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Techniques for Automating the User Session Based Test Case Generation and Optimization –A SURVEY

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Abstract: E-business sites are widely recognized as an important marketing and information tool. The key participants in the website development process become attached to the overall design and performances, but sometimes lose sight of how appealing the site is to the target audience .To ensure that your business website is highly reliable and secured on all levels, various testing methodologies should be incorporated. The key to successful testing is the designing of the test cases, which contributes to 40% of the testing life cycle. This paper discusses the various test case generations and optimization techniques available for User Session based testing, the issues and challenges and finally the research question involved.

I. INTRODUCTION

In recent days, the web applications play a major role in the success of a business. These applications mostly rely on the daily activities of the business. Hence they have a real time impact on the society which in turn affects the growth. The Quality of web application and user-friendliness are attributes to attract the users towards the business. A simple miss-communication or gap in the functionality will lead to a heavy loss.

To overcome this situation the reliability and quality of the web application needs to be strengthened. Software testing is the key which ensures the quality of the application. Extensive testing is required to provide high quality, but testing is not given much importance by the developers. Developers have testing as the final step in the development process.

When the customer approaches and requests for developing a web portal, the developers are pressurized to deliver the product in a very short time and hence the testing phase is skipped due to lack of time. This results in low quality leading to application failure which ultimately affects the Business.

This fast world requires a fast but reliable and secured web application. To deliver a reliable application within the stipulated period, this process needs to be automated .Forty percent of the testing life cycle is consumed in designing test cases. These test cases need to be efficient in order to identify the faults. When this phase is automated, more Time is saved. Moreover the approach used for generating the test cases automatically needs to be more-efficient for identifying the maximum number of the faults. This paper discusses the various approaches and techniques used for test case generation and optimization for testing a web application. Section 2 discusses the background. Section 3 and 4 discusses the approaches used for generating and optimizing the test cases. Section 5 gives light on the issues and challenges.

II. BACKGROUND

A. *Web Application*

A web application is a software system which consists of a numerous web pages in the form of forms. These forms are interlinked based on the User-requirement. The user gives some input data in the form field and the request is submitted to the web service via a Browser. Based on the users request the state of the system changes.

B. *User Session Based Testing*

When a user gives data in the web page and sends a request to the web-server, the data is passed over via browser in the form of name-value pairs. The time period between the login and logout of the user is called as a user-session. The user-session data is available in the server logs. These are used for testing the web-application. This type of testing is called as user –session based testing.

III. TEST CASE GENERATION TECHNIQUES

A. *Chen and Miao Approach*

Chen and Miao [5] have proposed a model for generating test cases by combining Logical components (LCs), Page flow diagrams and automaton. The steps involved are as follows:

[a] The use case model of the web application is taken into account.

[b] The view of the web application based on the actor could be easily derived by developing the page flow diagrams (PFD).
[c] From the PFD the logical components are partitioned.
[d] After partitioning the web application based on the dependency relationships between the LC, test sequence are generated.
[e] Each LC is depicted by automaton and Automata compositions are used to model the interactions between LCs.
[e] All the input and output are mapped with actual operations.
[f] Then the test data are added to the final automaton.
[g] Finally the complete test cases are generated automatically.

B. *Ricca and Tonella's Approach*

According to their approach [3] model is created using the web objects as nodes namely web pages, forms and frames. These nodes are interlinked using edges which depicts the relationships or dependencies among the pages. Then, the test requirement is generated with the help of the path expression. The test cases generated using the path expression forms the quasi test cases. The tester tests the applications by providing the input values and test cases are executed. Thus the test cases designed will consist of a set of web pages to be visited and the values for successful and unsuccessful visit.

C. *Youxin and Dafa Approach*

Their approach [9] is based on the standard of program slicing and Z specification refinement. These authors use the static program slicing standard. The steps for the test case generation model are as following.

[a] The program code is taken.
[b] Each statement is considered to be nodes.
[c] These nodes are linked using edges.
[d] The control flow graph is designed.
[e] The dependency between the nodes are classified into control dependency and data dependency.
[f] Each node is identified based on the dependency and the program is statically sliced.
[g] The specification is refined further.
[h] Then the slicing is done for Z-spec.
[i] est cases are generated based on the program slice.

