Novel Approach for Test Case Prioritization Using ACO Algorithm

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Abstract—**Regression testing is used to retest the component of a system that verifies that after modifications defects are removed from the in effected software. Automation tools are required for these types of testing. This work is based on manual slicing and automated slicing for test case prioritization to detect maximum number of faults from the project in which some changes are done for the new version release. The slicing is the technique which will divide the whole project function wise and detect associated functions. To test the performance of proposed and existing algorithm MATLAB is being used by considering the dataset of ten projects. Each project has seven functions and four numbers of changes are defined for the regression testing. In the simulation it is being analyzed that fault detection rate is increased and execution time is reduced with the implementation of automated test case prioritization as compared to manual test case prioritization in regression testing.**

Keywords-test case prioritization; ACO; regression testing

I. INTRODUCTION

The software systems are built, evolved as well as maintained through software engineering process. On several domains, a set of problem solving approaches, technologies as well as mechanisms are applied with the help of software engineering [1]. The type of testing in which code is visible to the tester is known as white-box testing which is also known as glass or structural testing. Another type of testing in which the internal working of system is ignored is known as black-box or functional testing [2]. Within the test cycle, the testing process which ensures that the features are not affected due to the changes made is programs, is known as regression testing. The modified software present within the maintenance phase is verified through this process [3]. The regression faults are identified through this highly costly testing method. There are three major components that collectively generate a test case represented as [I,S,O]. The data input given to the system is denoted here by I. the state of system at which input data is given is defined as S. The expected output of system is denoted by O [4]. The functional specification of the software or detailed knowledge relevant to the internal structure of software is utilized to design the test case. An activity through which the existing features can be improved, errors can be corrected, optimized and deleted is known as software regression testing approach. [5]. Thus, all the tests that are present within accessible programs or suites are re-executed through regression testing. However, the cost, time and resources involved here are very high. Within regression testing, an important technique to be applied is known as test case prioritization [6]. A meta-heuristic technique through which the hard combinatorial optimization issues can be resolved is known as ACO. The pheromone trial that is spread by the ants as well as the behavior followed by them to communicate with each other have inspired this algorithm. [7].

II. LITERATURE REVIEW

Fatemeh Sharif et.al (2018) proposed a test- case failure technique which can be used in the form of non-code and specification based test selection and reduction. Hence, in this respective paper there is exploration of other events that does not require any source code or verified documents. It uses basic Information Retrieval (IR) methods which are being written naturally [8]. It is based on the manually managed frequency.

Dipesh Pradhan et.al (2018) proposed a Black-box dynamic approach in which mining and multi-objective search (REMAP) work has used [9]. Rule Miner, static prioritizer and Dynamic Executor are three main parts of this Black- box. All three performs some specific task like the Rule Miner extract the executed results from the present relations and executes them with historical executed data while Static Prioritizer performs two task one is Fault Detection capability (FDC) and second is the arrangement of the test cases statistically.

Robeala Abid et.al (2017) proposed a technique called new multiple criteria. This technique works on the basis of test cases prioritization [10]. It further arrange the algorithms using two additional criteria in which one is primary and the other one is secondary. Primary criteria prioritize test cases while the secondary criteria will break the knot among two test cases when more than two test cases give equal results as shown by the primary one.

Yi Bian et.al (2017) Epistatic Test case Segment (ETS) for multiobjective search-based regression Test Case Prioritization (MoTCP) [11]. This technique works on the basis of epistatis theory which shows the relation between genes in development period. It is an updated version of test regression processing files. V8 industrial program explains the described approach along with the three other benchmarks. It is guided by the theory which helps in the improvement of the performance of the MoTCP.

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Md. Hasan Mahmood et.al (2017) proposed integrates the real life practical aspects in order to arrange test cases files. It works in accordance with the present requirement [13]. It ensures that all the errors should be properly detected and covers whole business development are. By arranging them in such a manner that it expands the market economically, it encloses less number of test cases. Author also describes a new technique which covers maximum number of software.

