Ryann Sim Wei Jian

PhD · Algorithmic Game Theory

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Profile

I am a graduating Ph.D. student at SUTD in the Engineering Systems and Design pillar, supervised by Georgios Piliouras. My primary research interests are in applying game theory, machine learning and optimization to better understand the properties of multiagent systems. In addition, I am also broadly interested in the intersection between practical ethics, social choice theory and game theory. My PhD research revolved around understanding the algorithmic and dynamical properties of simple online learning processes such as Multiplicative Weights Update in various contexts, ranging from multi-agent to quantum settings.

Education

Singapore University of Technology and Design   *Singapore*

Ph.D., Engineering Systems and Design   *Sep. 2019 - May 2024*

- Awarded SUTD President's Graduate Fellowship
- Supervised by Georgios Piliouras
- Thesis Title : Online Learning in Games: Clairvoyance, Convergence and Recurrence

Singapore University of Technology and Design   *Singapore*

B.Eng., Engineering Systems and Design (Summa Cum Laude)   *May 2016 - Aug. 2019*

- Awarded Wilmar Scholarship
- Focus Track : Operations Research

Conference Publications

1. Stratis Skoulakis, Tanner Fiez, *Ryann Sim*, Georgios Piliouras, and Lillian Ratliff. **Evolutionary Game Theory Squared: Evolving Agents in Endogenously Evolving Zero-Sum Games**. In *AAAI Conference on Artificial Intelligence*, 2021.

2. Tanner Fiez, *Ryann Sim*, Stratis Skoulakis, Georgios Piliouras, and Lillian Ratliff. **Online Learning in Periodic Zero-Sum Games**. *Advances in Neural Information Processing Systems*, 34, 2021.

3. *Ryann Sim*, Stratis Skoulakis, Lillian J Ratliff, and Georgios Piliouras. **Fast Convergence of Optimistic Gradient Ascent in Network Zero-Sum Extensive Form Games**. In *International Symposium on Algorithmic Game Theory*. Springer, 2022.

4. Georgios Piliouras, *Ryann Sim*, and Stratis Skoulakis. **Beyond Time-Average Convergence: Near-Optimal Uncoupled Online Learning via Clairvoyant Multiplicative Weights Update**. *Advances in Neural Information Processing Systems*, 35, 2022.

5. Rahul Jain, Georgios Piliouras, and *Ryann Sim*. **Matrix Multiplicative Weights Updates in Quantum Zero-Sum Games: Conservation Laws & Recurrence**. *Advances in Neural Information Processing Systems*, 35, 2022.

6. Volkan Cevher, Georgios Piliouras, *Ryann Sim*, and Stratis Skoulakis. **Min-Max Optimization Made Simple: Approximating the Proximal Point Method via Contraction Maps**. *SIAM Symposium on Simplicity in Algorithms*, 2023.

Working/Submitted Papers

1. Wayne Lin, Georgios Piliouras, *Ryann Sim*, and Antonios Varvitsiotis. **Quantum Potential Games, Replicator Dynamics, and the Separability Problem**. Submitted to Quantum Journal, 2023.

2. Wayne Lin, Georgios Piliouras, *Ryann Sim*, and Antonios Varvitsiotis. **No-Regret Learning and Equilibrium Computation in Quantum Games**. Submitted to Quantum Journal, 2024.

Experience

Shanghai University of Finance and Economics

Shanghai, China

RESEARCH INTERNSHIP

Feb. 2023 - May 2023

- Worked under Prof. Wang Xiao in online optimization and game theory, with a focus on studying the dynamical behavior of alternating online algorithms.

British Petroleum Singapore

Singapore

CORE DATA STRATEGY INTERNSHIP

May 2018 - Aug. 2018

- Implemented quarterly charts, navigation widgets and bug fixes in Python and HTML for a price dashboard used by traders globally.
- Developed and deployed an easy-to-use Python module that allows shiptrackers to perform logical checks on multi-source information, and create their own checks.

British Petroleum Business Service Centre Malaysia

Kuala Lumpur, Malaysia

MASTER DATA MANAGEMENT INTERNSHIP

Nov. 2015 - Mar. 2016

- Organized HR records for over 300 employees working in the Business Service Centre using Excel VBA.

