Beliefs We Can Believe in: Replacing Assumptions with Data in Real-time Search

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Motivation

Real-time Search: agent has bounded time to select next action for execution
Setting is deterministic, single agent
Must efficiently allocate limited number of search node expansions
Classical solutions are often intuitive adaptations of offline search, such as RTA* and LSS-LRTA*

What if we designed for real-time planning from scratch?

Searching use beliefs

Risk-based Expansion: given beliefs about top level action values, expand nodes on the frontier under top level action that minimizes risk, the expected regret

Where do beliefs come from?

Purpose of search is to gather information to inform decision-making process. Which information on the search frontier should be used to form beliefs about top level actions?

Data-Driven Nancy

Gathering data:
1. Run weighted-A* on random problems
2. Collect all states
3. For each observed h value pick common states
4. Compute h*

Example h* belief for unit tiles: h = 10

Conclusions

- Nancy framework outperforms conventional LSS-LRTA*
- Replacing assumptions with data increase robustness
- All uncertainty is due to bounded rationality
- Metareasoning about uncertainty pays off, even for deterministic domains!