

A Review Paper on Brief Introduction of Genetic Algorithm

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Abstract—

In this paper we discuss about basics of genetic algorithm. Genetic algorithm is search and optimization technique that produce optimization of problem by using natural evolution. Genetic algorithm mainly depends on best chosen chromosomes from various steps that described by author in this paper. Optimization is an act, process, or methodology of making something such as design, system, or design.

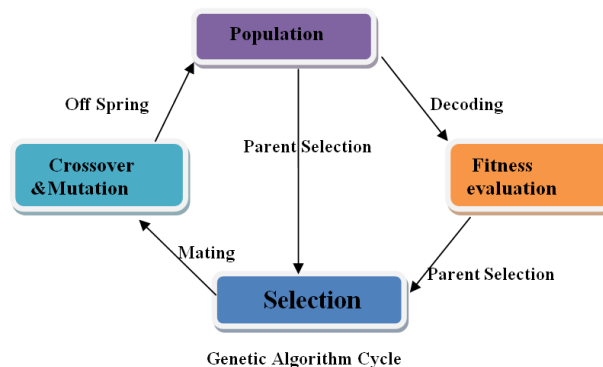
Keywords— Genetic algorithm, population, chromosomes, selection, crossover, mutation, replacement,

I. INTRODUCTION

Genetic Algorithm [1] is the search and optimization algorithm. It is based on principal of natural evolution. It was first introduced by John Holland in 1970s. It is used in the medicine and engineering, space research and banking to find best solution of different type of problems. It is the algorithm that dictates how population of organisms should be formed, modified and evaluated. For example: genetic algorithm determines how to select organisms for sexual reproduction and another that organism will be deleted from population. These types of problems solved by genetic algorithms that helps takes from data mining technique. It is determine how to convert real world problem into genetic material on a computer. It takes two type of process, first is the production of next generation and second is the crossover and mutation techniques [2]. Genetic algorithm accepted by the evolutionary, computation community. It means that most Genetic Algorithm having some element. Such as population of chromosomes [3]. In selection phase choose the individual for reproduction. Inside the reproduction phase for combining crossover and mutation are applied. After that replacement operator is performed. It decide which individual stayed or not in the population. when the population converges towards the optimal solution algorithm stopped.

The method of GA is

```
Procedure Genetic Algorithm {  
    t=1;  
    Initialize population (t);  
    While(max number of generates)  
    {  
        Evaluate fitness population (t);  
        Parent (t)=Select Parents (Population (t));  
        Offspring (t)=Reproduction operator (parents (t));  
        Population =Generational replacement (offspring)  
        T=t+1; }  
}
```



II. STEPS OF GENETIC ALGORITHM

- Initialization** It is the first Step of Genetic Algorithm. In which individual solution is randomly generated to form an initial population. The size of population depends on the nature of problem and it contains several possible solutions.
- Selection:** It is the next operator in the reproductive phase of genetic algorithm. It is the process in which according to evaluation function chromosomes are selected randomly from the population. In this selection of individual depend upon the fitness function [4]. It select fit individual that is survival of fittest [5] according to Darwin's theory of evaluation.

Types of Selection are:

1. *Roulette Wheel Selection (RWS)*: It is also known as Fitness Proportionate Selection. It is a generic operator used for the selecting potentially useful solution for recombination
2. *Elitism Selection*: To arrange the chromosomes in descending order according to their fitness value. Genetic algorithm is applied between strong and weak chromosomes.
3. *Rank Selection*: It set by the chromosomes fitness value after that new fitness value is generated by the another fitness function. The roulette wheel can be used to choose the selected chromosomes. It worked as in the following steps:
 - a. Arrange the chromosomes in descending order according to fitness value.
 - b. Take a rank value to each chromosome.
 - c. Calculate the new Fitness Value for each Chromosomes using equation.
$$F = \frac{\text{max} - (\text{max} - \text{min}) * \text{rank} - 1}{N_{\text{pop}} - 1}$$
4. *Binary Tournament Selection*:
 - a. Randomly select two chromosomes.
 - b. Choose the chromosomes with highest fitness value.
- C. *Cross Over*: It combine two chromosomes that produce new chromosomes or offspring. After selection method it is used for produce a new offspring.

Types of Crossover:

1. *Single Point Crossover*: These Type of technique used in the past [6]. A single Crossover selected by random number such as (1, 1L). 1L is the Length of chromosomes.
 2. *N-Point Crossover*: Value of N Vary from 1...n-1. These type of crossover basic principle is point crossover. Its means that exchange the two parents points.
 3. *Uniform Crossover*: it does not the divide parent chromosomes into segment. It selects the no. of crossover point in the chromosomes. It select the parents via random generated crossover [7].
 4. *Partially Matched Crossover*: It is proposed by Goldberg and Lingle [8] for Travelling salesman problem.
- D. *Mutation*: It changes the one or more than gene value in a chromosomes. This operator random flips some of the bits of chromosomes.

Type of Mutation

1. *Flip Bit*:

1. Select one gene randomly.
2. Flip the value of selected gene.

2. *Boundary*:

1. Select one gene randomly
2. Replace the value of gene upper or lower value.

3. *Uniform*:

1. Select one gene randomly.
2. Replace the value of a selected gene with a uniform random value between the specified upper gene and lower bounds for gene.

E. *Replacement*: It compare between several chromosomes for choose the best.

Types of replacement:

1. *Binary Tournament*: It takes the two chromosomes according to their fitness and best one between them and ignore another one.
2. *Triple Tournament*: It replace the two chromosomes between three chromosomes with the highest value.

III. CONCLUSIONS

Genetic algorithm is the search and optimization technique and used to find the best optimal solution with the help of some method such as initialization, selection, crossover, mutation, replacement. In these steps we first select the chromosome depend on the nature and after that selection a new offspring is produce with the help of fitness value and choose the best solution.

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