

Testing JavaScript Programs with Pareto Corner Search Evolutionary Algorithm (PCSEA)



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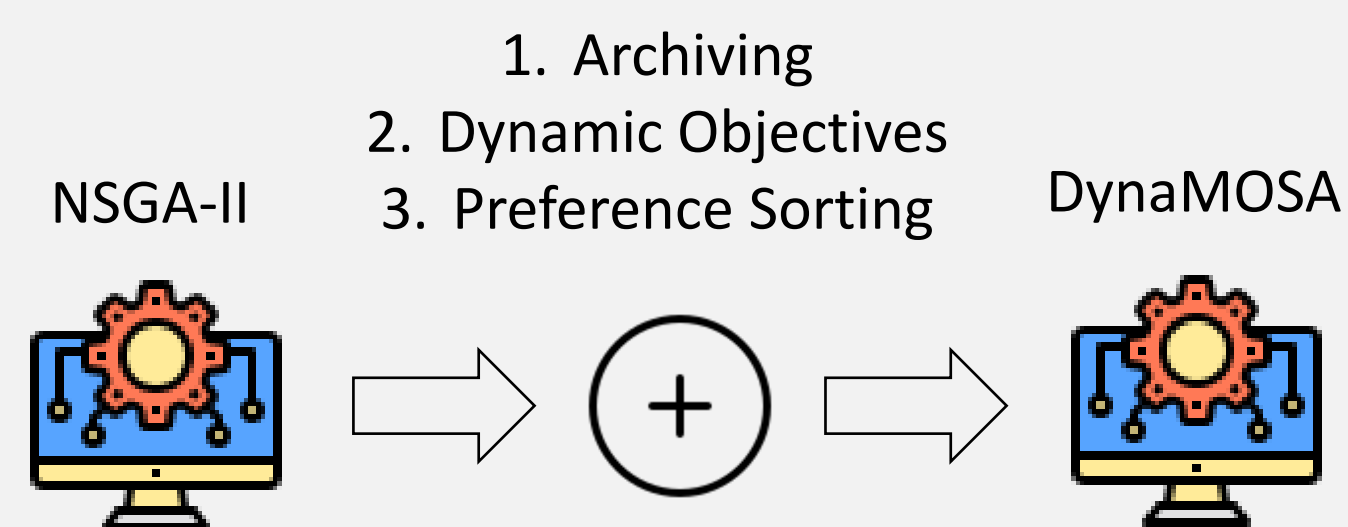
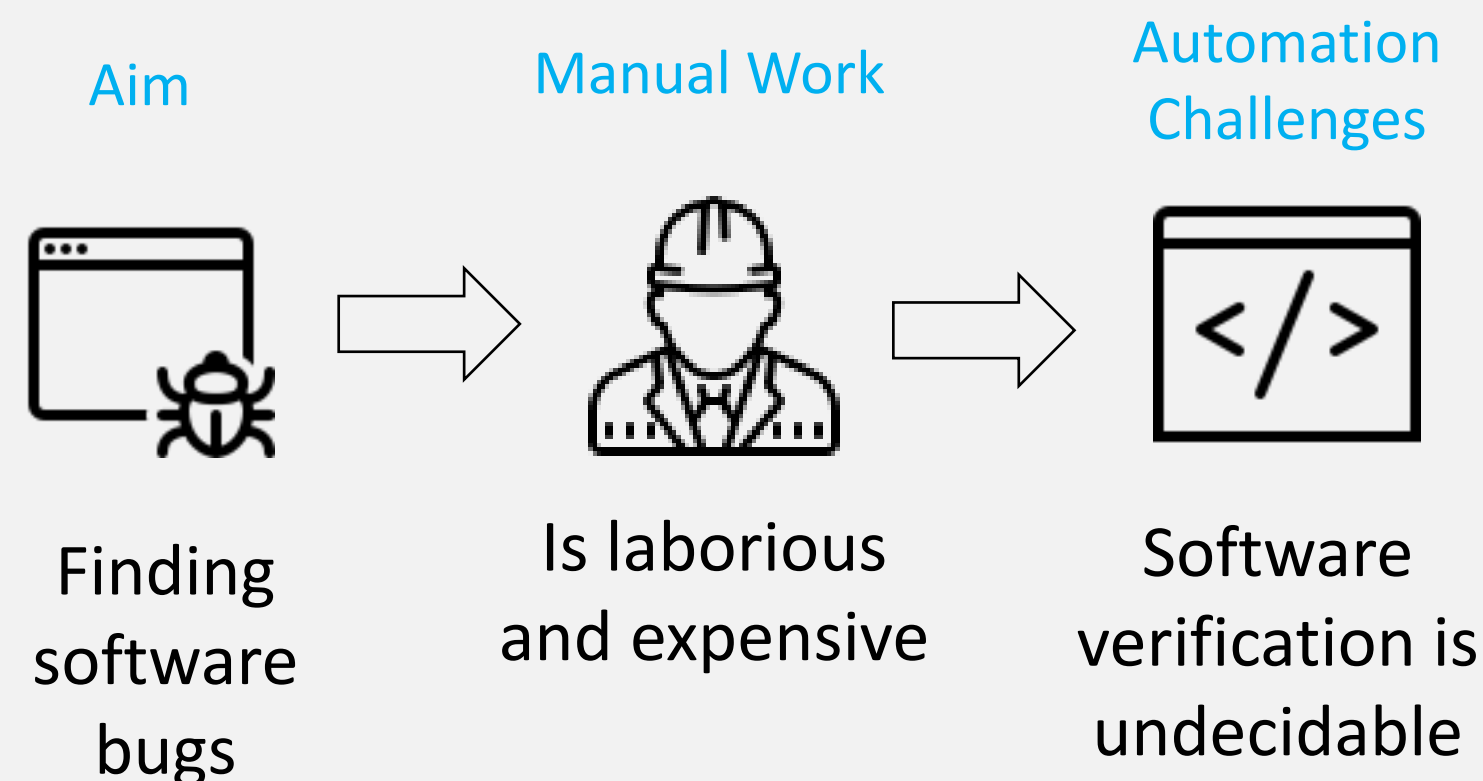
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1) Introduction

