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A Cognitive Framework for Timely AI Communication

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Abstract

AI systems and technologies that can interact with humans in real time face a communication dilemma: when to offer assistance and how frequently. Overly frequent or contextually redundant assistance can cause users to disengage, undermining the long-term benefits of AI assistance. We introduce a cognitive modeling framework based on Partially Observable Markov Decision Processes (POMDPs) that addresses this timing challenge by inferring a user's latent cognitive state related to AI engagement. A key component is counterfactual reasoning: the AI considers how well the user would perform independently and weighs the potential boost in performance against the risk of diminishing engagement with the AI. This adaptive strategy outperforms baseline policies where assistance is always provided or never provided. Our results highlight the importance of balancing short-term decision accuracy with sustained user engagement, showing how communication strategies can be optimized to avoid alert fatigue while preserving the user's receptiveness to AI guidance