III. Research Methodology

A. Steps of the Proposed ACO Algorithm

Following are the various steps of proposed ACO algorithm

1. In the improved multi-objective algorithm, the function importance is also calculated on the basis of number of functions associated. The function which has maximum association is considered as the most important function
2. To calculate the number of functions associated, the technique of automated slicing is been applied which traverse the DFD and generate final result.
3. The automated slicing will work in the iterative manner and search the best value of the test case as which maximum number of errors get detected from the project

B. Proposed Algorithm

Input :

Test cases=P(i)

Number clicks on each function =F(i)

Output: prioritized testcases

I<-Consider value of F(i) for the each test case

Test case F(i) value <- i

while (fault value of each test case is calculated)

a=F(i)

calculate number of links L(i)=F(i)'/F(i)

if(L(i)>L(i+1)

b=L(i)

else

b=L(i)

end

Calculate fault value Fault (i+1)=fault(i)/L(i)

if Fault(i) > Fault(i+1)

best_so_far <-Fault(i)

i <- generate an individual randomly

end

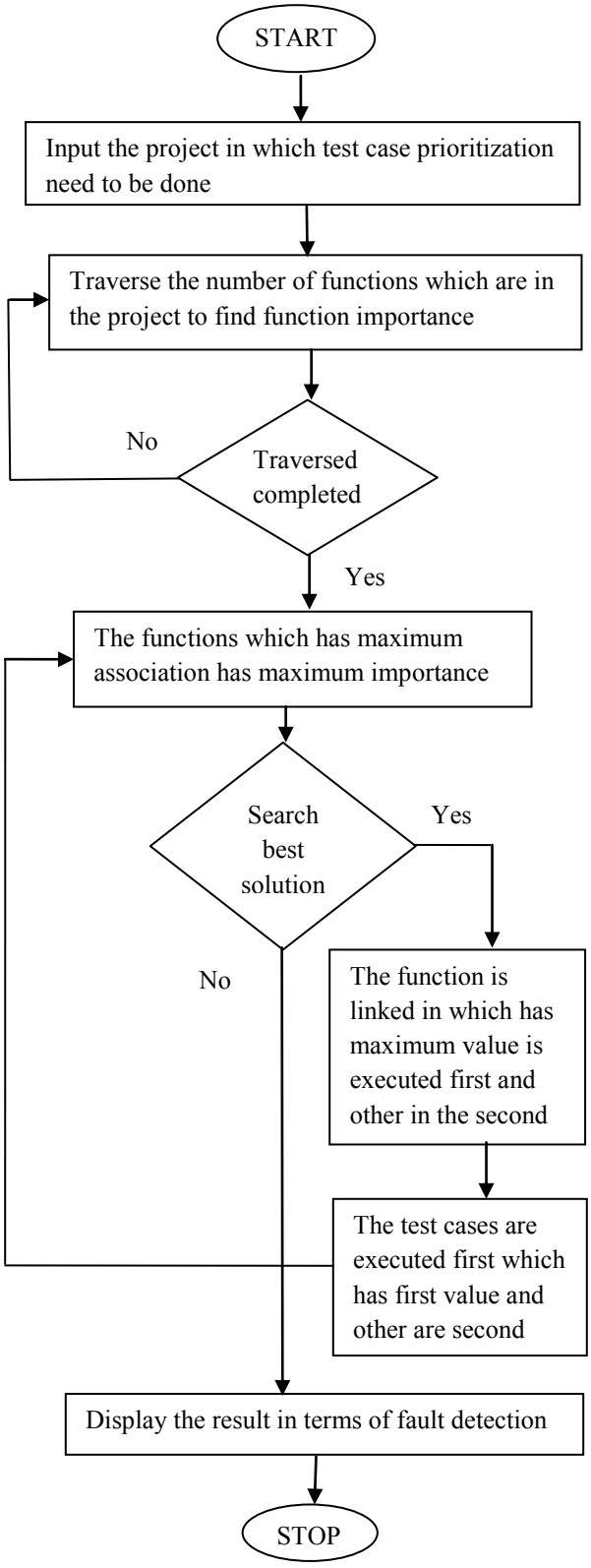

Figure 1." Proposed flowchart.

IV. Experimental Results

The proposed work has been implemented in MATLAB and the results are evaluated by making comparisons of proposed work with existing in terms of several parameters.

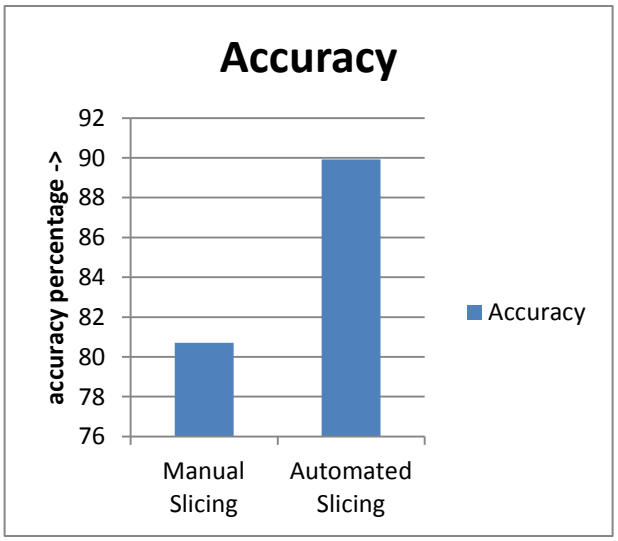

Figure 2." Accuracy comparison.

As shown in figure 2, the accuracy of the manual slicing and automated slicing is compared for the performance analysis. The accuracy of the manual slicing is less as compared to automated slicing due to do not use of optimization algorithm.

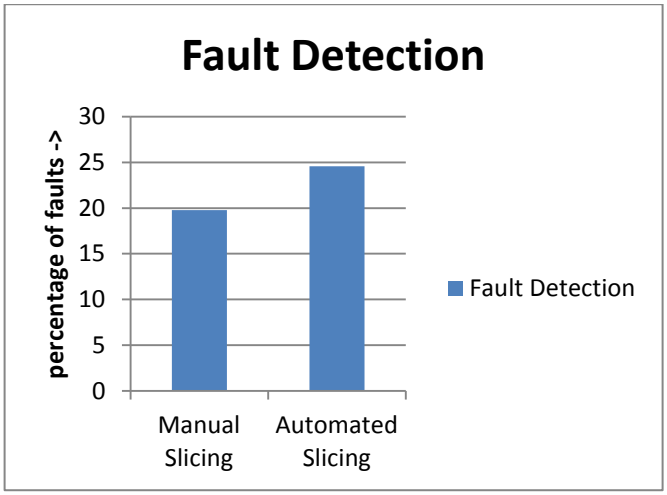

Figure 3." Fault detection comparison.

As shown in figure 3, the fault detection of the manual slicing and automated slicing is compared for the performance analysis. The fault detection of the manual slicing is less as compared to automated slicing due to do not use of optimization algorithm.

As shown in figure 4, the execution time of the manual slicing and automated slicing is compared for the performance analysis. The execution time of the manual slicing is high as compared to automate slicing due to do not use of optimization algorithm.

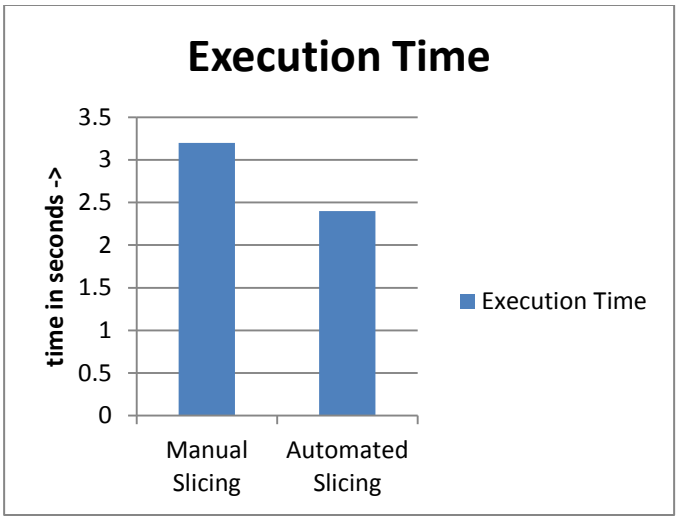

Figure 4." Execution time comparison.

