

Louis Sharrock

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SUMMARY

HIMR Data Science Research Fellow in the School of Mathematics at the University of Bristol. Previously PhD Student in Computational Statistics and Machine Learning at Imperial College London.

Research interests include machine learning, optimisation, and computational statistics, with a particular focus on stochastic gradient Markov Chain Monte Carlo methods. Current research focuses on new algorithms for high dimensional optimisation and sampling, the analysis of two-timescale stochastic gradient descent in continuous time, and online inference for interacting particle systems and mean-field equations.

RESEARCH EMPLOYMENT

2022 - Present **Heilbronn Data Science Research Fellow**
Department of Mathematics, University of Bristol

EDUCATION

2018 - 2021 **PhD in Computational Statistics and Machine Learning**
Department of Mathematics, Imperial College London
Thesis: "On the Theory and Applications of Stochastic Gradient Descent in Continuous Time."
Supervisors: Dr Nikolas Kantas, Professor Dan Crisan.
Reading Groups: Computational Statistics and Machine Learning, Optimisation and Inference.

2017 - 2018 **MRes in Mathematics (Distinction - 93%)**
Department of Mathematics, Imperial College London
Thesis: "Large Scale Inference with Applications to Environmental Monitoring." (91%)
Supervisor: Dr Nikolas Kantas.
Selected Modules: Partial Differential Equations, Dynamical Systems, Data and Uncertainty, Numerical Methods, Stochastic Calculus, Machine Learning.

2016 - 2017 **MSc in Statistics (Distinction - 80%)**
Department of Mathematics, Imperial College London
Thesis: "An Application of Bayesian Networks to Yield Prediction in Bayesian Viticulture." (91%)
Supervisor: Dr Ben Calderhead.
Selected Modules: Probability for Statistics, Fundamentals of Statistical Inference, Applied Statistics, Computational Statistics, Bayesian Data Analysis, Machine Learning, Big Data, Statistical Bioinformatics and Genetics.

2013 - 2016 **MA (Hons) in Mathematics (2.1)**
Emmanuel College, University of Cambridge
CATAM Computational Project: 98% (2nd year), 95% (3rd year).
Selected Modules: Principles of Statistics, Statistical Methods, Stochastic Financial Models, Markov Chains, Probability, Optimisation.

PUBLICATIONS

Published

- 2022** L. Sharrock and N. Kantas (2022). “Two Timescale Stochastic Gradient Descent in Continuous Time with Applications to Joint Online Parameter Estimation and Optimal Sensor Placement.” To appear in *Bernoulli*, 28:3.
- 2021** L. Sharrock and N. Kantas (2022). “Joint Online Parameter Estimation and Optimal Sensor Placement for the Partially Observed Stochastic Advection-Diffusion Equation.” *SIAM / ASA Journal on Uncertainty Quantification*, 10:1, 55-95. <https://doi.org/10.1137/20M1375073>.
- 2021** C. Leadbeater*, L. Sharrock*, B. Coyle, and M. Benedetti (2021). “F-Divergences and Cost Function Locality in Generative Modelling with Quantum Circuits.” *Entropy*, 23:10, 1281-1304. <https://doi.org/10.3390/e23101281>.

Preprints

- 2021** L. Sharrock, N. Kantas., P. Parpas, and G.A. Pavliotis (2021). “Parameter Estimation for the Stochastic McKean-Vlasov Equation.” In submission to *Stochastic Process and their Applications*. <https://arxiv.org/abs/2106.13751>.

In Preparation

- 2021** Sharrock, L. “Two-Timescale Stochastic Approximation in Continuous Time: A Central Limit Theorem.” In preparation for *Electronic Communications in Probability*.

PRESENTATIONS

- 30 Mar 2022** **Invited Talk**, “Parameter Estimation for the McKean Stochastic Differential Equation”, *Computational Statistics and Machine Learning Seminar, Lancaster University*.
- 4 Mar 2022** **Invited Talk**, “Parameter Estimation for Weakly Interacting Particle Systems and Stochastic McKean-Vlasov Processes”, *Statistics Seminar, University of Bristol*.
- 11 Aug 2021** **Contributed Talk**, “Parameter Estimation for Stochastic McKean-Vlasov Equations”, *Joint Statistical Meetings 2021 (Virtual)*.
- 23rd Jul 2021** **Contributed Talk**, “Parameter Estimation for Weakly Interacting Particle Systems and Stochastic McKean-Vlasov Processes”, *Bernoulli-IMS 10th World Congress in Probability and Statistics (Virtual)*.
- 11th Jun 2020** **Contributed Talk**, “Two Timescale Stochastic Gradient Descent in Continuous Time with Applications to Joint Online Parameter Estimation and Optimal Sensor Placement”, *Mathematics of Data Science Conference (Virtual)*
- 20th Nov 2019** **Contributed Talk**, Large Scale Inference with Applications to Environmental Monitoring, *MATHMET 2019 International Conference (Lisbon, Portugal)*.
- 13th Nov 2019** **Contributed Talk**, “Joint Online Parameter Estimation and Optimal Sensor Placement with Applications to a Stochastic Advection Diffusion Equation”, *Conference on Big Data, Data Assimilation and Uncertainty Quantification, CliMathParis 2019 (Institut Henri Poincaré, Paris, France)*.

