# Software Testing using Intelligent Technique

Kevilienuo Kire Lovely Professional University Phagwara Punjab

# ABSTRACT

This paper proposed software testing system by using Artificial Intelligent techniques. In today's scenario, Software Testing is a critical issue in software development and maintenance for increasing the quality and reliability of the software.

In Software Testing, regression testing is often performed and researchers are finding ways to reduce the regression testing cost. In this paper, an approach is proposed which draws inspiration from Swarm Intelligence to reduce test suite for regression testing. .This approach will strive to get the best optimal solution and contribute a lot in considerably reducing the testing cost, efforts and time of regression testing.

# **General Terms**

Algorithms, Regression Testing, Test Case, Prioritization

### **Keywords**

Ant Colony Optimization, Pheromone, Swarm intelligence ,Genetic algorithms, Simulated Annealing Algorithms, Bee Colony Optimization, Test Case Prioritization, Test Case Selection.

# 1. INTRODUCTION

Testing is a process of executing a program with the goal of finding errors. To test the code there are different types of testing among which regression testing is one of it. Regression testing is performed frequently by the Testers as they retest to ensure that the program behaves as expected. An innovative approach to effective fault-revealing regression test cases is by taking the advantages of Swarm Intelligence. Swarm intelligence (SI) is used to solve optimization problems. The main areas of SI are Ant Colony Optimization, Particle Swarm Optimization; Biogeography based Optimization and Bee Colony Optimization.

Swarm AI Principle:

Principle 1: Create a system of agents that work individually on a common problem

Principle 2: Agents are simple, fast, and have a limited perspective

Principle 3: Indirect Simple Inter-Agent Communication. [5]

The intent of this paper to reduce and prioritized the test cases based on Swarm Intelligence by using Ant Colony Optimization. Many literatures illustrated that Ant Colony System Algorithm is more competent and efficient in local search.

Ant Colony Optimization algorithms should conform to the ACO-Meta heuristic:

Set parameters, initialize pheromone trails

1) While termination condition is not met do

Neha Malhotra Lovely Professional University Phagwara Punjab

2) Construct Ant Solutions

3) Apply Local Search (optional)

Update Pheromones

5) End while.[3]

The rest of the paper is organized as follows: Section 2 Literature Review Section 3 describes the proposed approach to cost effective regression Section 4 concludes, is presented.

# 2. LITERATURE REVIEW

On realizing the importance of software testing various literature surveys are conducted whereby Daniel Di Nardo in the industrial case study pointed out the importance of Test Case Prioritization with real regression faults because in regression testing when the code changes we have to retest even those successfully executed test suites to check whether the changes have introduced to new bugs or faults .As a result the problem here is that there is time consuming and extra efforts and resources needed.

Wang Jun proposed test case prioritization by using genetic algorithm and the regression-based testing was improved in the way that faults can be revealed more quickly, increase the Software Reliability and also save computational time and resources [7].

Geniana Ioana Laiu tested the evolutionary algorithms by generating the path test data and their results are compared. The result shows that Simulated Annealing gives quality test data as compared with Particle Swarm Optimization and Genetic Algorithm [11].

Chengying Mao stated that Ant Colony Optimization is not still deeply studied in generating test case and prioritization and proved that Ant Colony Optimization outperforms the algorithms namely: Simulated Annealing and Genetic Algorithm is and also stated "The possible future improvement can be focused on reducing the time of global/local search and pheromone update" [1].

