

Which Node to Expand?

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Heuristic Search

- Goal is to select nodes for expansion until a path has been created from the start node to some goal node
- Nodes are generally selected in a fashion so that those with lower f -values are selected first.
- Paired with an admissible heuristic, this exploration strategy results in optimal solutions.

Real-Time Heuristic Search

The same method of exploration is used in real-time search algorithms.

- LSS-LRTA* selects nodes for expansion such that f is minimized
- Dynamic- \hat{f} selects nodes so that \hat{f} is minimized

This results in optimal solutions in heuristic search. But is it the optimal exploration strategy in real-time scenarios?

Real-Time Heuristic Search

It can be argued that picking the lowest cost node for expansion is erroneous in real-time scenarios.

Online and offline search have different goals, and therefore should base their exploration on different strategies.

Different Goals Require Different Strategies

- The goal of heuristic search is to find a path from start to goal, time isn't really a concern.
- The goal of real-time heuristic search is to gather information from the search space.
 - Want information so that informed decision can be made once the expansion or time limit has expired.
 - Ideally, the decision strategy is well informed about the environment as a result of an efficient exploration strategy.

New Exploration Strategy

This thesis will explore an alternative exploration strategy to those previously used. Instead of selecting a node such that cost is minimized, nodes will be selected for expansion such that the change in confidence of the best top-level action is maximized.

Project Scope

This thesis will include:

- The implementation of a prototype algorithm that utilizes such an exploration strategy.
- The evaluation of this prototype algorithm by comparing it to other real-time search algorithms such as:
 - LSS-LRTA*
 - \hat{f}
 - A*
 - Beam search
 - K-best

Project Scope Continued...

- The comparison of these algorithms on classical heuristic search benchmarks such as:
 - Tree World
 - The Sliding Tile Puzzle
 - Race track
 - Grids?

Nancy

The proposed algorithm, at this time named Nancy, will consist of a new exploration strategy and a decision strategy that aims to minimize the expected minimum path cost.

Nancy

Exploration Strategy:

- 1 Identify the most promising top-level action (Done by calculating the confidence of each top level action, or the probability that the action is at least as good as any other action)
- 2 For the nodes under consideration for expansion, calculate how they will impact the confidence of the best top-level action
- 3 Expand the node which maximizes the change in this confidence

Nancy

Decision Strategy: Take a Cserna Backup of all frontier nodes under a top-level action. Take the action with the lowest expected value.

Tree World Results So Far...

Tree World Results So Far...

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Current Problems

- Currently only works on branching factor of two (2 TLAs)
- Currently only considers the lowest cost nodes under each TLA for expansion
 - Should account for higher cost nodes with larger variance

Future Work

- Address the problems previously stated
- Finish LSS-LRTA* and \hat{f} implementations
- Evaluate on additional domains

Questions?

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