SIU LUN CHAU, DPHIL

Postdoctoral Researcher at CISPA Helmholtz Center for Information Security

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RESEARCH INTERESTS

My research aims at building practical statistical models for **Responsible AI** along the directions of **uncertainty modelling**, **explainability**, and **preference modelling**. I believe

- Proper **uncertainty modelling** allows us to be honest with what the model doesn't know.
- **Explainability** tool will enable us to simplify and learn about the complex signals black-box models have captured.
- Incorporating **preference and social values** into learning can become the key to proper model alignment.

I also have research experience in kernel methods, Gaussian processes, and Causal Inference.

EDUCATION

DPhil in Statistical Science | St.Peter's College, University of Oxford — 2018 – 2023

Supervisor: Prof. Dino Sejdinovic, Prof. Mihai Cucuringu, and Prof. Xiaowen Dong.

- Thesis: *"Towards Trustworthy Machine Learning with Kernels"*
- Published 8 papers with 6 first authored. Selected research contributions include:
  - (Bayesian kernel methods) Proposed Bayesian Conditional Mean embeddings, Causal Bayesian Conditional Mean Embeddings, and Deconditional Gaussian processes to model uncertainty while learning distributional representations in the RKHS. This resulted in 2 first authored NeurIPS publications.
  - (Explainable kernel methods) Proposed the first kernel method specific SHAP-based explanation framework RKHS-SHAP; Extended RKHS-SHAP to model non-parametric preference model and proposed PREF-SHAP. This resulted in 2 first authored NeurIPS publications.

MMATH in Mathematics and Statistics | Lady Margaret Hall, University of Oxford — 2014 – 2018

Supervisor: Prof. Mihaela Van Der Shaar, Prof. Geoff Nicolls

- First Class Honors, ranked 2^{nd} in 4^{th} year and 1^{st} in 3^{rd} year.

WORK EXPERIENCES

Postdoctoral Researcher | CISPA Helmholtz Center for Information Security, Germany — Sep.2023 – Present

Supervisor: Dr. Krikamol Muandet

- Conducted research and supervised students on topics related to uncertainty modelling and explainability:
  - (Uncertainty) Proposed a collaborative and explainable Bayesian optimisation framework (accepted for AISTATS 2024); Developed an imprecise learning framework for OOD generalisation that allows the model operator to specify their generalisation strategy at test time.
  - (Explainability) Developed the first Gaussian process specific SHAP-based explanation framework (accepted for NeurIPS 2023 as spotlight); Studied the strategic behaviour of utility-maximising agents when exposed to model explanations under the causal strategic learning framework (accepted for AAAI 2024 as Oral).

Research Assistant | CISPA Helmholtz Center for Information Security, Germany — Mar.2023 – Aug.2023

- Completed my DPhil thesis while helping PhD students from the Rational Intelligence Lab with their research.

Data Scientist | Ravio (HR Tech Startup), London UK — Dec.2022 – Mar.2023

Project: *Job title alignment using LLMs, Compensation modelling*

- Utilised pre-trained language models to align heterogeneous job titles across companies for standardisation.
- Developed a tree-based quantile regression with monotonic constraints to model compensations.

Applied Scientist II Intern | Amazon, London UK — Jun – Dec.2022

Project: *Coherent Multi-granularity Forecasting for the Amazon Transportation Service Outbound Network*

- Developed deep probabilistic coherent demand forecasting models for the EU transportation network. Solutions developed in and deployed into production-ready AWS infrastructure.

Research Intern | Max Planck Institute of Intelligent System, Tubingen Germany — Oct.2021 – June.2022

Project: *Interface between Machine Learning and Economics (Supervised by Dr. Krikamol Muandet)*

- Researched relaxing restrictive assumptions in Instrumental variable regression and examined potential non-parametric hypothesis testing framework for regression discontinuity designs.

Machine Learning Consultant | Catalyst AI, Cambridge UK — Apr.2019 – Oct.2020

- Worked closely with SDEs to develop forecasting models for clients from fashion tech and agricultural companies.

RESEARCH FUNDING AND AWARDS

- ICML 2024 Spotlight paper — May.2024
- AAAI 2024 Oral paper — Feb.2024
- NeurIPS 2023 Spotlight paper — Dec.2023
- Helmholtz Association Postdoc funding — Sep.2023
- EPSRC and MRC Studentship for DPhil in Statistics and Machine Learning — 2018
- Department Prize for FHS Mathematics and Statistics Part B (Top of the year) — 2017

PUBLICATIONS

14. Domain Generalisation via Imprecise Learning | ICML 2024 — code pdf
Anurag Singh, **Siu Lun Chau**, Shahine Bouabid, Krikamol Muandet (Spotlight paper)

13. Collaborative and Explainable Bayesian Optimisation | AISTATS 2024 — code pdf
Masaki Adachi, Brady Planden, David A. Howey, Krikamol Muandet, Michael A. Osborne, **Siu Lun Chau**

