[5] Xin Guo, Xinyu Li, and Yufei Zhang, *An α-potential game framework for N-player games*, arXiv:2403.16962, 2024.

[6] Bekzhan Kerimkulov, David Šiška, Łukasz Szpruch, and Yufei Zhang, *Mirror descent for stochastic control problems with measure-valued controls*, Submitted, arXiv:2401.01198, 2024.

[7] Bekzhan Kerimkulov, James-Michael Leahy, David Šiška, Łukasz Szpruch, and Yufei Zhang, *A Fisher-Rao gradient flow for entropy-regularised Markov decision processes in Polish spaces*, Revision at Foundations of Computational Mathematics, arXiv:2310.02951, 2023.

[8] Xin Guo and Yufei Zhang, *Towards an analytical framework for dynamic potential games*, Revision at SIAM Journal on Control and Optimization, arXiv:2310.0225, 2023.

[9] Eyal Neuman, Wolfgang Stockinger, and Yufei Zhang, *An offline learning approach to propagator models*, Submitted, arXiv:2309.02994, 2023.

[10] Eyal Neuman and Yufei Zhang, *Statistical learning with sublinear regret of propagator models*, Revision at The Annals of Applied Probability, arXiv:2301.05157, 2023.

[11] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Optimal regularity of extended mean field controls and their piecewise constant approximation*, preprint, arXiv:2009.08175v2, 2020.

TECHNICAL REPORTS

[1] Tanut Treetanthiploet, Yufei Zhang, Lukasz Szpruch, Isaac Bowers-Barnard, Henrietta Ridley, James Hickey, and Chris Pearce, *Insurance pricing on price comparison websites via reinforcement learning*, arXiv:2308.06935, 2023.

[2] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Path regularity of coupled McKean-Vlasov FBSDEs*, arXiv:2011.06664, 2020.

AWARDS

- The Mathematical Institute DPhil Thesis Prize 2021, *University of Oxford*.
- G-Research PhD Prize in Maths and Data Science, *G-Research*, 2020.
- Academic Support Grands, *The Queen's College, University of Oxford*, 2017.
- Departmental Studentship, *Mathematical Institute, University of Oxford*, 2017–2021.

GRANTS

- CNRS-Imperial "Abraham de Moivre" International Lab in Mathematics Short-Term Exchange Grant, £1,400, 2024.
- Co-Investigator, "Reinforcement Learning for Insurance Pricing" in partnership with The Alan Turing Institute, £39,000, November 1, 2022 to April 28, 2023.

PH.D SUPERVISION

- Philipp Plank (2024-now, Imperial College London).

WORKSHOPS & SEMINARS ORGANISATION

- Co-organizer of the workshop "Bridging Stochastic Control and Reinforcement Learning" at the Isaac Newton Institute Satellite Program
  - Proposal got funded £119,840 by the Isaac Newton Institute to host a one-month program at the Alan Turing Institute in 2025.
- Co-organizer of the workshop "Advances in Stochastic Control and Reinforcement Learning: Theory and Application" at the Banff International Research Station, Canada (April 27-May 2, 2025)
  - Proposal got funded by Banff to support a one-week workshop with 42 in-person participants and 200 online participants.
- Co-organizer of the London Mathematical Finance Seminar series (September 2021-now)
  - Bi-weekly seminars involving academics from multiple London institutions and industry practitioners.
- Co-organizer of the Algorithmic Learning in Games Seminar (September 2024-now)
  - Bi-weekly seminars involving applied mathematicians, computer scientists and economists.
- Co-organizer of 8th-London-Paris Bachelier Workshop, Paris (September 2024).
- Co-organizer of ETH–Hong Kong–Imperial Mathematical Finance Workshop, London (June 2024).
- Co-organizer of 7th-London-Paris Bachelier Workshop, London (September 2023).

REVIEWERS

- Journals (in alphabetical order)
  - in **mathematical finance**: Applied Mathematical Finance, Finance and Stochastics, Journal of Computational Finance, Mathematical Finance, Market Microstructure and Liquidity, SIAM Journal on Financial Mathematics and others.
  - in **control and optimization**: Automatica, IEEE Transactions on Automatic Control, SIAM Journal on Control and Optimization, Operations Research, and others.
  - in **machine learning**: Journal of Machine Learning Research, Journal of Machine Learning, and others.
  - in **probability**: Stochastic Processes and Their Applications, and others.
  - in **computational mathematics**: Advances in Computational Mathematics, SIAM Journal on Scientific Computing, and others.
  - in **other areas of applied mathematics**: Discrete and Continuous Dynamical Systems Series B, Journal of Mathematical Analysis and Applications, and others.
- Conferences
  - in **machine learning**: Advances in Neural Information Processing Systems (NeurIPS 2021), Conference on Mathematical and Scientific Machine Learning (MSML 2020).