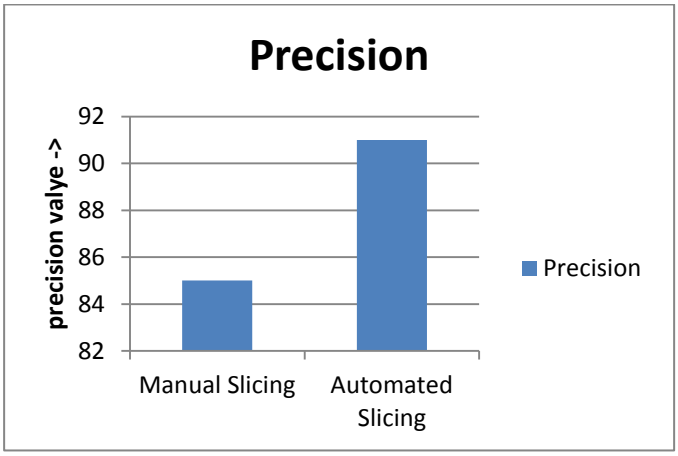

Figure 5." Precision comparison.

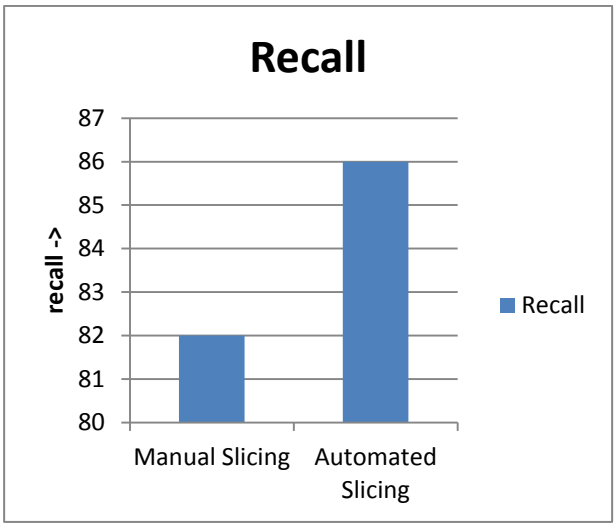

Figure 6." Recall comparison.

As shown in figure 5, the precision of the manual slicing and automated slicing is compared for the performance analysis. The precision of the manual slicing is less as

compared to automated slicing due to do not use of optimization algorithm.

As shown in figure 6, the recall of the manual slicing and automated slicing is compared for the performance analysis. The recall of the manual slicing is less as compared to automated slicing due to do not use of optimization algorithm.

As shown in figure 7 the fault prediction value of the manual slicing is compared with the automated slicing. In the manual slicing the values are entered manually and on the other side in the automated slicing values are selected automatically. The comparison between the manual and automated slicing is done on the different set of changes which are change 1, change 2, change 3 and change 4.

