Implementation of Dejong Function By Various Selection Method And Analyze Their Performance

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Abstract—: Genetic algorithm is the search and optimization technique. Genetic algorithm solves highly mathematical and simulation problems. In this paper researcher implements the dejong function1 (sphere model) with the help of matlab code. Results are described by the formulation of graphs. In this paper researcher proposes two selection strategies as roulette wheel selection and elitism selection. With these selection schemes results of the dejong function1 is calculated and compared. In this paper basically results of the roulette wheel selection and the elitism selection are compared.

Keywords- Dejong function, Elitism selection, Genetic algorithm, Roulette wheel selection.

I. INTRODUCTION

Genetic algorithm[1,2] was first invented by john Holland in 1960’s. Genetic algorithm is an searching and optimization technique. GA can search for the optimal or near optimal solutions for an optimization problem[3]. The idea of the genetic algorithm based on the natural selection and genetics. Genetic algorithm have been applied to many fields like optimization design, fuzzy logic, neural network, expert system etc.[4]. This algorithm works on number of individuals (chromosome) and some operations are applied to these individuals to get an optimal solution of the problem and after that a new generation is obtained. Operations of the genetic algorithm are based on the four steps as:

INITIALIZATION

SELECTION

REPRODUCTION

‘REPLACEMENT’

Initialization is the first step of the genetic algorithm. In this step population of chromosomes are randomly generated [5]. A selection phase chooses the individuals for reproduction and after that reproduction operators is applied. In reproduction phase crossover and mutation operator is applied for mating or combining. The last step of the genetic algorithm is the replacement. This step decides which individual is stayed in the population and which is not. Wherever Times is specified, Times Roman or Times New Roman may be used. If neither is available on your word processor, please use the font closest in appearance to Times. Avoid using bit-mapped fonts if possible. True-Type 1 or Open Type fonts are preferred. Please embed symbol fonts, as well, for math, etc.

II. PROPOSED WORK

In this paper author describe the dejong function1 and analyzes the performance of the algorithm. genetic algorithm is used to find the optimized values. Dejong constructed a environment of problems in function minimization. Dejong evaluate their functions with two types. One type is the offline mode and second is the online mode and by using these dejong gives the best or optimized values of their function. In this paper researcher solve problems online by using a platform of matlab and then shows their results. In this paper researcher used some genetic operators and by using these operators gives the better results. Those operators are as:
Genetic algorithm gives the best results by using their operators. In this paper authors discusses their results by using specific operators of genetic algorithm which are shown in the flow chart.

1) **Random initialization:** Initialization is the basic step of the genetic algorithm. In this paper authors uses the random initialization.

2) **Selection by elitism:** Selection is the second operation of genetic algorithm. Elitism provides a means for reducing genetic drift by ensuring that the best individual(chromosome) is allowed to pass to the next generation[6]. Genetic drift is that which is used to explain the stochastic changes in gene frequency through random sampling of finite population[7]. In this paper selection is done by following the elitism operation.

3) **Arithmetic crossover:** Arithmetic crossover is that in which arithmetic creates offspring that are the weighted arithmetic mean of two parents. Off springs are feasible with respect to linear constraints and bounds.

\[ \text{Offspring} = \alpha \times \text{parent1} + (1 - \alpha) \times \text{parent2} \]

In this if there are two parents as parent1 and parent2 and parent1 has the better fitness value , then the function returns the child[8].

4) **Mutation:** Mutation is also a genetic operator which is used to maintain the genetic diversity of the genetic algorithm from one generation to the next generation. In this paper author uses the uniform operator to give the better results. Uniform operator replaces the value of chosen gene with a uniform random value. The uniform operator can only be used for integer and float values of genes. After successfully completing these operators a termination condition condition occurs.

III. IMPLEMENTATION

In this paper author implements the dejong function1 by using the matlab code. Dejong[9] gives the five test function in 1975. Dejong functions are also used as the evaluation functions in the genetic algorithm. these are also called as the benchmark functions. Dejong invent these functions when he is doing his thesis. Dejong gives many functions. Some of his functions are shown by the table below. These are the first five functions which are given by dejong.

In this research we use dejong function1 only which is also called as the “Sphere model”. In this research authors compare the two selection methods as the roulette wheel selection and the elitism selection. By using these two selection operators dejong function1(sphere model) is implemented as:

\[ F_1(x_1) = \sum_{i=1}^{n} x_i^2 \]

where range of the dejong function1 is 

\[-5.12 \leq x_i \leq 5.12.\]

This is the first function of dejong as sphere model. Sphere model is smooth, strongly convex. Sphere model is a unimodel. This paper shows the results by graphs as:

Fig: 1 Dejong function1(50 generation)

Fig: 2 Dejong function1(100 generation)

Fig: 3 Dejong function1(200 generation)

In these graphs x-axis shows the number of generations and y-axis shows the fitness value. In this paper author
works on three generations as 50 generation, 100 generation and 200 generations. All the results are calculated and on the basis of selection techniques two selection strategies are compared as roulette wheel selection and the elitism selection. After the completion of process the results describe that the elitism selection gives better results as compared to the roulette wheel selection. The values that come are as:

<table>
<thead>
<tr>
<th>NUMBER OF GENERATION</th>
<th>MINIMUM VALUES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roulette wheel selection</td>
<td>Elitism</td>
</tr>
<tr>
<td>50 Generation</td>
<td>4.679</td>
<td>0.0195</td>
</tr>
<tr>
<td>100 Generation</td>
<td>0.0734</td>
<td>0.02329</td>
</tr>
<tr>
<td>200 Generation</td>
<td>0.3863</td>
<td>0.01019</td>
</tr>
</tbody>
</table>

Table 1: Values of selection schemes

IV. CONCLUSION

In this paper researcher describes the two types of selection strategy (i.e. roulette wheel and elitism) in genetic algorithm to solve the dejong function1(sphere model). In this paper authors compare the values of both these selection schemes which are represented by the table. By doing this we found that the elitism gives better results than to roulette wheel selection. All the results are shown by the graphs which describe that the elitism selection gives more satisfied results to the authors. In this paper authors compare their results for 50 generation, 100 generation and 200 generation. After calculating the results authors found that the results of elitism in every geenration is better than roulette wheel selection.

V. REFERENCES