INVITED TALKS

- *12th Bachelier World Congress of the Bachelier Finance Society*, Rio de Janeiro, July. 8-12, 2024.
- *New Trends and Challenges in Stochastic Differential Games*, Banff, June. 23-28, 2024.
- *ETH-Hong Kong-Imperial Mathematical Finance Workshop*, London, June. 17-20, 2024.
- *Probability for Machine Learning seminar*, Oxford, June. 12, 2024.
- *Mathematical Finance seminar*, Bielefeld, June. 5, 2024.
- *Bachelier seminar*, Paris, April. 17, 2024.
- *Fields-CFI Bootcamp on Machine Learning in Quantitative Finance*, Toronto, April. 25-26, 2024.
- *Recent advances in stochastic control, machine learning and quantitative finance*, Shanghai, April. 15-19, 2024.
- *IMSI workshop on Decision Making and Uncertainty*, Chicago, Feb. 2-9, 2024.
- *IMSI workshop on Decision Making and Uncertainty*, Feb. 2-9, 2024.
- *CityU-NUS MFG/MFC seminar*, Jan. 30, 2024.
- *16th International Conference of the ERCIM WG on Computational and Methodological Statistics*, Berlin, Dec. 16-18, 2023.
- *7th London-Paris Bachelier Workshop on Mathematical Finance*, London, Sept. 18-19, 2023.
- *The Second HKSIAM Biennial Meeting*, Hong Kong, Aug. 28-Sept. 1, 2023.
- *Recent Advances on Quantitative Finance*, Hong Kong, Aug. 27-30, 2023
- *10th International Congress on Industrial and Applied Mathematics*, Tokyo, Aug. 20-25, 2023.
- *11th Advanced Mathematical Methods for Finance Conference*, Bielefeld, June 26-30, 2023.
- *Stochastic Analysis and Math Finance Seminar*, Berlin, June 22, 2023.
- *Berlin Probability colloquium*, Berlin, June 21, 2023.
- *North British Probability Seminar*, The University of Edinburgh, June 14, 2023.
- *Data Science Seminar*, The University of Essex, May 11, 2023.
- *2nd Workshop on Machine Learning for PDEs*, Imperial College London, Apr. 3-4, 2023.
- *Probability Seminar*, The University of Bath, Jan. 9, 2023.
- *World Online Seminars on Machine Learning in Finance*, Virtual, Nov. 22, 2022.
- *Machine Learning and Optimal Control*, Royal Statistical Society, Virtual, Oct. 19, 2022.
- *Finance and Stochastic Seminar*, The University of Sydney, Oct. 11, 2022.
- *London-Paris Bachelier Workshop on Mathematical Finance*, Paris, France, Sept. 15-16, 2022.
- *Machine learning for PDEs*, London, UK, Sept. 6-8, 2022.

- *The 9th International Colloquium on BSDEs and Mean Field Systems*, Annecy, France, June 26–July 1, 2022.
- *Machine Learning and Mean-Field Games Workshop*, The Institute for Mathematical and Statistical Innovation, Chicago, May 23–27, 2022.
- *Maxwell Institute Probability Seminar*, Heriot-Watt University and University of Edinburgh, Mar. 24, 2022.
- *Finance and Stochastic Seminar*, Imperial College London, Mar. 23, 2022.
- *Financial/Actuarial Mathematics Seminar*, University of Michigan, Virtual, Mar. 16, 2022.
- *SIAG/FME virtual seminar*, Virtual, Mar. 10, 2022.
- *15th German Probability and Statistics Days*, Virtual, Sept. 27-Oct. 1, 2021.
- *2nd Fudan-Warwick Workshop on Financial Mathematics and Stochastic Analysis*, University of Warwick, UK, July 30–31, 2019.
- *3rd International Conference on Computational Finance*, A Coruña, Spain, July 8–12, 2019.
- *International Workshop on PDE-Constrained Optimization, Optimal Controls and Applications*, Sanya, China, Dec. 10–14, 2018.
- *10th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis*, Oxford, United Kingdom, Nov. 29–Dec. 1, 2018.
- *14th Viennese Conference on Optimal Control and Dynamic Games*, Vienna, Austria, July 3–6, 2018.

Teaching Experience

- Lecturer at Imperial College London:
  - Simulation Methods for Finance — Spring 2024, 2025
  - Advances in Machine Learning — Spring 2025
  - Interest Rate Models — Spring 2025
- Lecturer at London School of Economics:
  - Stochastic Process — Fall 2021, 2022
  - Stochastic Simulation — Spring 2023
  - Computational Methods in Finance and Insurance — Spring 2022, 2023
- Tutor at University of Oxford:
  - Analysis II — Spring 2021
  - Fixed Income — Spring 2021
  - Financial Derivatives — Fall 2020
  - Introduction to Probability — Fall 2020
  - Advanced Numerical Methods — Spring 2020
  - Numerical Methods — Fall 2019

Professional Memberships

- Member, Institute of Mathematics and its Applications
- Member, Society for Industrial and Applied Mathematics
- Member, Bachelier Finance Society

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