

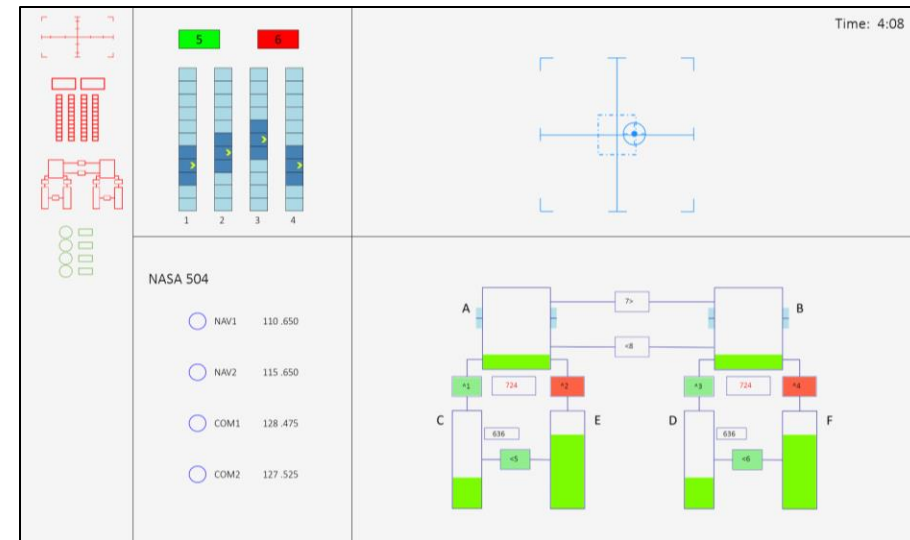
Human-Aware Reinforcement Learning for Adaptive Human Robot Teaming

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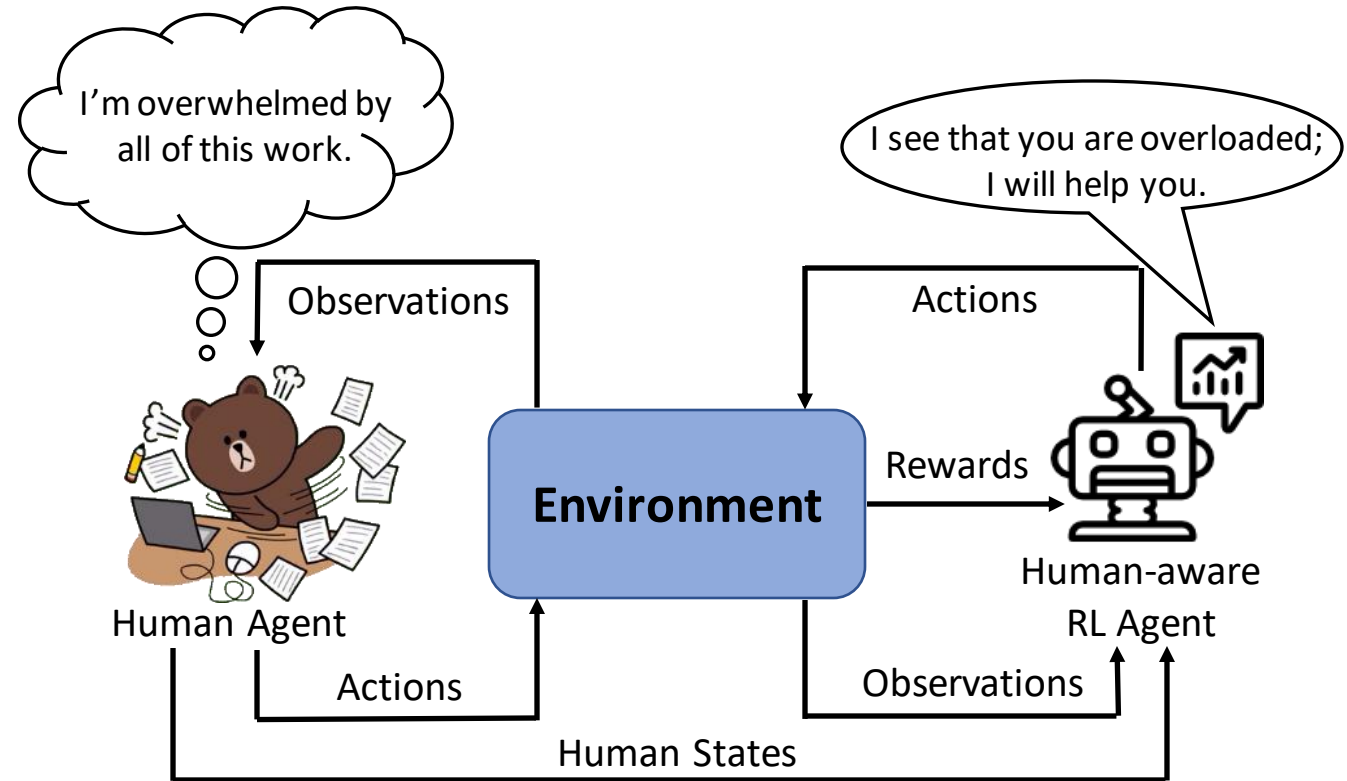
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Research Question

