Behavior-Informed AI: Factoring in Human Behavior for Robust Learning and Improved Decision-Making Assistance

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The rapid advancement of artificial intelligence (AI) has revolutionized the way we approach problem-solving, innovation, and interaction with technology. Central to this evolution is AI's ability to learn from vast amounts of human-generated and annotated data, empowering machines to mimic and even surpass human capabilities across various domains. As AI continues to progress, there lies immense potential to harness its power to augment and enhance human decision-making, ultimately fostering more informed choices and improved outcomes. However, humans are known to make imperfect or even biased decisions. This imperfection impedes AI development by introducing biases into the data used to train AI. Furthermore, to optimally assist humans and prevent them from succumbing to their biases, it is crucial for AI to understand and incorporate knowledge of human behavior and biases.

In this proposal, our goal is to design behavior-informed AI that accounts for human behavior in data generation and decision-making, leading to AI systems that are robust to biased training data and are able to enhance human decisions. To achieve this goal, we will pursue the following research threads:

- Understand and model human behavior: We plan to conduct behavioral experiments to examine human behavior in the context of data annotation and decision-making. Subsequently, we will develop interpretable and accurate human models by leveraging cognitive sciences and machine learning.

- Develop a robust learning framework for AI to learn from humans: The framework includes creating bias-mitigated datasets by designing cognitively-grounded bias-mitigation interventions during data collection and developing post-hoc learning algorithms that consider human biases during training.

- Design behavior-aware assistive AI to improve human decision-making: We'll create assistive AI systems accounting for human behavior and biases to improve decision-making. The AI will adaptively offer structured assistance and update the decision-making environment using behavioral insights.

The proposed research will be assessed within the application domains of crowdsourcing data collection, homelessness prevention, and pilot augmentation. We will collaborate with domain experts to refine our methodologies, ensuring alignment with the targeted domains, and develop comprehensive evaluation plans.

Intellectual Merit. This proposed research will contribute to the empirical understanding of human behavior in the context of human-AI interactions. It will also provide theoretical foundations for studying the interactions between humans and AI algorithms, through incorporating human models in both learning frameworks and assistive AI design. The results of the proposal will provide insights into developing human-centered machine learning algorithms and in combining humans and machines to solve problems neither can solve alone. This research is interdisciplinary in nature, combining ideas and techniques from machine learning, algorithmic economics, and online behavioral social science.

Broader Impacts. This research has a direct impact on the design of a broad range of online platforms with active human participation. Moreover, it contributes to improve policy making for societal issues. In particular, the PI has existing collaborations with domain experts in the department of Psychology and Brain Sciences, Brown School of Social Work, and Medical School on practical problems such as allocation of scarce resources for homeless prevention and living donor kidney transplantation. The PI plans to continue and expand the collaborations through the Center for Collaborative Human-AI Learning and Operation (HALO) and the Division for Computational and Data Sciences (DCDS) at the Washington University in Saint Louis to address societal issues. This proposal also includes a comprehensive plan for enhancing the education and broadening the research outreach, including creating a course in human-AI collaborations, engaging undergraduate research, and hosting summer workshops for high-school students.