ROBERT SIMON FONG

r.s.fong@bham.ac.uk ⋄ rsfong@gmail.com ⋄ (+852) 9192 6282

RESEARCH INTERESTS

- Differential Geometry, Information Geometry: theory and applications in Manifold Optimization
- Machine Learning and Dynamical Systems: Reservoir Computing
- Black-box Optimization: Bayesian Optimization, Zeroth-order Optimization.

EDUCATION

University of Birmingham *Sept. 2015 - July 2020*
Ph.D., Computer Science
Thesis: Stochastic Optimization on Riemannian Manifolds
Supervisors: Prof. Peter Tiňo, Prof. Joshua Knowles

University of Waterloo *Sept. 2013 - Aug. 2014*
Master of Mathematics, Computational Mathematics
Supervisor: Prof. Thomas Coleman

University of Waterloo *Sept. 2007 - Apr. 2012*
Bachelor of Mathematics, Pure Mathematics (Honours)

INDUSTRY EXPERIENCE

Senior Researcher, Theory Lab, Huawei *Aug. 2022 - Mar. 2024*

- Quantum-Inspired Optimization: theory of Hamiltonian-based solver and its applications on Boolean Satisfiability Problem, Electronic Design Automation (EDA), Hardware Verification, Graph partitioning, and MIMO Decoding.
- Reservoir Computing-based Time Series Forecasting
- Photonic Circuit: hardware Placement and Routing modelling

Researcher, Noah's Ark Lab, Huawei *Aug. 2020 - Aug. 2021*

- Theory of Deep Neural Nets: convexity, modelling, and optimization
- Application and implementation of Deep Neural Nets and Bayesian Optimization: 5G+ High Frequency Surface (HFS) antenna design, Integrated Circuit Partition.

Research Analyst, Cayuga Research Associates *Jan. 2013 - Aug. 2015*

- Optimization and Simulation of Container Port control system.

Consultant, Hong Kong International Terminals Limited *Apr. 2012 - Jan. 2013*

- Integer Programming Modelling and Abstraction of ISO container placement

ACADEMIC POSITIONS

Research Fellow, University of Birmingham *Feb. 2021 - present*

- Reservoir Computing: Universality and applications on biological signal processing.
- Funded by Alan Turing Institute, Prof. Peter Tiňo's Alan Turing Institute Fellowship
  Machine Learning in the Space of State-Space Dynamic Models

Ph.D. Candidate, University of Birmingham *Sept. 2015 - Jul. 2020*

- Theory of Manifold Optimization using Differential Geometry, Information Geometry and Simplicial Geometry.

Master Student, University of Waterloo *Sept. 2013 - Aug. 2014*

- Derivative-free optimization: Simulated Annealing and Derivative-Free Zeroth-Order surrogate directional search methods. (with Prof. Thomas Coleman)
- Computational Algebra: Solving multivariate polynomials using diagonal subgroup of linear group action. (with Prof. George Labahn)

Undergraduate Research Assistant, University of Waterloo *Jan. 2012 - Apr. 2012*

- Integer Programming and applications on Quary Crane Scheduling problem (special case of Traveling Salesman problem)

Undergraduate Research Assistant, Penn State University *Jan. 2009 - Mar. 2009*

- Optimization of Gravitational Wave Detectors in Laser Interferometer Gravitational-Wave Observatory(LIGO).

TEACHING EXPERIENCE

Teaching Assistant, University of Birmingham *Sept. 2021 - Jan. 2022*

- **Courses:** Mathematical Foundations of Artificial Intelligence and Machine Learning (MSc) [06 32250], Algorithms for Data Science (MSc) [06 32258]

Teaching Assistant, Lab Demonstrator, University of Birmingham *Sept. 2015 - Jan. 2019*

- **Courses:** MSc/ICY Software Workshop (Java) (1,2), Mathematical Foundations of Computer Science

Graduate Teaching Assistant, University of Waterloo *Sept. 2013 - Dec. 2013*

- **Course:** Math 106 Linear Algebra for Arts (Co-organized).

BOOKS AND MONOGRAPHS

- **Robert Simon Fong** and Peter Tiňo. *Population-Based Optimization on Riemannian Manifolds*, volume 1046 of *Studies in Computational Intelligence (SCI)*. Springer, 2022. ISBN: 978-3-031-04292-8 (eBook ISBN: 978-3-031-04293-5)

SELECTED PUBLICATIONS

- Boyu Li, **Robert Simon Fong**, and Peter Tino. Simple Cycle Reservoirs are Universal. *Journal of Machine Learning Research*, 25(158):1–28, 2024
- Peter Tiňo, **Robert Simon Fong**, and Roberto Fabio Leonarduzzi. Predictive modeling in the reservoir kernel motif space. *IEEE WCCI / IJCNN 2024*, (to appear), 2024
- Robert Simon Fong. *Stochastic optimization on Riemannian manifolds*. PhD thesis, University of Birmingham, 2020
- **Robert Simon Fong** and Peter Tiňo. Extended stochastic derivative-free optimization on riemannian manifolds. In *Proceedings of the Genetic and Evolutionary Computation Conference Companion*, GECCO '19, pages 257–258, New York, NY, USA, 2019. ACM
- **Simon Fong** and Peter Tiňo. Induced dualistic geometry of finitely parametrized probability densities on manifolds, 2018

- David Tsang, Andrew Lundgren, Ruxandra Bondarescu, **Simon Fong**, and Mihai Bondarescu. Optimizing finite mirrors for advanced gravitational wave detectors. In *APS April Meeting Abstracts*, 2009

SKILLS

Programming Languages and Frameworks
MATLAB, Python, R, Java, LaTeX, Microsoft Office

Languages
English (native), Chinese Mandarin (fluent), Chinese Cantonese (native)

AWARDS AND SCHOLARSHIPS

Honorary Research Fellowship, University of Birmingham *2021 - 2026*
President's Scholarship, University of Waterloo *2008*
AP Scholar with Distinction , The College Board *2007*
Second Honour , Third Pan Pearl Delta plus Chinese Elite Schools Physics Olympiad *2007*
Third Honour, Hong Kong Physics Olympiad *2007*
Third Honour, Hong Kong Physics Olympiad *2006*