Chun Kai Ling

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EXPERIENCE

National University of Singapore   2024-present
Assistant Professor, School of Computing, Computer Science
Sung Kah Kay Assistant Professorship   2024-present

IEOR, Columbia University   2023-2024
Postdoctoral Research Scientist
Supervisors: Christian Kroer, Garud Iyengar

Computer Science Department, Carnegie Mellon University   2017-2023
Ph.D. Student, Computer Science
Advisors: J. Zico Kolter, Fei Fang

National University of Singapore (NUS)   2011-2015
B.Eng.(Hons), First Class, Computer Engineering, GPA: 5.0/5.0
Minor in Mathematics, Exchange Program to HKUST.

RESEARCH

Postdoctoral Research Scientist, Columbia University
Game theoretic approaches for logistics, patrolling, and cybersecurity (ongoing)
Proposed game models for each of logistics, patrolling and cybersecurity applications.
Studied computational complexity of solving variants of these games and proposed
empirically tractable methods towards finding these equilibrium.

Sparse Equilibrium in Games (ongling)
Studied running times, quality of solutions, theoretical properites of optimal sparse-
support strategies against an adversary in both randomized and succinct games.

Graduate-Research Assistant(Ph.D. student), CMU
End-to-End Learning of Two-Player Zero Sum Games
Designed a differentiable module able to learn payoff-matrices in 2 player extensive-form
imperfect information games, using only samples from equilibrium strategies. Proposed
a novel solution concept for bounded rationality in extensive-form games and efficient
methods to solve it for zero-sum games.
Skills: Pytorch, Cython, Optimization, Game Theory

Online Solving of General-sum Games (ongoing)
Proposed the first online methods to approximate Stackelberg and Extensive-Form
Correlated Equilibrium online without having to solve the full game upfront. For both
solution concepts, I was able to solve substantially larger games than existing offline
solvers while enjoying guarantees on solution quality with respect to a blueprint policy.
Skills: C/C++, Optimization, Game Theory, OpenMP, OpenSpiel

Function Approximation for Solving General-sum Games (ongoing)
We approximate Stackelberg Extensive-Form Correlated Equilibrium by learning the
Pareto Frontiers for each state and applying Fitted Value Iteration with an appropri-
ate Bellman-like loss. Our method guarantees incentive compatibility and has solution
quality lower bounded in terms of function approximation errors.
Skills: Pytorch, Game Theory

Other projects:
- Learning multi-player correlated behavior with deep reinforcement learning.

- Efficient solvers and qualitative analysis for Extensive Form Correlated Equilibrium.

- Learning fully differentiable joint Cumulative Distribution Functions and Copulas.

- Solving multiple-leader Stackelberg Equilibrium with correlated commitments.
- Partial Information Decomposition (PID) for quantifying feature interactions.

Summer Research Intern, Facebook AI Research, NYC 2019
Project: *Safe Search for Stackelberg Equilibrium in Extensive-Form Games*
Supervised by Noam Brown.
Skills: Python, Rust, Optimization, Game Theory

Research Assistant, Department of Computer Science, NUS 2017
Project: *Network Anomaly Detection*
Applied statistics and machine learning to cluster and identify potential anomalies in unlabelled netflow data. Supervised by Prof. Kian Hsiang Low and Mun Choon Chan.
Skills: Applied Machine Learning

Signal Processing Lab, DSO National Laboratories 2015-2016
Projects: *Computer Vision, Image Processing, Machine Learning, Optimization*
Applied machine learning and signal processing for object detection, segmentation, image and video enhancement and super-resolution. System administrator for the lab.
Skills: Matlab, Image Processing, Optimization

Honors Dissertation, NUS 2014-2015
Project: *Planning and Learning in Spatiotemporal Environmental Phenomena*
Formulated, analyzed and evaluated the Gaussian Process Planning framework, a novel non-myopic, Bayes-adaptive model-based planning framework with applications in Bayesian Optimization and Active Learning. Published in AAAI '16.
Skills: Gaussian Processes, Machine Learning

Undergraduate Part-time Research Assistant, NUS 2014
Project: *Point Cloud Registration*
Performed feature extraction used to align noisy point clouds obtained via Structure from Motion. Experimented with standard LIDAR datasets and attempted to reproduce results on noisy point clouds obtained using SfM.

