STDS22-Assignment3
Simulated Annealing for Travelling Salesman Problem

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1 Task description

Implement an optimization algorithm called Simulated Annealing (SA). It is based on sampling and the optimization procedure is similar to the Metropolis-Hastings (MH) algorithm. Because the optimization is based on sampling, SA allows to optimize even non-differentiable functions, and thus it is applicable to optimizing combinatorial problems. Find the optimal traveling salesman path using SA for 30 most populated cities.

2 Solution

All implementation files can be found in the github repository.
There are the algorithm implementation and test jupyter notebook with some documentation and comments.

2.1 SA Algorithm

The Simulated Annealing algorithm includes the following steps:

1. Generate a random path connecting the cities, select initial temperature **T** and **annealing rate**

2. Generate candidate: 1) select two cities at random, 2) reverse the path between them

3. Change state to the new path with the probability of $p = \frac{oldLength - newLength}{T}$

4. Update $T = (1 - AnnealingRate) * T$

5. Repeat steps 2-4 until the T $\approx$ 0.

6. Done. The obtained result path is supposed to be the optimal solution and the shortest path among all.

2.2 Travelling Salesman Problem

2.2.1 Track the speed of convergence for different values of the annealing rate

I have picked 3 values for annealing rate:

- 0.01 - Slow cooling

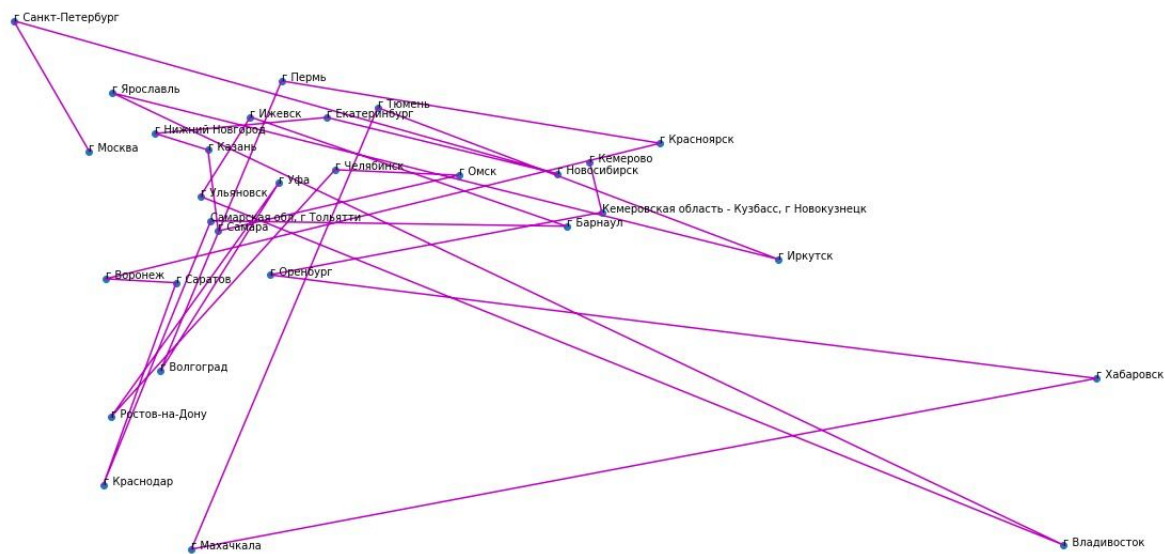- 0.5 - Average cooling

- 0.99 - Fast cooling

There are 2 graphs: correlation with time of convergence and with total distance of the result path.

Speed of convergence for different values of the annealing rate

Total distance of cities sequence for different values of the annealing rate
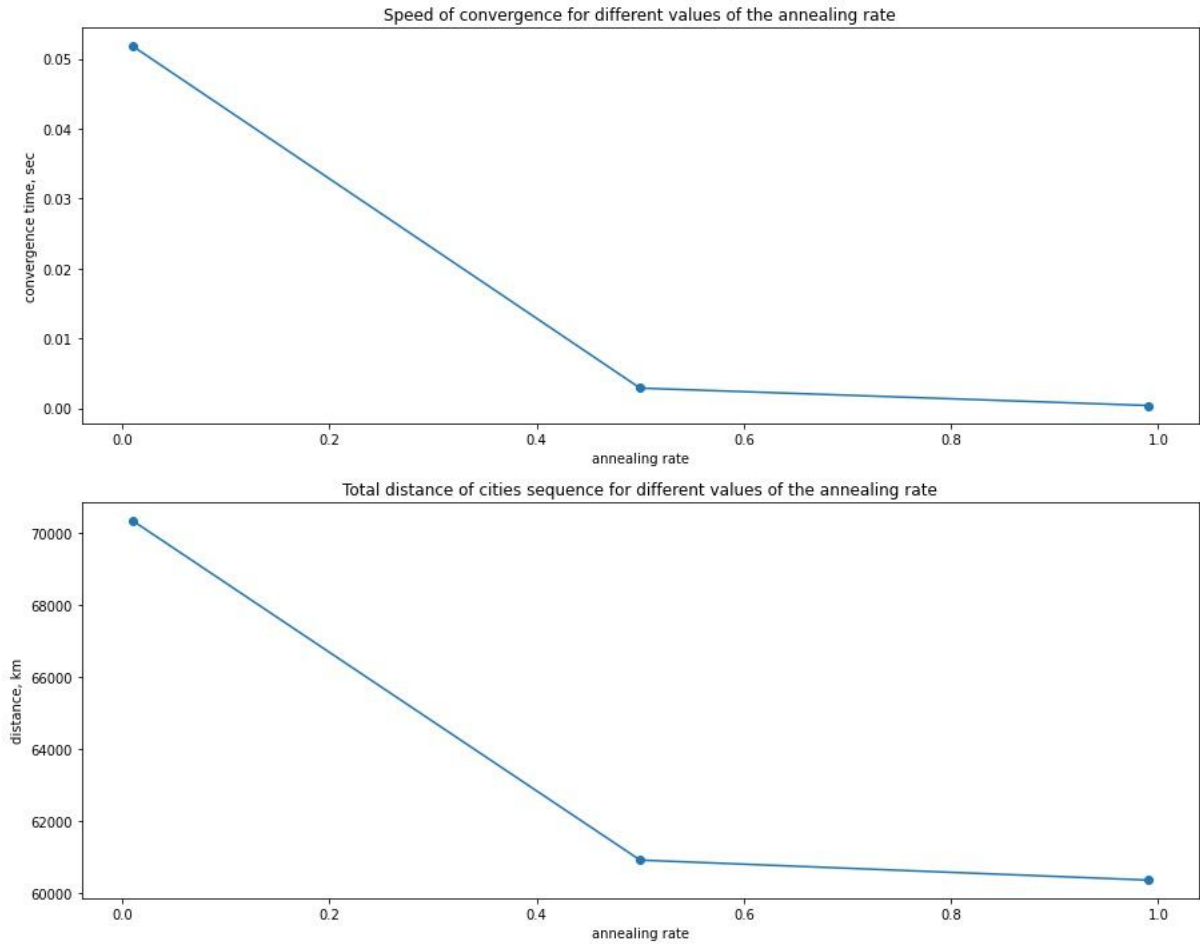
2.2.2   Animation

I tried to attach .gif animation file to this latex report, but I really have no idea how to do it properly, so I'm failed ;(
But you can find it in the github repo. Here, leave just the screenshot:

г Санкт-Петербург

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г Ярославль

г Тюмень

г Ижевск

г Екатеринбург

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г Москва

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г Казань

г Новосибирск

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Distance: