TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Business and Economics
Chair for Economics, esp. Economic Policy and Economic Research

Game Theory Experiments with Large Language Models

Summer Semester 2025

Description

The rapid rise of artificial intelligence (AI), especially large language models (LLMs) like ChatGPT, has revolutionized how we simulate and understand human decision-making. This seminar offers a unique opportunity to explore the cutting-edge intersection of game theory and AI, where students actively engage in both designing and conducting experiments with seminar participants and LLMs like ChatGPT. Through this hands-on approach, participants will experience how LLMs perform in classical game theory settings and how their behavior compares to human decision-making.

The seminar aims to provide students with foundational knowledge of game theory concepts while simultaneously introducing them to the exciting and emerging field of LLMs in experimental economics. The interactive nature of the seminar encourages students to critically assess whether AI can truly mimic or diverge from established human behaviors in economic games and to explore how different prompts and setups influence results.

By the end of the seminar, students will have acquired practical skills in conducting game theory experiments with LLMs, analyzing their outputs, and comparing them with human behavior. They will also be equipped to thoughtfully discuss the implications of AI-generated behavior for experimental economics and its broader applications.

Instructors

Prof. Dr. Alexander Kemnitz, office hours: Tuesday, 1:00-2:00 pm, SCH C 265, e-mail: alexander.kemnitz@tu-dresden.de

Dimitria Freitas, MA, office hours: by appointment, SCH C 261, e-mail: dimitria.freitas@tu-dresden.de

Prerequisites

Knowledge of economics as taught in the modules Introduction to Economics (EVWL) and Introduction to Microeconomics, and Game Theory, as taught in the module Strategy and Competition.

Modules

Programs of Faculty of Business and Economics: BA(D)-WW-VWL-2703, WW-BA(D)-201-AWIP
Bachelor/Master International Relations: BA-IB-AWP
Other programmes: according to export and/or learning agreements.

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Block Seminar Schedule

Period	Description
April 08, 2025, 9:20 – 10:50 pm *room tbd*	**Kick-Off Meeting**
April 08 – April 15, 2025 *OPAL*	Topic Selection & Group Formation
April 14 – May 31, 2025 *Check our office hours*	Facultative Feedback on Classroom Experiment Setup
June 17, 2025 *OPAL*	Presentation & Experiment Reports Submission Deadline
June 24, 2025 *room tbd*	**Group Presentations / Experiments (Full Day Seminar)**
September 01, 2025 *OPAL, Wipo Secretary Office*	Seminar Paper Submission Deadline

Examination and Grading

Participants **form groups of five to six students** by choosing a topic (see list below) in OPAL. The examination consists of a presentation, participating in the seminar and a seminar paper all in English.

Presentation (40%):

- Conducting and assessing the classroom experiment: **25 minutes**
- Presenting the previously prepared LLM experiment results: **20 minutes**
- Comparing both in a discussion: **15 minutes**

Discussion (10%):

- Active participation in other groups' experiments and discussion.

Seminar Paper (50%):

- **Explain and Lay Out the Key Takeaways of the Assigned Literature:** Provide an overview of the key takeaway of the assigned literature, including research questions, methodologies, differences and similarities in findings, and limitations.
- **Describe and Interpret Experiment Results:** Clearly present the findings from both the classroom experiment and the LLM experiment, discussing how results align with or deviate from expectations.
- **Compare with Assigned Literature:** Analyze how your experimental results relate to the assigned literature, highlighting similarities, differences, and possible explanations.

The maximum length of the seminar paper (excluding bibliography) should not 20 pages (based on 12pt fonts size, 1.5 line spacing). The seminar papers are to be uploaded on time in OPAL and handed over to the secretary of the chair (Heike Becker, SCH C 264, office hours 8:00 am - 12:00 pm).

Seminar Topics

Group 1 – Prisoner's Dilemma

Literature on Original Game:

- Axelrod, Robert, und William D. Hamilton. „The Evolution of Cooperation". Science, 27. März 1981. https://doi.org/10.1126/science.7466396.