# 3. PRESENT WORK

Presently, Bharti Suri implemented Ant Colony Optimization Algorithm for Test Case Selection and Prioritization. They have showed how the ACO is useful for choosing the optimal solution and also there was reduction in the test suite size. The results obtained are closely related to the optimal solution. The best solution was not found by them for all cases. Thereby seeds an inspiration for the possible improvements [15].

| Program      | TDG_GA       |               |             |                     | TDG_SA      |               |             |                     | TDG_ACO     |               |             |                     |
|--------------|--------------|---------------|-------------|---------------------|-------------|---------------|-------------|---------------------|-------------|---------------|-------------|---------------------|
|              | avg<br>cori. | succ.<br>rate | arg<br>gens | avg<br>time<br>(ms) | avg<br>cov. | succ.<br>rate | avg<br>gens | avg<br>time<br>(ms) | avg<br>cov. | succ.<br>rate | avg<br>gens | avg<br>time<br>(ms) |
| triangleType | 0.95         | 0.76          | 13.79       | 10.83               | 0.9988      | 0.994         | 42.17       | 3.77                | 1.00        | 1.00          | 5.76        | 6.22                |
| gcd          | 1.00         | 1.00          | 0.76        | 0.85                | 1.00        | 1.00          | 2.69        | 0.15                | 1.00        | 1.00          | 0.36        | 1.37                |
| calDay       | 0.9631       | 0.65          | 35.80       | 35.73               | 0.9997      | 0.996         | 28.29       | 1.79                | 1.00        | 1.00          | 9.51        | 12.84               |
| isValidDate  | 0.9995       | 0.994         | 21.69       | 11.68               | 0.9821      | 0.963         | 15.16       | 2.43                | 0.9998      | 0.998         | 15.16       | 19.94               |
| cal          | 0.9902       | 0.987         | 15.24       | 11.41               | 0.9927      | 0.965         | 10.26       | 0.73                | 1.00        | 1.00          | 9.57        | 11.18               |

# 4. COMPARATIVE ANALYSIS OF EXISTING TECHNIQUES

Fig 1: Experimental results of Algorithms for Test Data Generation[1].

# 5. THE PROPOSED APPROACH

In this paper, an approach is proposed to reduce the test suite of regression testing by using Ant Colony Optimization. The researchers are working on to find a better way for solving test case selection and prioritization problem using Ant colony Optimization. The results obtained by the researchers till date are close to optimal results but the best solution was not obtained.[15].

In the proposed system Ant Colony Optimization algorithm will be used for test case selection and prioritization.

Our proposed approach performs the following tasks:

- 1) Generating path details for each iteration.
- 2) Eliminating the redundant test cases.
- 3) Generating the pheromone table.
- 4) Selecting and prioritizing test cases.
- 5) Selecting the best path with minimum execution time

The proposed approach will attempt to get a better result out of it using Ant Colony Optimization. Selecting test cases from the test suites will reduce the test efforts and incorporating it with prioritization using appropriate Optimization algorithm will lead to better and effective fault revealing.

So, in this paper an approach is proposed that will use a better ACO for regression testing .This approach will contribute a lot in considerably reducing the testing cost ,efforts and time of regression testing .It will strive to get the best optimal solution

The figure below shows a sample Model of Input and Output for the proposed approach.



Fig 2: A Sample Model of Input and Output for the proposed approach

The basic flow of the proposed approached is shown below.



Fig 3: Basic Flow of the Proposed Approached.

#### 6. EXPECTED RESULT

The proposed approach will result in:

- Minimizing execution cost.
- Minimizing test design efforts/cost
- Maximum coverage ability of codes .

# 7. CONCLUSIONS

The quality of test case gives a great impact to software testing activity in 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. In future, the proposed approach will be implemented in C++ code complied using TurboC++ compiler. The result will be observed from the graphical representation that the nodes connected via the edges with maximum weight (pheromone) will be selected as the final solution or the best path.

### 8. ACKNOWLEDGMENTS

Taking this privilege to thank Neha Malhotra for undoubtedly supporting to carry out with the works and thank her for the continuous support and for her patience, motivation, enthusiasm, and for her immense knowledge. Without her valuable suggestions, it is not possible for to carry out with this proposal paper.

