TBat: A Novel Strategy for Minimization of T-Way Interaction Test Suite Based on the Particle Swarm Optimization and the Bat Algorithm

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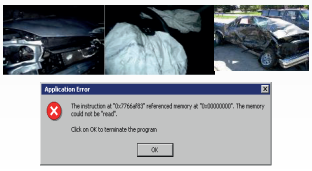
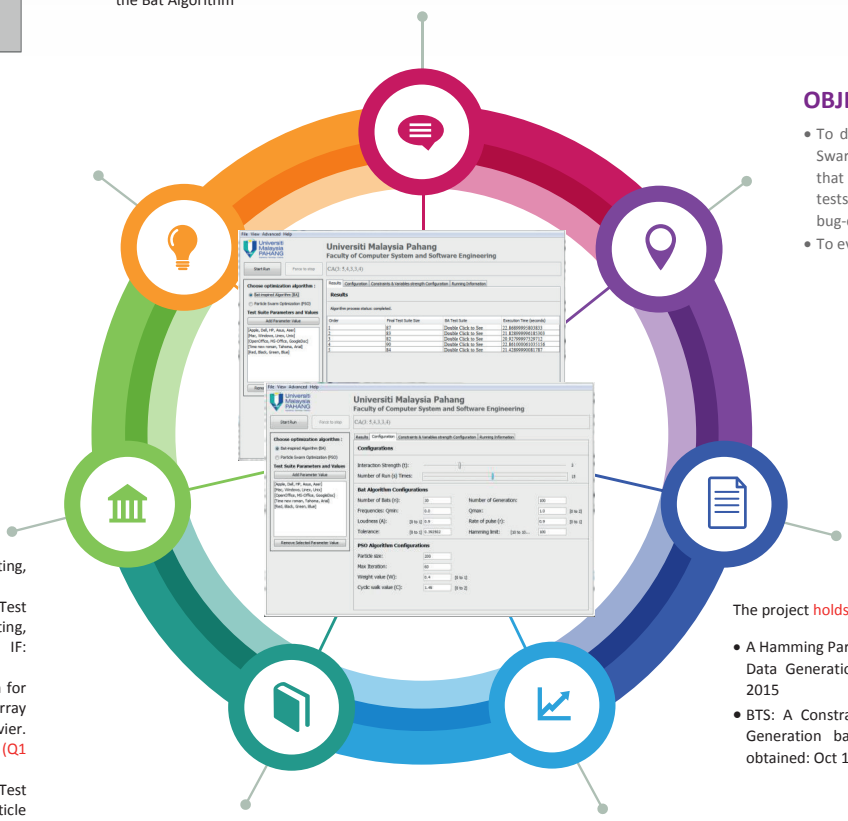


INTRODUCTION

Our continuing dependencies on software raise issues of reliability. Lack of testing can lead to disastrous consequences including loss of data, loss of fortunes as well as loss of lives. For these reasons, many combinations of possible input parameters, hardware/software environments, and system conditions need to be checked against for conformance based on the system's specification. Often, this results into combinatorial explosion of test cases. This project develops a novel strategy to minimize the test consideration using the Particle Swarm Optimization and the Bat Algorithm

BENEFITS

- TBat minimizes the tests required for assessing product conformance. In turn, TBat also minimizes the test costs.
- TBat can help prioritize tests that have more impact on the product under test.



OBJECTIVE

- To develop a strategy based on the Particle Swarm Optimization and the Bat Algorithm that is able to minimize and optimize the tests consideration without sacrificing the bug-detection capability
- To evaluate the effectiveness of the strategy

PUBLICATIONS

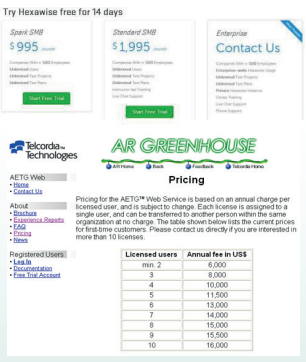
- Research Book: Combinatorial t-way Testing, UMP Publisher, 2015
- A Tabu Search Hyper-Heuristic for t-way Test Suite Generation, Applied Soft Computing, 44(2016), July 2016, pp. 57-74, Elsevier, IF: 2.679 (Q1 Journal)
- Application of Particle Swarm Optimization for Uniform and Variable Strength Covering Array Construction, Applied Soft Computing, Elsevier. 12(4), April 2012, pp. 1330-1347. iF: 2.679 (Q1 Journal)
- A Variable Strength Interaction T-Way Test Suites Generation Strategy Using Particle Swarm Optimization, Journal of Systems & Software 84, December 2011, pp. 271-285, Elsevier. IF: 1.4 (Q2 Journal)
- A Bat-inspired Strategy for T-Way Interaction Testing, Advanced Science Letters, vol. 21, no. 7, pp. 2281-2284(4), (Scopus Q3 Journal).

PATENT/COPYRIGHTS

The project holds two Malaysian Copyrights:

- A Hamming Particle Swarm Optimization based tway Test Data Generation Strategy. Copyright obtained: Oct 13 2015
- BTS: A Constraints Variable Strength t-way Test Suite Generation based on the Bat Algorithm. Copyright obtained: Oct 13, 2015

COMPETITORS



NOVELTY

- TBat is the first Bat and PSO based t-way strategy for t-way testing
- TBat integrates all forms of integration possibilities, hence, giving engineers flexibility to choose the sampling method.
- TBat outperforms many existing benchmarked experiments for t-way testing
- TBat implementation supports many operating system and platform

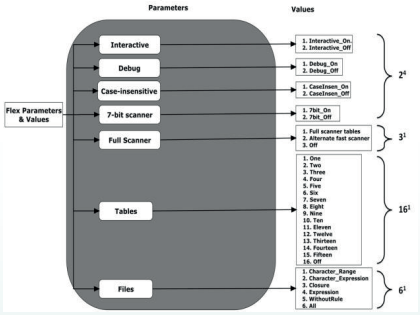
Sizes of the test suites used

2-way	3-way	4-way	5-way	6-way	Exhaust.
96	290	764	1708	2579	4608

TS/	f1	f2	f3	f4	f5	f6	f7	f8	f9	f10	f11	f12	f13	f14	f15	f16	f17	f18	%f. Cov.
2-way			✓	✓	✓		✓	✓	✓	✓			✓			✓	✓	✓	61.11 %
3-way	✓		✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	77.77 %
4-way	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	88.33 %
5-way	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	88.33 %
6-way	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	88.33 %
Exhaust.	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	88.33 %

RESULT/CASE STUDIES

- Testing of Flex v.2.4.7 from Software Infrastructure Repository (http://sir.unl.edu) with 8291 commented LOCs, containing 18 seeded faults can be manually turned on or off with CA (N; t, 2^4 3^1 16^1 6^1).



MARKETABILITY

- Received RM 80K Riyal @ USD 20K as on using TBAT for "Testing wireless sensor network" from Saudi Arabia

ACHIEVEMENTS

- MOSTI - eScienceFund Grants "Development of Constraint T-Way Testing Strategy with MCDC", RM 123,000 @ USD 40K.
- Gold Medal @ 14th International Conference and Exposition on Inventions by Institutions of Higher Learning 2015
- Gold Medal @ National University Carnival on Elearning 2015