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CS 7641
Assignment 2

1 Introduction

In this paper I will be exploring the performance and trade-offs of four randomized optimization algorithms: randomized hill climbing, simulated annealing, genetic algorithms, and MIMIC against three problems. Later in the paper I will rexamine work I did previously in Assigment 1 and attempt to optimize the weights of a multi-layered perceptron using these same four algorithms. For the purposes of this assignment I used the mlrose library [1] which was publicly available.

2 Comparison of Randomized Optimization Algorithms

This section is dedicated to a comparison of the four algorithms andomized hill climbing, simulated annealing, genetic algorithms, and MIMIC against the One Max Problem. I will briefly introduce parameters I will be varying for each algorithm here and then we will compare their performance in each problems subsection below.

Simulated Annealing

Simulated Annealing

Randomized Hill Climbing

Genetic Algorithm

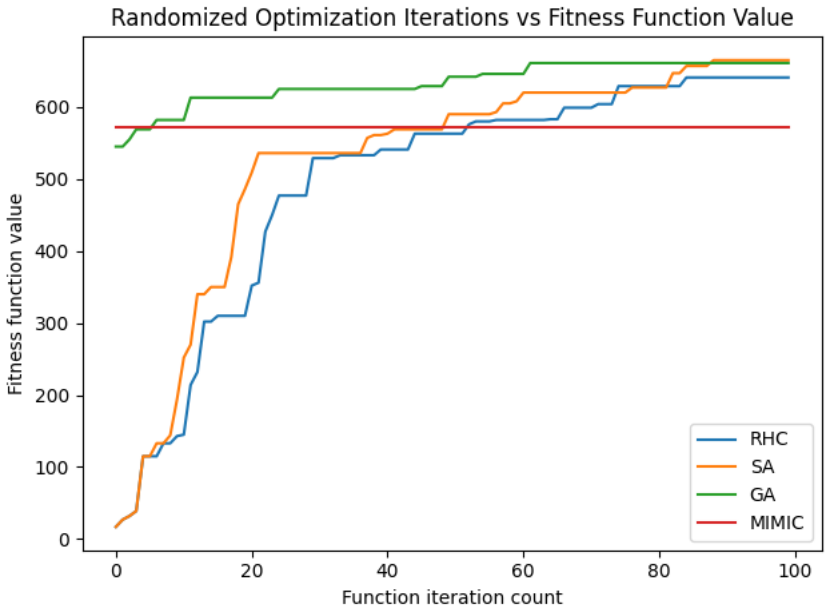
MIMIC

2.1 One Max Problem

The One Max Problemis a fitness function that seeks to maximize a vector v such that:

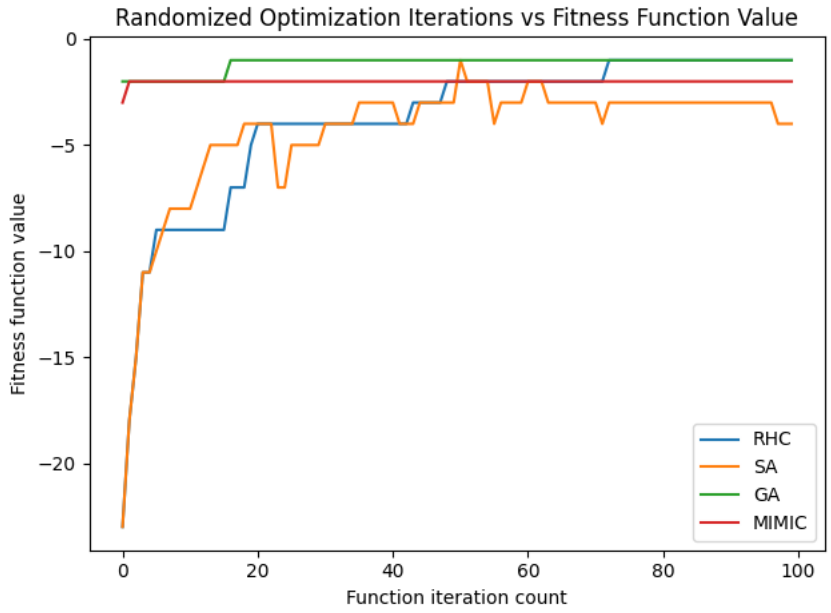
$$\sum_{i=0}^{n-1} v_i \tag{1}$$

is a maximum, where v_i is the ith component of vector v with length n. This is a relatively easy optimization problem to understand and it illustrates the effectiveness of MIMIC and Genetic Algorithms quite nicely from an efficiency standpoint.



2.2 8-Queens

The eight queens problem is a specific implementation of the n-queens optimization problem. [2] It poses an nxn board like in chess where n queens need to be placed such that a minimum number of queens could "attack" each other (diagonally, horizontally, or vertically.)



2.3 K-Colors

3 Neural Network Weight Optimization

References

[1] G Hayes. mlrose: Machine Learning, Randomized Optimization and SEarch package for Python. `https://github.com/gkhayes/mlrose`, 2019. Accessed: 20 September 2020.

[2] S. Russell and P Norvig. Artificial intelligence: A modern approach, 3rd edition. Prentice Hall, New Jersey, USA., 2010.