Optimization Technique for Maximization Problem in Evolutionary Programming of Genetic Algorithm in Data Mining

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***Abstract* - The optimization technique is used for the identification of some best values from the various populations. The Evolutionary algorithm is used as a basic concept of the Evolutionary Programming Strategy. To solve many of the numeric and combinatorial problems the evolutionary programming is applied. The optimization problem is obtained using the crossover and mutation. The mutation operation is performed to identify the best fitness values and solution so as to obtain the result. This paper focuses on Optimization technique which is based on the solution selection process. This process helps to enhance the performance of the optimization technique. This paper mainly helps to identify the best fitness values from the various other populations.**

I. INTRODUCTION

The optimization methods are based on some mechanisms like selection and genetics which are stochastic to Genetic algorithm or Evolutionary Programming. Many possibilities are need for the use of Genetic Algorithm. In an organic evolutional the Evolutionary programming is some of the simplified models. To find the solution for more than one optimum solution that is called as multimodal function optimization. Now-a-days the Evolutionary Programming and its strategies have been applied to solve some of the multimodal function optimization problems. This is very easy for implementation and shows the fast coverage because of its defined features. The evolutionary programming and its algorithm are non conventional tools for solving difficult real world problems Using this Evolutionary programming the optimization technique is summarized in two major steps.

1. Perform a Mutation Operation for the currently generated population
2. The next generation (population) is selected from the mutation which is done for the pervious or current generation.

Here the mutation operation plays a vital role for generating an offspring (New Population) and the Second step is used to test the newly generated offspring where in which it can survive. Formulating the EP which gives us some of the search algorithms such as Evolutionary Strategies (ES), Genetic Algorithms (GA), Simulated Annealing (SA), Tabu Search (TS) and various others, The Major disadvantage which we face while using the Evolutionary Programming is,

- While solving the Multimodal optimization problems its slow coverage.

The evolutionary programming and its algorithms are most useful for the identification of the Survival of the fittest. By identifying this we can opt for the *Best Solution from various populations*. Form the best solution which is obtained we can identify the maximization offspring from various offspring which is generated. This paper focus on the optimization technique to identify the maximum (Best Offspring) from the various populations which is generated.

II. PROPOSED ALGORITHM

As stated from the Introduction, the proposed algorithm uses the concept of Evolutionary algorithms and strategies, where it stores the highest (Maximum) values from the newly generated offspring and perform a tournament operation. The population of the individuals is maintained based on the fitness function which is the quality of the individuals [3] The Genetic algorithm is mostly based on the following

1. Random generation of solutions.
2. Population
3. Calculating the Fitness Function
4. Parameters of the Genetic Algorithm [3].

To formulate this in the computer, the population/ chromosome is considered in the binary format for example take it as 2.0 and 4.0

0	0	1	0

Population 1

0	1	0	0

Population 2

The Populations represents a group of individuals that may interact with each other to produce a new population. The interaction can be from mating, offspring generation. It is a set of solutions.

II.1 *Methodology of Evolutionary Programming*

The Evolutionary Programming (EP) is termed as Population based or Mutation based algorithm. This is based on various searching strategies in EP; the Optimization is based on the three major categories namely,

- Initialization
- Cross Over
- Mutation
- Selection

II.1.1 *Initialization*

Here, the initialization is an important factor for the optimization technique to obtain the solution. The population are initialized randomly which is composed of K parent solutions. Each and every element in the population which is generated is based on some specified range.

The populations can be generated as,

P1= 3*rand (1, 10) and P2 = 4*rand (1, 10)

The population is generated and the evaluation is done to identify the best solution from the newly generated Offspring.

II.1.2.*Cross over*

Cross over is a Genetic Operators [3]. In the crossover two elements (Individuals) are chosen from the population to swap the code where it produces a offspring. The crossover is of three different types

- Single Point Crossover
- Two Point Crossover
- Multipoint Crossover

The given example shows the single point and two point crossover. This is based on some binary values.

Parent 1:	**0000**	0000000
Parent 2:	**1111**	1111111
Offspring1:	**1111**	1111111
Offspring 2:	**0000**	0000000

Example1: Single Point Crossover

Parent 1:	0000	**000**	0000
Parent 2:	1111	**111**	1111
Offspring1:	1111	**111**	1111
Offspring 2:	0000	**000**	0000

Example 2: Two point Crossover

III.1.3.*Mutation*

The Mutation is nothing but a sudden change in the population which is generated. The below example depicts the mutation operation.

