

On AI, Markets and Machine Learning

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ABSTRACT

What is fun about artificial intelligence (AI) is that it is fundamentally constructive! Rather than theorizing about the behavior of an existing, say social system, or understanding the way in which decisions are currently being made, one gets to ask a profound question: how *should* a system for making intelligent decisions be designed? In multi-agent systems we're often interested, in particular, in what happens when multiple participants, each with autonomy, self-interest and potentially misaligned incentives come together. These systems involve people (frequently people and firms), as well as the use of AI to automate some parts of decision making. How should such a system be designed?

In adopting this normative viewpoint, we follow a successful branch of economic theory that includes *mechanism design*, *social choice* and *matching*. But in pursuit of success, we must grapple with problems that are more complex than has been typical in economic theory, and solve these problems at scale. We want to attack difficult problems by using the methods of AI together with the methods of economic theory. In this talk, I will highlight the following themes from my own research, themes that emerge as one lifts nice ideas from economic theory and brings them to bear on the kinds of problems that are at the heart of modern AI research:

1. Preferences need to be elicited, and cannot be assumed to be known or easily represented.
2. Mechanisms don't need to be centralized. Rather, we can use (incentive aligned) distributed optimization!
3. Many interesting problems are temporal and involve uncertainty, leading to rich challenges that have been largely untouched by economic theory.
4. Markets become algorithms, and market-based optimization is a powerful and increasingly real paradigm.
5. Scale becomes an opportunity, as large systems beget data, this data enabling new approaches to robust incentive alignment.
6. Computation becomes a tool— machine learning has taken automated mechanism design up to the frontier of knowledge from 35 years of auction theory.

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The future will bring a tighter and ever more compelling integration of AI with markets. The human and societal interface will remain, and become ever more important as there is more that can be automated. The anticipated “agent-mediated economy” is almost upon us, and holds much promise as long as we make sure that AIs represent our preferences and system designs capture our values as society.

CCS Concepts

•**Information systems** → *Electronic commerce*; •**Theory of computation** → *Algorithmic mechanism design*; *Computational pricing and auctions*; •**Computing methodologies** → *Multi-agent systems*; *Supervised learning*;

Keywords

Mechanism design; multi-agent systems; market-design; rationality; learning; auctions.

Short Bio

David C. Parkes is George F. Colony Professor of Computer Science, Harvard College Professor, and Area Dean for Computer Science at Harvard University, where he founded the EconCS research group and leads research with a focus on market design, artificial intelligence, and machine learning. He is co-director of the Harvard University Data Science Initiative. Parkes served on the inaugural panel of the Stanford 100 Year Study on Artificial Intelligence, and co-organized the 2016 OSTP Workshop on AI for Social Good. He served as chair of the ACM Special Interest Group on Electronic Commerce (2011-16), and was Treasurer of IFAA-MAS (2008-13). Parkes is Fellow of the Association for the Advancement of Artificial Intelligence (AAAI), and recipient of the 2017 ACM/SIGAI Autonomous Agents Research Award, the NSF Career Award, the Alfred P. Sloan Fellowship, the Thouron Scholarship, and the Roslyn Abramson Award for Teaching. Parkes has degrees from the University of Oxford and the University of Pennsylvania, serves on several international scientific advisory boards, and has been a technical advisor to a number of start-ups.

