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Agent-Based Regression Test Case Generation using Class Diagram, Use cases and Activity Diagram

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Abstract

In Regression testing, test case generation is a process of generating test cases from the existing test suite to ensure that modifications made in the system have not affected its existing functionality. The use of modeling based UML class diagram identifies changes at syntax level, whereas use cases and activity diagram identify changes at semantic level. In this research, we have used the combination of UML class diagram, use cases and activity diagram to identify changes at both syntax and semantics level. We compared UML class diagrams, use cases and activity diagrams of old and modified code to identify these changes. It is found that the use of UML class diagram, use cases and activity diagram results in better identification of changes and hence leads to efficient test case generation. Additionally, agents developed in Java Agent Development Environment are used to collect these changes from different stake holders in the distributed environment. The distribution of testing tasks among mobile agents reduces the average time required for generation of test cases in regression testing.

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Keywords:Regression Test case generation, Agent based testing

1. Introduction

Regression testing is one of the significant and expensive activities of software testing. It involves testing of modified code to ensure that the modifications applied to existing software have not affected its previous

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functionalities [13]. In order to achieve confidence, the complete modified software is required to be thoroughly tested but such a process becomes very time consuming and expensive. To reduce the testing cost, it is preferred to test the portion of system rather than the whole system. Several techniques for regression testing have been suggested by experts to identify changes in the software. Arora & Bhatia [1] conducted systematic review of existing approaches in agents oriented testing and regression testing. They recommended use of model based, formal specification, structural and functional techniques with agents. Arora and Bhatia [2] presented multi-agent based regression test case generation using model based UML class diagram, sequence diagram and formal specifications. Agents move in distributed environment to collect changes in the software to reduce effort and time required for regression testing. In this study, we are extending our work by incorporating agents to extract information from UML class diagram and activity diagram. In UML class diagram, we get only static aspects of specifications, whereas use cases and activity diagram provides behavioural information. Thus combining UML class diagram with use cases and activity diagrams may achieve better coverage of all the important aspects of specifications and lead to identification of syntactic and semantic changes. Multi-agents are used to gather information in the form of XML files and XMI files from different stakeholders' in the distributed environment.

2. Literature Survey

Researchers have suggested many techniques for model based test case generation using activity diagram and use cases. Hettab, *et al* [4] converted UML activity diagram into graph grammars to capture all the relevant features for test case generation. Wang et al. [5] proposed use case modeling to generate executable test cases from use case specifications by applying Natural Language Processing (NLP). Shirole *et al* [7] transformed activity diagram into Extended Control Flow Graphs (ECFG). Evolution algorithm with concurrent path coverage is used to generate paths in the activity diagram. We identified existing studies in UML activity diagram and use cases in regression testing and pointed them in Table 1.

Table 1: Regression testing techniques using UML Activity diagram and use cases

S. No	Technique Used	Research Gap
1.	Dahiya *et al*.[3] used UML class, sequence and activity diagrams for regression test case generation	Proposed approach lacks in identifying changes at distributed environment
2.	Sunitha [6] incorporated OCL into activity diagram for test case generation	Unable to identify complete behaviour and static changes
3.	Vincent *et al.* [8] represented use cases as state charts for test case generation	Lacks formal specifications and needs validation
4.	Ye *et al.* [9] used classification to select retestable and feedback-directed test cases using activity diagram	Unable to identify static changes at class level and use cases
5.	Chen [10] matched Java program traces with behaviour activity diagram to identify changes	Unable to indentify static changes
6.	Sapna & Mohanty [11] converted UML activity diagrams into tree structure to prioritize the scenarios by assigning weights to nodes and edges	Lacks in in-depth code coverage and unable to identify static changes
7.	Mingsong *et al.* [12] generated test cases from design specifications using UML activity diagrams	Lacks in in-depth code coverage and case study to validate the approach
8.	Gorthi *et al.*[13] changed behaviour and version number in activity diagram to generate test cases	Prototype model with retail system needs more case studies for validation