

## Introduction

- Why automatic test generation?
  - Software testing is essential for assuring the software systems' quality.
  - Testing is an effort-intensive task and requires a significant time budget.
  - The testing produced by the software developers is usually ineffective.
- What is EvoSuite?
  - State-of-the-art tool for automatic generation of unit test cases in Java.
  - Produces various test suites based on the selection of coverage criteria.
  - Allows investigation of its performance on many popular open-source projects.
- Combining Branch coverage and Output diversity as coverage criteria?
  - Branch coverage criterion in EvoSuite achieves the best results among all possible fitness functions. Output diversity is a promising new black-box testing criterion.

## Research question

When and how does Output Diversity affect the number of bugs detected when combined with branch coverage?

## Conclusion

- Class metrics correlate with the performance of the different coverage criteria used in EvoSuite; especially CBO, LCOM\* and LOC.
- Branch + Output coverage criterion performs better than the Branch coverage criteria in terms of fault detection and achieves almost identical branch coverage.
- We can argue that the performance of the various coverage criteria correlates with the complexity of the classes under test.
- Increasing the time budget from 1 to 3 minutes increases the performance of all fitness functions. After the third minute, the increase becomes minimal and even can have a negative effect when combining many different coverage criteria.

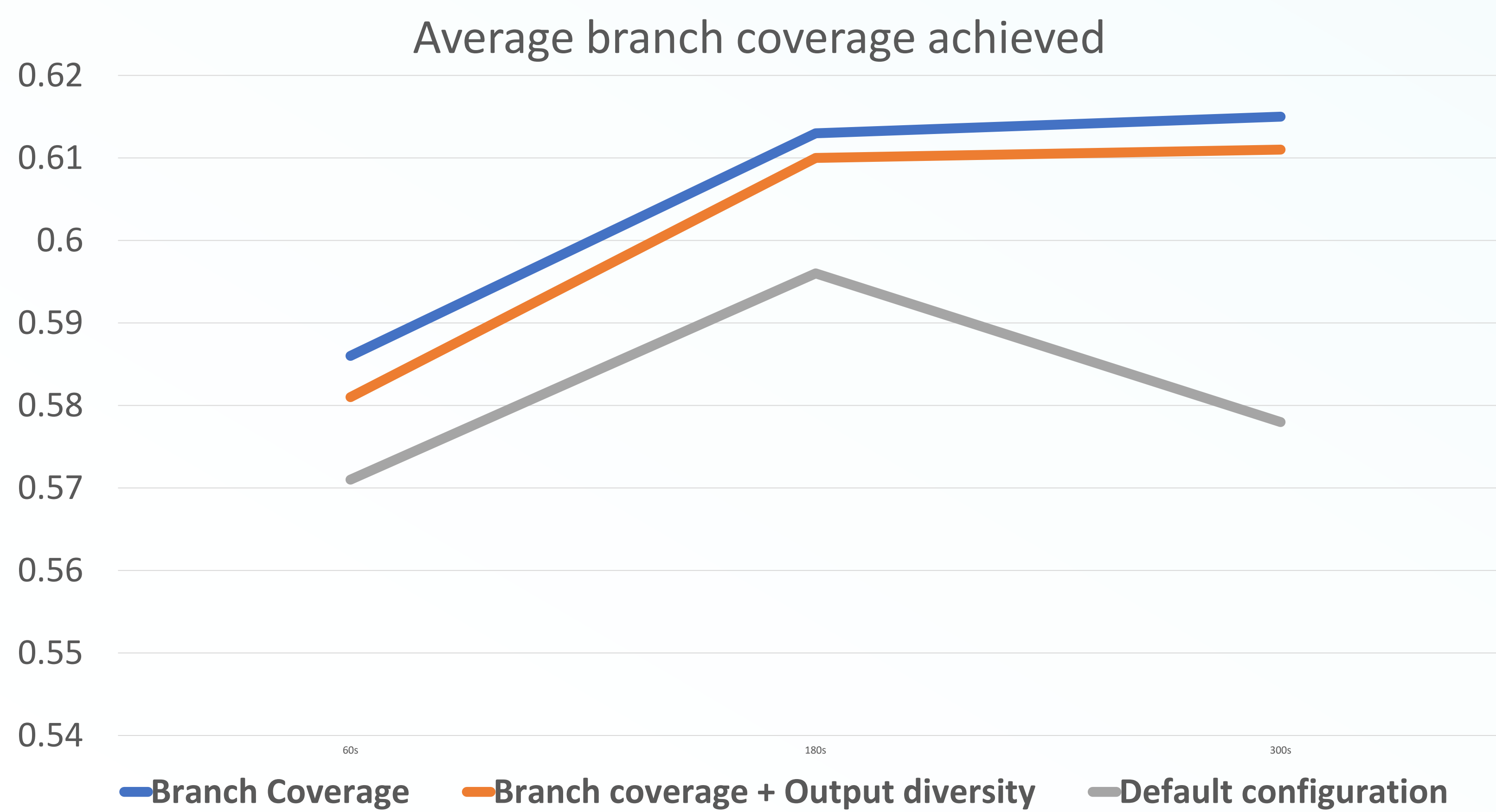


Figure 3: Average branch coverage for 60s, 180 and 300s

## Methodology

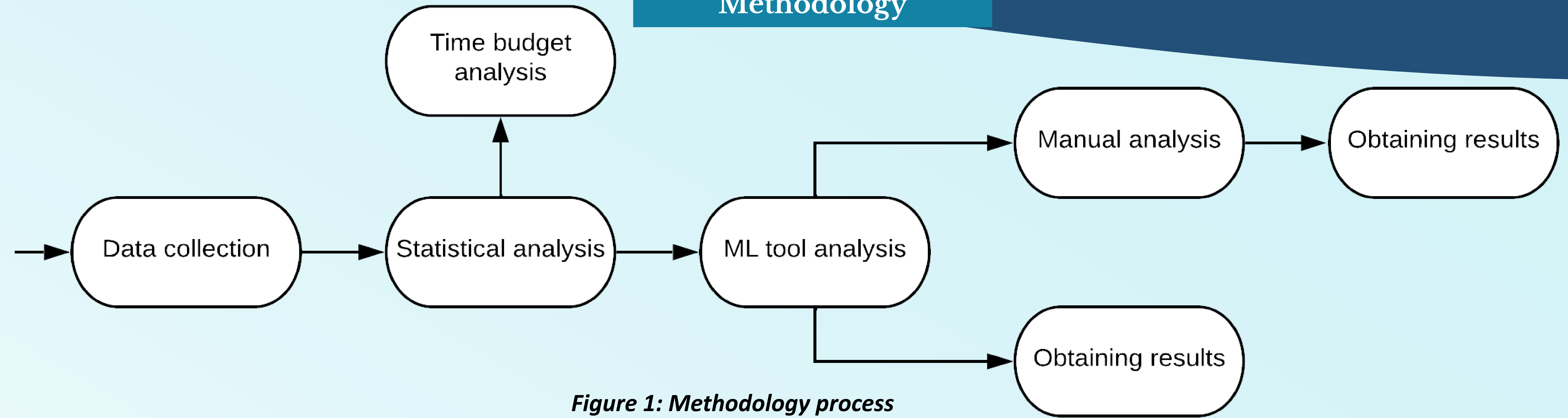


Figure 1: Methodology process

Feature selection - 18 configurations; Outlier removal - 5 configurations; Data Balancing - 14 configurations; Classifiers – 733 configurations

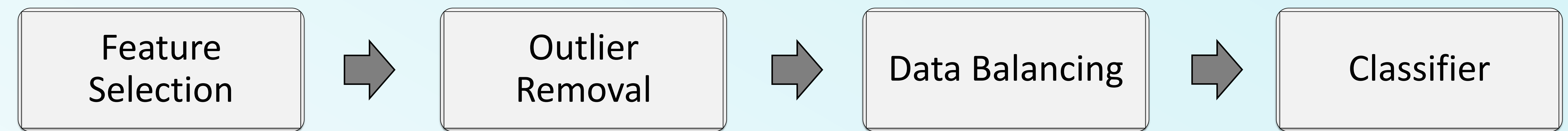


Figure 2: Data analysis tool pipeline

## Results

Table 1: Statistical significance test

| Dataset                      | All classes | Classes with significant difference |
|------------------------------|-------------|-------------------------------------|
| BO/BC – branch coverage 60s  | 346         | 33                                  |
| BO/DC – branch coverage 60s  | 346         | 60                                  |
| BO/BC – branch coverage 180s | 346         | 25                                  |
| BO/DC – branch coverage 180s | 346         | 73                                  |
| BO/BC – branch coverage 300s | 346         | 24                                  |
| BO/DC – branch coverage 300s | 346         | 70                                  |
| BO/BC – mutation score 60s   | 346         | 81                                  |
| BO/DC - mutation score 60s   | 346         | 98                                  |