Undergraduate Research Opportunities Programme, NUS 2013-2014
Project: *Computational intelligence for MRI image segmentation*
Studied Markov random fields and experimented with t-mixture models to improve robustness in brain tumour segmentation.
Skills: Matlab, Graphical Models

Research Intern, Centre for Strategic Infocomm Technologies 2014
Project: *Static Analysis of Binary Executables*
Investigated and proposed methods to perform automatic function and instruction matching of x86 assembly code, in the absence of function symbols. Wrote tools to distinguish between code and data in disassembled binaries.

AWARDS

Best Reviewer Award
ICML 2024

GameSec'23 Best Paper Award 2023
Out of 18 acceptances and 35 submissions.

NUS Development Grant 2022, 2023
Support for Singaporeans early in their academic career.

IJCAI'18 Distinguished Paper Award 2018
7 papers out of 710 acceptances and 3470 submissions.

DSO National Laboratories
KiNETIC and Group accomplishment award for a classified project.   2016

National University of Singapore
Valedictorian for the class of Computer Engineering graduates.   2015
IES Gold Medal. Top graduating student.   2015
Lee Kuan Yew Gold Medal. Best graduate through the course of study.   2015
DSTA Gold Medal. Best final year student for Computer Engineering.   2015
NUS Faculty Scholarship.   2011-2015
Deans List for Semesters 1 through 6. Amongst top 5 % of students.   2011-2014
Alcatel Lucent Telecomm. Award. Best performance in a class for Networks.   2014
Top 2 Term Project for the class 'AI Planning and Decision Making'.   2014
Micron Prize. Top 2nd year student.   2012
Finalist in NUSACM iCode intra-college algorithmic programming competition. 2012

PUBLICATIONS
(*joint 1st author)

Jakub Cerny, **Chun Kai Ling***, Darshan Chakrabarti, Jingwen Zhang, Gabriele Farina, Christian Kroer, Garud Iyengar (2024). Contested Logistics: A Game Theoretic Approach. (GameSec'24).

Davin Choo, Themistoklis Gouleakis, **Chun Kai Ling***, Arnab Bhattacharyya (2024). Online bipartite matching with imperfect advice. (ICML'24)

Jakub Cerny, **Chun Kai Ling***, Christian Kroer, Garud Iyengar (2024). Layered Graph Security Games. (IJCAI'24)

Weijia Zhang, **Chun Kai Ling**, Xuanhui Zhang. Deep Copula-based Survival Analysis for Dependent Censoring with Identifiability Guarantees. (AAAI'24)

Yixuan Xu, **Chun Kai Ling**, Fei Fang. Learning Coalition Structures with Games. (AAAI'24)

Paul Pu Liang, Yun Cheng, Xiang Fan, **Chun Kai Ling**, Suzanne Nie, Richard J. Chen, Zihao Deng, Nicholas Allen, Randy Auerbach, Faisal Mahmood, Ruslan Salakhutdinov, Louis-Philippe Morency. Quantifying & Modeling Multimodal Interactions: An Information Decomposition Framework. (Neurips'23)

Zimeng Song, **Chun Kai Ling***, Fei Fang. Multi-defender Security Games with Schedules. (GameSec'23)
Best Paper Award out of 18 accepted papers and 35 submissions.