12. Causal Strategic Learning with Competitive Selection | AAAI 2024 — code pdf
Kiet Vo, Muneeb Aadil, **Siu Lun Chau**, Krikamol Muandet (Oral paper, top 2% submissions)

11. Stochastic Shapley values for Gaussian Process Models | NeurIPS 2023 — code pdf
Siu Lun Chau, Krikamol Muandet*, Dino Sejdinovic* (Spotlight paper, top 3% submissions)

10. Gated Domain Units for multi-source domain generasliation | TMLR 2023 — code pdf
Simon Föll†, Alina Dubatovka†, Eugen Ernst*, **Siu Lun Chau***, Martin Maritsch, Patrik Okanovic, Gudrun Thäter, Joachim M. Buhmann, Felix Wortmann, Krikamol Muandet

9. Towards Trustworthy Machine Learning with Kernels | DPhil Thesis — pdf
Siu Lun Chau

8. Giga-scale Kernel Matrix-Vector Multiplication on GPU | NeurIPS 2022 — code pdf
Robert Hu, **Siu Lun Chau**, Dino Sejdinovic, Joan Alexis Glaunès

7. Explaining Preference with Shapley Values | NeurIPS 2022 — code pdf
Siu Lun Chau*, Robert Hu*, Jaime Ferrando Huertas, Dino Sejdinovic

6. RKHS-SHAP: Shapley Value for Kernel Methods | NeurIPS 2022 — code pdf
Siu Lun Chau, Robert Hu, Javier Gonzalez, Dino Sejdinovic

5. Spectral Ranking with Covariates | ECML PKDD 2022 — code pdf
Siu Lun Chau, Mihai Cucuringu, Dino Sejdinovic

4. Learning Inconsistent Preference with Gaussian Processes | AISTATS 2022 — pdf
Siu Lun Chau, Javier Gonzalez, Dino Sejdinovic

3. BayesIMP: Uncertainty Quantification for Causal Data Fusion | NeurIPS 2021 — pdf
Siu Lun Chau*, Jean Francois Ton*, Yee Whye Teh, Javier Gonzalez, Dino Sejdinovic

2. Deconditional Downscaling with Gaussian Processes | NeurIPS 2021 — code pdf
Siu Lun Chau*, Shahine Bouabid*, Dino Sejdinovic

1. Kernel-Based Graph Learning From Smooth Signals: A Functional Viewpoint | IEEE 2020 — pdf
Xingyue Pu, **Siu Lun Chau**, Xiaowen Dong, Dino Sejdinovic

SELECTED INVITED TALKS

- Institute of Informatics, Ludwig-Maximilians-Universität München (LMU) — Mar.2024
- Australian Data Science Network 2023 — Dec.2023
- School of Computing, Australian National University — Nov.2023
- Data 61, CSIRO, Melbourne — Nov.2023
- School of Computing and Information Systems, University of Melbourne — Nov.2023
- Australian Institute for Machine Learning, University of Adelaide — Nov.2023
- The Department Management, Technology, and Economics, ETH Zurich — Sep.2023
- ETH AI Center — Sep.2023
- Oxford-Man Institute, University of Oxford — Sep.2023
- CISPA – Helmholtz Center for Information Security — Feb.2023
- ELISE Theory Workshop on ML Fundamentals, EURECOM — Sep.2022
- S-DCE Alan Turing Institute seminar — Jun.2022
- Gatsby Unit, University College London — May.2022
- UCL SML group — Feb.2022
- Imperial & Oxford StatML seminar — Feb.2022
- Max Planck Institute for Intelligent Systems — Oct.2021
- Warwick ML Group, University of Warwick — Jun.2021

SUPERVISION \ MENTORSHIP EXPERIENCE

PhD Students

Anurag Singh, Kiet Vo (University of Saarland) — Saarbrucken, Germany
Mentoring junior PhD students in our group — Mar.2023 - Present

Masters Students

Swathi Suhas (University of Saarland) — Saarbrucken, Germany
Project: *"Explainable Machine Learning"* — Mar.2024 - Present

Oscar Yung (University of Oxford) — Oxford, United Kingdom
Thesis: *"Two Sample Testing for Regression Discontinuity Design"* — Feb.2022 - May.2022

Samuel Weinman (University of Oxford) — Oxford, United Kingdom
Thesis: *"Analysis of Price-Volume Interplay in Financial Markets via Machine Learning"* — May.2020 - Aug.2020

Undergraduate Students

Mohammad Mehdi Mojarradi, Jihong Lee (Williams College) — Oxford, United Kingdom
Williams-Exeter Exchange Program at Oxford University — Mar.2021 - Nov.2021

William Conyers, Daniel Park (Williams College) — Oxford, United Kingdom
Williams-Exeter Exchange Program at Oxford University — Jan.2020 - Mar.2020

TEACHING

University of Oxford

Tutor, A12 Simulation and Statistical Programming — 2020
Tutor, SB1.1 Applied Statistics — 2020
Tutor, SB1.2 Computational Statistics — 2020
Tutor, SB2.2 Statistical Machine Learning — 2021
Teaching Assistant, SB2.1 Foundations of Statistical Inference — 2019