Teaching

Teaching Assistant, 40.012 Manufacturing and Service Operations

Singapore

ENGINEERING SYSTEMS AND DESIGN, SUTD

Spring 2021

- Ran tutorial sessions and organized project meeting sessions. Awarded ESD Outstanding Teaching Assistant Award.

Teaching Assistant, 40.015 Simulation Modeling and Analysis

Singapore

ENGINEERING SYSTEMS AND DESIGN, SUTD

Fall 2020

- Ran tutorial sessions and provided project mentorship. Awarded ESD Outstanding Teaching Assistant Award.

Undergraduate Teaching Assistant, 40.014 Systems Architecture

Singapore

ENGINEERING SYSTEMS AND DESIGN, SUTD

Spring 2019

- Helped students during office hours, helping improve their skills in Capella and R.
- Mentored students for their respective final projects.

Instructor, Introduction to LaTeX

Singapore

INDEPENDENT ACTIVITY PERIOD, SUTD

21 Jan. 2019

- Helped create material and teach a class to help 35 participants learn how to use LaTeX in their research and coursework.

Undergraduate Teaching Assistant, 10.004 Advanced Mathematics

Singapore

CLUSTER OF SCIENCE AND MATH, SUTD

Fall 2018

- Guided first-year students in the course, which focused on Multi-variable Calculus and Ordinary Differential Equations

Instructor, Freshmore Learning Hub

Singapore

SCIENCE AND MATH CLUSTER, SUTD

Fall 2018

- Taught various topics in Multi-variable Calculus and Ordinary Differential Equations, in supplement to the material taught in 10.004.

Undergraduate Teaching Assistant, 10.007 Systems World

Singapore

SCIENCE AND MATH CLUSTER, SUTD

Spring 2018

- Guided first year students in course material that spanned various topics in Systems Modelling and Systems Optimization.
- Held review sessions before exams and ran a LaTeX workshop to help students prepare for report submissions.

Undergraduate Teaching Assistant, 3.007 Introduction to Design

Singapore

SCIENCE AND MATH CLUSTER, SUTD

Fall 2017

- Mentored first-year students while they were designing their respective products, with a focus on design thinking.

Undergraduate Teaching Assistant, 10.001 Mathematics Bootcamp

Singapore

SCIENCE AND MATH CLUSTER, SUTD

Summer 2017

- Assisted students who had previously failed the course, helping them understand concepts in Differentiation and Integration.
- Graded homework assignments to ensure students understood material and stayed on track.

Instructor, Introduction to HTML and CSS

Singapore

INDEPENDENT ACTIVITY PERIOD, SUTD

9 Jan. 2017

- Helped instruct a class that sought to help participants learn how to create their own website.

Honors & Awards

2021	**ESD Outstanding Graduate Teaching Assistant Award**, SUTD	*Singapore*
2019	**President's Graduate Fellowship**, SUTD	*Singapore*
2019	**Outstanding Undergraduate Teaching Assistant Award**, SUTD	*Singapore*
2019	**Meritorious Winner**, COMAP Interdisciplinary Contest in Modeling (ICM) Problem D	*Singapore*
2017	**Best Video Award, 1st Position**, Singapore Amazing Flying Machine Competition 2017 (Category D Semi-Autonomous)	*Singapore*
2016	**Math II Honors Class (Linear Algebra)**, Faculty of Science and Math, SUTD	*Singapore*
2016	**Wilmar Scholarship**, Wilmar International	*Singapore*

Talks & Presentations

2023	Poster Presentation for 'Matrix Multiplicative Weights Update in Quantum Zero-Sum Games: Conservation Laws and Recurrence', NEURIPS	*New Orleans, USA*
2023	Poster Presentation for 'Beyond Time-Average Convergence: Near-Optimal Uncoupled Online Learning via Clairvoyant Multiplicative Weights Update', NEURIPS	*New Orleans, USA*
2022	Invited Talk for 'Fast Convergence of Optimistic Gradient Ascent in Network Zero-Sum Extensive Form Games', SAGT	*Colchester, UK*
2021	Virtual Talk for 'Online Learning in Periodic Zero-Sum Games', NEURIPS	*Online*
2021	Virtual Poster Presentation for 'Evolutionary Game Theory Squared: Evolving Agents in Endogenously Evolving Zero-Sum Games', AAAI	*Online*

Academic Service

Reviewed for NEURIPS and ICLR. Sub-reviewed for WINE, AAAI, ICDCS and AAMAS.

