

# A survey on UML model smells detection techniques for software refactoring

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## Abstract

Bad smells tend to have a negative impact on software by degrading its quality. It is beneficial to detect model smells to avoid their propagation to later stages of software development. The objective of this paper is to present the state-of-the-art research on techniques for detecting UML model bad smells. The detection techniques are compared and evaluated using a proposed evaluation framework. The framework consists of two parts. The first part of the framework compares the techniques in terms of the implemented approach, the investigated model, and the explored model smells, while the experimental design is explored in the second part of the framework. We found that the detection of bad smells in class and sequence diagrams is accomplished via design patterns, software metrics, and predefined rules, while model smells in use cases are detected using metrics and predefined rules. We also found that the class diagram is the most investigated UML model in the context of model smell detection, whereas there is a lack of work on other UML models. In addition, there is a scarcity of independent studies on sequence diagrams. Furthermore, the studies investigating class diagrams are mostly validated, whereas use case diagrams and sequence diagrams are rarely validated.

## KEYWORDS

bad smell detection, maintainability, model bad smells, software refactoring