Literature on ChatGPT Experiment:

- Brookins, Philip, and Jason Matthew DeBacker. "Playing Games With GPT: What Can We Learn About a Large Language Model From Canonical Strategic Games?" SSRN Electronic Journal, 2023. https://doi.org/10.2139/ssrn.4493398.
- Akata, Elif, Lion Schulz, Julian Coda-Forno, Seong Joon Oh, Matthias Bethge, und Eric Schulz. „Playing Repeated Games with Large Language Models". arXiv, 26. Mai 2023. https://doi.org/10.48550/arXiv.2305.16867.
- Guo, Fulin. „GPT in Game Theory Experiments". arXiv, 11. Dezember 2023. https://doi.org/10.48550/arXiv.2305.05516.

Group 2 – Battle of the Sexes

Literature on Original Game:

- Hawkins, Robert X. D., und Robert L. Goldstone. „The Formation of Social Conventions in Real-Time Environments". PLOS ONE 11, Nr. 3 (22. März 2016): e0151670. https://doi.org/10.1371/journal.pone.0151670.

Literature on ChatGPT Experiment:

- Akata, Elif, Lion Schulz, Julian Coda-Forno, Seong Joon Oh, Matthias Bethge, und Eric Schulz. „Playing Repeated Games with Large Language Models". arXiv, 26. Mai 2023. https://doi.org/10.48550/arXiv.2305.16867.

Group 3 – Dictator Game

Literature on Original Game:

- Charness, Gary, and Matthew Rabin. "Understanding Social Preferences with Simple Tests." The Quarterly Journal of Economics 117, no. 3 (2002): 817–69.

Literature on ChatGPT Experiment:

- Horton, John J. "Large Language Models as Simulated Economic Agents: What Can We Learn from Homo Silicus?" Working Paper. Working Paper Series. National Bureau of Economic Research, April 2023. https://doi.org/10.3386/w31122.

- Brookins, Philip, and Jason Matthew DeBacker. “Playing Games With GPT: What Can We Learn About a Large Language Model From Canonical Strategic Games?” SSRN Electronic Journal, 2023. https://doi.org/10.2139/ssrn.4493398.
- Fan, Caoyun, Jindou Chen, Yaohui Jin, and Hao He. “Can Large Language Models Serve as Rational Players in Game Theory? A Systematic Analysis.” Proceedings of the AAAI Conference on Artificial Intelligence 38, no. 16 (March 24, 2024): 17960–67. https://doi.org/10.1609/aaai.v38i16.29751.

Group 4 - The Ultimatum Game

Literature Original Game:

- Houser, D. and McCabe, K. Chapter 2 - experimental economics and experimental game theory. In Glimcher, P. W. and Fehr, E. (eds.), Neuroeconomics (Second Edition), pp. 19–34. Academic Press, San Diego, second edition edition, 2014. ISBN 978-0-12-416008-8. doi: https://doi.org/10.1016/ B978-0-12-416008-8.00002-4. URL https: //www.sciencedirect.com/science/ article/pii/B9780124160088000024.
- Krawczyk, D. C. Chapter 12 - social cognition: Reasoning with others. In Krawczyk, D. C. (ed.), Reasoning, pp. 283–311. Academic Press, 2018. ISBN 978-0-12-809285-9. doi: https://doi.org/10.1016/ B978-0-12-809285-9.00012-0. URL https: //www.sciencedirect.com/science/ article/pii/B9780128092859000120.

Literature on ChatGPT Experiment:

- Aher, Gati V., Rosa I. Arriaga, und Adam Tauman Kalai. „Using Large Language Models to Simulate Multiple Humans and Replicate Human Subject Studies“. In Proceedings of the 40th International Conference on Machine Learning, 337–71. PMLR, 2023.
- Guo, Fulin. „GPT in Game Theory Experiments“. arXiv, 11. Dezember 2023. https://doi.org/10.48550/arXiv.2305.05516.