### 9. REFERENCES

- Chengying Mao, YuXinxin, Chen Jifu, Chen Jinfu (2012)"Generating Test Data for Structural Testing Based on Ant Colony Optimization "12th International Conference on Quality Software, Xi'an, Shaanxi, pp. 98– 101.
- [2] Ding Rui, Feng Xianbin, Li Shuping, Dong Hongbin (2012) "Automatic Generation of Software Test Data Based on Hybrid Particle Swarm Genetic Algorithm", IEEE Symposium on Electrical & Electronics Engineering (EEESYM), Mudanjiang, Kuala Lumpur, pp. 670 – 673.
- [3] Gokalp Osman and Ugur Aybars (2012) " Improving Performance of ACO Algorithms Using Crossover Mechanism Based on Mean of Pheromone Tables". International Symposium on Innovations in Intelligent Systems and Applications (INISTA), Trabzon, pp. 1 – 4.
- [4] Gupta Nirmal Kumar and Rohil Mukesh Kumar (2013) "Improving GA based Automated Test Data Generation Technique for Object Oriented Software", IEEE International Advance Computing Conference (IACC), Ghaziabad, pp.249 - 253.
- [5] http://www. IJCSI.org/ Proposed Software Testing Using Intelligent techniques (Intelligent Water Drop (IWD) and Ant Colony Optimization Algorithm (ACO))
- [6] http:// http://www.python.org / Software Product Lines System Test Case Tool: A Proposal.
- [7] Jun Wang, Yan Zhuang, Chen Jianyun (2011) "Test Case Prioritization Technique based on Genetic Algorithm", International Conference on Internet Computing and Information Services, Hong Kong, pp. 173 – 175.
- [8] Karnaveland K and Santhoshkumar J (2013) "Automated Software Testing for Application Maintenance by using Bee Colony Optimization algorithms (BCO)", International Conference on Information Communication and Embedded Systems (ICICES), Chennai, pp. 327 – 330.
- [9] Kan Stephen H (2002).Metrics and Models in Software Quality Engineering, Second Edition, Addison Wesley.
- [10] Kothari, C.R (2004).Research Methodology, Methods and Techniques, 2nd Revised edition, New Age International Publisher, Jaipur, pp.348-350.
- [11] Latiu Geniana Ioana, Cret Octavian Augustin, Vcariu Lucia (2012) "Automatic Test Data Generation for Software Path Testing using Evolutionary Algorithms", International Conference on Emerging Intelligent Data and Web Technologies, Bucharest, pp.1-8.
- [12] Di Daniel, Alshahwan Nadia, Briand Lionel, Labiche Yvan (2013) "Coverage-Based Test Case Prioritization: An Industrial Case Study", IEEE Sixth International Conference on Software Testing, Verification and Validation", Luembourg, pp. 302 – 311.

- [13] Musa John D (2004).Software Reliability Engineering: More Reliable Software Faster and Cheaper,2nd. Edition, JWOMINGTON, IND1ANA47403.
- [14] Souza Luciano S. de, Miranda Pericles B. C. de, Prudencio Ricardo B. C., Barros Flavia de A. (2011) "A Multi-Objective Particle Swarm Optimization for Test Case Selection Based on Functional Requirements Coverage and Execution Effort",23rd IEEE International Conference on Tools with Artificial Intelligence, Boca Raton, FL,pp. 245 – 252.
- [15] Suri Bharti, Singhal Shweta (2011)" Implementing Ant Colony Optimization for Test Case Selection and

Prioritization" International Journal on Computer Science and Engineering (IJCSE), India, pp.1924-1932.

- [16] Suri Bharti, Singhal Shweta (2012)" Literature Survey of Ant Colony Optimization in Software Testing" CSI Sixth International Conference on Software Engineering (CONSEG), Indore, pp.1-7.
- [17] Yi Minjie (2012),"The Research of path-oriented test data generation based on a mixed ant colony system algorithm and genetic algorithm", International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM), Shanghai, pp.1-4.