

Critical Review on Test Case Generation Systems and Techniques

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ABSTRACT

Software testing has valuable and important place in software development life cycle. It is used to identify the quality and good performance of software. For the software testing phases we have to need the proper test case. Test case may be generated manually and automatically. Generating test case manually will take more time and cost. Automatic test case generation will reduce time and cost. This paper combine review on test case generation systems, object oriented, and procedure oriented and component based development and agent oriented system. This paper also gives the overview on the techniques which is used to generate the test case.

Keywords

test case generation, techniques, specification based, sketch diagram based, source code based, systems, object oriented, agent oriented, service oriented, component base software.

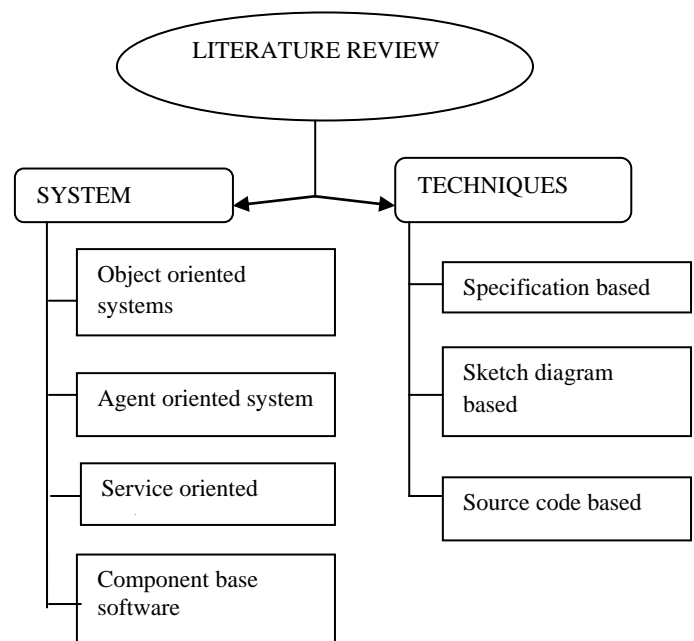
1. INTRODUCTION

Software development life cycle consist five phases. They are follows: (1) requirement analysis, (2) design, (3) coding, (4) testing and (5) maintenance. Testing consumes maximum time and effort and cost in comparison of other phases to the overall of a software when it come to existence. Testing can be dividing in two forms: black box testing, white box testing. Performance and reliability of software depend on the testing. Test cases are required to check weather software is working according to the requirement or not. Testing depends on the good test case. If the test cases have good quality then testing process will be good and performance of software will be good. In present time few methods are very famous and use by researchers and practitioner. These methods are path oriented, random method and heuristic approaches [1]. When software release, customer gives view of software performance. Before releasing the software, the performance of software check by testing and testing depends on the good test case [2]. So quality of test case should be good. There are many techniques which are used to yield the test cases, these techniques are unified modeling language, genetic algorithm, and state chart diagram.

2. LITERATURE REVIEW

This section describes software system and techniques which help to generate the test cases. This paper describes software system one by one. This paper divides the literature review in two parts.

1. Literature review of system
2. Literature review of techniques



2.1 Literature Review of System

Object oriented system: V. mary sumalatha and G.S.V.P.Raju et al. [3] have proposed an approach for object oriented system. Test cases are generated by using the unified modeling language (UML) diagrams and genetic algorithm.

UML is basically used for the object oriented system. For test case generation, UML sequence diagrams are made by the help of unified modeling language. Various notations are used in sequence diagram. After creating the sequence diagram, convert the sequence diagram in sequence graphs. Assign weights to node in sequence graph. In this research paper, genetic algorithm applies to the sequence graph. With the help of fitness function, new generation selected in this research paper, all operation of genetic algorithm selection and crossover and mutation are used. Best test cases are selected in the end. In this research paper spider card games is taken and apply all rules for generating the test cases.

A.v.k shanthi and dr.g.mohan Kumar et al. [4] have proposed approach to automated test cases generation for object oriented software. In this paper UML (unified modeling language) is used for creating a suitable model and designing of software. UML is very famous in industry for creating the UML model and designing of software. Design specification technique has advantage that it allows test case generation

early in software development life cycle. This paper has used the data mining concept. Tool is used in this research paper, which get the information from the UML class diagram. Genetic algorithm is used to generate an automated test case generation. A tree structure is created with the help of that information which are get by the UML class diagram. Cross over operator applies on the tree to discover all possible paths.

