

Motivation

A **mental model** is a person's belief state of their environment, including their understanding of relevant tasks and objects, their situation awareness, their task strategies, and other aspects.

When in teams, **people estimate the mental model of their teammates** and use this *team mental model* to guide their own planning, navigation, high-level goals, and communication.

Today, robots typically treat people as black boxes and avoid understanding their human collaborators on an individual level, however, a *team mental model* could have wide implications for robot planning and communication – **could we make robots construct a team mental model?**

Contributions

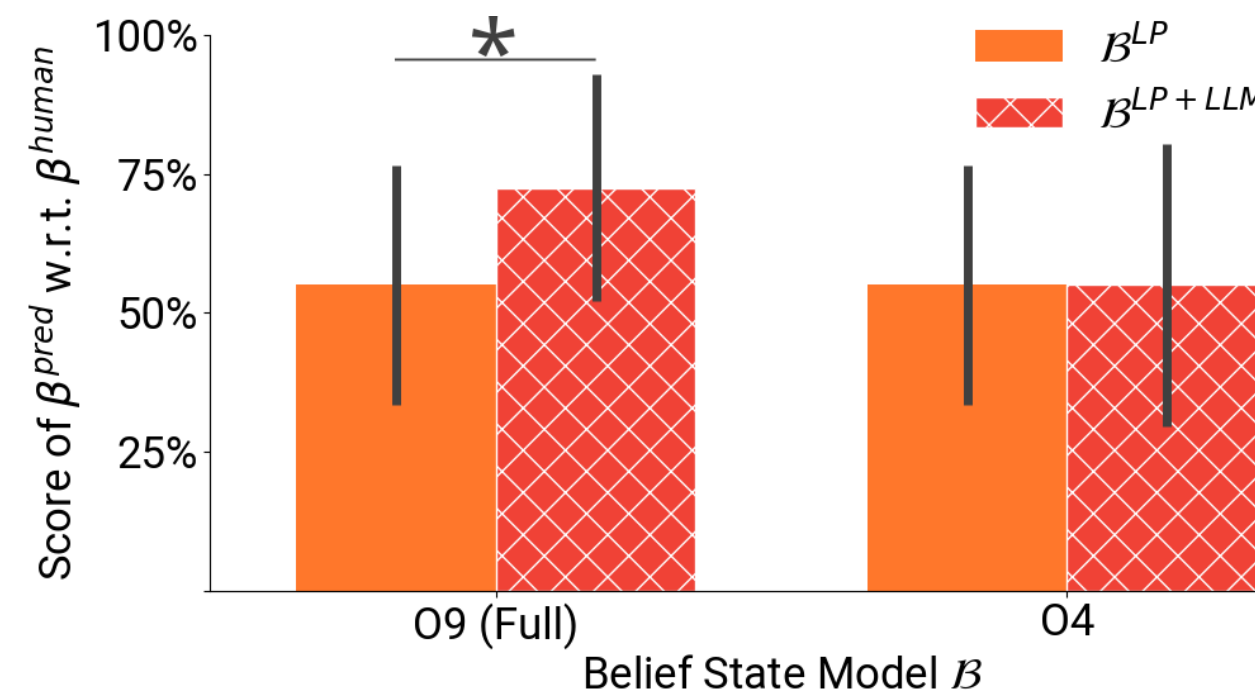
In this work we:

1. Present a **partially-observable** variant of the Overcooked-AI domain.
2. Develop a system for an agent to construct a scene graph of the environment, **with object permanence**, and **estimate the user's scene graph** from observations.
3. Compare two models that **predict answers to user situation awareness questions**: a logical predicates model (LP), and an LLM prompt.
4. Compare the **predicted situation awareness responses** against **real user responses** from an online user study.

