Kai Wang

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Education

Harvard University   2017 - Present
Ph.D. in Computer Science   *Massachusetts, United States*
Advised by Professor Milind Tambe

National Taiwan University   2012 - 2017
B.S. in Electrical Engineering and Mathematics   *Taipei, Taiwan*
Overall GPA: 4.07/4.3   Major GPA: 4.13/4.3(EE) 4.03/4.3(Mathematics)

Honors

USC Asian Pacific Alumni Association   2018
Scholarship

International Mathematical Olympiad   2010, 2011
Silver Medals

Google Code Jam   2019
Advanced in Round 3 (T-shirt awarded)

Facebook Hacker Cup   2020
Advanced in Round 2 (T-shirt awarded)

Research and Technical Experience

Optimization in Multi-agent Systems
- Solved optimization problems in multi-agent systems with non-cooperative decentralized agent behavior.
- Studied the hardness of solving equilibria in multi-agent systems and proposed approximate algorithms to find approximate solutions.

Differentiable Optimization
- Integrated optimization and decision-making problems as a differentiable layer in the training pipeline, enabling optimization layer to be chained end-to-end in the training pipeline.
- Proposed a sub-sampling approach and a surrogate approach to improve the scalability of the differentiable optimization layer.
- Applied such approach to real domains in wildlife conservation, movie recommendation, and portfolio optimization to demonstrate its improvement in solution quality and scalability.

Sample Complexity of Differentiable Optimization (Applied Statistical ML Focused)
- We studied how the additional differentiable optimization layers affects the sample complexity of the entire model. It has been shown that linear optimization layers can preserve the order of sample complexity.
- In our NeurIPS 2020 paper, we showed that shrinking the size of the optimization layers can reduce the sample complexity.
- One of our ongoing works is to extend this sample complexity result to smooth convex optimization layers.

Illegal Smuggling Prevention: Application of Differentiable Optimization in Multi-agent Systems
- We expressed decision-making process of agents as a differentiable optimization layer, where the end-to-end differentiable optimization approach can be adopted to improve the overall performance.
- We applied such AI-powered approach to protect important targets against malicious attackers, e.g., endangered animals and vulnerable infrastructures, by smartly allocating limited security resources.

Conference Publications

- **Kai Wang**, Lily Xu, Andrew Perrault, Michael K. Reiter, and Milind Tambe
  "Getting Agents to Reach Better Equilibria: A Gradient-based Optimization Approach", under review.

- Lily Xu, Elizabeth Bondi, Fei Fang, Andrew Perrault, **Kai Wang**, and Milind Tambe
  "Dual-Mandate Patrols: Multi-Armed Bandits for Green Security", *AAAI 2021*

- **Kai Wang**, Bryan Wilder, Andrew Perrault, and Milind Tambe
  "Automatically Learning Compact Quality-aware Surrogates for Optimization Problems", in *NeurIPS 2020 (spotlight)*.

- Ayan Mukhopadhyay, **Kai Wang**, Andrew Perrault, Mykel Kochenderfer, Milind Tambe, and Yevgeniy Vorobeychik
  "Robust Spatial-Temporal Incident Prediction", in *Conference on Uncertainty in Artificial Intelligence 2020*.

- **Kai Wang**, Andrew Perrault, Aditya Mate, and Milind Tambe.
  "Scalable Game-Focused Learning of Adversary Models:Data-to-Decisions in Network Security Games", in *International Conference On Autonomous Agents and Multi-Agent Systems 2020*.

- Nitin Kamra, Umang Gupta, **Kai Wang**, Fei Fang, Yan Liu, Milind Tambe.
  "DeepFP for Finding Approximate Nash Equilibrium in Continuous Action Spaces", *Conference on Decision and Game Theory for Security 2019*

- Sarah Cooney, **Kai Wang**, Elizabeth Bondi, Thanh Nguyen, Phebe Vayanos, Hailey Winetrobe, Edward Cranford, Cleotilde Gonzalez, Christian Lebiere, and Milind Tambe.
  "Learning to Signal in the Goldilocks Zone: Improving Adversary Compliance in Security Games", *European Conference on Machine Learning 2019*.