Parent:	00**1**1100101**1**0101
Offspring:	00**0**1100101**0**00101

Example3: Mutation Operation.

II.1.4. *Selection*

In the Evolutionary Programming approaches there are various types of selection they are Roulette Wheel Selection, Scaling Selection, and Tournament Selection etc. Here in this paper we will follow the Roulette, Rank and Tournament selection procedures.

III. METHODOLOGY AND STEPS FOLLOWED IN OPTIMIZATION TECHNIQUE

III.1. *Optimization Technique Constraint*

The constraint which is stated below is an optimization technique to identify the maximum solution from the population

Here the p={p1,p2…pn} which maximizes the function and satisfies the constraints.

Maximize *f{p1, p2,p3…..pn}*

Subject to $g(p) \leq 0$ i=1,2…n

$h(p) = 0$ j=1,2….m

Where, f (P) is termed as our Objective/Optimization function and the g(p) and h(p) is said to be equality functions.

III.2 *Fitness Evaluation*

The fitness function is problem specific. The fitness is calculated based on the below formulae.

```
function
for i=1:n
        p(i)= p1(i,1)+4*p2*(i,2) ---------(1)
end
```

This will provide the various offspring. For example consider the value of n as 10 it will gives us 10 newly generated offspring

From 100 populations we can get 100 fitness values are generated. From this 100 fitness the 10 best solutions are chosen

```
for i=1….n
        Bestfit = max(f (p))        }
        [new fitness]=new(f)        }  ---- (2)
End                                 }
```

All the best fitness are plotted into a new matrix as in the format given below,

Maxfitness= [bestfit1, bestfit2…..bestfit n]

From the maxfiness matrix we need to plot the graph.

III.3 *Basic Operations on Evolutionary Programming*

The Evolutionary programming is a population based algorithm

Here, each individual element which is defined here is considered as two element tuple ($p1_i$, $p2_i$), where $p1_i$ € P. i indicates the position of the population.

Here are some of the basic criteria which helps to improve the performance of the evolutionary programming in terms of the population, crossover and mutation. The population can be small or large [3]. The GA and EP are very powerful algorithms for solving various and wide range of problems.

Step 1: Generate P number of populations solution initially where ($p1_i$, $p2_i$) is two element tuple

Step 2: For every parent who is generated, create the new population (offspring) from formula (1)

Step 3: From the offspring which is generated perform a mutation operation for each solution.

Step 4: Evaluate the fitness for the offspring based on the formulae

Step 5: The Tournament selection and rank based selection is performed between the parents and the offspring.

Step 6: Based on the step 5 and formulae (2) the maximum solution will replace the minimum or smaller values and it is considered as *win*.

