PUCPR

Escola Politecnica

Lab Report

Swarm Optimization Algorithms

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Chapter 1

Implementation of a Differential Evolution Algorithm

1.1 Results

We run the Particle Swarm Optimization algorithm with 3 different sets of parameters on the I_BEAM function and compare the results with the genetic and differential evolution algorithms.

1. Parameters:
   Population number = 25
   w = 0.9
   c1 = 0.4
   c2 = 0.6
   Maximum Iterations = 1000

   (a) 1st run
   Best solution: x = [60.87 41.24 0.90 0.90]
   Best value: z = 127.47

   (b) 2nd run
   Best solution: x = [47.66 50.00 0.90 0.90]
   Best value: z = 131.36

   (c) 3rd run
   Best solution: x = [61.03 41.17 0.90 0.90]
   Best value: z = 127.47

2. Parameters:
   Population number = 25
   w = 1.5
   c1 = 0.8
   c2 = 0.2
   Maximum Iterations = 1000

   (a) 1st run
   Best solution: x = [80.00 38.83 0.90 0.90]
   Best value: z = 140.31

   (b) 2nd run
   Best solution: x = [80.00 34.79 0.90 0.90]
   Best value: z = 133.04

   (c) 3rd run
   Best solution: x = [62.60 44.66 0.90 0.90]
   Best value: z = 135.18

3. Parameters:
   Population number = 25
   w = 0.2
   c1 = 0.1
   c2 = 0.9
   Maximum Iterations = 1000

   (a) 1st run
   Best solution: x = [43.85 30.77 1.50 1.78]
   Best value: z = 170.50

   (b) 2nd run
   Best solution: x = [34.57 28.67 1.64 2.59]
   Best value: z = 196.91

   (c) 3rd run
   Best solution: x = [42.77 19.82 1.18 3.62]
   Best value: z = 185.94

We can see from the results that when w is very small the found solutions are not as good as when w larger. Also comparing with the previous used algorithms like Differential Evolution and Genetic Algorithm the results are more robust with respect to the parameters. Finally some results were better than the ones using the $fmincon$

1.2 Knapsack Problem

We employ the Genetic Algorithm, Differential Evolution Algorithm, Particle Swarm Optimization and Ant Colony Optimization algorithms on the knapsack problem with the default parameters and compare their results. As we can see from the figures below the Genetic Algorithm has the best performance as it needs the least number of iterations to find the best value, then Differential Evolution and Particle Swarm Optimization algorithms have the same performance in every case and finally the Ant Colony Optimization has the poorest perfomance as it needs many more iterations to find the same result. Also we can see that when the data are uncorrelated or weakly correlated the algorithms perform the same but when the data are strongly correlated all algorithms give much better results.

FIGURE 1.1: Genetic Algorithm

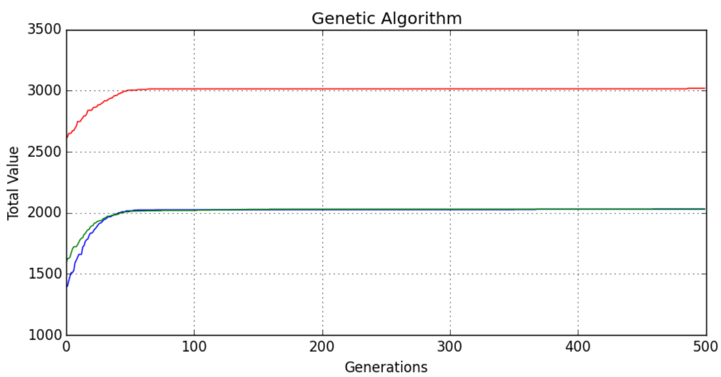

FIGURE 1.2: Differential Evolution Algorithm

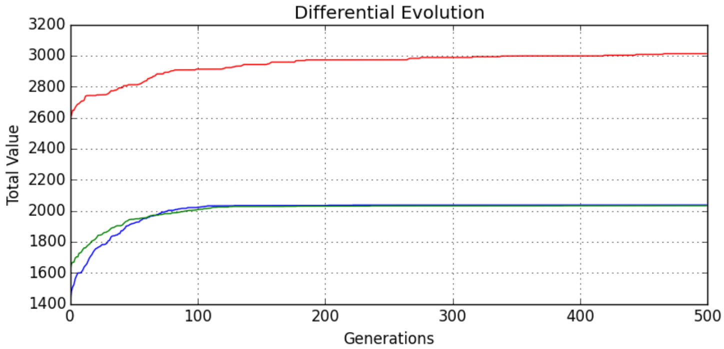

FIGURE 1.3: Particle Swarm Optimization

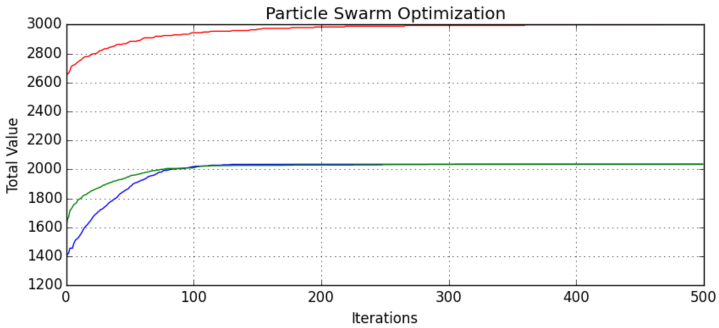

FIGURE 1.4: Ant Colony Optimization