

# Chun Kai Ling

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## EDUCATION

**Computer Science Department, Carnegie Mellon University** 2017-present  
Ph.D. Student, Computer Science  
Fields: Artificial Intelligence, Machine Learning, Game Theory.  
Advisors: J. Zico Kolter, Fei Fang  
Expected graduation date: Summer 2023

**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

### **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 appropriate 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**

**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**

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

Yixuan Xu, **Chun Kai Ling**, Fei Fang. Learning Coalition Structures with Games. (Accepted to 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

**End-to-end Learning in Normal and Extensive Form Games.**

	2018 AAMAS-IJCAI Workshop on Agents and Incentives in Artificial Intelligence (AI <sup>3</sup> )	
	2018 IJCAI main track (at Stockholm)	
	2018 Cylab Partners Conference (at CMU)	
<b>TEACHING</b>	Artificial Intelligence Methods for Social Good (08-737)	Spring 2018
	Graduate Artificial Intelligence	Spring 2019
<b>SERVICE</b>	GameSec 2022 Web Chair	2022
	CMU Speakers Club, Computer Science Department	2021- present
	CMU Graduate Application Support Program	2020
<b>COURSEWORK</b>	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
<b>OTHERS</b>	<b>Software Engineering Intern, Graymatics</b>	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.	
	<b>Temporary Administrative Assistant, Health Promotion Board</b>	2012
	<b>Temporary Tax Officer, Inland Revenue Authority of Singapore</b>	2011
	<b>Air Defence Weapon Operator, 160 Squadron</b>	2009-2011