Step 7: These solutions will form the population for the next generation

Step 8: Terminate if, we have maximum number of *wins.*

The basic operation of the EP is depicted in the below figure

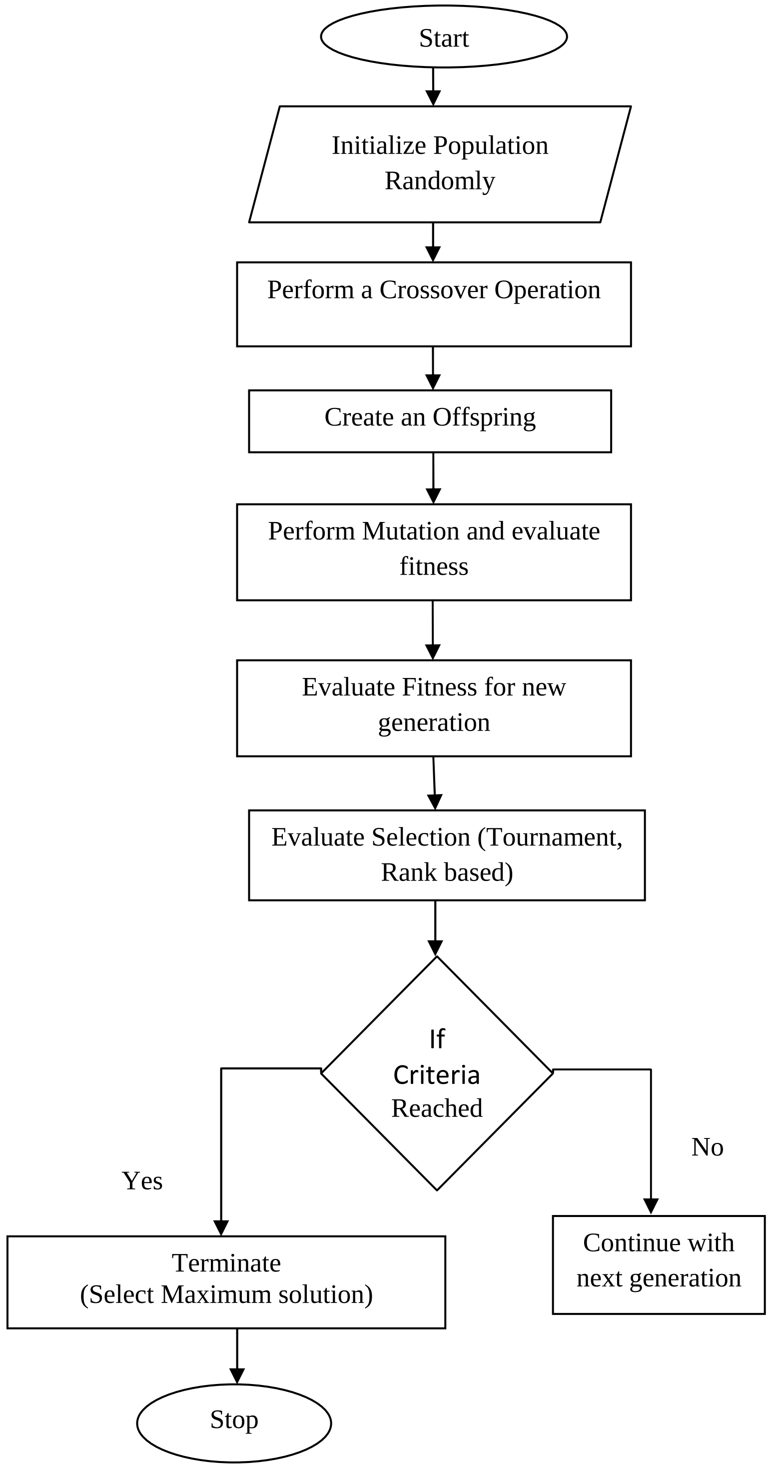

Figure 1: Process of Optimization Technique in EP

III.4 *Basic Idea behind the Optimization Technique for Maximization Problem*

The basic idea behind the optimization technique is that,

Here we will consider every element as a tuple which is represented as P→(p1, p2).

- ✓ For this two element tuple offspring is generated as (p1´ and p2´) and from this offspring another new population can be generated which is defined as (p1´´, p2´´)

- ✓ Fitness function is calculated for the population and offspring is generated which is shown in previous step.
- ✓ Best fitness chosen based on (2)
- ✓ Tournament operation is performed between the best and other population
- ✓ If the fitness is smaller the other solution is awarded as win.

IV. IMPLEMENTATION ALGORITHM

IV.1.*Algorithm for Population Generation.*

```
range=[0 3 , 1 5, 0 1];
p1=3*rand(1,10)
p2=4*rand(1,10)+1;
p1=p1´;      } convert to column matrix
p2=p2´;      }     -do-
P=[p1 p2]    } // two column tuple
```

IV.2 *Fitness Evaluation*

```
for i=1:n
        P(i)=p1(i,1)+2*p2(i,2);
end
```

IV.3 *Tournament Selection Operation*

```
R1=round(10*rand(1,1));
R2=round(10*rand(1,1));
If E(R1,1)>E(R2,1)
        E(R2)=E(r1);
        newP(R2,: )= D(R1,: )
else
        E(R1)=E(R2)
        newP(R1,: )=D(R2, : )
end
        newP; //Displays the newly created Population after the tournament operation is performed.
```

IV.4 *Best Fitness values Generation.*

```
for i=1:N
        newP=tournament(P, fit);
        Bfit=fitn(newP);
        Best(i)=max(Bfit);
End
A=[Bfit, Bfit1, Bfit2………BfitN]; //shows all the best fitness which is generated.
```

V. RESULTS AND DISCUSSIONS

From our optimization technique for the maximization problem the below Table I depicts the population generation of two individuals which shows the population as tuple.