- 6th Nov 2019** **Poster Presentation**, “Large Scale Inference and Optimal Design with Applications to Environmental Monitoring”, *The Postgraduate Institute Conference* (National Physical Laboratory, Teddington, UK).
- 3rd July 2019** **Poster Presentation**, “Online Parameter Estimation in Continuous Time with Applications to a Stochastic Advection Diffusion Equation”, *Workshop on Stochastic Parameterisations and Their Use in Data Assimilation* (Imperial College London, London, UK).
- 21st May 2019** **Poster Presentation**, “Large Scale Inference with Applications to Environmental Monitoring”, *Postgraduate Forum* (Imperial College London, London, UK).
- 1st Nov 2018** **Contributed Talk**, “An Application of Bayesian Networks to Yield Prediction in Portuguese Viticulture”, *6th Annual BayesiaLab Conference* (Chicago, USA).

PRIZES AND AWARDS

- Research Funding**
- 2021** **Doris Chen Mobility Fund.** *Department of Mathematics, Imperial College London.* A fund providing travel and subsistence for a PhD student with exceptional potential to take their research to another university abroad.
- 2018** **CliMathParis Travel Grant.** *Institut Henri Poincaré.* A grant to fund attendance at the CliMathParis 2019 conference on big data, data assimilation, and uncertainty quantification.
- 2017** **Warner Prize.** *Statistics Section, Department of Mathematics, Imperial College London.* A prize awarded to support a talented MSc statistics student further develop their research project.
- Student prizes**
- 2020** **Doris Chen Merit Award (nominee).** *Department of Mathematics, Imperial College London.* An award to recognise exceptional early promise, progress and achievement in PhD studies.
- 2019** **Best Poster Prize, Statistics Section, Postgraduate Forum.** *Department of Mathematics, Imperial College London.*
- 2018** **MRes Student of The Year.** *MRes Mathematics of Planet Earth, Imperial College London.* A prize awarded to the best overall student on the course.
- 2013 - 2016** **BP STEM Scholarship.** *University of Cambridge.* A highly competitive scholarship of £5000/annum, awarded to ten STEM students each year.
- 2013** **Rowley Mainhood Award.** *Emmanuel College, University of Cambridge.* An award recognising outstanding achievement in pre-admission examinations.

RELEVANT EXPERIENCE

- Research**
- Mar 2022** **Visiting Researcher, Department of Statistics, Lancaster University**
- Research visit funded by UKRI-EPSC Turing AI Fellowship.
- Nov 2021** **Visiting Researcher, Department of Statistics, Boston University**
- Research visit funded by The Doris Chen Mobility Fund.
- May - Aug 2021** **Quantum Machine Learning Scientist, Cambridge Quantum Computing**
- Research on new methods for mitigating exponentially vanishing gradients (‘barren plateaus’) in Quantum Neural Networks.
- Supervisors: Marcello Benedetti and Mattia Fiorentini

Teaching , . . .

- 2014 - present** **Mathematics Tutor, MyTutorWeb**
- Deliver one-to-one tutorials to secondary school, undergraduate, and postgraduate students. Over 850 hours of lessons, 175 five-star reviews.
- Awarded ‘premium tutor’ status to reflect ‘impressive expertise and experience’
- 2018 - 2021** **Graduate Teaching Assistant, Imperial College London**
- Support teaching of undergraduate and postgraduate courses in statistics and machine learning, including group tutorials and lecturing.
- Courses include Data and Uncertainty (postgraduate), Computational Statistics (postgraduate), Probability and Statistics (undergraduate)
- 2014 - 2015** **Mathematics Teaching Assistant, STIMULUS.**
- Volunteered as a mathematics teaching assistant at a secondary school in Cambridge during undergraduate studies.
- 2014** **English Language Teacher, Jinju Health College, South Korea**
- Planned and led English lessons (30 hours p.w.) for a class of Korean students.
- Achieved highest test average (82%) among ‘advanced’ classes.
- Provided personal academic and pastoral support outside of teaching hours.

Other ,

- 2019 - 2021** **Specialist Academic Editor, AsiaEdit**
- Edit academic papers, articles, and grant proposals relating to Machine Learning and Statistics.
- 2018 - 2020** **Statistics Postgraduate Student Representative, Imperial College London.**
- Represented views of students in academic & pastoral matters; organised social activities for staff and students.
- 2015** **Investment Banking Summer Analyst, Lazard**
- Prepared pitch-book materials for client meetings, including financial analysis, market research, valuation models, and due diligence.

ACADEMIC SERVICE

- 2021 - present** **Reviewer.** *Bernoulli.*
- 2021** **Conference Organiser.** *4th Annual MPE CDT Symposium on Wellbeing, Inclusivity, Diversity and Equality in STEM (Virtual)*

COMPUTING SKILLS

- Computing** **Programming Languages.** Python (advanced), R (advanced), TensorFlow (experienced), PyTorch (proficient), MATLAB (proficient), C (proficient).
Document Markup Languages. LaTeX (advanced), HTML (basic).
Version Control Software. Git.