Matt Schwarz and Reed Andreas

CS 4260

Final Project Proposal

29 October 2023

Strengths and Weaknesses of Genetic Algorithms

Our group was particularly interested in the applications of AI algorithms in local search. Specifically, we want to understand the power in an algorithm derived from a natural process such as a genetic algorithm. We believe that diving in depth on this will reveal an approach quite dissimilar from many more deterministic and foundational algorithms we have learned in our Computer Science curriculum thus far. This will help grow our perspective and appreciation of how various AI techniques can be applied where simpler algorithms may struggle.

We will implement a genetic algorithm in order to solve several local search and optimization problems including the knapsack problem, an airline flight schedule, and the 8-queens problem. We are interested in local search and optimization problems and wish to understand the tradeoffs between different algorithms and approaches. As such, we will compare our genetic algorithm implementation against a more “standard” approach to each problem. To understand the benefits and drawbacks of the different approaches, we will benchmark the running time of each and document characteristics such as the number of states explored. We will analyze and compile these findings into a report summarizing the advantages and disadvantages of genetic algorithms within the context of our chosen problems.

We will measure success in a few ways. First of all, for each of our chosen problems we want to ensure we implement a successful algorithm. This means that we will expect the loss (or distance from a proper solution) to be decreasing over time and we expect it to reach a level either reasonably approaching or outperforming a traditional algorithm. We will do this by comparing the loss of the genetic approach vs a traditional approach after a fixed runtime (such as 60s). In addition, we think another measure can be our ability to observe and document differences in the algorithms as they run such as the states they explore or the changes in loss per step. Finally, we think a successful project will also include a clear and comprehensive analysis of the tradeoffs between traditional algorithms and a genetic algorithm and advice on when to utilize either approach.