

Course: CS131 Artificial Intelligence

Assignment: Genetic Algorithms

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Design Part:

There are five phases in my algorithm:

1. Initial population:

In `initial_population` function, I generate a list of chromosomes represented by a 12size list of True and False value with their fitness score. The chromosomes represent how the boxes would be chosen. True for choosing the box and False for not choosing the box. The size of population is according to the value assigned with 'number_of_population'.

2. Fitness Function:

The `compute_fitness` function calculates the fitness score: total value and total weight of each chromosome. Those chromosomes with total weight larger than 250 limit will be set with -1 value.

The `fitness_sort` function sorts the chromosomes list from the largest value to the least value and removes the 50% chromosomes with least value.

3. Selection:

The chromosome that will be selected for reproduction is based on its fitness score: total value. The higher total value, the higher chance will be selected. There will be two chromosomes chosen in `selected_prob` function. Since the chromosomes list is descending sorted, so I create this math function to randomly pick two indexes following the "higher value, higher chances" rule.

4. Crossover:

5. Mutation:

Crossover process and Mutation process are implemented together in `generate_new_population` function. The chosen two chromosomes will crossover with each other and generate two new chromosomes and each new chromosomes will be stored in a `crossover_list`. There is a population size long loop for selecting crossover chromosome and making them crossover.

And based on the low mutation probability, there would be a threshold to constrain the probability to determine each chromosome in crossover_list will be mutated or not. At this time, the old population will be cleared and all the new generated chromosomes will be added to the population. In addition, the fittest chromosome from last generation will also be stored in the new population.

And repeat the phases 2 to 5 until the genetic algorithm has provided a set of solutions to our problem.

Test Part:

The size of population and the generation loop times is set as 100 and 500.

It could be manually set as other number.

number_of_population represents the size of population

generation_number represents the generation loop times