## Advancing UI Testing Techniques

### Context of the research activity

Testing of User Interfaces (UI) of modern typologies of applications consists in writing test cases that exercise the UI and allow performing end-to-end testing of the whole software in an automated way. Despite the presence of several mature frameworks for many different domains, UI tests show a limited adoption. This issue is mainly due to the significant effort needed in writing the test cases, and in the inherent fragility and difficulty in maintaining test suites. Additionally, most testing techniques are focused on the verification of non-graphical application data, and not on the verification of the actual appearance of the software under test as it is shown to the user. The usage of image recognition techniques to verify the visual appearance of the GUIs is still limited in both research and practice. Finally, modern ways of conveying user interactions (e.g., conversational, textual and vocal interfaces) are also scarcely tested with the aid of automated tooling.

The main objective of the proposed research plan is to devise and integrate new methodologies to perform effective, reproducible and robust testing through modern user interfaces.

### Objectives

The objectives of the research are:

1. **Identification of test fragilities**
   - This step is about the definition of techniques to detect the patterns that cause test fragility. A comprehensive taxonomy (O1.1) is the prerequisite. The automatic detection of fragilities (O1.2) can then be developed. A tool that can work as a plug-in of an IDE represents the main outcome.

2. **Definition of novel testing techniques**
   - The identification of the fragility-inducing patterns represents the basis also for a gap analysis of existing techniques (O2.1). Novel techniques should be defined (O2.2) typically by leveraging the relative strengths of existing ones and using novel techniques, e.g., computer vision to generate accurate tests of the actual graphical appearance of the GUI, or the usage of virtualization environments for the execution of test suites in a continuous integration/continuous development context.
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<th>Task</th>
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<tr>
<td>O3. Definition of test cases through modern user interfaces</td>
<td>Many software artifacts nowadays are provided with conversational (e.g., textual or vocal) interfaces. These interfaces provide a different paradigm of human-machine-interaction that require the definition of new testing methodologies, metrics and practices (O3.1) and the implementation of tools capable of enforcing them (O3.2).</td>
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| Skills and competencies for the development of the activity | Computer science, software engineering, experimentation |