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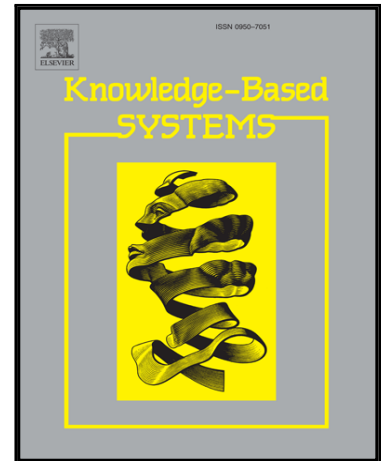
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Design pattern detection based on the graph theory

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Abstract

Design patterns are strategies for solving commonly occurring problems within a given context in software design. In the process of re-engineering, detection of design pattern instances from source codes can play a major role in understanding large and complex software systems. However, detecting design pattern instances is not always a straightforward task. In this paper, based on the graph theory, a new design pattern detection method is presented. The proposed detection process is subdivided into two sequential phases. In the first phase, we concern both the semantics and the syntax of the structural signature of patterns. To do so, the system under study and the patterns asked to be detected, are transformed into semantic graphs. Now, the initial problem is converted into the problem of finding matches in the system graph for the pattern graph. To reduce the exploration space, based on a predetermined set of criteria, the system graph is broken into the possible subsystem graphs. After applying a semantic matching algorithm and obtaining the candidate instances, by analyzing the behavioral signature of the patterns, in the second phase, final matches will be obtained. The performance of the suggested technique is evaluated on three open source systems regarding precision and recall metrics. The results demonstrate the high efficiency and accuracy of the proposed method.

Keywords: Design pattern detection, Pattern signature, Graph theory, Semantic graph

1. Introduction

Design patterns are the description of classes, objects, and relations between them that are customized to overcome a typical design issue in a particular context. In recent years, design patterns have attracted increasing attention in the software engineering research area and practice, as they encapsulate valuable knowledge, and influence the design quality heavily[1].

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