The University Of Sheffield.

Automated Search For "Good" Coverage Criteria

Position Paper

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Coverage Criteria:
The “OK”, The Bad and The Ugly

The “OK”

- Divide up system into things to test
- Useful to generate tests on if no functional model exists
- Indicates what parts of the system are and aren’t tested

The Bad

- Not based on anything to do with faults, not even:
  - Fault histories
  - Fault taxonomies
  - Common faults

The Ugly

- Studies disagree as to which criteria are best

- Coverage or test suite size?

The Key Question of this Talk

Can we evolve "good" coverage criteria?

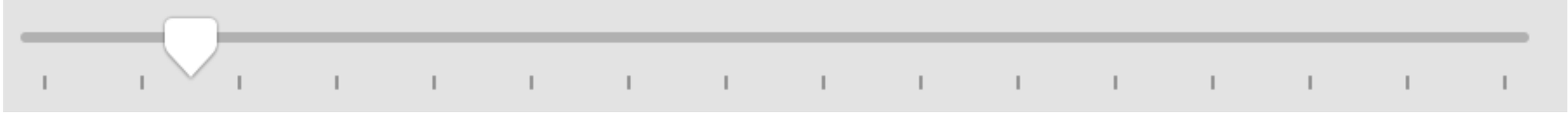
Coverage criteria that are better correlated with *fault revelation*?

Why This Might Work

- The best criterion might actually be a mix and match of aspects existing criteria
    - For example “cover the top *n* longest d-u paths, and then any remaining uncovered branches”
- Or…

Maybe this is One Big Empirical Study using SBSE

… which aspects of which criteria and how much



What About Including Aspects Not Incorporated into Existing Criteria

Non functional aspects

- For example timing behaviour, memory usage
  - “Cover all branches using as much memory as possible”

Fault histories

- “Maximize basis path coverage in classes with the longest fault histories”

“Isn’t This Just Mutation Testing?”

Our criteria are more like *generalised strategies*

- Potentially more insightful to the nature of faults
- Cheaper to apply
  (coverage is generally easier to obtain than a 100% mutation score)

Perhaps different strategies will work best for different types of software, or different teams of software developers

How This Might Work

Fault Database

Need examples of real faults

- Defects4J
- CoREBench
- … or, just use mutation

Fitness Function

"Goodness" is correlation between greater coverage and greater fault revelation

- Needs test suites to establish

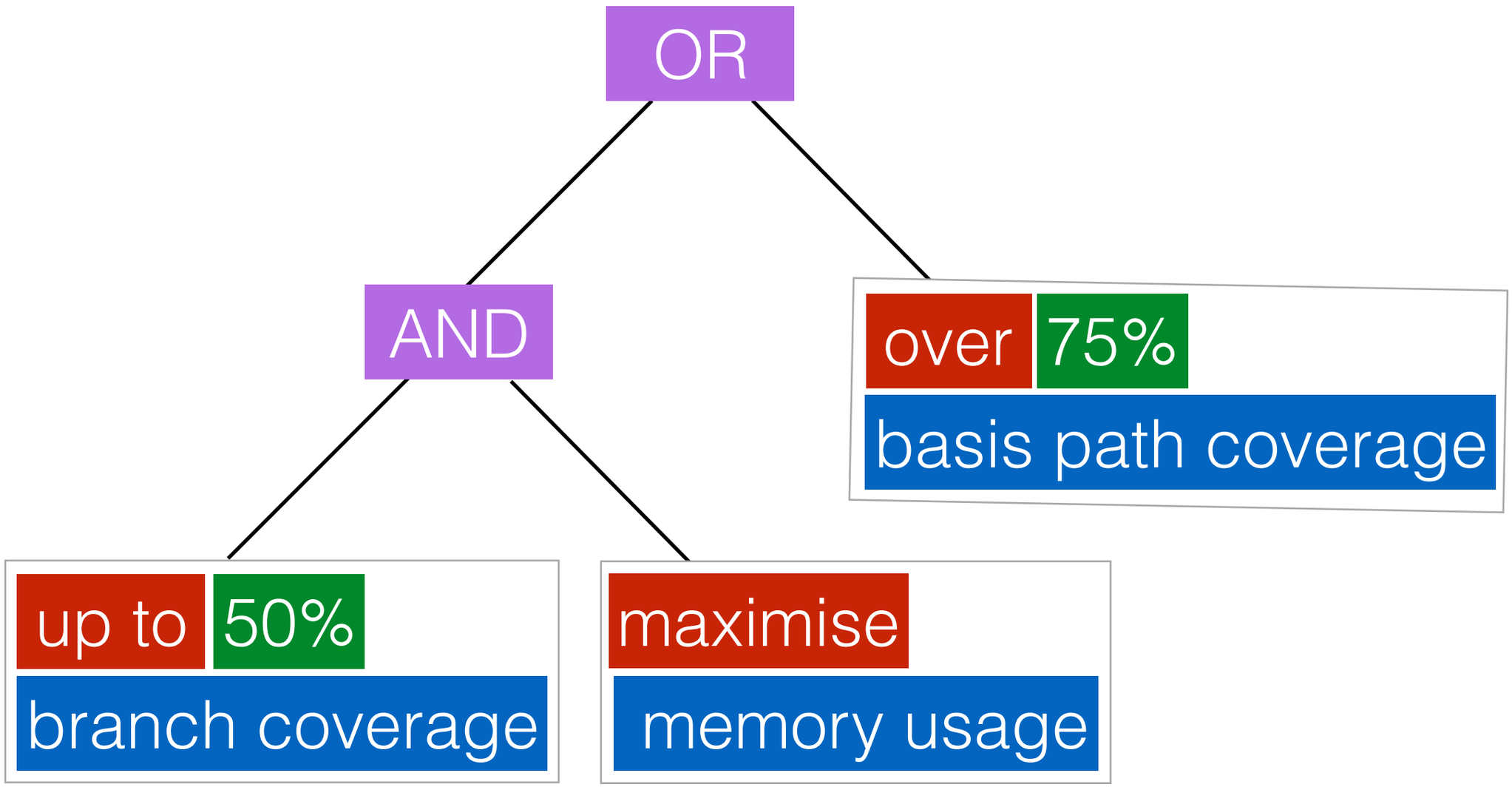
Generation of Test Suites

At least two possibilities

- Generate up front universe of test suites
- Generate specific test suites with the aim of achieving specific coverage levels of the criteria under evaluation (drawback: expensive)

Search Representation

GP Trees



Handling Bloat

GP techniques classically involve “bloat”

- Consequence: generated criteria may not be very succinct

- Various techniques could be applied to simplify the criteria, e.g. delta debugging

Overfitting

The evolved criteria may not generalise beyond the systems studied and the faults seeded

- May not be a disadvantage:
  - insights into classes of system
  - faults made by particular developers
- … apply traditional techniques from machines learning to combat overfitting.

Summary

Our Position:

SBSE can be used to automatically evolve coverage criteria that are well correlated with fault revelation

Over to the audience:

Is it feasible that we could do this?