AME 596: Machine Learning for Aerospace and Robotic Applications

Homework Assignment 2

Due: Midnight, March. 26, 2020

1. Dr. Henry Walton "Indiana" Jones enters the abandoned legendary El Dorado (City of Gold) treasury somewhere in Northern Brazil. He has a knapsack in which he can carry 15 kg of treasure. The El Dorado treasury has more than 100 items each with a specific mass and value (selling price). Dr. Jones needs to make a selection of items to take back to his expedition investors that maximizes value but without exceeding the mass limit of the knapsack. If the knapsack were to exceed 15 kg in mass, it will burst open and Dr. Indiana Jones will not be able to carry any treasure back home.

   Presume each of the 100 item has a mass of between 0.05 kg and 9 kg and is randomly distributed in 0.25 kg increments. Presume the treasure is valued at the current price of gold per kg multiplied by historic value (1.5), hence ($51,204.9) × 1.5 = $76,807.33/kg. Dr. Jones will be getting 1/3 of the total value of the treasure brought back to his investors. Using Evolutionary Algorithms presented in class to devise a solution – that is the best selection of treasure that weighs 15 kg or less. Devise an appropriate goal function, genotype, phenotype and constraints to apply to this problem.

   (a) Using an Evolutionary Algorithm, determine a solution that maximizes return for Dr. Jones with the fewest number of treasures. Develop an appropriate goal function to be maximized. Repeat your simulation runs 30 times and obtain population best averaged over 30 runs.

   (b) Reconfigure the Evolutionary Algorithm so that Dr. Jones is expected to make maximum amount. Show the entire simulation process until reaching population max convergence. Repeat your simulation runs 30 times and obtain population best averaged over 30 runs.