World Applied Sciences Journal 11 (6): 752-754, 2010
ISSN 1818-4952

Genetic Algorithm and Comparison with Usual Optimization Methods

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Abstract: Various factors are effective in genetic algorithm velocity initial population amounts of displacement and mutation probability, manner of displacement and mutation performance, propriety function and the way next stag- population are chosen are among these factors. How these factors effect convergence velocity of genetic algorithm depends on the problem and is obtained vie experiment. In this paper genetic algorithm in most of problems, reaches to answer with more velocity in comparison with algorithm RLT-BB.

Key words: Genetic algorithm · Optimization methods

INTRODUCTION

Genetic algorithm is a statistical method for optimization and search Special characteristics of this algorithm enables us to nominate it a simple random searcher [1-3]. Initial idea of this method is inspired by Darwin's theory of Evolution and its function is based on natural genetic for the first time in 1960, Evolutional calculation concept was formed by Rechenberg who was investigating about Evolutional strategy. Later, his theory was developed by other researchers initial principles of genetic algorithm was offered in 1969, in Michigan university by Holland *et al.*

Algorithm:

- Formation of initial population randomly
- Current population decoding
- Calculation of target function figures for current population
- Members propriety is calculated using corresponding target function figures
- Effectual population is derived from current population.
- Operator members integrate both effective population attributable to the operation and integration between the two is played.
- Mutation operator is done on new population
- New population members are decoded
- Convergence criteria is controlled based on new variables
- In the case convergence provision is established, calculation is stopped.
- In the case convergence provision is not established, current population is substituted by new population and figure, calculation is repeated.

Genetic Algorithm Flowchart: Genetic algorithm termination provisions:

- generation number reaches certain number
- chromosomes convergence limit reaches certain valve or account example, when 90% of chromosomes are the same or similar to each other we make a termination provision
- program run time reaches certain valve
- average amount of propriety function in several generations doesn't change more than tolerance.

Difference of Genetic Algorithm from Current Methods of Optimization:

- genetic algorithm does not deals with data directly but works with encoded data
- genetic algorithm uses least information (target function and adverbs) to solve problems and doesn't need derivation and other information
- genetic algorithm uses probability laws rather than certain lauds
- genetic algorithm probes population of answers and not just one answer

Example: If x is an integer in the distance [0, 31] and y is an integer in the distance [0, 7], obtain below function maximum using genetic algorithm

$$f(x,y) = \sqrt[2]{x^2 + y^2}$$

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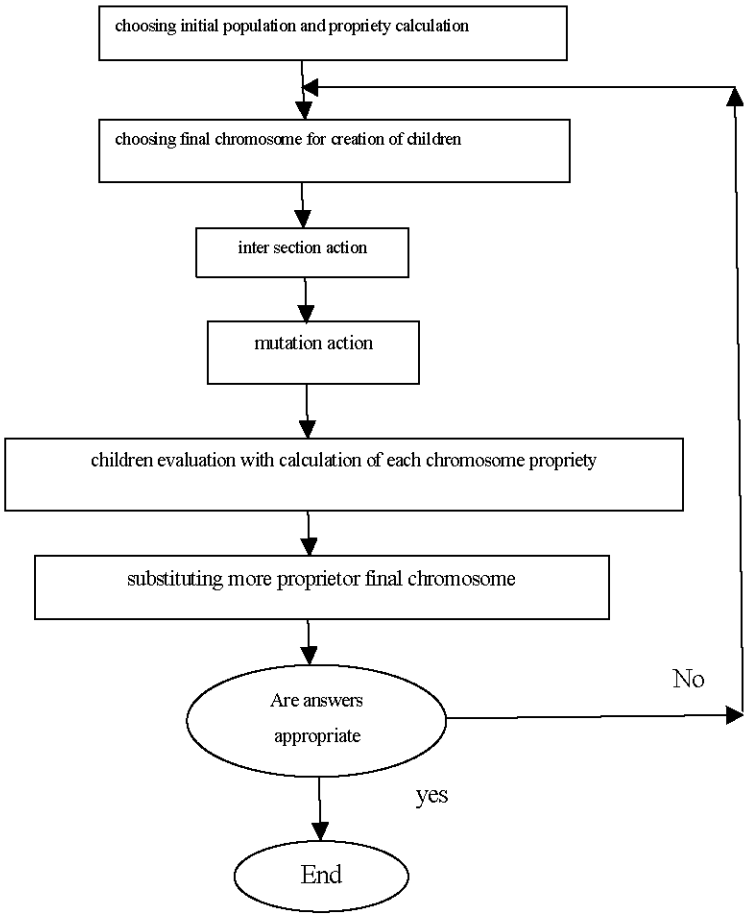

