

Spoiled for Choice? Personalized Recommendation for Healthcare Decisions: A Multi-Armed Bandit Approach with a Dynamic Discrete-Choice Scheme

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Abstract

Patient engagement is considered a critical element of patient-centered care. In terms of healthcare, however, patients are laymen who do not have medical knowledge or expertise. To better prepare patients for health management, in this study, we propose a personalized recommendation approach to help patients to reduce uncertainty in their decision making. Taking into account that making effective healthcare recommendations requires decision makers to consider individuals' unique characteristics and to adjust their recommendations dynamically along with individuals' evolving conditions/behaviors, we employ a multi-armed bandit (MAB) model to develop our recommendation framework. MAB is a classical framework in the machine-learning literature for addressing the exploration-versus-exploitation tradeoff, which is usually encountered when decision makers do not have full knowledge of the relevant environment but want to sustain reasonable payoffs. To determine the empirical performance of this MAB-driven recommendation approach, we combine it with a structural model, i.e., a single-agent model, to help us to rationalize individuals' behavior schemes under healthcare recommendations. Through analyzing data collected from a leading online weight-loss platform, we show that personalized recommendations for weight-loss challenges can boost weight-loss performance significantly for users in a variety of groups. In addition, our empirical estimates derived from the single-agent model show that individuals' perceptions about a weight-loss challenge may not be in line with its true effectiveness, which further confirms the need to provide personalized guidance for individuals' healthcare decision making. These results provide valuable insight into patients' health management and healthcare platform design.

Keywords: online healthcare platforms, patients' engagement, personalized healthcare recommendation, weight management, multi-armed bandit (MAB), single-agent model