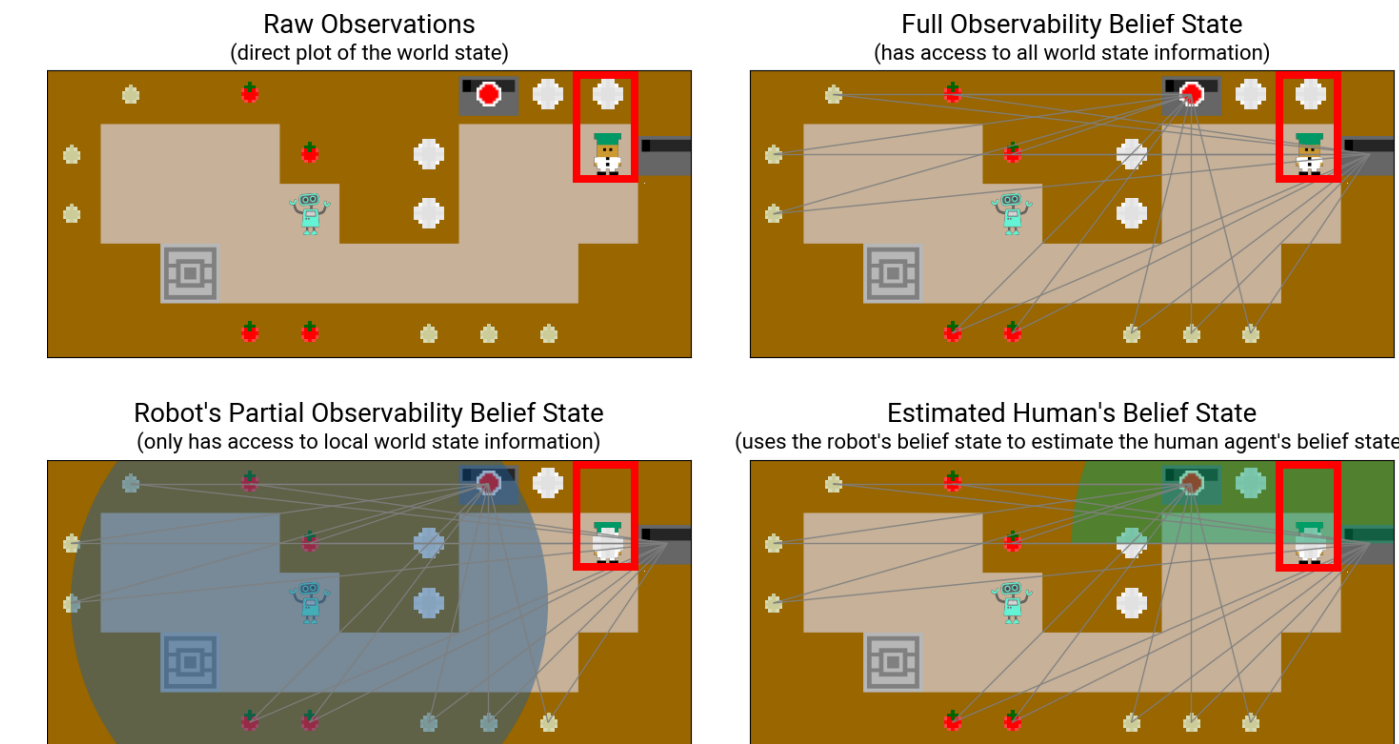
Takeaways

Key takeaways include:

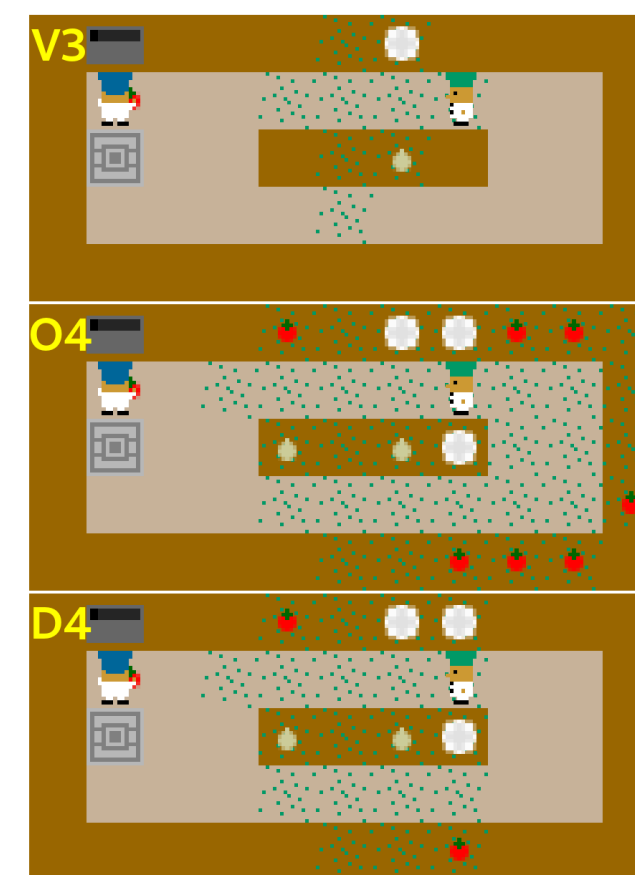
1. **Both models were resilient to low observability**, however the LLM model outperformed at high observability.
2. Users performed at ~60-80% accuracy to the ground truth, indicating that the environment was challenging enough for users.
3. The models **predicted user responses to ~50-75% accuracy**, motivating future work.



