G.H. Raisoni College of Engineering and Management, Wagholi
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

TAE 2

AI Knowledge Representation and Reasoning

Genetic Search Algorithm

Genetic Algorithms(GAs) 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.

How genetic algorithms work

Initialization-The evolutionary process begins with initialization, wherein an initial population of candidate solutions is generated. There are many different methods of initializing populations, but with Genetic Algorithms the most popular method of initialization is simply to create a population of randomly initialized binary strings. Once the initial population has been created, the evolutionary generational cycle begins.

Selection- At each generational step, a pool of parents is chosen from the parent population based on the fitness values of each individual using a selection mechanism, such that the fittest individuals will have a greater probability of passing on genetic material to subsequent generations.

Variation- Once the parent population is fully populated via the selection process, a child population is created which will form the basis of the next generation. This child population is generated by variation operators.

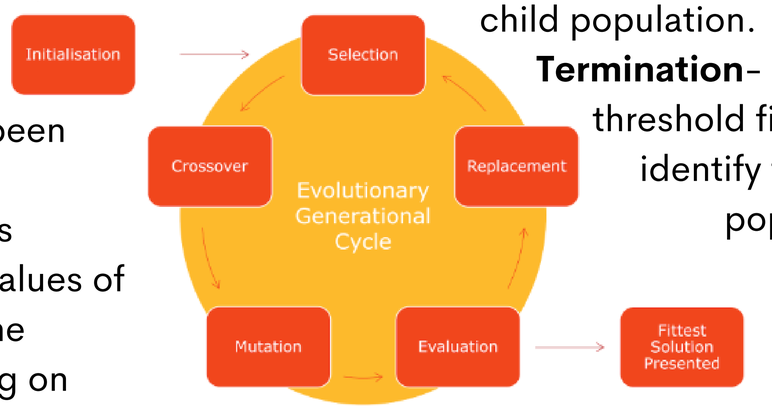
Crossover- This operator swaps the genetic information of two parents to reproduce an offspring.

Mutation- This operator adds new genetic information to the new child population. This is achieved by flipping some bits in the chromosome.

Evaluation- Once the child population has been created, all children then need to be evaluated in order to assign a fitness value by which they can be judged against their peers.

Replacement- Generational replacement takes place in this phase, which is a replacement of the old population with the new child population.

Termination- The algorithm will terminate after the threshold fitness solution has been attained. It will identify this solution as the best solution in the population.



Advantages of genetic algorithm

- It has excellent parallel capabilities.
- It can optimize various problems such as discrete functions, multi-objective problems, and continuous functions.
- A genetic algorithm does not need derivative information.

Application :

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 used to develop parametric aircraft designs.

used to establish the DNA structure using spectrometric information.

They are used to provide multiple optimum solutions in multimodal optimization problems.

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