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A Survey on Test case selection Using Optimization Techniques in Software Testing

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Abstract

This Project Objective is Software Testing using Optimization Techniques. Identification, characterization and automatic prioritization of test cases in software testing using optimization techniques. Proposing a new approach for software testing process, optimizing testing effort, testing complexity, quality & reliability issues. In software development life cycle (SDLC), testing phase is the most important phase. In regression testing there evolves the number of test cases that are impractical to test all. Therefore to overcome this problem, testing phase is done using selected test cases to reduce the effort and get the desired result accurately.

Keywords: *Test Case Selection, Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Software Testing. Ant Colony Optimization (ACO), Bee Colony Optimization (BCO), Regression Testing, Test Case Prioritization.*

1. Introduction

Software test suit optimization is one of the most important problems in software engineering research. Software Testing is one of the time consuming and costly phases in software development process. It takes lot of time and consumes 55% of the cost of a software development. It requires lot of effort on developing software testing tools that can reduce time and cost of software development. Testing system is essential To make suitable test data from unsuitable data. Testing a software product is just a Mechanism to compare the outputs on a given set of outputs The software testing process also doesn'Ensure that there is no error in the product but may that error is acceptable.

Software Engineering is the discipline of computer science which applies principles to create, operate, modify and maintain of software components. Software engineering can be subdivided into many sub disciplines. It forms the important component of software quality. Testing is used to find error and bugs. Testing is static and dynamic process. Testing is further divided into many categories like unit Testing, black-box testing, white-box testing, system testing etc. The development of the software, verification and validation is the main phases. The main aim of the verification is to check whether the System is working according to its specification. Validation aims is whether the system behaves just like the customer's requirements.

Software testing consists of some activities:
Selecting test inputs, running the inputs on the software for testing, and evaluating the correctness of the desired outputs. Software testing occurs continuously during the software development life cycle to detect errors as early as possible and to ensure that existing software do not break the software. Selection and prioritization of test cases are the two major solutions to the problem of test case optimization. Any test case prioritization algorithm can be used a test case selection Algorithm. Test suite minimization is a selection of smallest subset the test cases.

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i) Bee Colony Optimization (BCO):

Bee colony is optimization technique which is based upon the natural phenomena and find out optimal solution at the end. It is self organizing technique. Two types of bee available in the bee hive. Upon these two bees all the food collecting technique is depended. Scot bee is going outside in the search of the food and come back to the bee hive when out of energy. Waggle dance is performed in shape of digit 8 by the scout bee in the bee hive to communicate with the forager bee. With the communication forager bee came to know about the best quality of food in the direction of sun then follow the same path for the collection of the food. Scout bees explore the path where as forager bees exploit the path. A BCO algorithm is used to find out maximum number of faults.

ii) Ant Colony Optimization (ACO):

It is a meta-heuristic technique which is based upon the natural phenomena. ACO is a probabilistic technique which gives solution by using previous results. In this process each ant follow different path to reach to the destination and secrete pheromone liquid on the way to destination. The path which has the highest liquid pheromone is considered as the shortest path and all other ants follow the same path. So pheromone liquid is used to attract the other ant and update the latest information about the path.

iii) Genetic Algorithm (GA):

Genetic algorithm, a adaptive search procedure is introduced by John Holland broadly studied by Goldberg and De Jong. It is an optimization technique which provides near optimal solution to NP-hard problems. GA is applied to solve many problems like travelling salesman problem knapsack problem etc.
Genetic Algorithm is based on the idea on the natural evolution. The foundation of GA lies on the concept of the survival of fittest into a solution space. Each cycle of GA process includes initialization (encoding), selection based on fitness function, reproduction using crossover or mutation. The cycle is repeated till a solution is found that satisfies the minimum criteria or a fixed number of generations has been reached.

iv) Particle swarm optimization (PSO):

The techniques described are: Particle Swarm Optimization (PSO). The PSO is a global optimization algorithm based on heuristic search. The idea was given by John Kennedy and Eberhert, in 1995 , after observing the group of animals, flock of birds and fishes, where each individual follows the path of ―global best particle within its population, e.g. in ocean, while searching for good food source, a school of fish. The inside story: every fish is observing its neighbours' position and velocity then compare it with global best position and velocity. The best position and velocity is chosen and updates are made by individuals in their position and velocity. Thence, each fish converges towards the best position after modification in its velocity, which helps to move towards the food faster.

