

CS4725/CS6705

Chapter 5: Adversarial Search

Additional Notes: Monte Carlo Tree Search

Monte Carlo Tree Search

- A different approach to the issue of not being able to search an entire game tree is **Monte Carlo Tree Search** (MCTS).

MCTS - Basic idea

- Cut off the tree at a certain depth; treat nodes at that level as leaf nodes.
- To evaluate those nodes:
 - Simulate random moves until the end of the game (“playouts”) and record the result.
 - Repeat this as many times as possible.
 - A node’s score is the average performance over all of these simulations.
- [Tic-tac-toe example on the board]

MCTS Improvements

- People have looked at several ways to improve the MCTS technique
 - *e.g.*: rather than equal numbers of simulations at each node, focus **more** on the ones that look most promising after a few simulations

Some advantages of MCTS

- No need to work out an evaluation function; no knowledge of game strategy is needed
- Simple to implement
- Simulations can be stopped at any time and can provide the move that looks best up to that point.

Disadvantages of MCTS

- The strength/reliability of the method depends on the number of simulations that can be run.
- Depending on the amount of time available to choose a move, there might not be time for very many playouts.
 - Some nodes might not be visited very often and so our estimates for their values might be poor.