- In human-robot teams, robots can understand what is going on around them using various sensors.
- What about human behavior and human's internal states?

Methodology



Results

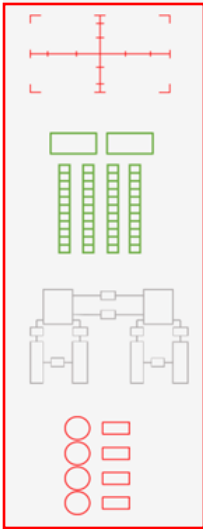
Can we use human states such as workload, fatigue and comfort in a Reinforcement Learning paradigm to improve human-robot team performance?

Research Question

Methodology

Results

Task Status Bar

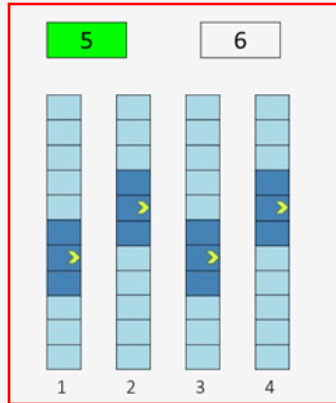


Automated (green)

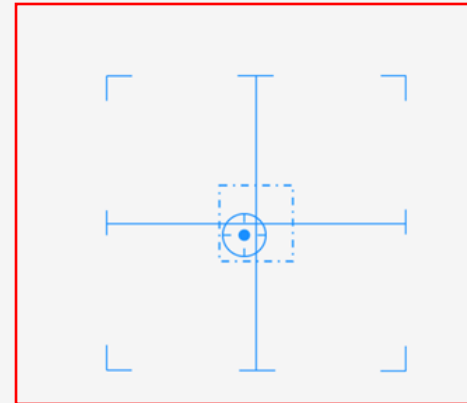
In range (gray)

Need Attention (red)

