

Overview. Algorithms today are increasingly entrusted with decisions that have tangible impacts on peoples' lives. With real stakes on the line, participants will game these systems to improve their outcomes if they can. The field of *algorithmic mechanism design* uses the tools of game theory to design *mechanisms*: algorithms that guarantee that *even when the participants act in their own self-interest*, the algorithm's objectives are achieved.

Past work in algorithmic mechanism design, including works by the PI, have successfully studied the design of revenue-maximizing auctions in scenarios motivated by real-world settings. This proposal focuses on analogous questions in domains where societal welfare can be improved.

In healthcare, the high level research question is how to align the incentives of patients, doctors, insurers, and the government while guaranteeing efficiency and quality. For example, how should a budget-constrained government determine which Medicaid patients get which treatments? How should medical reimbursement contracts be designed to maximize patient health and align doctors' incentives? In online labor markets, the key issues are how to design platforms so as to mitigate discrimination, and how to design mechanisms that guarantee near-optimal worker-employer matches. The objective of proposed research is to address these questions and more using methods from algorithmic mechanism design.

Intellectual Merit. During her postdoctoral fellowship, the PI plans to initiate a "mechanism design for social good" research agenda, advancing knowledge in three ways:

First, the PI will bring mathematical formality to social issues. By formulating a precise theoretical question—such as “how should Medicaid allocate medical treatments to patients in order to maximize the objective of {value for treatment received minus payments charged}?”—one can rigorously analyze and provide solutions to serious problems facing society. Further, one can formally embed practical constraints into the problem formulation, e.g., by requiring that the mechanism be deterministic, or by limiting the number of options available to a patient.

Second, the PI will develop the mathematical foundations of mechanism design for objectives motivated by social good. While tools from the literature on revenue and welfare maximization will be helpful, the issues and objectives that arise in healthcare and online labor markets are very different and will require new theoretical approaches.

Third, the PI will collaborate with domain experts to ensure that this theoretical work will be relevant and impactful.

Broader Impacts. The proposed research is motivated by and focused on broader societal impact in the realm of healthcare and online labor markets. The research goals include collaboration with practitioners to ensure that the theory is useful to those who might implement it.

The PI publishes articles, disseminates work through conference and seminar talks, and makes her work available through arXiv and her website. Beyond this, she has organized two Mechanism Design for Social Good (MD4SG) workshops, delivered two different 90-minute tutorials at EC and WINE, and has written articles for academic newsletters *Sigecom Exchanges* and *AI Matters*. The PI plans to continue engaging in similar activities. She is beginning to prepare a survey on Menu Complexity for *Sigecom Exchanges*. During her postdoctoral work, the PI aims to write a survey on Mechanism Design for Social Good, and to lay the foundations for a future course on the topic.

Further, the PI is committed to increasing the participation of underrepresented groups in mathematical fields. Throughout undergraduate and graduate study, the PI have been involved in women in computing and math organizations, serving as founder and co-chair of many initiatives, including programs to mentor junior women. For these efforts and others, the PI was awarded the 2016 Google Anita Borg Scholarship. She also secured grants to fund 17 researchers who could not afford to attend the MD4SG workshops, including three students from African nations. During her postdoctoral fellowship, the PI will continue to work toward equal access to STEM fields for all. She plans to participate in women-in-computing activities at Columbia, to mentor junior students, and to use her position and energy to advocate for members of underrepresented groups.