Lecture 8: Local Search

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1 Intro

Local search uses the single current state to move to neighbouring states. Advantages of local search:

- Very little memory usage
- Find often reasonable solutions in large or infinite state spaces

It is also often useful for pure optimisation problems by finding the best state according to some *objective function*.

2 Hill-Climbing Search

Keep changing current state in the direction of a better one. It then terminates when a peak is reached. Hill climbing does not look ahead of the immediate neighbours of the current state. It also chooses randomly among the set of best successors if there is more than one. Hill climbing is also known as *greedy local search*.

2.1 Drawbacks of Hill-Climbing Search

There are a few scenarios which often result in a hill-climbing search algorithm getting stuck not on a global maximum:

- **Ridge**: a sequence of local maxima difficult for greedy algorithms to navigate
- **Plateaux**: an area of the state space where the evaluation of a function is flat

2.2 Stochastic Hill-Climbing

There are a number of variations of hill-climbing search, one of which is called Stochastic hill-climbing. It involves a random selection among the uphill moves. The selection probability can vary with the steepness of the uphill move.

2.3 First-Choice Hill-Climbing

Cf. stochastic hill-climbing by generating successors randomly until a better one is found.

2.4 Random-Restart Hill-Climbing

Tries to avoid getting stuck in local maxima.

2.5 Simluted Annealing

To explore a greater area of the search space, the program can try to escape local maxima by allowing *bad* moves but gradually decreasing their size and frequency.

2.6 Local Beam Search

Keep track of k states instead of one.

1. k random states
2. Determine all successors of k states
3. If any successors are goal states then finished.
   Otherwise select k best from successors and repeat

The major difference between this and random-restart search is that informatino is shared among k search threads. However, this method can suffer from lack of diversity.