Communication Task
Mouse



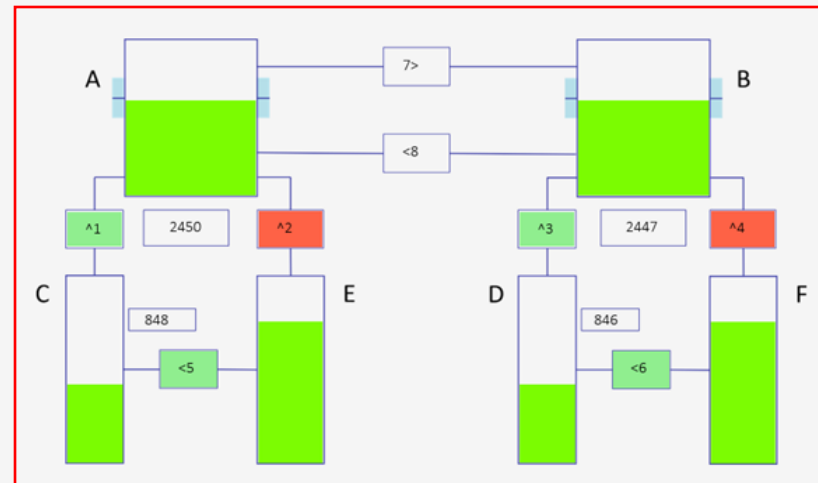
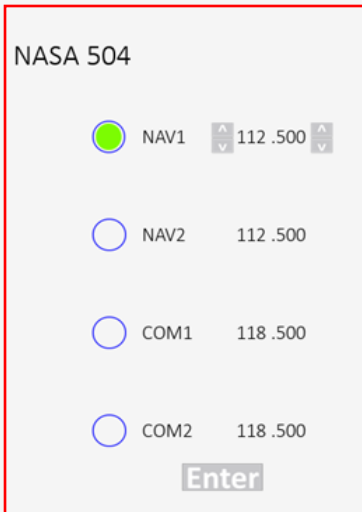
System Monitoring Task
Keys 1 - 6



Tracking Task
Joystick



Time: 0:46



Resource Management Task
Keys Num1 - Num8



NASA Multi-Attribute Task Battery (MATB-II) – a high-stress multitask environment – was used to induce different levels of workload.

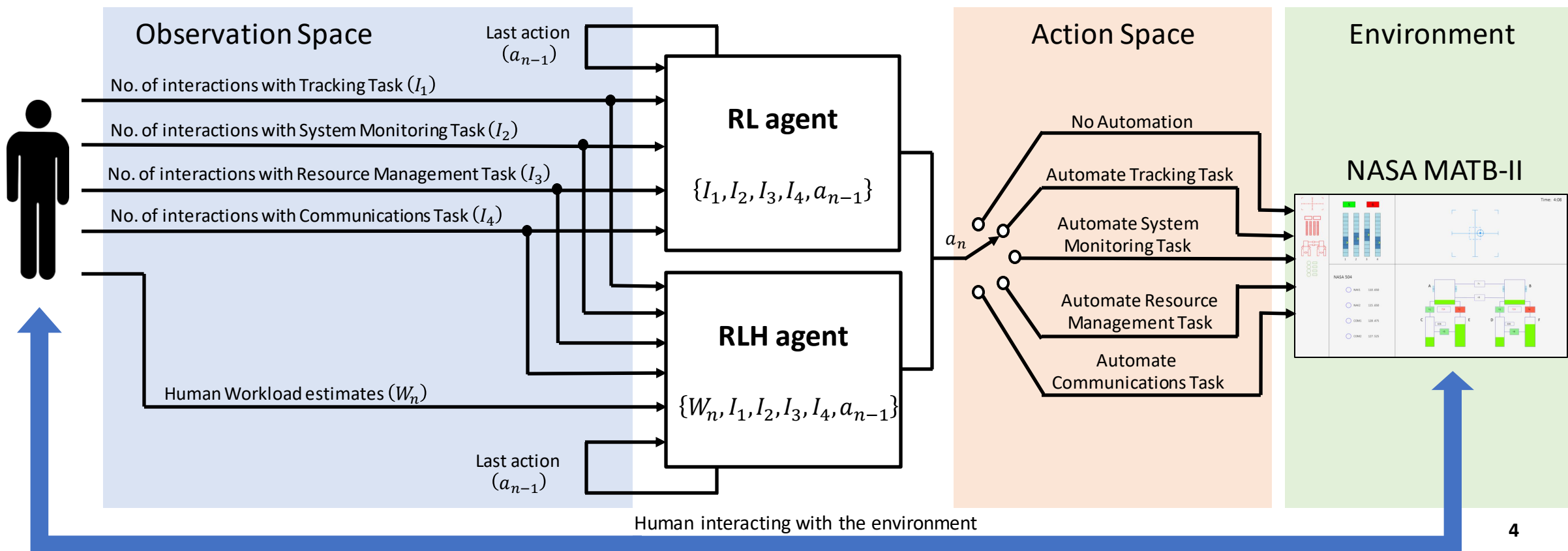
Research Question

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This work employs the Soft Actor-Critic (SAC) algorithm to decide which task is automated in an adaptive autonomy paradigm where a human and an agent work as a team in a multi-task environment.

