A REFP has important theoretical guarantees: it always exists, unlike both a Walrasian equilibrium and an EFP. Moreover, for the case of agents in the TAC game and for the case of single-minded bidders (a fundamental benchmarked used to investigate combinatorial markets) we propose efficient algorithms to obtain REFP outcomes and investigate their properties both theoretically and experimentally. Experimentally, we found that for different distributions of input markets, our solution concept retains most of the guarantees of EFP outcomes *despite* the fact that only winners are guaranteed to be envy-free. Moreover, our algorithms outperform other algorithms in the literature on several important metrics such as welfare and revenue. Some of the tested distributions were based on real-world web-usage data, showing the potential real-world applicability of our methods.

Our AAMAS paper is thus an example that illustrates the core of my research agenda: achieving economic efficiency (for example, a *Walrasian Equilibrium*) within the realm of computational efficiency (correspondingly, *Restricted-Envy-Free Pricing*) as it pertains to resource allocation problems and equilibrium computation. From an applied point of view, the goal of this research is to support automated decision makers in increasingly complex environments.

The Future (and Present) of Decision Making

Real-world markets are among the most important and complex systems known to man. Their complexity entails that decision making cannot rely on faulty reasoning. Moreover, modern markets operate on *real-time*, which means that decisions must be made in fractions of a second. Our economies today rely to some extent on automated decision makers, but the evidence suggests that the economies of the future will rely even more on automated agents. My research will help us create economically-*principled* and computationally-*efficient* agents for complex market environments.

Our initial results show that this is a promising research direction. In the case of the TAC AdX game, our first prototype of an automated agent bidding based only on a REFP[2] was capable of accumulating a positive score against other non-principled bidding agents (see [7] for a similar approach to principled agents). In ongoing experiments,we are testing the hypothesis that bidding based on an approximation of a *Walrasian Equilibrium* can produce a robust agent against other agents that are highly optimized for the specific rules of this game, shedding light on the functioning of the game and thus, on the functioning of real ad-exchange markets.

TAC AdX is just one example of the potential applicability of our research. Other examples include the already mentioned spectrum auctions. In this case, one can also think of constructing an autonomous agent that bids based on a REFP and in fact, we plan to build such an agent using a value-generator based on real-world data from the Canadian spectrum auction. These examples illustrate how my research will pave the way for the construction of *principled* bidding agents capable of making *fast* and *near-optimal* decisions.

[2]Code is available in `http://github.com/eareyan/envy-free-prices`

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