D. *Qian Approach*

[a] The server log consists of the request details of a user.
[b] The access record in the log consist of the user□s IP address, the URL ,status code ,the number of bytes of data requested and responded ,etc.
[c] These records are initially preprocessed to identify the irrelevant data, for example the record which has a status code of 400 is omitted.
[d] After removing the irrelevant records the user sessions are created. When the IP address is new, a new user session is created. When request comes simultaneously from the same IP address, the data is appended to the same user session otherwise a new one is created.
[e] The redundant user sessions are eliminated using an algorithm.
[f] The reduced set of user sessions is grouped into test suites.
[g] Then they are sequenced using genetic algorithm.
[h] The final set forms the set of test cases.[1]

IV. TEST CASES OPTIMIZATION TECHNIQUES

A. *Optimization Using Clustering*

In this approach [2], a service profile of the application is used as the base requirement for optimizing the set of test specification. If the specification is not available it is generated from the code using the reverse engineering process. The set of user sessions generated are associated with each service identified from the service profile. After all the user sessions are associated, the cluster is formed .All the user sessions belonging to the same service are considered to be one cluster and are identified .Then the user session which satisfies the maximum of the requirement are selected from the cluster. The dependency graph should be drawn which consists of link dependency and data dependency based on the service profile. The number of outgoing solid edges from each node in the dependency graph is counted which is denoted as LDC and the number of dotted edges determines the DDC. The user session with maximum count is also selected apart from those selected from the cluster. Finally, the test cases generated are optimized using the clustering and dependency relation.cases. The service profile is obtained from the user-

B. *Optimization Through Concept Analysis*

Concept analysis [4] is similar to the mathematical lattice concept. This is a technique by which the similar user sessions are grouped. The user sessions or the test cases which were generated are taken and the relation table is derived. Each service is considered to be a node of the lattice and the edges between the nodes are the relationships between them. The user sessions are marked based on the levels. The user session just above the base level are considered to be the optimized set of test cases.[6]

C. *Ant colony Optimization*

The behavior of the ant is simulated as ant colony optimization [8]. Initially the travelling salesman problem was solved using the ACO .The ACO is a probabilistic technique .In this algorithm, the simulated artificial ants are used to search for the best test cases out of the original set of test cases. The food search behavior of the real ants is taken as an experience in the search algorithm. This is a pheromone approach which helps in constructing the probabilistic solution.

D. *Artificial Bee Colony Optimization*

ABC [8] optimization algorithm is a simulation of the food search behavior of honey bees. The steps involved are

[a] Each test case is maintained and the neighbor state is determined based on the feasible path.
[b] If the path is not feasible then the corresponding test case is removed. Then a new search is started.
[c] When a path is determined, each node is associated with an integer value which is called happiness value.
[d] After all the test nodes are traversed, the test cases corresponding to the happiness value is identified
[e] These steps are continued until optimized test cases are finalized.

V. ISSUES

A. Chen and Miao approach has a very good advantage of the supporting concurrent access and interaction between LCs .The stable space explosion problems is avoided .But the major gap here is that the test cases generated are only static. It does not support dynamic generation.

B. Ricca and Tonella□s approach was successful for various real world applications. It is also useful for assessing the quality of site. But the manual activities needed for the initial stage like the state unrolling and merging need to be reduced.

C. The Formal specification based approach given by Youxin and Dafa is only a theoretical explanation No practical performance evaluation is presented. Moreover the security issues are not dealt with.

D. Zian,,s approach evaluates the effectiveness of test case generated and optimized based only on the test coverage criteria. Other factors like running cost of test case, time required for running, time for loading etc. are not answered.

E. The concept analysis based approach does not answer the question of new URLs introduced as the application grows.

F. The major problem with ACO is that the initial time spent creates a time overhead which is a mere waste. Moreover when the upper bound is reached the ants cannot find the solution and a new set of ants are to be deployed.

VI. CONCLUSION AND FUTURE WORK

Many Approaches for testing the functionality of web applications are proposed. Though these approaches are found promising during the early stages of the test suite creation, they have drawbacks due to the difference in the architecture of the web applications.

The various challenges to be considered while testing the web application are

A. The way a web application is used may have a sudden change.

B. The maintenance rate of a web application is very high when compared to other software systems.

C. The architecture of a web application may be heterogeneous.

In spite of all these challenges it is very important that the web application which is delivered to the real world must be of high quality, reliability & security. To achieve a very high quality, the test cases which form the basis for testing need to be generated and optimized with high care. The future research would be to develop a strategy for this overcoming all the issues discussed earlier using a soft computing technique.

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