

Data Mutation Testing Applied to a Modelling Tool

(Abstract)

Hong Zhu

Department of Computing, Oxford Brookes University, Oxford OX33 1HX, UK

Email: hzhu@brookes.ac.uk

Computer software is increasingly applied to processing data that are not only in large volumes but also in high complexity, which consist of elements connected in complicated ways. A typical example is software modelling tools whose valid inputs are diagrams that contain interconnected elements complying with the syntax rules and satisfying well-formedness and consistent constraints defined by a modelling language. Other well-known software systems with structurally complex input include compilers of textual programming languages, XML document processors, software for computer aided designs, etc. To test such a software system adequately, test cases must be generated with a huge number of combinations of the values of the elements and valid ways they can be interrelated. Manually preparing such test cases is tremendously labour-intensive, difficult and error-prone. The data mutation was thus proposed to address the test case generation problem for such systems [SZ06, SZ07]. It was inspired by mutation testing methods [DLS78, Ha77]. However, while traditional mutation testing is a method for measuring test adequacy, data mutation is a method of test case generation. In traditional mutation testing, mutation operators are used to inject faults to the program under test in order to determine if faulty programs can be detected by the test cases. In contrast, data mutation operators are applied on input data to generate a large number of test data from a few seed test cases.

The talk will describe the general principles of data mutation testing method. It is then applied to testing an automated modelling tool. Experiment data clearly demonstrate that test data generated by the method can be adequate and cost effective. It is capable to detect over 80% faults.

References

- [SZ07] Shan, L.; Zhu, H.: Generating Structurally Complex Test Cases by Data Mutation: A Case Study of Testing an Automated Modelling Tool. *The Computer Journal*. Available online as Advance Access, doi:10.1093/comjnl/bxm043, June 2007.
- [SZ06] Shan, L. and Zhu, H.: Testing Software Modelling Tools Using Data Mutation, In *Proc. of AST'06*. ACM Press, May 2006.
- [DLS78] DeMillo, R. A., Lipton, R. J. and Sayward, F. G.: Hints on Test Data Selection: Help for the Practising Programmer. *Computer* 11, 1978; pp. 34-41.
- [Ha77] Hamlet, R. G.: Testing programs with the aid of a compiler. *IEEE Transactions on Software Engineering* SE-3, 1977; pp. 279-290.