- Two state-space encapsulations are explored:
- **RL** encompasses task and interaction information
 - **RLH** augments **RL** with human workload information

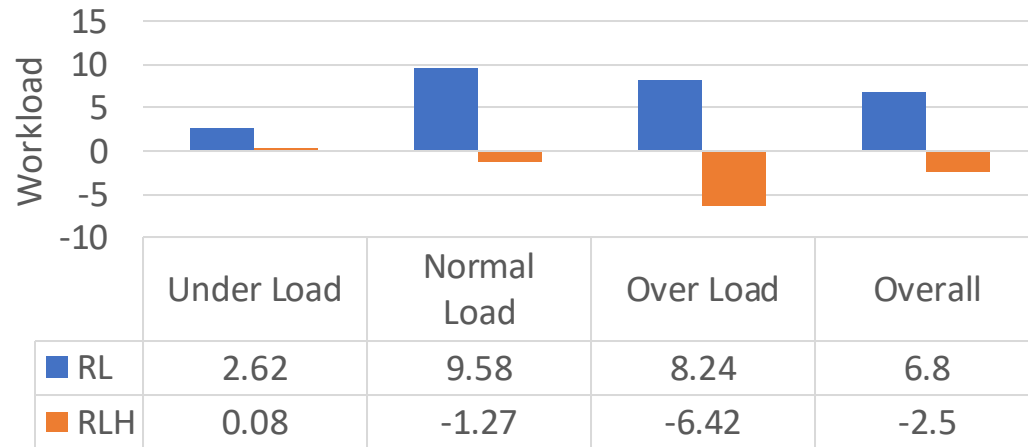


Research Question

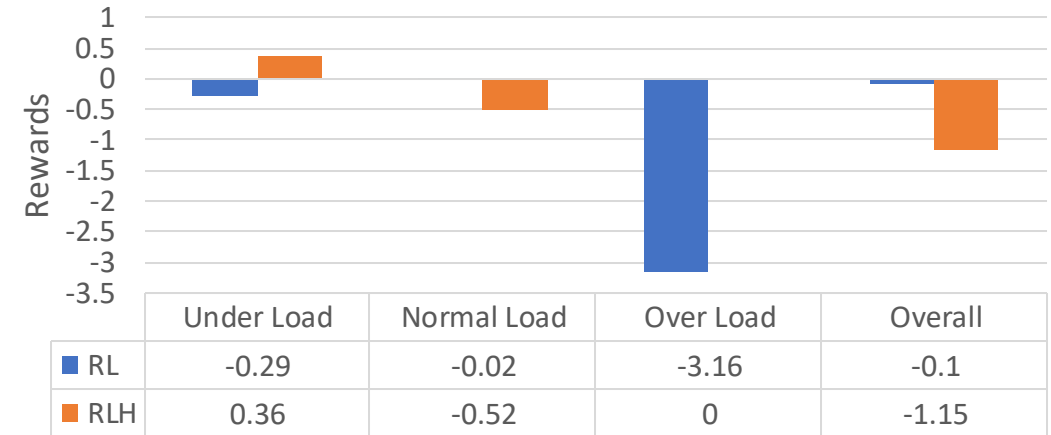
Methodology

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Change in Workload with respect to the Rule Based approach performance



Change in Rewards with respect to the Rule Based approach performance



Key takeaways:

- The addition of **human states** resulted in a **lower overall workload** but with **worse rewards**.
- **Most significant improvement** in human workload was observed **when the human was overloaded**.
- **Longer training times may be needed** for the RLH agent, due to the **more complex state space**.
- The **human-aware SAC agent** may have **learned action strategies** that are **fine-tuned to the human** teammate; however, **more data is needed** to better analyze the agent's performance.