Advantage:

1. Test cases are easily generated in software development life cycle in the design specification technique.
2. with the help of UML (unified markup language), designs (class diagram) are easily created.

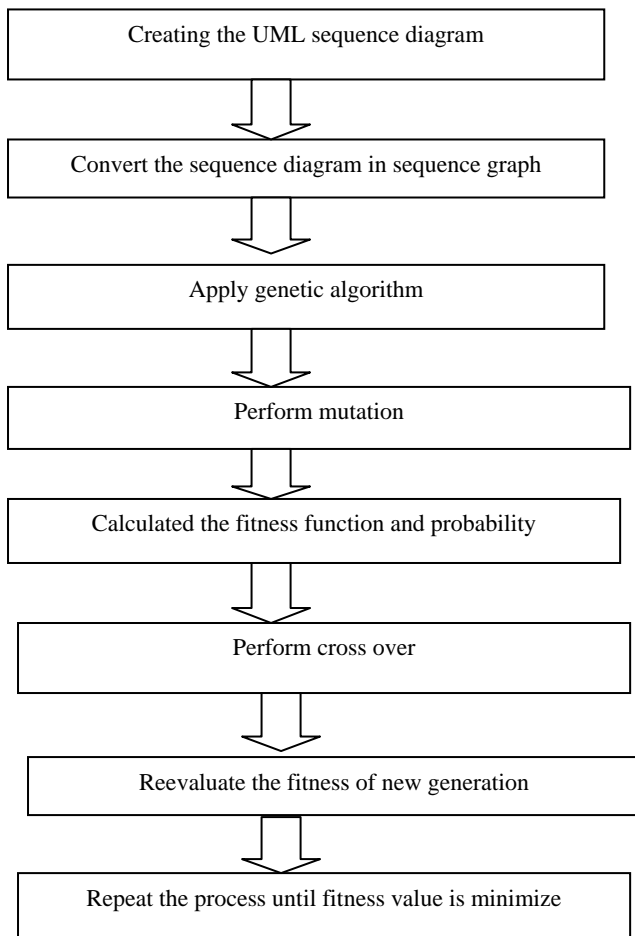


Figure1. Diagrammatic representation of the object oriented approach.

2.2 Service Oriented Architecture

Ebrahim shamsoddin-motlagh et.al [5] has proposed an approach for service oriented architecture. Service oriented architecture is newly architecture. This system reduces the gap between the business and software. Service oriented architecture has the different feature and specification in comparison of other software architecture. In this paper researcher, first create, the control flow graph of BPEL (business process execution language) file in the system and WSIG file is used to create sub graph of related services. With the help of genetic algorithm, it tries to create test cases, which will cover all sub graph of service in system. In this paper an approach is used to generate the test case automatically for BPEL language.

Challenges of this approach

1. Generated graph will be very large for the different services. It is very difficult to store and display on the screen.
2. Next challenge of this approach .the SOA system is distributed system that has been established on the systems with different hardware and software. It is need to test the system with a quality of
3. platform to support

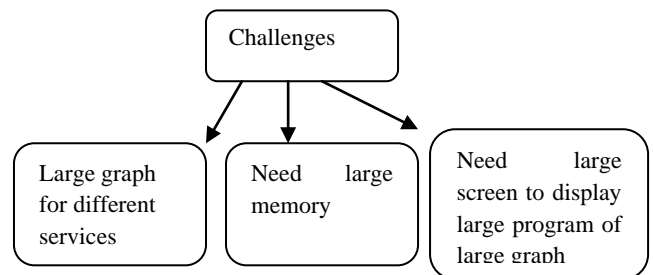


Figure2.Challenges of service oriented architecture

2.3 Agent Oriented System

N.siva kumar, K.Vivek anadan, A, Mohan et al. [6] have proposed an approach for agent based system. Agent oriented system has wide area for the research. Pole oriented approach is define in this research paper. This paper depends on the role of the agent and transforms the role diagram into the activity diagram. In this research paper, role diagram of user registration is describe, which is transform into activity diagram. All paths are covered by an activity graph which is validated by cyclomatic complexity. With the help of cyclomatic complexity test cases are generated. Role based approach discover the faults like as lacking in decision, lacking in loop and coordination lacking.

Advantage

1. Statement handling.
2. Loop handling.
3. Code handling.

Yacine kissoum and Zaidi sahnoun et al. [7] have proposed formal specification approach for test case generation for multi agent system. Formal specification approach uses the Maude algebraic language. MAL easily provides the explanation and internal behavior of each agent class. In this paper agent unified modeling language is used to cover all possible paths in activity and sequence diagram.

