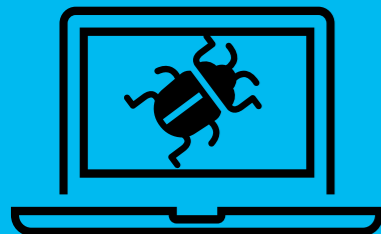# Can RVEA with DynaMOSA features perform well at generating test cases?
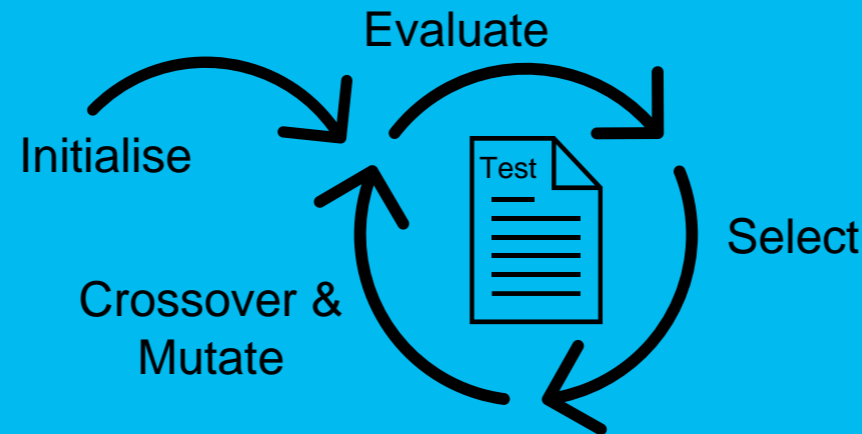
TUDelft

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1) Introduction

Developers claim that software testing is time-consuming [1]. So, researchers automated it.

Initialise → Evaluate → Select → Crossover & Mutate (cycle around Test)

DynaMOSA automatically generates test cases by evolving them using a Non-Dominated Genetic Algorithm II (NSGA-II) and test case generation knowledge. [3]
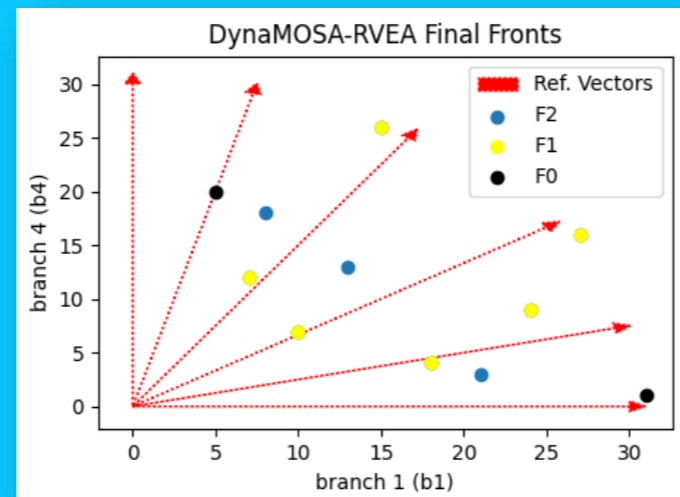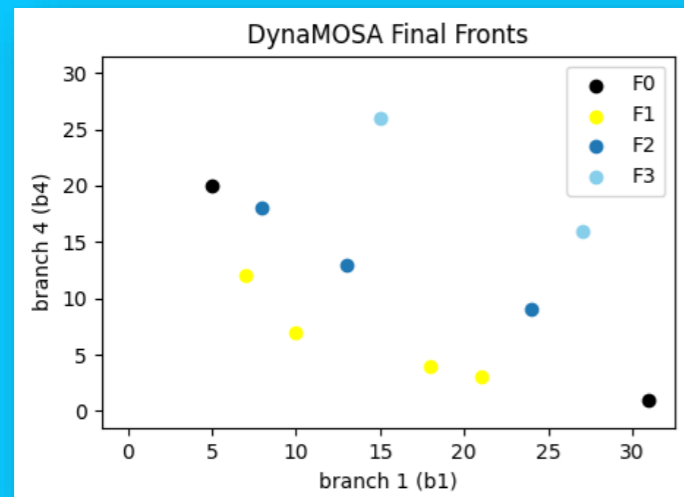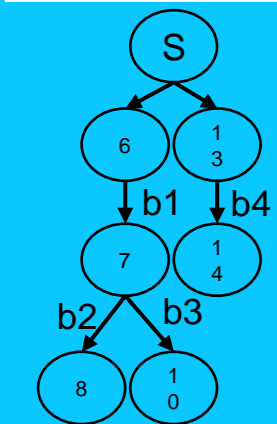
2) Knowledge Gap

What would happen if we changed NSGA-II in DynaMOSA to another evolutionary algorithm (EA)?
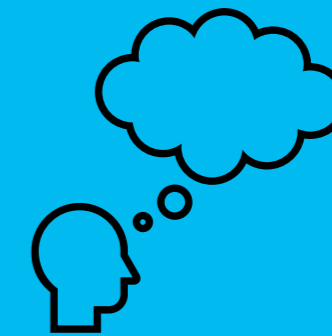
Let's see with a Reference Vector Guided Evolutionary Algorithm (RVEA) [2]

3) Approach

DynaMOSA Final Fronts

DynaMOSA-RVEA Final Fronts

Control dependency graph followed by graphs showing the assignment of individuals to different fronts. The Left is for DynaMOSA; the right is for DynaMOSA-RVEA.
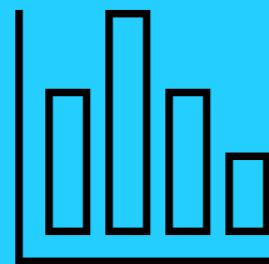
4) Study Design

- RVEA + domain knowledge = DynaMOSA-RVEA.

- Implement DynaMOSA-RVEA in SynTest and test on a SynTest-JavaScript-Benchmark consisting of 36 files (44 test units). SynTest

5) Results

Average Branch Coverage*
- RVEA: 48.93%
- DynaMOSA: 55.24%
- DynaMOSA-RVEA: 55.12%

Answer to RQ1: RVEA adapted for test case generation (DynaMOSA-RVEA) loses only once to DynaMOSA.

Answer to RQ2: Domain-specific knowledge of test case generation problem improves RVEA branch coverage in 15 files.

*Excluded some files because all algorithms had 0 branch coverage.

6) Conclusion & Future Work

- Domain-specific knowledge seems to help test case generation more than an EA.
- Could some subroutines of RVEA speed up DynaMOSA?
- To what extent does population diversity help with generating test cases?

7) References

[1] Maurizio Aniche. 2022. Effective Software Testing. Simon and Schuster
[2] R. Cheng, Y. Jin, M. Olhofer and B. Sendhoff, "A Reference Vector Guided Evolutionary Algorithm for Many-Objective Optimization," in IEEE Transactions on Evolutionary Computation, vol. 20, no. 5, pp. 773-791, Oct. 2016, doi: 10.1109/TEVC.2016.2519378.
[3] Annibale Panichella, Fitsum Meshesha Kifetew, and Paolo Tonella. 2018. Auto mated Test Case Generation as a Many-Objective Optimisation Problem with Dynamic Selection of the Targets. IEEE Transactions on Software Engineering 44, 2 (2018), 122–158. https://doi.org/10.1109/TSE.2017.2663435