QUAN ZHOU

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SUMMARY

I am interested in continuous optimization, and its applications in machine learning fairness, backed by four years of experience in operator-valued polynomial optimization. My PhD thesis is due in March 2024, with viva scheduled for the summer.

EDUCATION

Imperial College London, Dyson School of Design Engineering — United Kingdom
PhD in Design Engineering — *Oct 2022 - Summer 2024*
Supervisor: Prof. Robert Shorten, Dr. Jakub Mareček

University College Dublin, School of Electrical & Electronic Engineering — Ireland
PhD in Electrical and Electronic Engineering — *Feb 2020 - Aug 2022*
Supervisor: Dr. Jakub Mareček, Prof. Robert Shorten

University of Edinburgh, School of Mathematics — United Kingdom
MSc Operational Research with Risk — *Sep 2018 - Nov 2019*
Relevant modules: Optimization, Operational Research, Stochastic modelling, Time Series, Statistical Programming — Grade: 75, Distinction
Supervisor: Dr. Jakub Mareček, Prof. Jacek Gondzio

Hunan University, College of Finance and Statistics — China
BEc (Hons) Insurance — *Sep 2014 - Jun 2018*
Relevant modules: Calculus, Ordinary Differential Equation, Linear Algebra, Actuarial Science, Probability and Statistics — Grade: 87
Awarded The Second Prize Scholarship by Hunan University.

PUBLICATION LIST

Quan Zhou and Jakub Mareček. Learning of linear dynamical systems as a non-commutative polynomial optimization problem. *IEEE Transactions on Automatic Control*, 2023

Quan Zhou, Jakub Mareček, and Robert Shorten. Fairness in forecasting of observations of linear dynamical systems. *Journal of Artificial Intelligence Research*, 76:1247–1280, 2023

Quan Zhou, Jakub Mareček, and Robert N Shorten. Fairness in forecasting and learning linear dynamical systems. In *Proceedings of the AAAI Conference on Artificial Intelligence*, volume 35, pages 11134–11142, 2021

Quan Zhou, Jakub Mareček, and Robert Shorten. Subgroup fairness in two-sided markets. *Plos one*, 18(2):e0281443, 2023

RESEARCH EXPERIENCE

Group-Blind Optimal Transport to Group Parity Feb-Oct 2023
Submitted *https://arxiv.org/abs/2310.11407*

Prevailing algorithms in fair learning predominantly hinge on accessibility or estimations of these sensitive attributes, at least in the training process. We design a single group-blind projection map that aligns the feature distributions of both groups in the source data, achieving (demographic) group parity, without requiring values of the protected attribute for individual samples in the computation of the map, as well as its use. Instead, our approach utilises the feature distributions of the privileged and unprivileged groups in a boarder population and the essential assumption that the source data are unbiased representation of the population. We present numerical results on synthetic data and real data.

Maximum Entropy Voting Jan 2022-present

· Voting systems can be roughly divided into deterministic (e.g., majority rule) and probabilistic systems, where the latter generally outperforms. As one of probabilistic systems, The maximum entropy voting system (MEV0) (Sewell et al., 2009), is more likely to elect Condorcet winners, who win a majority of the vote in every head-to-head election against each of the other candidates. We focus on scaling down the MEV0 problem, where the number of variables is $n!$ for n candidates.

Machine Learning for Microsoft Azure Sep 2021-Jan 2022

· With an excellent team of researchers at DKI (Data, Knowledge, Intelligence) Group of Microsoft Research Asia, I explore the applications of machine learning in certain problems at Microsoft Azure.

Proper Learning of Linear Dynamic Systems May-Aug 2019
Postgraduate research project under the supervision of Dr. Jakub Mareček (IBM Research) and Prof. Jacek Gondzio (University of Edinburgh).

· The dissertation presents a new approach to proper learning of linear dynamic systems via non-commutative polynomial optimization. Based on unrolling of recursive equations in Kalman filtering, I formulated minimisation of least-squares forecast error in terms of the system matrices. By minimising the forecast error, the parameters of the underlying dynamic can be recovered as non-commutative variables (bounded operators with of unknown dimension). For solving this minimisation problem, I apply a hierarchy of SDP relaxations.

Insurance Company Economic Capital Measurement based on Copula Dec 2017 - May 2018
Undergraduate research project under the supervision of Prof. Dihong Chen (Hunan University).

· Built Nested Archimedean Copula model to describe the dependence between loss rates of business lines of a property insurance company, then used Tail Var method to measure how much economic capital the company shall hold to manage underwriting risk. Developed in-depth knowledge of copulas and risk management.

TALKS AT CONFERENCES & WORKSHOPS

2023 Machine Learning NeEDS Mathematical Optimization.

2021 ICLR-21 Workshop on Responsible AI (two posters).

2021 DET Seminar at Dyson School of Design Engineering, Imperial College London.

2021 Thirty-Fifth AAAI Conference on Artificial Intelligence.

SKILLS

Programming Languages	Python, Julia, MATLAB
Software Packages	Mosek, CPLEX, GAMS, Xpress

TEACHING EXPERIENCE

Small group teaching, and one lecture on fairness for *Machine Learning (2023)*.
Exam marking for *Signal Processing (2021)*, and *Optimization (2022)*.

VOLUNTEERING

Teacher, AIESEC

- (Kuala Lumpur, Malaysia, Mar 2018) Worked in a Christian charity house for one month and cooperated with a Vietnamese volunteer to teach English and mathematics to around 30 students. On holidays, we organized extracurricular activities.
- (Colombo, Sri Lanka, Jul 2016) Worked in a 6-person team to give English and Chinese courses in a Buddhist primary school and a high school, for one month.

REFERENCES

Dr. Jakub Mareček
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Prof. Robert Shorten
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