2.4 Component –Based System

Shaveta gupta and jimmy singal et al. [8] have proposed two approaches for automated test case generation using PETA tool and namely test case generation from UML activity diagram based on gray box method. Component based software engineering is depends on the components which are used to construct the software system. PETA is a java /eclipse based platform. Under this PETA tool we have to follow three steps.

1. Apply setting under this tool
2. Class diagram age generated
3. Finally test cases are generated

Neelam sirohi ,anshu parasharn et al.[9]:-

This paper defines what is component based system? and what is the architecture of the component based system. Component based system depends on the component (which is called third party) which is used to make the component system. So the quality of the component should be good. Component based software engineering follows the rule, we can create new software by using the outdate software. Example of component model is enterprise java beans, component object model, and .net model. This paper defines the various steps of component based system development [10]. Component based system is a new area for research and have a large space for research.

3. TECHNIQUES

We have various types of techniques for generating the test cases. They follow as (1) random approaches, (2) goal oriented technique, (3) specification based techniques, and (4) sketch diagram based technique, source code base technique [12]. In this section we describe the test case generation techniques.

Here we describe three techniques specification based technique, sketch based technique, source code base technique.

3.1 Specification Based Technique

To generate a set of test case from specification documents is called specification based techniques. Specification document are formal requirements specification and object constraint language specification [13], [14]. Specification method depends on the system is to do without having the knowledge how to implement it or how to do it [15]. Specification documents may be helped for output checking and may be helped to reduce to reduce the cost of testing. Specification based technique is better than non specification based techniques because it provide simple and formal approach to generate the functional test cases.

Antonio et.al [16] presented object constraint language (OCL) specification. OCL is the member of the UML 2.0. And it provides the specification of formal constraints in context of a UML model. Constraints are used to present constant of classes

There are many researchers who have worked on specification technique. Here we give brief review of the researchers since 1994 to 2015. [20] To [32].

Table 1.

YEAR	RESEARCHERS NAME	SPECIFICATION TECHNIQUE (WORKING OF RESEARCHES)
1994	Weyuker	Use Boolean specification method.
1996	Black burn and busser	Provide a tool for critical system, which are used to generate the test case.
1997	Kancherla	Generating test templates with the help of automated theorem proving.
1999	Cunning and rozenblit	They are used requirements specifications for automatic test case generation. they generated automatic test case for the real time embedded system.
1999	Offutt	Define the criteria for generating test case which

		are based on the specification based tests.
2000	Huaikou, M. and L. Ling.	Using Z specification method.
2001	Tran	Test generation using model checking
2001	Rayadurgam, S. and M.P.E. Heimdahal	Using formal requirement models.
2002	Jia X. and H.Liu	Define different types of testing of web application.
2003	Jia X. and H.liu	Used the method of formal structured specification for web application testing.
2006	Antonio, P., P.Salas and B.K.Aichering	Present a mutation approach for OCL.
2006	Nilsson ,R.,J.Offutt and J.mellin	Using mutation based testing method
2007	Harman	The current state and future of search based software engineering.
2009	Shen ,X.Wang ,Q, Wang P and Zhou,B.	Presented automatic generation of test cases based on GATS.
2010	Object management group	Presented object constraint language specification
2010	Brucker ,A.D.Krieger, M.P; Longuet ,D.and WOLFFB.	presented specification based test case generation method for UML /OCL
2012	Cabot , J. ,and Gogolla, M.	A definitive guide formal methods for model driven engineering
2012	Elberzhager , F. Rosbach , A., Munch , J.and Eschbach, R.	Presented reducing test effort. A systematic mapping study on existing approaches.
2015	A.Jalila, D.J.Mala, M.Eswaran	Presented early identification of software defects using OCL predicates to improve software quality.

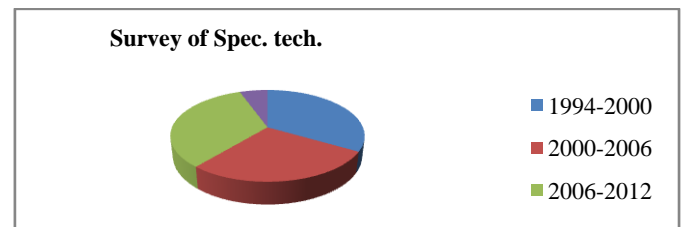


Figure3 .Survey of specification based technique.