Software testing is a common practice to ensure reliability of software. Software testing is a non-trivial task, both for humans and computers.

NSGA-II is a well-studied evolutionary algorithm that struggles in generating tests.

DynaMOSA improves upon NSGA-II for generating good test cases.



4) Method



SynTest is a state-of-the-art tool for generating test suites for JavaScript Programs. We implemented Corner Search and Dynamic Corner Search into the SynTest Framework.

SynTest JavaScript Benchmark is a diverse corpus of JavaScript files, collected from popular npm packages. We used these files to measure the branch coverages achieved by DynaMOSA, Corner Search, and Dynamic Corner Search.



- Commander.js
- Express
- JS Algorithms
- Lodash

5) Results

We measured the branch coverages achieved by each algorithm on the benchmark files, and we compared them for each benchmark file.

Dynamic Corner Search	#Win	#Tie	#Lose
vs. DynaMOSA	-	36	-
vs. Corner Search	2	33	1

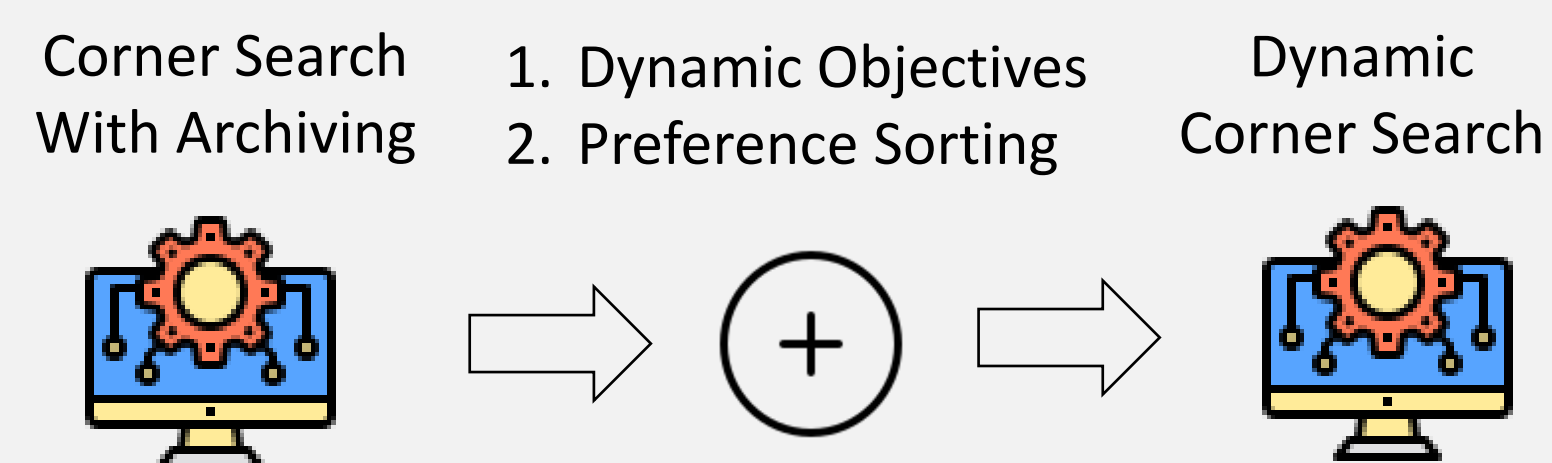
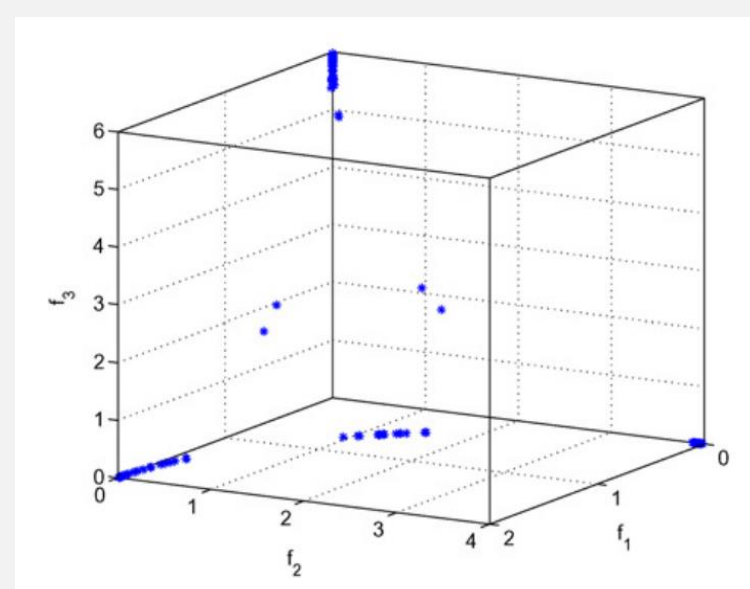
Mean branch coverages:

1. DynaMOSA: 39.8%
2. Dynamic Corner Search: 38.8%
3. Corner Search: 37.9%

2) Approach

Pareto Corner Search Evolutionary Algorithm (PCSEA), or Corner Search is an algorithm that finds corner solutions.

DynaMOSAPCSEA, or Dynamic Corner Search for short, is a novel algorithm we created by adding DynaMOSA heuristics into PCSEA.



3) Research Questions



