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A New Generation of Optimization process using Genetic Algorithm

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Abstract :- **Genetic Algorithm are based on the principal of survival of the fittest; sometimes called natural selection. Genetic Algorithm are good at taking larger potentially huge search spaces and navigating them looking for optimal combinations of things and solutions which might not find in a lifetime. Many potential solutions is evaluated to see how good it is. The best solution are allowed to breed with each other. This cycle continues in the hope that as we are breeding with the good solution, we will generally breeds better and better solutions. And the evidence supports that this is the case for a wide range of problems.**

Keyword – **Genetic Algorithm, Optimization, Chromosome, Crossover, Parent and Chlild.**

I. INTRODUCTION

Genetic Algorithm are search algorithm based on the mechanism of natural selection and natural genetics. They combine survival of the fittest among string structure with a structured yet randomized information exchange to form a search algorithm with some of the innovative flair of human search. In every generation a new set of artificial creatures is created using bits and pieces of the fittest of the old; an occasional new part tried for good measure.

Since genetic algorithm are relatively new type of algorithm so it contains three main parts of module [1] Evolution Module , [2] Population Module, [3] Reproduction Module. Genetic Algorithm have their origin in genetics the terms have carried through into the computer counterparts. Another most fundamental principle is the search for an optimal state. Optimization is the process of modifying the input or characteristic of a device mathematical process to obtain minimum or maximum of output. The input of optimization process is the cost function, objective function or fitness function and the output is the fitness function of the system. Many optimization algorithm have been developed in their original form. The goal of global optimization is to find the global optima, that is global maxima or minima of the objective function.

II. STEPWISE OPTIMIZATION: HOW GENETIC ALGORITHM WORKS?

Step I [Start] Generate random population of chromosomes, that is, suitable solutions for the problem.

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Step II [Fitness] Evaluate the fitness of each chromosome in the population.
Step III [New population] Create a new population by repeat following steps until the new population is complete.
a) [Selection] Select two parent chromosomes from a population according to their fitness. Better the fitness, the bigger chance to be selected the parent.
b) [Crossover] With a crossover probability, cross over the parents to form new offspring, that is, children. If no crossover was performed, offspring is the exact copy of parents.
c) [Mutation] With a mutation probability, mutate new offspring at each locus.
d) [Accepting] Place new offspring in the new population.
Step IV [Replace] Use new generated population for a further run of the algorithm.
Step V [Test] If the end condition is satisfied, stop, and return the best solution in current population.
Step VI [Loop] Go to step 2.

III. RELATED WORK

Many research work has been going since many year in the field of Genetic Algorithm. Gilbert (1950) [1] did the study of machining costs. In this study production rate and production cost ware considered. Several optimization methods for selection of cutting parameters for turning Genetic Algorithm have been proposed. Wang et. al (1996) [2] used genetic algorithm for determining the optimum cutting parameters and multi pass turning operations. Car, Barisic and Ikonic (2009) [3] used Genetic Algorithm in order to find optimal cutting parameters for CNC turning centre. Sarravanan et. al (2001) [4] deccribes various optimization methods for selection of cutting parameter for turning using conventional and non conventional techniques such as genetic algorithm and simulated annealing. Onwubolu and Kumalo (2001) proposed [5] an optimization method based on Genetic Algorithm for cutting parameters determination in multi pass turning . By Raymer M.L. et. al (2000) [6] Genetic Algorithm were applied to pattern reorganization problem. A new approach is suggested to feature extraction in which feature selection and feature extraction was simultaneously done using genetic algorithm. The Genetic algorithm optimize a feature weight vector used to scale the individual feature in the original pattern vector. Wei-Yen Wang and Li (2003) proposed [7] a novel approach to adjust both the control point of B-spline membership function and the weight of fuzzy neural network using reduced form genetic algorithm (RGA).A novel approach to solve very large scale instigation (VLSI) channel and switch box routing problem was discussed by Lienig et. al (1997). This approach [8] to based upon genetic algorithm that runs on a distributed network of workstation. An extensive investigation shows the qualitatively better results and significantly reduction in occurrence of cross talk. An orthogonal Genetic Algorithm approach for multimedia routing was suggested by Qing-Fu-Zhang et. al (1999) [9]- it can be investigated that the search space is statically sound and is well suited for parallel implementation and execution. The implementation result reveal that the orthogonal genetic algorithm can find near optimal solution within moderate number of generation for practical problem size. Gen M. et. al (1997) [10] tested that to find the shortest path genetic algorithm can be used to encode a path in graph into a chromosome. In this approach applicable with different size from 6 nodes to 70 nodes and from 10 edges to 211 edges.

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This encouraging results using genetic algorithm can find the optimum very rapidly and with very high probability.

IV. NEW GENARATION OPTIMIZATION MODULE OF GENETIC ALGORITHM

There are many optimization module familiar in Genetic Algorithm, but three proposed module for optimization used in new generation.