TABLE I. POPULATION GENERATION

P1	P2
2.8504	1.6228
0.6934	3.7419
1.8205	3.6676
1.4579	1.6411
2.6739	3.5746
2.2863	0.2316
1.3694	1.4115
0.0555	3.2527
2.4642	0.0394
1.3341	0.5556
.	.
.	.
.	.

From the population which is generated in the Table I the fitness function are calculated based on (2). The below Table II depicts the fitness function of all individuals which is generated.

TABLE II. FITNESS FUNCTION EVALUATED

P1	P2	Fitness
2.8504	1.6228	6.096
0.6934	3.7419	8.1772
1.8205	3.6676	9.1557
1.4579	1.6411	4.7401
2.6739	3.5746	9.8231
2.2863	0.2316	2.7495
1.3694	1.4115	4.1924
0.0555	3.2527	6.5609
2.4642	0.0394	2.543
1.3341	0.5556	2.4453
.	.	.
.	.	.
.	.	..
.	.	.

From the above Table II we need to identify the best fitness which is considered as the *Survival of the fittest*, and it is considered for the tournament operations. From this, we need to compare the best fitness along with least population and made a replacement by using the Tournament selection operation algorithm.

TABLE III. RESULTANT VALUES OBTAINED AFTER TOURNAMENT OPERATION.

2.4453
2.543
2.7495
4.1924
4.7401
6.096
9.8231
9.8231
9.8231
9.8231
9.8231
9.8231
9.8231
.
.

The Table III shows the result which is performed after the tournament operation. From the table it shows at the end of the stage all the results are same that is the maximum fitness which is generated by performing the operation.

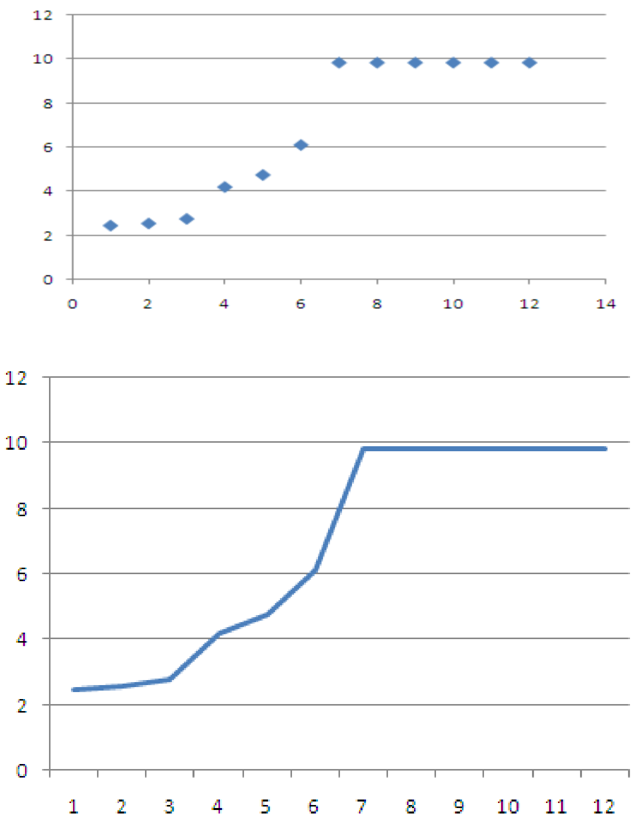

Figure 2: Graph showing the best fitness solutions

VI. CONCLUSION

This paper is concerned with the best fitness values which are obtained from the optimization technique. From the figure2 which is depicted above shows that the maximum (highest solution obtained) fitness is obtained after the tournament operation and considered to be winning. The algorithm which is followed here is used to solve the function optimization problem. The Table III depicts the solution which is obtained after the replacements of best solutions with the least solutions and finally we get all the best solutions for maximum number of resultant populations. The parameters can be prolonged based on the population size and can identify the best solution based on the algorithm which is depicted here.

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