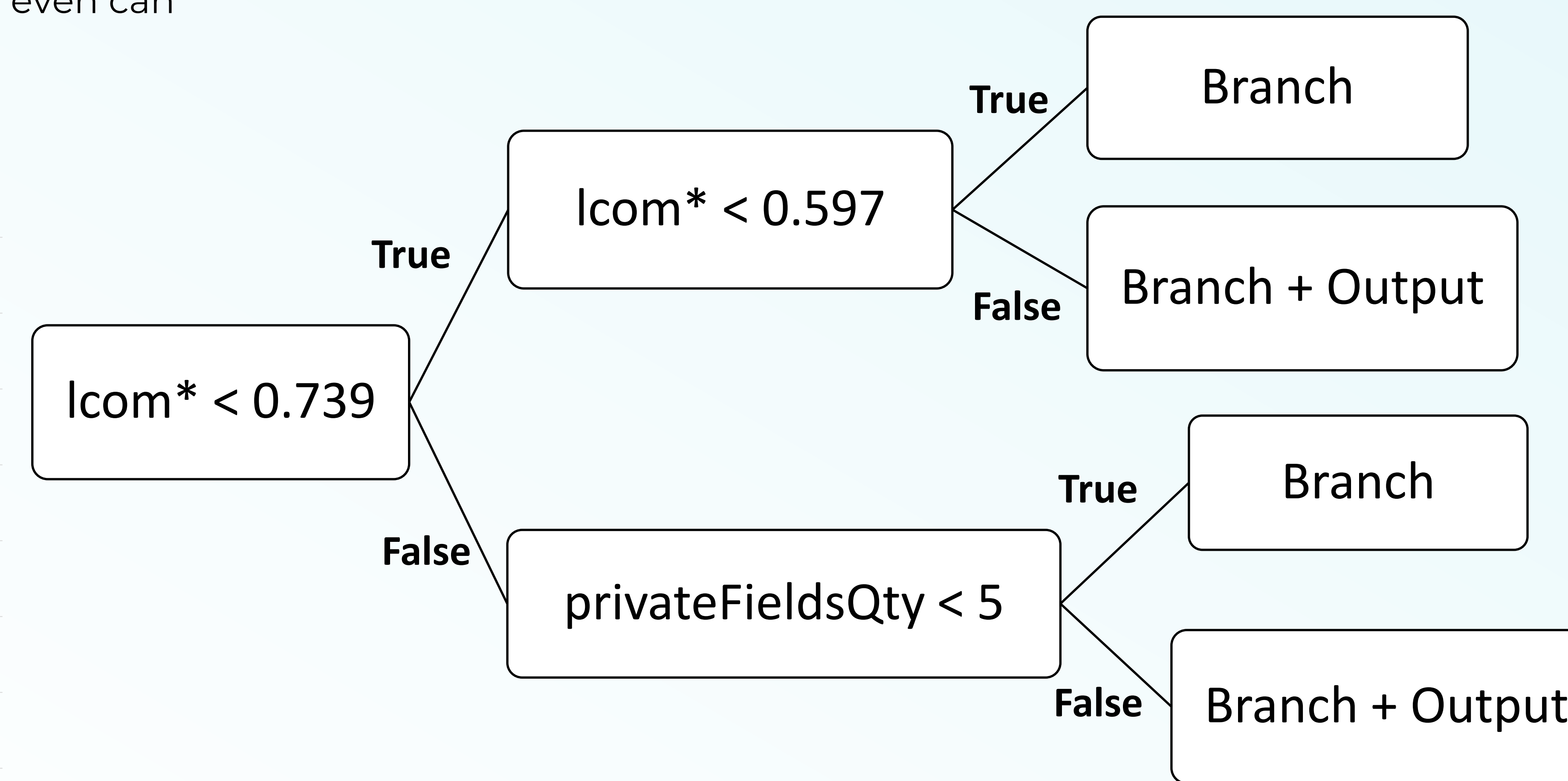


Figure 4: Decision tree for the comparison of Branch + Output coverage and Branch coverage fitness functions, in terms of branch coverage – 60s