Samuel Sokota, Ryan D'Orazio, **Chun Kai Ling**, David J. Wu, J. Zico Kolter, Noam Brown. Abstracting Imperfect Information Away from Two-Player Zero-Sum Games (ICML'23)

Chun Kai Ling*, J. Zico Kolter, Fei Fang. Function Approximation for Solving Stackelberg Equilibrium in Large Perfect Information Games (AAAI'23, Oral Presentation) [19% acceptance rate]

Chun Kai Ling*, Fei Fang. Safe Subgame Resolving for Extensive Form Correlated Equilibrium (AAAI'22, Oral Presentation) [15% acceptance rate]

Chun Kai Ling*, Noam Brown. Safe Search for Stackelberg Equilibria in Extensive-Form Games (AAAI '21) [21% acceptance rate]

Chun Kai Ling*, Fei Fang, J. Zico Kolter. Deep Archimedean Copulas (NeurIPS '20) [20.1% acceptance rate]

Dmitrii Kharkovskii, **Chun Kai Ling**, Bryan Kian Hsiang Low. Nonmyopic Gaussian

Process Optimization with Macro-Actions (AISTATS '20) [28.7% acceptance rate]

Gabriele Farina, **Chun Kai Ling**, Fei Fang, Tuomas Sandholm. Correlation in Extensive-Form Games: Saddle-Point Formulation and Benchmarks (NeurIPS '19) [21.6% acceptance rate]

Gabriele Farina, **Chun Kai Ling**, Fei Fang, Tuomas Sandholm. Efficient Regret Minimization Algorithm for Extensive-Form Correlated Equilibrium (NeurIPS '19, Oral Presentation) [21.6% acceptance rate]

Chun Kai Ling*, Fei Fang, J. Zico Kolter. Large Scale Learning of Agent Rationality in Two-Player Zero-Sum Games (AAAI '19) [16.2% acceptance rate]

Chun Kai Ling*, Fei Fang, J. Zico Kolter. What Game Are We Playing? End-to-end Learning in Normal and Extensive Form Games (IJCAI '18) [20.5% acceptance rate] **Distinguished Paper Award**. 7 papers were selected out of 710 acceptances and 3470 submissions.

Chun Kai Ling*, Kian Hsiang Low, and Patrick Jaillet. Gaussian Process Planning with Lipschitz Continuous Reward Functions: Towards Unifying Bayesian Optimization, Active Learning, and Beyond (AAAI '16) [25.8% acceptance rate]

WORKSHOP AND PREPRINTS	**Chun Kai Ling**, J. Zico Kolter, Fei Fang. What game are we playing? Differentiably learning games from incomplete observations. (NIPS '17 Deep Reinforcement Learning Symposium)

TALKS
Scalable Game Theoretic Approaches for Addressing Societal Challenges
2023 Penn State Center for Socially Responsible AI
End-to-end Learning in Normal and Extensive Form Games.
2018 AAMAS-IJCAI Workshop on Agents and Incentives in Artificial Intelligence (AI^3)
2018 IJCAI main track (at Stockholm)
2018 Cylab Partners Conference (at CMU)

TEACHING

Advanced Topics in Artificial Intelligence (NUS CS6208)	Fall 2024 - present
Artificial Intelligence Methods for Social Good (CMU 08-737)	Spring 2018
Graduate Artificial Intelligence(CMU 15-780)	Spring 2019

SERVICE

GameSec 2022 Web Chair	2022
CMU Speakers Club, Computer Science Department	2021-2023
CMU Graduate Application Support Program	2020

COURSEWORK

Analytical Performance Modeling (15-857)	Fall 2017
Fundamentals of Learning from the Crowd (10-709)	Fall 2017
Graduate Artificial Intelligence (15-780)	Spring 2018
Advanced Algorithms (15-850)	Fall 2018
Logical Foundations of Cyber-Physical Systems (15-824)	Fall 2018
Advanced Operating Systems and Distributed Systems (15-712)	Fall 2020

OTHERS

Software Engineering Intern, Graymatics 2013
Wrote tools to speed up machine learning pipelines. Contributed to the implementation of a image-sharing social media platform. Wrote a desktop application to help end-users organize digital media.

Temporary Administrative Assistant, Health Promotion Board	2012
Temporary Tax Officer, Inland Revenue Authority of Singapore	2011
Air Defence Weapon Operator, 160 Squadron	2009-2011