Topology Management in Peer-to-Peer Systems

Jorge J. Gómez

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1 Problem Statement

Using an algorithm based on the paper [1] by Jelasity and Babaoglu, this assignment asked to simulate a distributed node system managing it's topology. The algorithm involves having the nodes trading neighbor lists and selecting the closest nodes based on two distinct distance formulas. The result is that after a certain amount of cycles, the topology begins to converge to the optimal.

2 Approach

Following the notes in the assignment, the algorithm was created in Python 2.7.1. The nodes where instantiated as objects that had a gossip method in which the node would trade neighbor lists with one of its neighbors. The node would then select the k closest nodes, where k is an input parameter. The node class had other methods for finding the distance to a given node and choosing the closest neighbors. The distance formula changes depending on the command line input with either a 1 dimensional distance or 2 dimensional Eucledian distance (chord distance on a unit circle). Another class was made to help set up a system and simulate it. More information can be found in the source code `hw1.py`.

3 Results and Figures

The code was written with unit tests to ensure every step of development was correct and development proceeded without major issues. Figure 1 shows the plot for a one-dimensional distance simulation. The system converges to a total distance of 120,000. Figure 2 shows the plot for a two-dimensional distance simulation. The system converges to a total distance of 505.

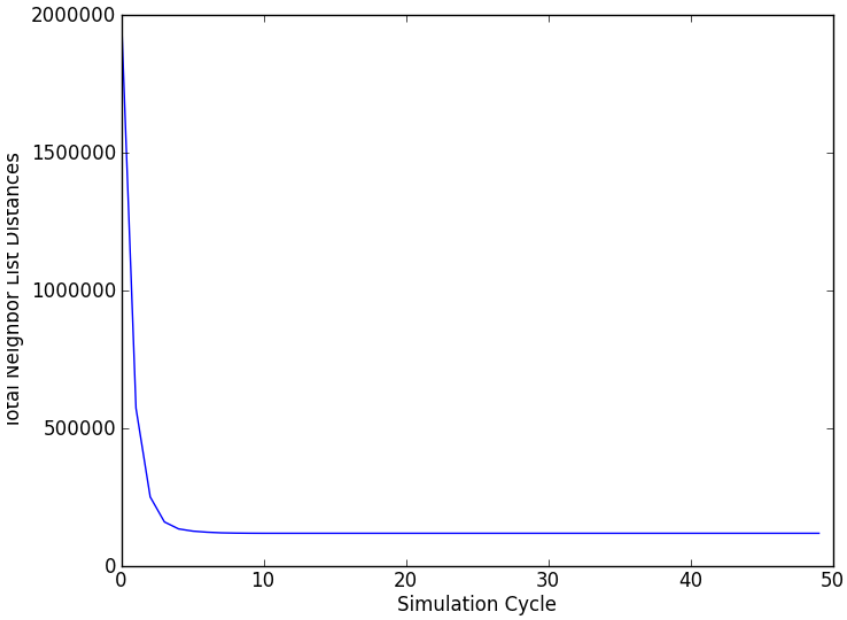

Figure 1: Total Distances in Neighbors over 50 simulation cycles with system size of 1000 nodes, neighbor list length of 20, and 1-D distances.

References

[1] Mrk Jelasity and Ozalp Babaoglu. T-man: Gossip-based overlay topology management. In Sven Brueckner, Giovanna Serugendo, David Hales, and Franco Zambonelli, editors, *Engineering Self-Organising Systems*, volume 3910 of *Lecture Notes in Computer Science*, pages 1–15. Springer Berlin / Heidelberg, 2006.

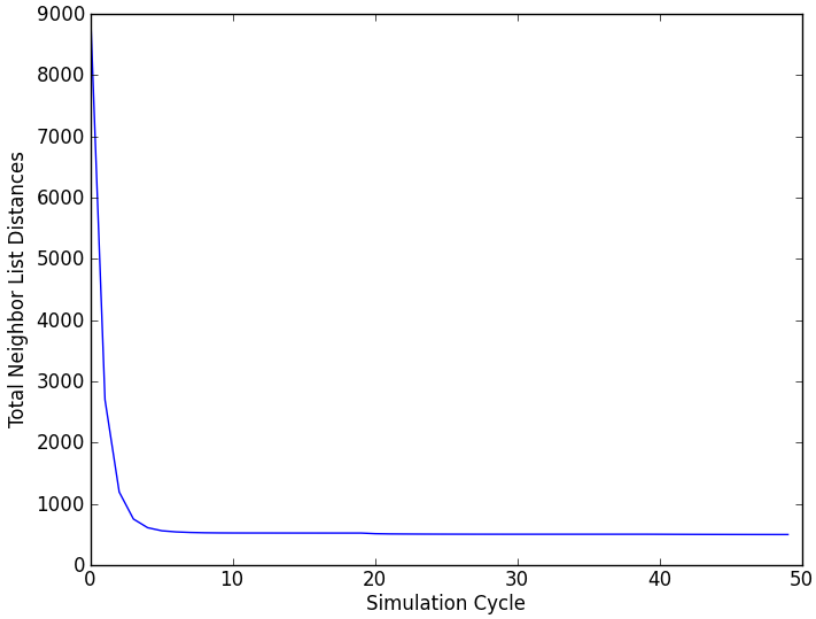

Figure 2: Total Distances in Neighbors over 50 simulation cycles with system size of 1000 nodes, neighbor list length of 20, and 2-D distances.