Table 1: View original population

Number		Chromosome equivalent	Propriety
1	(1,3)	00001011	3.1622
2	(5,1)	00101001	5.0990
3	(0,2)	00000010	2

Table 2: Intersection operation results

Chromosomes participating in the intersection	Intersection operation results (x, y)	Chromosome equivalent	Fitness of new chromosomes
{2,1}	(1,1)	00001001	1.4142
	(5,3)	00101011	5.8309
{3,1}	(1,2)	00001010	2.2360
	(0,3)	00000011	3
{3,2}	(5,2)	00101010	5.3851
	(0,1)	00000001	1

Table 3: Mutation operation results with $\rho_m=0.2$

(x,y)	Random numbers								(x,y)	propriety
(1,1)	0.9160	0.6813	0.0186	0.1722	0.3529	0.1763	0.3185	0.9501	(5,5)	7.0710
(5,3)	0.3759	0.8463	0.2988	0.8132	0.4057	0.8214	0.2311	0.8318	(5,3)	5.8309
(1,3)	0.1252	0.8153	0.2599	0.1355	0.4447	0.6068	0.5028	0.2026	(19,2)	19.1049
(0,3)	0.7468	0.3389	0.1169	0.6154	0.4860	0.7095	0.6721	0.4451	(4,3)	5
(5,2)	0.2028	0.1103	0.0919	0.1913	0.4289	0.8381	0.9318	0.3987	(11,2)	11.1803
(0,1)	0.8936	0.9218	0.0196	0.3046	0.7622	0.4660	0.6038	0.0579	(8,3)	8.5440

Table 4: View the new population

Number		Chromosome equivalent	Propriety
1	(19,2)	00001011	19.1049
2	(8,3)	00101001	8.5440
3	(11,2)	00000010	11.1803

First we need a series of dual threads the length of thread is corresponding to desired accuracy For example if he range of X_j variations is $[a_j,b_j]$ and destined accuracy is to k decimal figure, the length of required thread will be commuted from below relation

$$2^{mj-1} \le (b_j - a_j) \times 10^k \le 2^{mj} - 1$$

So, for this example we have

$$(y_{\max} - y_{\min}) \times 10^0 = (7-0) \times 10^0 = 7$$
$$l = l_x + l_y = 5 + 3 + 8$$

So the length of each chromosome is 8 bits For doing intersection action, the junction point of two variables x and y is chosen as inter section point Initial population who has been chosen randomly is shown in Tables 1-4.

Now from among new chromosomes obtained from intersection and mutation action and initial chromosomes, chromosomes with greatest amount of propriety are chosen as new population for next stage of algorithm.

Comparing Tables 1 and 4 it is shown that chromosomes obtained from one time performing algorithm stages have higher propriety in comparison with initial chromosomes new chromosomes are next stage initial chromosomes. Displacement and mutation action are done on them and best results are chosen.

This procedure continues until properties function finally is obtained in this case algorithm terminates.

Genetic Algorithm Convergence

Significant Question Is This: Do genetic algorithm methods converge towards absolute optimum? Ronklof researches in the 1994, theories genetic algorithm under special conditions in this study it is shown that convergence towards absolute optimum is not an inherent characteristic of genetic algorithm but is possible with observing certain provisions.

Mathematical analyses performed within several theorem frameworks and by the use of Markoph Chain model, have shown in the event that in each production stage of genetic algorithm, best results are kept and enter another stage with probability of one, algorithm converges towards absolute optimum [4-7].

CONCLUSION

In this paper, we defined genetic algorithm extensively and used it to solve problem in order to examine two algorithm efficiency, we had shown calculation results on the collections of nonlinear systems, typical of $\{m \in R^n, Ax \le b, l \le x \le u\}$ which are created randomly. As it is shown in the Table 4 genetic algorithm in most of problems, reaches to answer with more velocity in comparison with algorithm RLT-BB.

ACKNOWLEDGEMENT

With special thankful from IslamicAzad University of Minodasht Branch that this article is resulting from research project published in this University.

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