RQ1: How do Corner Search and Dynamic Corner Search perform compared to each other with regards to branch coverage?



RQ2: How does Dynamic Corner Search perform compared to DynaMOSA with regards to branch coverage?

6) Conclusion and Future Work

From our results we conclude that:

1. Corner Search is a feasible algorithm (similar performance to DynaMOSA)
2. Dynamic Corner Search is a feasible algorithm
3. DynaMOSA heuristics impacted Corner Search's performance minimally.
4. Automatic test case generation is still in its infancy.

Some interesting future work include:

1. Using a different distance metric for PCSEA, because Euclidian distance loses meaning in high dimensions².
2. Implementing DynaMOSA's preference criterion in a different way.
3. Investigating the performances of the algorithms for different search budgets.

1: H. K. Singh, A. Isaacs and T. Ray, "A Pareto Corner Search Evolutionary Algorithm and Dimensionality Reduction in Many-Objective Optimization Problems," in IEEE Transactions on Evolutionary Computation, vol. 15, no. 4, pp. 539-556, Aug. 2011, doi: 10.1109/TEVC.2010.2093579.

2: Aggarwal, C.C., Hinneburg, A., Keim, D.A. (2001). On the Surprising Behavior of Distance Metrics in High Dimensional Space. In: Van den Bussche, J., Vianu, V. (eds) Database Theory — ICDT 2001. ICDT 2001. Lecture Notes in Computer Science, vol 1973. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-44503-X_27