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Education

University of British Columbia   *Vancouver, Canada*

PHD ECONOMICS   *2016 - 2023 (expected)*

- Fields: Microeconomic Theory, Algorithmic Learning, Econometrics
- Committee: Li Hao (co-supervisor), Vitor Farinha Luz (co-supervisor), Michael Peters

Institute for Advanced Studies   *Vienna, Austria*

MSc ECONOMICS   *2014 - 2016*

Karl Franzens University   *Graz, Austria*

BA ECONOMICS   *2010-2014*

References

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Papers

WORKING PAPERS

Reinforcement Learning and Collusion, *Job Market Paper*

This paper presents an analytical characterization of the long run behaviors learned by algorithms that interact repeatedly. I show that these behaviors correspond to equilibria that are stable points of a tractable differential equation. As a running example, I consider a repeated Cournot game of quantity competition, for which the stage game Nash equilibrium serves as non-collusive benchmark. I give necessary and sufficient conditions for this Nash equilibrium not to be learned. These conditions are requirements on the information algorithms use to determine their actions, and the stage game. When algorithms determine actions based only on the past period's price, the Nash equilibrium can be learned. However, conditioning actions on a richer type of information precludes the Nash equilibrium from being learned. This type of information allows for the existence of a collusive equilibrium that will be learned with positive probability.

Consistency of Multi-Agent Batch Reinforcement Learning

This paper provides asymptotic results for a class of actor-critic batch - reinforcement learning algorithms in the multi-agent setting. At each period, each agent faces an estimation problem (the critic, e.g. estimating value function $Q(s,a)$), and a policy updating problem. The estimation step is done by parametric function estimation based on a batch of past observations. I give sufficient conditions on the environment, growth rate of the batch-size and speed of their stepsizes, so that each agent's parametric function estimator is consistent in the following sense: For large t, the optimal parameter θ_t is close to a true optimal parameter θ_t^*, depending on t only through the current period's policy profile.

This result greatly simplifies the asymptotic analysis of multi-agent learning, e.g. in the application of long-run characterisations using stochastic approximation techniques.

Estimating Diffusion over multiple large Networks in a dynamic linear panel Model (with Andreea Rotarescu and Kevin Song)

Spillover of economic outcomes often arises over multiple networks, and distinguishing their separate roles is important in empirical research. For example, the direction of spillover between two groups (such as banks and industrial sectors linked in a bipartite graph) has important economic implications, and a researcher may want to learn which direction appears prominent in data. For this, we need to have an empirical methodology that allows for both directions of spillover simultaneously. In this paper, we develop a dynamic linear panel model and asymptotic inference with large n and small T, where both directions of spillover are accommodated through multiple networks. Using the methodology developed here, we perform an empirical study of spillovers between bank weakness and zombie-firm congestion in industrial sectors, using firm-bank matched data from Spain between 2005 and 2012. Overall, we find that there is positive spillover in both directions between banks and sectors.

Awards, Fellowships, & Grants

		CAD
2016-2021	**Four Year Fellowship**, University of British Columbia	20,000-26,000 p.a.
2019,2020	**Graduate Fellowship in Gambling Research 6798**, University of British Columbia	CAD 32,000 p.a.
2020	**SSHRC Explore - Faculty of Arts Adaptation Research Assistant Grant**, University of British Columbia	CAD 4,000
2019	**Faculty of Arts Graduate Award**, University of British Columbia	CAD 3,800
2018	**Best 2nd Year Paper Award**, University of British Columbia	CAD 1,000
2017	**Best Student in 1st Year Micro, Macro and Econometrics Class**, University of British Columbia	CAD 600
2014-2016	**Full Scholarship**, IHS Vienna	EUR 20,000
2015	**Excellence Award**, IHS Vienna	

Presentations (including forthcoming)

2022 ACM Economics and Computation, Game Theory and Applications, CORS/INFORMS, Canadian Economic Theory

2021 Stony Brook International Conference on Game Theory

Teaching Experience

2020	**Comprehensive Exam in Microeconomics**, Official Tutor	UBC
2018,2019	**PhD Math Camp**, Instructor (Math review course for 1st year PhD students)	UBC
2017,2018	**Microeconomics**, Teaching Assistant (MA level)	UBC
2015	**Time Series Econometrics**, Teaching Assistant (MSc level)	IHS Vienna

Languages

Software
Matlab, PYTHON, Julia, SQL

Language
English (Fluent), German (Native), French (CEPR: C1), Spanish (CEPR: B2), Mandarin (CEPR: A2)