The Traveling Salesman

Machine Learning Project Presentation

Amine Boukrout

Lecturer: Prof. Celik

8 June 2018

Introduction

The problem statement: To find a method that can establish a path to visit or perform a set of actions that will provide the most "benefit" or score.

The basic idea: Try every possible manner in solving a particular problem

But, is this feasible?

The Traveling Salesman

Statement:

A salesman that has to travel N cities, where the order of visiting each city does not matter, as long as each city is visited only once, and ends with the city that was initially started with. How can this be solved?

The Process

- Reinforcement Learning, particularly Q-Learning
- Allow random walks at first
- At the start, all cities are connect, i.e. there are n^n possible routes
- Once solved, there will be only one route from one city to another such that the two cities cannot be visited again.
- The final result will be a non-cyclic graph indicating the path

The Q-Learning Algorithm

The Q-Learning is based on rewards and punishments. The algorithm follows the preceding steps:

1. Define the Q table setting all the values to zero.
2. Define an initial state s_0
3. Define the possible actions from s_0 represented as A_0
4. By making use of the $\epsilon-greedy$ policy choose an action, see below for details
5. The next state is defined a_{n+1}
6. Possible actions from the next state are determined
7. An update to the Q table is made as follows: $Q(s, a) \leftarrow \gamma max_{a'} Q(s', a')$
8. Set the current state to the next state

References

- Irwan Bello, Hieu Pham, Quoc V Le, Mohammad Norouzi, and Samy Bengio, *Neural combinatorial optimization with reinforcement learning*, arXiv preprint arXiv:1611.09940 (2016).
- Luca M Gambardella and Marco Dorigo, *Ant-q: A reinforcement learning approach to the traveling salesman problem*, Machine Learning Proceedings 1995, Elsevier, 1995, pp. 252–260.
- Péter Stefán, László Monostori, and Ferenc Erdélyi, *Reinforcement learning for solving shortest-path and dynamic scheduling problems*, Proceedings of the 3 rd International Workshop on Emergent Synthesis, IWES, vol. 1, 2001, pp. 83–88.