[1] EVALUATION MODULE : This module is responsible for evaluating a chromosome. It is very important to note that this is the only part of the genetic algorithm that has any knowledge about the problem that is to be solved. The rest of the genetic algorithm modules are simply operating on bit string with no information about the problem. Example- Genetic Algorithm that is trying to solve travelling salesman problem would be evaluate each chromosome based on how long the tour distance was. As the evolution module needs to know about the problem a different evolution module will be needed for each type of problem, but the rest of the algorithm remain same.

[2] POPULATION MODULE : It is also categorized into some several techniques. **[a] Initialization Technique:** Initialization technique determines how the initial population is initialized. It is often the cause than a random initialization is done. In the case of a binary coded chromosome this means that each bit is initialized to a random zero or one. This technique basically suitable where user know of a good solution but try to want improve on it. However , if user combine seeding the population with elitism then used guarantees that to at least find the some good solutions and not have to suffer the embarrassment of finding a solution worse that those you started with. **[b] Deletion Technique :** This technique determines how the population is deleted at each generation of the Genetic Algorithm. Three common deletion methods are generally used. STEADY-STATE : This method deletes an old member and replaces them with a new member. STEADY-STATE-NO-DUPLICATES : This is the same as the steady-state technique but the algorithm checks that no duplicate chromosomes are added to the population. This adds to the computational overhead but can mean that more of the search space is explored. DELETE-ALL : This techniques deletes all the members of the current population and replace them with the same number of chromosome that have just been created. **[c] Parent Selection Technique :** When breeding new chromosomes user need to decide which chromosomes to use as parent. Then it need to established the fittest individuals from the populations but also want to sometimes use less fit individuals so that more of the search space is explored and no increase the changes of producing promising offspring. There are two common parent selection method generally used. [I] An innovative idea that in each individuals is given a chance to become a parent in proportion to its fitness evaluation. Obviously those with the largest fitness have more chance to being chosen. It is calculated in following manner…

[i] Sum the fitness of all the population members. Call this total fitness.

[ii] Generate a random number r, between 0 and total fitness

[iii] Return the first population number whose fitness added to the preceding population number is greater than or equal to r.

[II] Another innovative idea of selecting parents,

and which has been used with some success. In effect, potential parents are selected and a tournament is held to decide which of the individuals will be the parent. They are many ways this can be achieves and two suggestions are…

[i] Select a pair of individuals at random. Generate a random number , R , between 0 and 1. Also consider a parameter r for this method. If R<r use first individuals as a parent. If R>=r then use the second individual as the parent. This is repeated to select the second parent.

[ii] Select two individuals at random. The individual with the highest evaluation becomes the parent. Repeat to find second parent.

[**d] Fitness Technique :** Sometime it may happen that each chromosome given two value, an evaluation and a fitness. The fitness is a normalized evaluation so that parent selection is done more fairly.

[3] REPRODUCTION MODULE : The reproduction module is responsible for the breeding of chromosome. Typically, the reproduction module will ask the population module for two parents. These two parents will breed and the children will be passed back to the population module to be able to the population. Reproduction is done by operators, with mutation playing a lesser, but still important role. The first genetic algorithm operator to be developed was one point crossover. The other operators have been added as the genetic algorithm field has developed. There have also been operators developed for specific problems.

[a] One-Point Crossover : One point crossover takes two parents and breeds two children. It work as follows..

Parent 1							
Parent 2	1	1	0	0	1	1	***0***

Child 1	1	0	0	0	1	1	0
Child 2	1	1	1	1	1	0	1

Here two parents are selected. A crossover point is chosen at random (Shown above by the dotted line). Child 1 is build by taking genes from parent 1 from the left of the crossover point and genes from parent 2 from the right of crossover point. Child 2 is build in the same way by it takes genes from the left of the crossover point of parent 2 and genes from the right of the crossover point of parent 1.

[b] Two-Point Crossover : It is work in a similar way as one point crossover but two crossover points are selected. It is also possible to have n-point crossover. Two point crossover is considered beneficial when, for example, the highlighted bits (in the above example) would provide a good solution if they were next to each other. Using one-point crossover this can never happen but two-point crossover will allow this.

[c] Uniform Crossover : For each bit position of two children we decide, at random, which parent will contribute its bit value to that child. This algorithm can be implemented as follows..

Parent 1	1	0	1	1	1	0	1
Parent 2	1	1	0	0	1	1	0

Template	0	1	1	0	0	1	0

Child 1	1	0	1	0	1	0	0
Child 2	1	1	0	1	1	1	1

Here two parents are selected. A template is created which consists of random bits. Child 1 receives bits from parent1 indicated by a one in the template and bits from parent2 indicated by zero in the template. Child 2 is build in the same way but receives bits from parent1 where there is a zero in the template and bits from parent 2 when there is a one in the template.

V. CONCLUSION

In this paper we have worked for the different optimization method that will use for real life problem using genetic algorithm. Genetic algorithm is new era of optimization and it combination of Bioinformatics and soft computing. This paper mainly focus three main module of optimization namely Evolution module, Population Module and Reproduction module. Hope these modules will deal all the necessary and essential events in future for optimization process.

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