3.2 Sketch Diagram Based Test Case Generation Technique

It is used to generate the test cases for the model diagram. Model diagram are such as UML, USE CASE diagram, UML state diagrams. This technique is used for traditional and web based application [17] [18] [19]. Many researchers have worked on this technique. Here we are giving brief review on this technique. [33] TO [44]

Table2.

YEAR	RESEARCHER NAME	RESEARCH FIELD
2000	Cavarra, A., C. Crichton, J. Davies, A. Hartman, T. Jeron and L. Mounier	Automatic test case generation with the help of UML.
2000	Kung, D.C, C.H. Liu, and P. Hsia	Presented a model that is object oriented for web application.
2000	Ryser, J. and M. Glinz	They presented a method for system test. And also derived the test case systematically.
2001	Heumann, J.	Presented a use case method for generating test cases.
2001	Ibrahim K. El-Far and James A. Whittaker	Presented MBT Method and also Include the FSM
2003	Manish Nilawar, Sergiu Dascalu	Explain unified modeling language and use this approach for testing the web application
2004	Anneliese A. Andrews, Jeff Offut Roger T. Alexander	Testing Web Applications by Modeling with FSMs.
2005	Avik Sinha, Carol Smidts	Present a technique which is model based and increase testing of domain specific.
2006	Santiago, V., A, S, M. DO-Amaral, N.L. vijay kumar, M.D.F. M. attiiello-Francisco, E. Martins and O.C. Lopes	Using state chart generate test case automatically.
2006	Shams, M., D. Krishnamurthy and B. Far	For testing the performance of web application they used model based approach.
2007	A.Z. Javed, P.A. Strooper, G.N. Watson.	Using model driven architecture for the automatic test case generation.
2008	Reza, H., ogaard, K. and Malge, A.	Use the state charts.

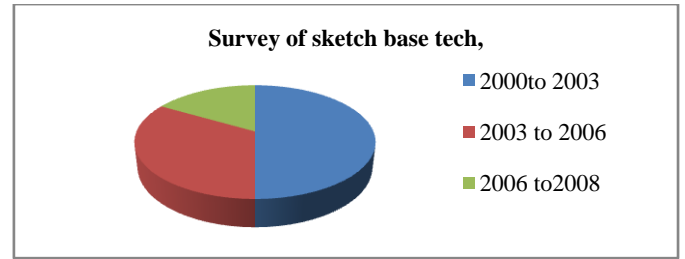


Figure4. Survey of sketch based technique.

3.3 Source Code Based Test Case Generation Technique

Source code based technique based on the control flow information. Control flow information is used to recognized (point out) a set of path to be covered and generated test cases for these path [20]. In this section we described test case generation technique (source code based) which is used by many researchers. [45] TO [51].

Table3.

YEAR	AUTHOR NAME	RESEARCH FIELD
1995	Avritzer, A And E. J Weyuker	Presented load test suites. And check the resulting software.
1990	Korel, B.	Automated software test data generation.
1999	Pargas, R.P, M J. Harrold and R.R Peck	Using genetic algorithms.
1999	Yang, J.T, J.L. Huang, F. J. Wang and W.C. Chu	Use CFG to create the web application.
1998	Neelam Gupta, Aditya P Mathur, Mary Lou Soffa	Using iterative relaxation methods generate the automated test cases.
2003	Beydeda and gruhn	Proposed an approach BINTEST Binary search based test case generation.
2008	D.A. Turner, M. Park ,J. Kim and J. Char	Presented activity oriented approach for testing web application

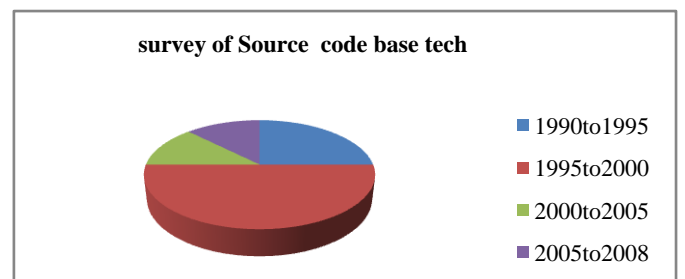


Figure5. Survey of source code base technique

4. CONCLUSION

This research paper is based on test case generation technique and systems. In this research paper we have described the techniques year wise. We have represented the techniques

with the help of pie chart. We have represented the brief literature survey of system. In this research paper we have represented the three techniques which are used to generate the test case generation.

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