2. Literature Review

Kaur A. & Bhatt (2011) presents a combined analytic view of evolutionary computation techniques namely Genetic Algorithm and Particle Swarm Optimization. The PSO is an optimization technique, where global solution is constructed by analysis of the local optimal solution.

Li K.& Zhang Z. et al proposes (2010) a new method to breeding software test data called GPSMA for structure data test generation, introducing a new strategy to replace the mutation operation in traditional genetic algorithm, and using the "excellent rate of production" to implement the interaction between sub-populations.

Kire K. & Malhotra (2014) has worked on Optimization algorithms based on swarm intelligence can have some distinct advantages over traditional methods. It has been found that most SI-based algorithms use mutation and selection to achieve exploration and exploitation.

Rini D. & Siti et al (2011) have made review of the different methods of PSO algorithm. The process of PSO algorithm in finding optimal values follows the work of an animal society which has no leader. Particle swarm consists of a swarm of particles, where the particle represents a potential solution. Particle will move through a multidimensional search space to find the best position.

Sharma C. & Sabharwal (2013) has worked on applications of GA in different types of software testing are discussed. The GA is also used with fuzzy as well as in the neural networks in different types of testing. It is found that by using GA, the results and the performance of testing can be improved.

Singh A. & garg et al (2014) has worked on the quality of test case gives a great impact to software testing activity in

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fault-revealing. The intent of this paper is to propose an approach which uses Ant Colony Optimization Algorithm for reducing the test suite .This approach will contribute a lot in considerably reducing the testing cost, efforts and time of regression testing.

Tandon A. & malik (2012) has worked on the preliminary results from a genetic algorithm based approach to software test case breeding. The guiding fitness function can provide a focused search that produces a large number of localized test cases, or be loosened up for more random-like behaviors, depending on the testing scenario. High volume or long sequence testing involves the repeated execution of a substantial number of test cases.

Windisch A. & Joachim et al (2007) has reported on the application of particle swarm optimization to structural software testing. Both particle swarm optimization and genetic algorithms were used to automatically generate test cases for the same set of test objects.

Yang X. (2014) has worked on this ABC technique is used for the generation of the test data. The parallel behaviour of the bees makes generation of test cases faster and efficient. Here, independent test path coverage criterion is used as objective criteria to achieve the all test coverage with less number of test runs.

3. Limitation of Existing System

Test Case Selection is required to select particular Test suites or test case(s) in order to achieve fault free system with minimal cost and time consumption. So we need an effective mechanism of selecting test suits or test case(s).

4. Proposed Methodology

The main goal of research is to combine the power of two algorithms ACO and PSO. It proves its power and effectiveness towards solving the testing problems.

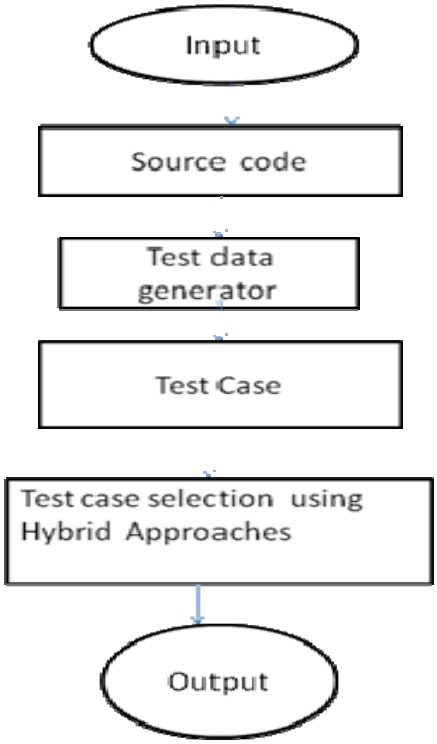

Fig. 1 Proposed Methodology.

5. Conclusions

The main goal of research is to combine the power of two algorithms ACO and PSO. It proves its power and effectiveness towards solving the testing problems. This Review indicates that particle swarm optimization is an attractive alternative to Ant colony Optimization since it is just as good as or even better than ACO in terms of effectiveness and efficiency and is a much simpler algorithm .The Observation shows that particle swarm Optimization is competitive with ACO and even outperforms them for complex cases. Present work surveyed on various techniques of Software Test Case Selection and Prioritization in Ant Colony Optimization as well as brief comparisons of ACO algorithm with GA, SA and PSO algorithms.

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