Genetic Algorithm & Fuzzy Logic

Semester-5

Practical-1

Name: Shivam Tawari

Roll no: A-58

Aim: Introduction to Genetic Algorithm (GA) implementation in Python.

Theory:

Genetic Algorithm:

A genetic algorithm (GA) is a method for solving both constrained and unconstrained optimization problems based on a natural selection process that mimics biological evolution.

They are adaptive heuristic search algorithms that belong to the larger part of evolutionary algorithms. Genetic algorithms are based on the ideas of natural selection and genetics. These are intelligent exploitation of random search provided with historical data to direct the search into the region of better performance in solution space. They are commonly used to generate high-quality solutions for optimization problems and search problems.

Population:

At the beginning of this process, we need to initialize some possible solutions to this problem. The population is a subset of all possible solutions to the given problem. In another way, we can say that the population is a set of chromosomes.

Fitness Function:

A Fitness Score is given to each individual which shows the ability of an individual to compete. The individual having optimal fitness score or near optimal are sought. The individuals having better fitness scores are given more chance to reproduce than others. The individuals with better fitness scores are selected who mate and produce better offspring by combining chromosomes of parents.

Parent Selection:

Parent selection is done by using the fitness values of the chromosomes calculated by the fitness function. Based on these fitness values we need to select a pair chromosomes with the highest fitness value. There are many ways for fitness calculation like Roulette wheel selection, rank selection.

Crossover:

Crossover is used to vary the programming of the chromosomes from one generation to another by creating children or offsprings. Parent chromosomes are used to create these offsprings.

Mutation:

Mutation brings diversity to the population. There are different kinds of mutations like Bit Flip mutation, Swap mutation, Inversion mutation, etc. The key idea is to insert random genes in offspring to maintain the diversity in population to avoid the premature convergence.

Examples:

Transport: Genetic algorithms are used in the traveling salesman problem to develop transport plans that reduce the cost of travel and the time taken. They are also used to develop an efficient way of delivering products.

Aircraft Design: They are used to develop parametric aircraft designs. The parameters of the aircraft are modified and upgraded to provide better designs.

DNA Analysis: They are used in DNA analysis to establish the DNA structure using spectrometric information.

Conclusion: Hence, Introduction to Genetic Algorithm (GA) implementation in Python has been implemented successfully.