Team Brainiacs

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Week - 3 Lab Presentation

Learning Objectives

- **Deterministic Search** - Single path from input to output.
- **Non-Deterministic Search** - Can take many paths, with some arriving at the same outputs, and others arriving at different outputs. (*Used to find approximate solutions*).
  Example- execution of concurrent algorithms with race conditions, which can exhibit different outputs on different runs.
- **Randomised Search** - It adds external data to the given input. It may not always produce the correct output. It's used when random inputs have a better chance of producing the correct output (brute force process).
- **Simulated Annealing** - It is multiobjective randomized search (with parameters like temperature, acceptance probability, neighbourhood)

Problem Statements

- **Travelling Salesman Problem:** Given a graph in which the nodes are locations of cities, and edges are labelled with the cost of travelling between cities, find a cycle containing each city exactly once, such that the total cost of the tour is as low as possible
- **Rajasthan Tour Planner:** For the state of Rajasthan, find out atleast 20 tourist locations. Suppose your relatives are about to visit you next week. Use Simulated Annealing to plan a cost effective tour of Rajasthan. It is reasonable to assume that the cost of travelling between two locations is proportional to the distance between them.

Travelling Salesman Problem (Deterministic)

- Given n cities there are n! Combinations possible. Considering the tour to be a complete cycle, and graph to be directed the number of distinct tours becomes (N-1)!/2, which still in the order of n!
- **Brute Force** solution becomes of the order of **n!**
- Another Approach is **Dynamic Approach** of Time Complexity **O(n^2.2^n)**, which is better than n! Of brute approach, but still it is very costly.

Metropolis Algorithm

In the Iterated hill method if the current solution falls in local minima then algorithm remains trapped in the minima, unless you choose a solution outside the minima. That's where Metropolis algorithms comes to rescue:

It states that given two points i, j, if Energy Difference $\delta E = E_i - E_j$, is positive then State j, becomes new current state, if $\delta E \leq 0$, then the probability of state j becoming current state is given by:

$$P_r(current - state = j) = e^{\frac{E_i - E_j}{k_b T}}$$

T represents the temperature of the solid and k_B is the Boltzmann constant.

Ref. Simulated annealing: From basics to applications,Daniel Delahaye, Supatcha Chaimatanan, Marcel Mongeau

TSP Problem

shorturl.at/CGPR8

20 Cities

shorturl.at/jrzKS

DP Solution of TSP

shorturl.at/atwS8

A modified very fast Simulated Annealing

Authors : Mohammad-Taghi, Vakil-Baghmisheh, Alireza Navarbaf

Link : https://ieeexplore.ieee.org/document/4651272

Thanks!

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