Scientific Programming Assignment 3

MPhil in Computational Biology

November 29, 2022

If there are errors found, I will update the assignment on the moodle.

Due date: 2023-01-16 23:45

Please submit your report to the Moodle website as a single PDF. Name your file `spa3_XXX.pdf`, where XXX is your six digit ID.

Your report must be a maximum of ten pages, excluding the appendix. (List your code in the appendix.) This course work will consist of 30% towards your overall mark for this module.

1 Travelling salesman problem [30 marks]

Your task is to investigate the Travelling salesman problem (TSP), a classic problem in optimisation with biological applications. See: `https://en.wikipedia.org/wiki/Travelling_salesman_problem` for background.

Choose two of the following three methods to solve the TSP problem:

1. Genetic algorithms (Larrañaga et al., 1999).
2. Elastic net (Durbin and Willshaw, 1987)
3. Self-organising map (Beale and Jackson, 1990; Sasamura et al., 2002)

Write a report that compares the two methods, describing the key decisions that you had to make when implementing each algorithm. Demonstrate your algorithms on tours where the optimal solution is known (`http://comopt.ifi.uni-heidelberg.de/software/TSPLIB95/`).

Compare the algorithms that you chose in terms of performance, efficiency and ease of understanding.

References

Beale, R. and Jackson, T. (1990). *Neural Computing - An Introduction*. CRC Press.

Durbin, R. and Willshaw, D. (1987). An analogue approach to the travelling salesman problem using an elastic net method. *Nature*, 326(6114):689–691.

Larrañaga, P., Kuijpers, C. M. H., Murga, R. H., Inza, I., and Dizdarevic, S. (1999). Genetic algorithms for the travelling salesman problem: A review of representations and operators. *Artificial Intelligence Review*, 13(2):129–170.

Sasamura, H., Ohta, R., and Saito, T. (2002). A simple learning algorithm for growing ring SOM and its application to TSP. In *Proceedings of the 9th International Conference on Neural Information Processing, 2002. ICONIP '02.*, volume 3, pages 1287–1290 vol.3. ieeexplore.ieee.org.

All references are available from `https://paperpile.com/shared/30dyBT`