Semih Kara

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Citizenship: USA, Turkey

Employment

2024–Present
Urbana, IL
Postdoctoral Research Assistant
University of Illinois at Urbana-Champaign
Supervisor: Prof. Tamer Başar
Projects:
- Reinforcement learning under partial observability and applications to finance
- Multi-agent reinforcement learning in symmetric games
- Learning leader-optimal policies in Stackelberg games

2019–2024
College Park, MD
Graduate Research Assistant
University of Maryland, College Park
Advisor: Prof. Nuno C. Martins
Projects:
- Nash equilibria learning for large populations
- Inverse reinforcement learning in large multi-agent systems
- Applications to congestion control

2023
Laurel, MD
Intern
Johns Hopkins University Applied Physics Laboratory
Projects:
- Mixed criteria optimal controller toolbox
- Estimation of GPS variables from lower earth orbit satellites

2017–2022
College Park, MD
Graduate Teaching Assistant
University of Maryland, College Park
Classes:
- Optimal Control (graduate level)
- Control Systems
- Elements of Discrete Signal Analysis

Education

2017–2024
College Park, MD
Ph.D. in Electrical and Computer Engineering
University of Maryland, College Park
- Dissertation: Learning in Large Multi-Agent Systems
- Advisor: Prof. Nuno C. Martins

2017–2019
College Park, MD
M.Sc. in Electrical and Computer Engineering
University of Maryland, College Park

2013–2017
Ankara, Turkey
B.Sc. in Electrical and Electronics Engineering
Bilkent University

Skills

Math background: Probability Theory and Statistics, Game Theory, Reinforcement Learning, Dynamical Systems and Control, Optimization, Functional Analysis

Coding: Python, Matlab

Publications

Journal

[1] **Semih Kara** and N. C. Martins, "Learning Nash equilibria in large populations with constrained strategy switching," *IEEE Control Systems Letters*, vol. 8, pp. 1265–1270, 2024. DOI: 10.1109/LCSYS.2024.3408102.

[2] **Semih Kara** and N. C. Martins, "Excess payoff evolutionary dynamics with strategy-dependent revision rates: Convergence to Nash equilibria for potential games," *IEEE Control Systems Letters*, vol. 7, pp. 1009–1014, 2023. DOI: 10.1109/LCSYS.2022.3229962.

[3] **Semih Kara** and N. C. Martins, "Pairwise comparison evolutionary dynamics with strategy-dependent revision rates: Stability and δ-passivity," *IEEE Transactions on Control of Network Systems*, vol. 10, no. 4, pp. 1656–1668, 2023. DOI: 10.1109/TCNS.2023.3237485.

Conference

[1] **Semih Kara**, N. C. Martins, and M. Arcak, "Population games with Erlang clocks: Convergence to Nash equilibria for pairwise comparison dynamics," in *2022 61st IEEE Conference on Decision and Control (CDC)*, 2022, pp. 7688–7695.

[2] Ö. Yavuz, **Semih Kara**, O. Tokel, I. Pavlov, and F. Ö. İlday, "Doppler effect on nanopatterning with nonlinear laser lithography," in *2017 European Conference on Lasers and Electro-Optics and European Quantum Electronics Conference*, Optica Publishing Group, 2017, CM_6_5.

[3] Ö. Yavuz, **Semih Kara**, O. Tokel, I. Pavlov, and F. Ö. İlday, "Doppler effect on structure period of nonlinear laser lithography," in *APS March Meeting Abstracts*, ser. APS Meeting Abstracts, vol. 2017, Mar. 2017, K36.014.

Preprint

[1] **Semih Kara** and N. C. Martins, *Differential equation approximations for population games using elementary probability*, 2023. arXiv: 2312.07598 [cs.GT].

Work In Progress Near Completion

[1] **Semih Kara** and N. C. Martins, *Learning population games*.

[2] Y. Sönmez, **Semih Kara**, C. Kızılkale, M. Arcak, and A. Kurzhanskiy, *Optimal electric vehicle charger placement*.

Relevant Projects

2024 **Traffic Simulator**

- Improved the sequential queuing-based traffic simulator at `https://github.com/ucbtrans/BerkeleyTrafficSimPATH` by integrating electric vehicles and their charging behavior
- In collaboration with Murat Arcak and his group at University of California, Berkeley
- Coded in Python

2022 **Satisfiability Modulo Theory (SMT) Based Optima and Nash Equilibria Finder**

- Finds global maxima and Nash equilibria using Microsoft's Z3 SMT solver
- Works under non-differentiable and non-convex objective functions and payoffs

Community Involvement

Reviewer IEEE Transactions on Automatic Control, IEEE Control Systems Letters, IEEE Conference on Decision and Control, IEEE American Control Conference, European Control Conference

Participant Teaching math and physics to students in low-income neighborhoods of Ankara, Turkey