

Generalized Algorithmic Debugging and Testing

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This paper presents a method for semi-automatic bug localization, generalized algorithmic debugging, which has been integrated with the category partition method for functional testing. In this way the efficiency of the algorithmic debugging method for bug localization can be improved by using test specifications and test results. The long-range goal of this work is a semi-automatic debugging and testing system which can be used during large-scale program development of nontrivial programs.

The method is generally applicable to procedural languages and is not dependent on any ad hoc assumptions regarding the subject program. The original form of algorithmic debugging, introduced by Shapiro, was however limited to small Prolog programs without side-effects, but has later been generalized to concurrent logic programming languages. Another drawback of the original method is the large number of interactions with the user during bug localization.

To our knowledge, this is the first method which uses category partition testing to improve the bug localization properties of algorithmic debugging. The method can avoid irrelevant questions to the programmer by categorizing input parameters and then match these against test cases in the test database. Additionally, we use program slicing, a data flow analysis technique, to dynamically compute which parts of the program are relevant for the search, thus further improving bug localization.

We believe that this is the first generalization of algorithmic debugging for programs with side-effects written in imperative languages such as Pascal. These improvements together makes it more feasible to debug larger programs. However, additional improvements are needed to make it handle pointer-related side-effects and concurrent Pascal programs.

A prototype generalized algorithmic debugger for a Pascal subset without pointer side-effects and a test case generator for application programs in Pascal, C, dBase, and LOTUS have been implemented.

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Additional Key Words and Phrases: Algorithmic debugging, automated debugging, category partition testing, program slicing

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