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Optimization by Genetic Algorithm

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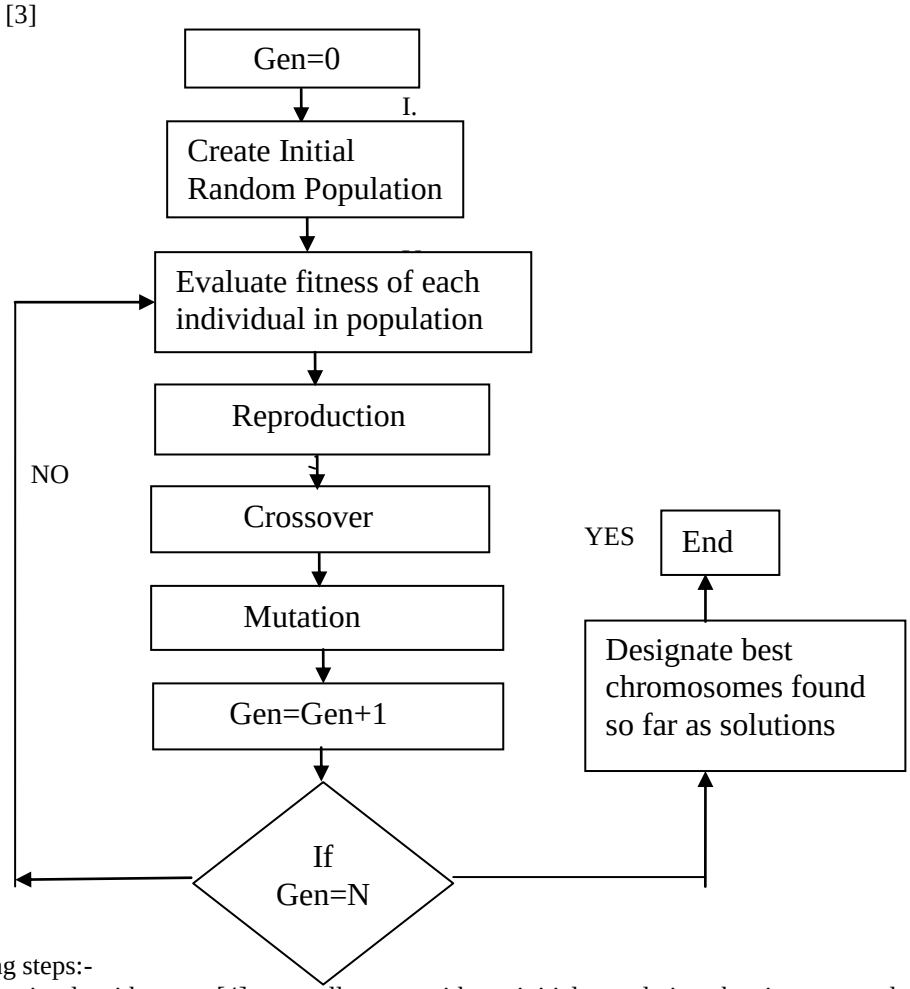
Abstract: ***The genetic algorithm is Search and optimization techniques that generate solutions to optimization problems using techniques inspired by natural evolution. Optimization is the central to any problem involving whether in engineering or economics. This paper presents experimental results of most important benchmark function i.e dejong function by genetic algorithm. This result shows that genetic algorithm provide more optimal solution.***

Keywords *— Genetic algorithm, Selection, Crossover, Dejong function.*

I. INTRODUCTION

Genetic algorithms [1] are search and optimization algorithms based on the principles of natural evolution, which were first introduced by john Holland in 1970. Genetic algorithms also implement the optimization strategies by simulating evolution of species through natural selections. Genetic algorithm is generally composed of two processes. First process is selection of individual for the production of next generation and second process is manipulation of the selected individual to form the next generation by crossover and mutation techniques [2]. The selection mechanism determines which individual are chosen for reproduction and how many offspring each selected individual produce. The main principle of selection strategy is the better is an individual; the higher is its chance of being parent.

Fig.1 GA Flow chart [3]



The GA has following steps:-

1. **Initialization**: genetic algorithm are [4] generally start with an initial population that is generated randomly some research has been conducted using special technique to produce a higher quality initial population. Thus an approach is designed to give the GA a good start and speed up the evolutionary process.

2. Selection: It select the two parent chromosome from a population according to their fitness better the fitness bigger the chance to be selected.

3.Reproduction :- It select the two chromosomes according to current selection procedure perform crossover on them and obtain one or two children, perhaps apply mutation as well and install the result back into that population, the least fit of population is destroyed.

4. Crossover: With a crossover probability crossover the parent to form new offspring (children).

5. Mutation:-After a crossover [5] this operator is performed. Mutation is a genetic operator used to maintain genetic diversity from one generation of a population of chromosomes to next.

