Semih Kara

Email: semihk@illinois.edu
Website: https://semihkara.github.io
Phone: +17193321082
Citizenship: U.S.A., Turkey

Education

- **PhD in Electrical and Computer Engineering** — Aug 2017 - June 2024
  University of Maryland, College Park — College Park, MD
- **MSc in Electrical and Computer Engineering** — Aug 2017 - May 2022
  University of Maryland, College Park — College Park, MD
- **BSc in Electrical and Electronics Engineering** — Sep 2013 - Jun 2017
  Bilkent University — Ankara, Turkey

Technical Skills

- **Quantitative Background**
  Reinforcement Learning, Probability & Statistics, Game Theory, Optimization, Deep Learning, Functional Analysis
- **Programming Languages and Tools**
  Python, MATLAB, PyTroch, Tensorflow, NLTK

Experience

- **University of Illinois at Urbana-Champaign** — Urbana, IL
  Postdoctoral Research Assistant (Supervisor: Prof. Tamer Başar) — Aug 2024 - Current
  - ▷ Developed reinforcement learning algorithms for partially observable environments. Implemented to optimize market-making strategies using deep learning techniques, such as LSTMs, in PyTorch.
  - ▷ Devised reinforcement learning algorithms that achieve faster convergence rates in multi-agent Markov decision processes (Markov games).

- **University of Maryland, College Park** — College Park, MD

  Graduate Research Assistant (Advisor: Prof. Nuno C. Martins) — May 2019 - Jun 2024
  - ▷ Developed methods and established sample complexity bounds for estimating system parameters from time series data in many-agent environments. Our methodology scales linearly with data size and supports online implementation, ensuring low cost and high efficiency.
  - ▷ Designed reinforcement learning algorithms for environments with network-structured action spaces.
  - ▷ Collaborated with researchers from the University of California, Berkeley, to develop a traffic simulation tool. Applied it to optimize electric vehicle charging station locations and route assignments in real-world road networks.
  - ▷ Established error bounds for stochastic approximation methods in large-scale symmetric games.
  - ▷ Designed decentralized learning algorithms that provably converge to Nash equilibria under multi-stage tasks and fluctuating action-revision rates.

  Graduate Teaching Assistant — Aug 2017 - May 2019
  - ▷ Assisted teaching the graduate-level optimal control course. Topics included dynamic programming, optimization in Banach spaces, gradient and Newton-Raphson methods, and Pontryagin's maximum principle.
  - ▷ Assisted teaching the senior-level control systems course. Topics included the root locus method, Bode diagrams, Nyquist plots, state-space methods for linear systems, and sampled-data systems.
  - ▷ Assisted teaching the sophomore-level signal processing course. Topics included sampling, linear transformations, orthogonal projections, Fourier transform, and discrete-time linear filters.

- **Johns Hopkins University Applied Physics Laboratory** — Laurel, MD

  Intern — Jun 2023 - Aug 2023
  - ▷ Created a toolbox for optimizing hyperparameters in H_2, H_∞, and LQR controllers. Applied to a state-of-the-art flight system.

Papers

- **Journal Publications**

  [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 Publications**

  [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.

- **ArXiv Preprints**

  [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, *Multi-agent inverse reinforcement learning in large population games.*

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

Awards and Scholarships

- *Twice received the Outstanding Teaching Assistant Award from the Department of Electrical and Computer Engineering at the University of Maryland, College Park, for outstanding performance as teaching assistant in the Optimal Control (ENEE 664) and Control Systems (ENEE 460) courses.*
- *Awarded the Merit Scholarship by Bilkent University for exceptional academic performance.*

Community Involvement

- *Reviewer for IEEE Transactions on Automatic Control, IEEE Control Systems Letters, IEEE Conference on Decision and Control, IEEE American Control Conference, and European Control Conference.*
- *Provided free physics and mathematics tutoring for students from a low-income area of Ankara, Turkey.*