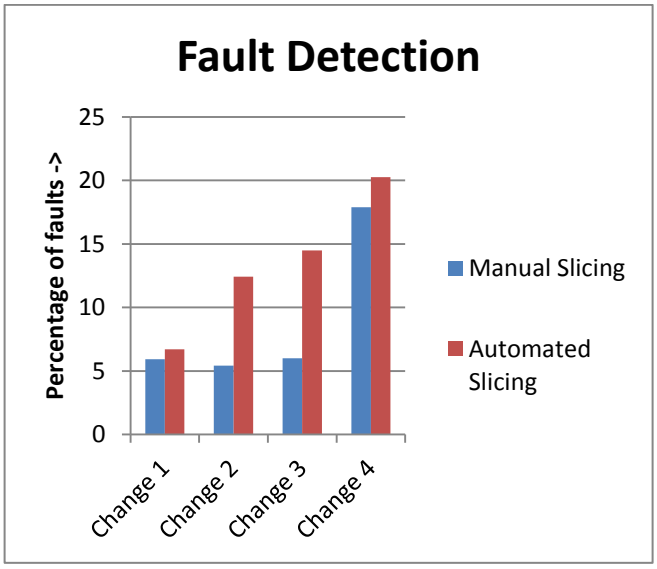

Figure 7." Fault prediction comparison.

V. Conclusion and Future Scope

In this work, it is concluded that regression testing is the type of testing which is applied to test the project after some changes are being done for future release. The test case prioritization is the technique of regression testing which is being applied to prioritize the test cases according to the defined changes. To analyze the performance of proposed and existing algorithm simulation is being done in MATLAB by considering ten projects with four changes. It is been analyzed that fault detection rate is increased and execution time is reduced by applying automated test case prioritization as compared to manual test case prioritization in regression testing.

References

[1]" Dharmveer Kumar Yadav, Sandip Dutta, "Test Case Prioritization Technique based on Early Fault Detection using Fuzzy Logic", 2016, IEEE

[2]" Dan Hao, Lu Zhang, Lei Zang, Yanbo Wang, Xingxia Wu, Tao Xie, "To Be Optimal Or Not in Test-Case Prioritization", 2016, IEEE

[3]" Remo Lachmann, Manuel Nieke, Christoph Seidl, Ina Schaefer, Sandro Schulze, "System-Level Test Case Prioritization Using Machine Learning", 2016, IEEE

[4]" Sonia Sharma, Ajmer Singh, "Model-Based Test Case Prioritization Using ACO: A review", 2016, IEEE

[5]" Passant Kandil, Sherin Moussa , Nagwa Bad, "A Methodology for Regression Testing Reduction and Prioritization of Agile Releases", 2015, IEEE

[6]" Tadahiro Noguch, Hironori Washizaki, Yoshiaki Fukazawa, Atsutoshi Sato, Kenichiro Ota, "History-Based Test Case Prioritization for Black Box Testing using Ant Colony Optimization", 2015, IEEE

[7]" Tanzeem Bin Noor, Hadi Hemmati, "Test Case Analytics: Mining Test Case Traces to Improve Risk-Driven Testing", 2015, IEEE

[8]" Fatemeh Sharif, Hadi Hemmati, "Investigating NLP-based Approaches for Predicting Manual Test Case Failure", 2018, IEEE

[9]" Dipesh Pradhan, Shuai Wang , Shaukat Al , Tao Yue, Marius Liaaen, "REMAP: Using Rule Mining and Multi-Objective Search for Dynamic Test Case Prioritization", 2018, IEEE

[10]" Robeala Abid , Aamer Nadeem, "A Novel Approach to Multiple Criteria Based Test Case Prioritization", 2017, IEEEio

[11]" Yi Bian, , Zheng Li, Member, IEEE, Ruilian Zhao, Member, IEEE, and Dunwei Gong, Member, "Epistasis Based ACO for Regression Test Case Prioritization", 2017, IEEE

[12]" Faiza Farooq, Aamer Nadeem, "A Fault based Approach to Test Case Prioritization", 2017, IEEE

[13]" Md. Hasan Mahmood, Md. Shazzad Hosain, "Improving Test Case Prioritization Based on Practical Priority Factors", 2017, IEEE

[14]" Riza Dhiman and Dr Vinay Chopra, "Modified ACO model for Regression Testing Using Automated Slicing "Journal of Emerging Technologies and Innovative Research,Vol. 5, Issue 6 (June 2018), pp. 180

[15]" Riza Dhiman, Vinay Chopra, "*Aco for Regression Testing By the Process Automated Slicing*", International Journal of Computer Sciences and Engineering, Vol.6, Issue.11, pp.602-606, 2018.