Ontology-based Unit Test-case Generation

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Introduction

A Test Generator System

**Test Oracle:** Specification of Unit Under Test

**Coverage Criteria:** Specification of what tests should be generated [2]

**Example:** Cover every transition pair

- **Test Oracle:** Specification of Unit Under Test
- **Coverage Criteria:** Specification of what tests should be generated [2]

**Test-case Generator**

Test Suite

Problem

Abstraction of test oracles [1]

Removal of knowledge about error-prone aspects of software [1]

Lack of control of test experts over generated test suite

Solution

The solution is to allow a test expert to:

1. Extend test oracle with their knowledge [1].
2. Define custom coverage criteria [1,3].

Test expert's control over the generated test suite:

- Identify test cases explicitly
- Choose coverage criteria rules
- Extend test oracle and Compose coverage criteria rules

Ontology based Testing

1. Generate Test Structures:
   - A test structure denotes the structure of a single test case.
   - Model the test oracle in an ontology and extend it with expert knowledge.
   - Define coverage criteria rules:
     - criteria for selection of test structure based on test oracle and expert knowledge -> structure of a test case
   - Generate test structures using reasoning.

2. Check Redundancy of a Test Structure:
   - Define redundancy checking rules:
     - specification of a test structure based on the test suite ontology -> existence of a test case
   - Use reasoning to identify existence of a test with a given test structure in a partially generated test suite ontology.

3. Generate Test-cases:
   - Generate test cases for a test structure that is not satisfied by the test suite and add it to the test suite ontology.

Ontology-based representation of test oracle is extensible and empowers test experts to use their knowledge and define custom coverage criteria to generate efficient test suites.

System Architecture

Test Expert

**Example:**

Cover every transition pair

Test Oracle:

Specification of Unit Under Test

Coverage Criteria:

Specification of what tests should be generated [2]

Test-case Generator

Test Suite

**Coverage Criteria:**

Coverage Criteria for selection of test structure based on test oracle and expert knowledge -> structure of a test case

**Test Structure Generator**

Test Writer

**OWL-DL**

- Ontology
  - Test Suite Model

**POSL**

- Rules
  - Test Structure Assessment Rules

**OOJREW**

- Reasoner
  - Test Structure Generator

**Test Structures**

- Selected Structures
- Test Case Description

**Concluding Remarks**

Ontology based representation of test oracle is extensible and empowers test experts to use their knowledge and define custom coverage criteria to generate efficient test suites.

**Bibliography**


For more information, please refer to our paper titled “Ontology-based unit test-case generation” in Proceedings of 2009 UNB CS Research Expo.

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