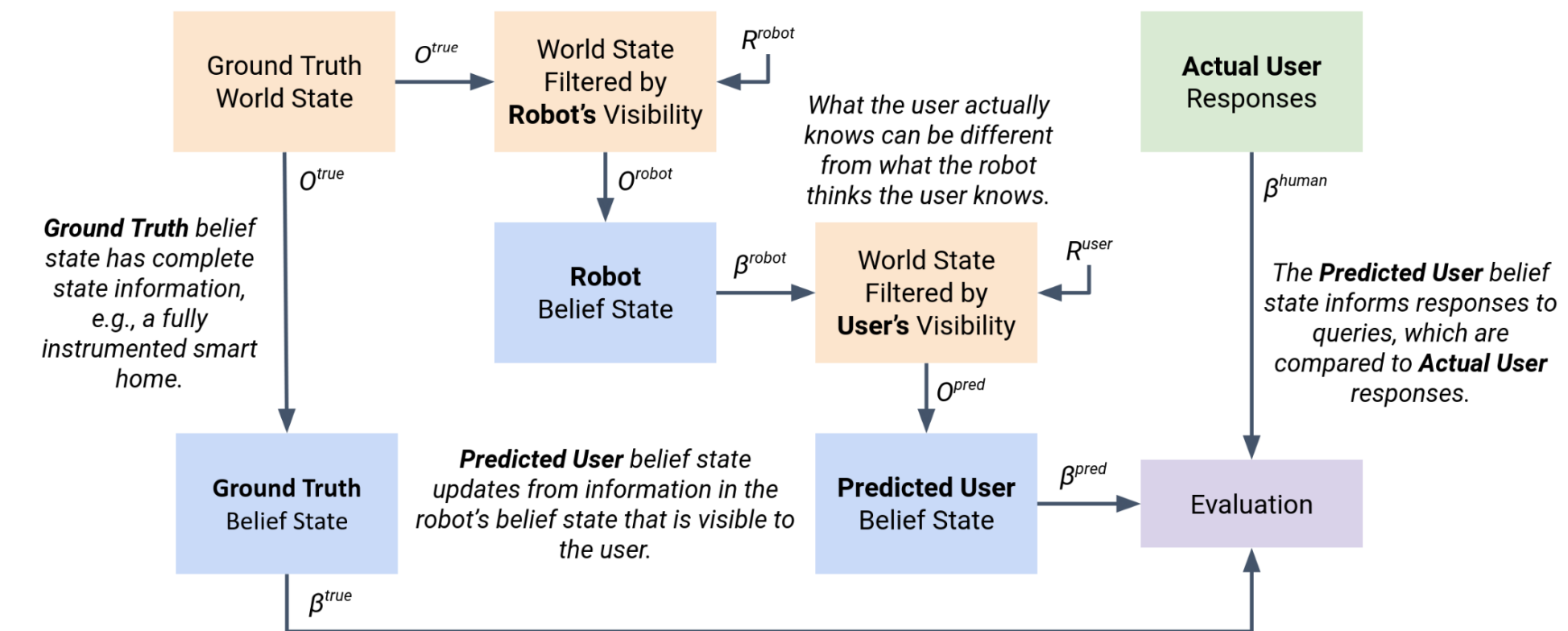
Performance of LP and LLM models at predicting user responses.



Demonstration of the partially observable environment and its implications on the robot's mental model.



Examples of visibility conditions.



System diagram from environment observations to predictions of the human user's belief state (represented by a scene graph).

All source code, user data, visualization scripts, and instructions for modifying the environment are available at: <https://github.com/gt-cec/tmm-hai>



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