Group 2 Project Proposal

Zachary Estrada Chandini Jain Jonathan Lai

April 4, 2012

Abstract: Group 2 proposes to study the convergence properties of simulated annealing, genetic algorithms, and ant-colony approaches towards finding optimal solutions for various travelling salesman problems. Code will be tested to find convergence rate, wall-clock time, and for solution space exploration. For future studies, we will consider looking at parallel and/or GPU solutions to accelerate algorithms.

0.1 Introduction

0.2 Simulated Annealing

Simulated annealing is a stochastic approach towards minimizing an energy function.

0.3 Genetic Algorithms

Unlike simulated annealing, genetic algorithms rely on a population approach to

0.4 Ant-Colony Approaches

0.5 Go with the Winner Approaches

Simulated annealing probabilistically convergences to the optimal solution at the rate of $O(\frac{1}{n})$ where n is the number of independent runs. Using heuristic schemes such as the "Go with the Winner" [1], hereby referred to as GWW, one can improve this convergence

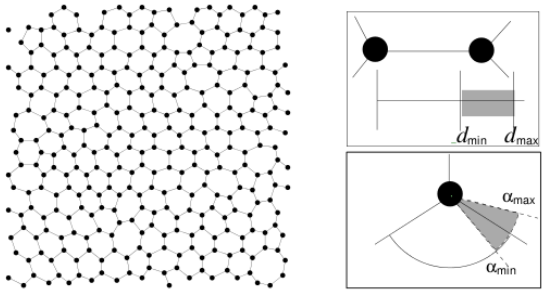

Fig. 1. left: an example of an amorphous structure with vertex degree 3 in two dimensions; right: the bond length and bond angle constraints

rate to $O(log\frac{1}{n})$ and have recently found their way into molecular modeling applications [2]. In general terms, the GWW algorithm mirrors that of simulated annealing; however, each independent run is periodically reassessed to determine if one is converging upon a losing solution. Runs with no chance for success are immediately discarded while runs with the best chance of finding an optimal solution are replicated; thus, GWW generates an ensemble of independent runs filled with "winners".

0.6 Analysis

To assess the performance of our optimization schemes, we would

References

[1] D. Aldous and Vazirani U. Go with the winners algorithms. *Proceedings of the 35th IEEE Symposium on Foundations of Computer Science*, pages 492–501, 1994.

[2] Marcus Peinado and Thomas Lengauer. 'go with the winners' generators with applications to molecular modeling. *RANDOM*, pages 135–149, 1997.