Effective software testing with the help of Genetic Algorithm

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***Abstract*— Software testing largely depends on test case generation, execution and evaluation. It helps to solve or handle the complexity of a program. It also improves software performance, dependability and safety concerns and ensures high quality software. Software testing consumes lot of time, cost, and money. We are using Different techniques and methodologies which are used to obtain solutions of problems quickly, accurately and acceptably but still we are finding evolutionary techniques for automatic test generation. So in this paper we have provided an overview of existing techniques, and work done by the various researchers in the field of evolutionary algorithms for automatic test generation. Genetic Algorithm is one such form of evolutionary algorithms.**

Keywords— Genetic algorithm, software testing

I. INTRODUCTION

Software engineering is a discipline production of a good testing software which requires a good software which should be reliable, portable and usable and can be maintained properly. Software engineering is playing an important role in software life and there is always a need of a high quality. Software testing is check the function it is true or not.

Software testing is remove the faults it the process of verification and validation. Verification testing is check the structure of program and Validation is check the function of program manual testing is not better then software testing Software testing is find out the errors. Software testing is manage the program software

requirement follow the steps and events input output and expected result. In our paper different type of genetic algorithm is completed genetic algorithm is generate the number of test cases.

II. GENETIC ALGORITHM

Genetic Algorithm search techniques premised on the evolutionary ideas of natural and genetic selection. The basic concept of GA is designed to simulate processes in evolution system. GA have been widely studied, experimented and applied in many fields in the engineering worlds. Genetic algorithms are based on the fundamental of the evolution via natural selection inducing operators, such as mutation and recombination. GA are useful and work efficiently when the search space is large, complex and poorly understood, when domain knowledge is scarce or expert knowledge is difficult to encode.

A. Simple Genetic Algorithm

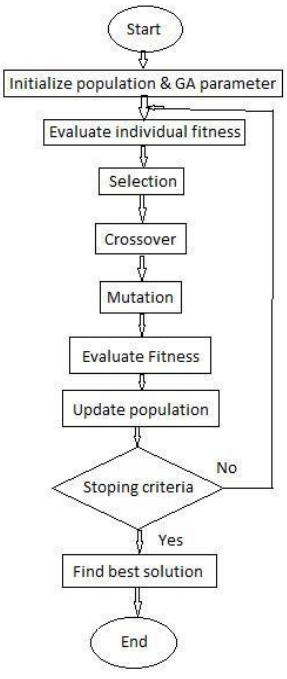

Fig 1: Flow of Genetic Algorithm

Genetic algorithm follows the following steps :

Step 1. Initialize the sample population and pass GA parameter
Step 2. Calculate the fitness value of individual
Step 3. Select the fitter chromosome for further iteration
Step 4. Crossover
Step 5. Mutation
Step 6. Evaluate fitness
Step 7. Update population
Step 8. Repeat the step 2 to 7 until the final criterion is met or optimal solution is obtained.
Step 9. Best solution is found.

III. OPERATION OF GENETIC ALGORITHM

Basically four different types of operators are used in the process of GA such as selection, crossover, and mutation and elitism

A. Selection

The use of selection is to select the best parents for performing GA operations. Usually selection is happen on the basis of fitness value of the individuals, which is obtained from the fitness method. Fitness method can be defined as a specific method depending upon the criteria which returns a number and it indicating the acceptability of the program. This method is used in the selection process to determine the optimum point and the variants survive to the next iteration. Selection methods have six different types such as stochastic universal sampling, roulette wheel, exponential rank, linear rank, binary tournament and truncation

B. Crossover

After selecting the better individuals by using selection operator, the crossover is applied to the chromosomes. In this operation two individuals swaps genes or sequence of bits between them when they satisfy the probability factor of the operator. For binary encoding there are different types of crossover operators are used like uniform, arithmetic, one point and two point.

For Example:

Input 1:- AaBbCc

Input 2:- 45678

Output Value= aAb45 (one out of many)

C. Mutation

Mutation is defined as slight change in chromosomes to introduce new good traits. It alters a one or more genes from initial chromosome to find new traits. The resultant solution can be entirely different from previous. Basically six types of mutation operators are used in Genetic algorithm such as flip bit, boundary, Bit string, Gaussian, uniform and non-uniform.

For Example:

Input 1:- aAbBcC

Input 2:- 123456

Output Value= aAbk56 (changing 4 to k)

D. Elitism

Elitism process involves copying a small proportion of the fittest candidates into the next generation, which are related to the best solution found.

IV. NEED FOR GENETIC ALGORITHMS IN SOFTWARE TESTING:

A. Drawbacks of manual testing:

- Speed of operation is not more efficient as it is carried out by humans.
- High investment in terms of cost, time.
- Limited availability of resources.
- Redundancy in test cases.
- Inefficient and inaccurate test checking.

B. Pros of using genetic algorithms in software testing:

- Parallelism is an important characteristic of genetic testing.
- It operates in a search space to less likely to get stuck in extreme ends of the code during testing.
- Only fitness function needs to be changed according to the problem, with the same encoding.

V. USING GENTIC ALGORITHM IN SOFTWARE TESTING

Genetic Algorithm is developed in 1970 by Holland. Genetic Algorithm is used to perform various testing techniques. Software testing is used to improve the problem to minimize number of test cases and time, cost and labor. And also increase the quality of the software. Genetic algorithm used with white box and black box testing.

A. White Box Testing

White box testing is structural testing. It is the internal part of system and perform the test cases. It is generate the levels and unit of the software testing. White box test design techniques are-

a) Path Testing:- Path testing using genetic algorithm is software quality control. It covers the each statement and branch. This techniques corresponds to testing all possible paths which means that each statement and branch is covered. it is a structure testing and it is based on code and algorithms.

1:-specification is correct

2:-data is run properly

3:-control flow

4:-independent path

b) Data Flow Testing:- Data flow testing is based on selecting path in the program. it covers the variable of path. it includes the

1:-test cases

2:-input of component

3:-variables of location

4:-path of program

c) Statement Testing:- This techniques focus on all exercising all programming statement with small tests.

B. Black Box Testing

Black box techniques is check the function of software. It is manage the requirements and specification. In black box testing we just concentrate on input and output of the software system.

a) Functions of Black Box Testing

1. Functional Testing:- Functional testing using genetic algorithm expected to generate fault test cases.
2. Non Functional Testing:-It is not related to specific functionality. But non-functional requirements such as task, usability.
3. Regression Testing:-Regression testing is type of software testing .it is perform recent code and tools and it is not change the existing features. it is selection of already executed test cases.

CONCLUSION AND FUTURE WORK

Software testing is a problem of a solution. It detects much solution. It is covered by the white box testing and black box testing. In this paper we are discussing the techniques of genetic algorithm of software testing. It has been studied that genetic algorithm gives better results to increase quality of software. Software testing is applying the black box testing and genetic algorithm and values.

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