Other Projects

Data Driven Robust Portfolio Optimization   *Singapore*

UNDERGRADUATE RESEARCH OPPORTUNITY PROGRAM, SUTD   *Jan. 2019 - Sep. 2019*

- The project uses asset returns data to create a robust portfolio optimization model that performs better than the standard minimum-variance portfolio.

Predicting Driver State & Environment with LSTM   *Singapore*

UNDERGRADUATE RESEARCH OPPORTUNITY PROGRAM, SUTD   *Jan. 2018 - Jul. 2018*

- Extending upon previous work done on binary classification of 6-second epochs of driver micro-glances, we sought to explore categorical classification using RNN and LSTM. We also explored vector embedding to convert macro glances into vector-based interpretations.

Augmented Human (Asian Leadership Program)   *Hangzhou, China*

INTERNATIONAL DESIGN CENTER, ZHEJIANG UNIVERSITY   *Sep. 2016 - Mar. 2017*

- Designed an indoor navigation API called JANUS using Android Studio and Python that shows the path to an indoor destination as an augmented reality display on users' mobile phones.

Autonomous Unmanned Aerial Vehicle with Innovative Obstacle Avoidance & Operation in Low Light Conditions (SAFMC)   *Singapore*

UNDERGRADUATE RESEARCH OPPORTUNITY PROGRAM, SUTD   *Sep. 2016 - Mar. 2017*

- Created a semi-autonomous drone with proprietary GPS navigation and high structural strength. Used the drone in the Singapore Amazing Flying Machine Competition 2017.

Extracurricular Activities

SUTD Graduate Student Association (GSA)   *Singapore*

VICE-PRESIDENT   *Mar. 2020 - Present*

- Helped plan and implement several events, including 3 Minute Thesis and Graduate Student Matriculation Afterparty.

SUTD Student Government (ROOT)

Singapore

DEPUTY VICE-PRESIDENT OF COMMUNICATIONS

Sep. 2017 - Sep. 2018

- Led a team of 11 members to make student life in SUTD more fulfilling by acting as a bridge between the student body and management.
- Founded a team made of passionate individuals to change SUTD culture in collaboration with the Lee Kuan Yew Centre for Innovative Cities.
- Created a website for the student government, which provides information and resources to the student body.

'Into the G.R.I.D.' Orientation Committee

Singapore

DEPUTY PROGRAMS DIRECTOR

Sep. 2016 - May 2017

- Organized and executed an Orientation camp for 450 freshmen in order to promote integration among students.
- Designed a 3 day itinerary with innovative and fun activities for all students. Novel technologies were used, such as Python scheduling to release clues for a treasure hunt.

SUTD Choir

Singapore

PRESIDENT

Nov. 2016 - Nov. 2017

- Led the choir in expanding our repertoire, with a particular focus on vocal technique.
- Participated in various concerts and performances in Singapore, including a performance at the Esplanade.

SUTD Vocomotives

Singapore

MUSIC DIRECTOR

Nov. 2016 - Nov. 2017

- Held training sessions twice a week to help the acapella group members improve vocal technique.

SUTD University Ambassadors

Singapore

MEMBER

Jun. 2016 - Sep. 2019

- Took part in various Acceptance Tea events, serving as a campus guide and student ambassador.
- Emcee and student helper for SUTD Open House 2018.

Languages and Skills

Programming	Proficient in Python, R, LaTeX, SQL, HTML and CSS
	Intermediate in JavaScript, Mathematica, MATLAB, AMPL, VBA and PyTorch
Tools/Software	Proficient in Microsoft Office, Adobe Premiere Pro and Adobe After Effects
	Intermediate in Tableau, Adobe Illustrator and Unity
Languages	Fluent in English, Mandarin and Malay (written and spoken)
	Intermediate in Cantonese
Hobbies	Choral singing, reading poetry, cooking, playing tabletop role-playing games and watching/analyzing films