departamento de informática
FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

Report on the PhD Thesis of Hana Pluháčková

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The thesis submitted by Hana Pluháčková is very well written and easy to follow, and the language is precise and accurate. The document is organized in 6 chapters. The first Chapter motivates and presents the main contributions of the thesis. The next Chapter presents basic concepts relevant to the reader and also on some fundamental related work, which is then complemented by a section on related work in each of the following chapters. These following Chapters report on original work and scientific contribution of Hana, namely on the applications of genetic algorithms on noise based testing, on the use of data mining in testing concurrent programs, anf then another Chapter on prediction coverage of expensive metrics from cheaper ones. The sixth and last Chapter presents the conclusions.

The thesis addresses a very relevant and up-to-date theme in computer science: *how to improve the process of validating that a piece of concurrent software follows its specification without flaws*?

Concurrent software is known to be difficult to test due to the very large state-space. On the one hand, software testing approaches that systematically explore the state-space provide full coverage and, hence, high confidence on the correctness of the application, but frequently the time to run such validations are unbearable. On the other hand, naïve statistical-based software testing approaches tend no be non-effective both in terms of time and of covering the application state-space, redering such approaches of limited usefulness. Noise-based statistical testing approaches aim at compromising good coverage with acceptable execution times. Hanna advances the state of the art on this matter by studying and proposing techniques for finding the right set of noise and testing parameters.

In Chapter 3 Hana studies the use of genetic algorithms for this matter, departing from an existing single-objective genetic algorithm and advancing the state-of-the-art by proposing and evaluating the application of the NSGA-II multi-objective genetic algorithm to solving the TNCS problem.

In this Chapter Hanna demonstrates that the proposed approach based in the multi-objective genetic algorithm (MOGA) solves the degeneration problem found when using the single-objective genetic algorithm (SOGA), that although both have similar efficiency, the parameters proposed by MOGA tend to be more coverage effective and provide more stable results.

In Chapter 4 Hanna studies the use of data mining techniques to improve the process of noise-based testing of the given program, aiming at determining the most appropriate noise injection heuristics and their parameters, as well as the best paramenter values for the tested programs. this research lead to the development of a data mining method based on classification by means of decision trees and the AdaBoost algorithm combined with noise-based testing. The results show evidence of the usefulness of this combination in fully-automated noise-based testing.

In Chapter-5 Hanna addresses the maximization of the coverage achieved with noise-based testing by exploring correlations between (cheap and costly) metrics and noise settings, proposing an approach that allows to estimate the coverage of expensive metrics from the results obtained with cheap(er) metrics, hence positively impacting the overall cost of testing a concurrent application.

Hanna's scientific contributions reported in thesis were validated by the scientific community by way of her multiple publications, going from posters to papers in workshops and conferences, to articles in journals. The most relevant contributions were published in world-class venues (conferences and journals).

For all of the above, I understand that the doctoral thesis submitted by Hana Pluháčková evidences her deep knowledge and understanding of the matters she worked on, namely on improving and optimizing heuristics for noise-based testing, and it meets the requirements for awarding Hana Pluháčková the right to the public defense and, eventually, the PhD degree.

Assinado por : **João Manuel dos Santos Lourenço**
Num. de Identificação: BI06992100
Data: 2020.05.10 21:31:20 +0100

João Manuel dos Santos Lourenço, Prof.
NOVA School of Science and Technology
NOVA University Lisbon
Portugal
https://docentes.fct.unl.pt/joao-lourenco