

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: 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 methods to compute Stackelberg and Extensive-Form Correlated Equilibrium online without having to solve the full game. For both solution concepts, we are able to solve substantially larger games than with existing offline solvers while enjoying theoretical 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 [under review].

Skills: Pytorch, Numba, 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.

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

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

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 (AI³)
2018 IJCAI main track (at Stockholm)
2018 Cylab Partners Conference (at CMU)

TEACHING

Artificial Intelligence Methods for Social Good (08-737) Spring 2018
Graduate Artificial Intelligence Spring 2019

SERVICE

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

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