6. Replacement: Use new generated population for a further run of algorithm.

II. RELATED WORK

De Garis proposed an iterative scheme [6] to involving a Sequence of fitness functions. A randomly initialized population is evolved by GA using the first fitness the resulting population is used as the initial population for a GA using the second fitness and so on. (schoenauer & Xanthakis 1993) used that idea for constrained optimization problems. In these works, the idea is purposely bias the initial population of the GA, but the tool is another GA. However this approach is highly problem specific, and requires from the user the design of appropriate sequence of fitness functions. John J. Grenfenstette has used genetic algorithms to find optimal parameters of genetic algorithm [7].

Sivaraj, R. et.al [8] proposed the boosting performance of genetic algorithm through Selective initialization The main success of genetic algorithm depend upon the individual chosen in the initial population and size of population. If the poor individual is select in the initial population, it will result in longer execution time and weaker optimal solution. This paper discuss about a novel approach to improve the performance of genetic algorithm by using selective initialization which aims at supplying more fit individuals in the beginning phase itself.

Bramlette, M.F. [9] proposed a general approach to improve the initialization procedure of GA in 1991. The initial population is built by taking the best of n randomly chosen individuals. Ramsey, C.L. suggest case based Initialization approach by including strategies in initial population of genetic algorithm [10]. The success of all approach relies on expertise of user in finding best individual in search space in 1993. Louis sushil J.& Johnson, Judy proposed a research paper on robustness of case initialized genetic algorithms.They investigate the robustness of case initialized genetic algorithm (CIGAR) system with respect to problem indexing. When confronted with a series of similar problems CIGAR stores potential solutions in a case- base or an associative memory and retrieves and uses these solutions to help improve a genetic algorithms performance over time. Indexing is the major issue for case- retrieval especially in poorly understood problem. This problem like Combinational circuit design, TSP and Scheduling are solved by Louis and Johnson with improved performance.

III. IMPLEMENTATION & OBSERVATION

In this section of paper Matlab code has been developed for dejong's function. The problem which the author discusses is dejong function which is one of NP hard problems often used as a benchmark for optimization. The code has been developed for dejong function like Rastrigin function. In this Implementation author show the result by graphs and table.

Dejong's function 4: Dejong function 4 is also known as Rastrigin function. It is based on function 1 with the addition of cosine modulation to produce many local minima. Thus test function is highly multimodal. However location of the minima is regularly distributed.

Function definition:

F4(X) =

$$10 \cdot n + \sum_{i=1}^{n} \left(x_i^2 - 10 \cdot \cos\left(2 \cdot \pi \cdot x_i\right) \right) \qquad -5.12 \le x_i \le 5.12$$

F4(x) =10.n+sum(x(i)^2-10.cos(2.pi.x(i))), i=1:n; -5.12≤x(i)≤ 5.12

Global minimum:

F4(x)=0, x(i)=0, i=1 to n.

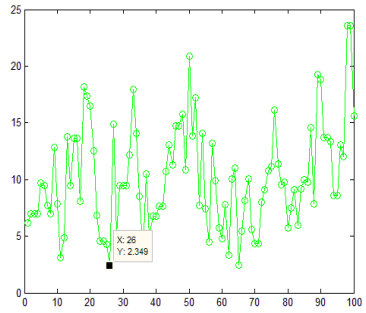


Fig 2: Dejong function 4 (100 generation)

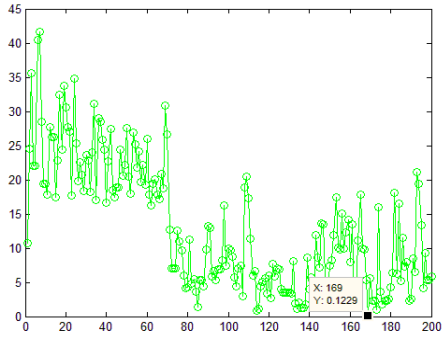


Fig 3: Dejong function 4(200generation)

Fig.2 and Fig.3 shows the minimum results of genetic algorithm.

Table 1.

*A. **Algorithm***	*B. **100 generation***	*C. **200 generation***
D. GA(MIN)	*E. 2.349*	*F. 0.1229*

IV. CONCLUSION

Genetic algorithms are based on evolutionary ideas of natural selection and genetics. Genetic algorithms solve the problems step by step and produce next generation. All evolutionary algorithms including Genetic Algorithm can find near optimal solution. A set of test functions including unimodal and multimodal benchmark functions is employed for optimization. In this paper we Discuss the dejong function 4 (rastrigin function) it is highly multimodal function and author show the result by graphs and table.

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