- Nitin Kamra, Umang Gupta, **Kai Wang**, Fei Fang, Yan Liu, Milind Tambe.
  "Deep Fictitious Play for Games with Continuous Action Spaces", extended abstract in *International Conference On Autonomous Agents and Multi-Agent Systems 2019*.

- Sara Marie Mc Carthy, Corine Laan, **Kai Wang**, Phebe Vayanos, Milind Tambe, and Arunesh Sinha.
  "The Price of Usability: Designing Operationalizable Strategies for Security Games", in *International Joint Conference on Artificial Intelligence 2018*.

- **Kai Wang**, Qingyu Guo, Phebe Vayanos, Milind Tambe, and Bo An.
  "Equilibrium Refinement in Security Games with Arbitrary Scheduling Constraints", in *International Conference On Autonomous Agents and Multi-Agent Systems 2018*.

- Haifeng Xu, **Kai Wang**, Phebe Vayanos, and Milind Tambe.
  "Strategic Coordination of Human Patrollers and Mobile Sensors with Signaling for Security Games", in *Association for the Advancement of Artificial Intelligence 2018*.

Workshop Publications

- **Kai Wang**.
  "Balance Between Scalability and Optimality in Network Security Games", *International Conference On Autonomous Agents and Multi-Agent Systems 2020 Doctoral Consortium*

- **Kai Wang**, Bryan Wilder, and Milind Tambe.
  "Adversarial Machine Learning with Double Oracle", *International Joint Conference on Artificial Intelligence 2019 Doctoral Consortium*

- **Kai Wang**, Bryan Wilder, Sze-chuan Suen, Milind Tambe, and Bistra Dilkina.
  "Improving GP-UCB Algorithm by Harnessing Decomposed Feedback", *European Conference on Machine Learning 2019 SoGood Workshop*

- Sarah Cooney, Wendy Gomez, **Kai Wang**, Jorja Leap, P. Jeffery Brantingham, and Milind Tambe.
  "Mobile Game Theory with Street Gangs", *European Conference on Machine Learning 2019 SoGood Workshop*

- **Kai Wang**, Hong-Jyun Wang, and Ho-Lin Chen.
  "Routing Games with Priorities", in *Asian Association for Algorithms and Computation 2016* (Oral Presentation)

Work Experience

BravoAI   March 2017 - July 2017
Software Engineer & Cofounder   *Taipei, Taiwan*
- Developed API and system for a new Chinese-based search chatbot.
- Led the front-end development of our customized chatbot interface.

Mixerbox Incorporation   April 2016 - March 2017
Software Engineer Intern   *Taipei, Taiwan*
- Developed music language recognition and implemented a global automatic music recommendation system.
- Developed music similarity recognition to detect cover songs.
- Implemented a crawler to retrieve effective data from Google Play Store and visualize the App ranking history.
- Applied users' installation lists to build collaborative filtering with matrix factorization for recommendation system.

Teaching and Leadership Experience

Teaching Fellow   Spring 2020
Harvard CS 127/227 Cryptography
- Held office hours to help with homeworks and led the discussion in class.
- Advised students' final projects in the advanced cryptography.

President   August 2013, August 2015
IMO Summer Camp
- Provided opportunities for high school students to learn about advanced math and the connection to other research.
- Fostered the interest of students by fun lectures, challenging contest, and interesting boardgames.
- The camp has incubated several IMO medalists in the next few years and many MIT undergrad students.

Captain   June 2014 - June 2015
National Taiwan University Varisity Volleyball Team
- Led the team to the 3rd place in the national final round.

Professional Service

Program Committee   AAAI 2021, IJCAI AI4SG workshop 2020, 2019, IJCAI AIWC workshop 2018
       Subreviewer   NeurIPS 2020, AAMAS 2020, AAAI 2020