Motivation

Quality software?
Motivation

Regression Test Suite

\[ T = \langle t_1, t_2, \ldots, t_n \rangle \]
Motivation

Regression Test Suite

\[ T = \left\langle t_1, t_2, \ldots, t_n \right\rangle \]
Motivation

Pass

Fail
Motivation

- Pass
- Fail
Motivation

Pass

Fail
Motivation

Use testing to assess quality?
Motivation

Trivial test suite?
Background

Mutation Testing!
Mutation Testing

Original

Mutant
Mutation Testing

Original

Mutant
Mutation Testing

\[ a > b \]
Mutation Testing

Relational Operator Replacement (ROR)

a > b
Mutation Testing

- $a > b$

Relational Operator Replacement (ROR)

- $a \geq b$
- $a \leq b$
- $a == b$
- $a != b$
Mutation Testing

Alive

Killed
Mutation Testing

- Alive
- Killed
Mutation Testing

Alone

Killed
Mutation Testing

\[ MS_T = \frac{\text{Killed}}{\text{Total}} \]
Mutation Testing

$$MST_T = \frac{\text{Killed}}{\text{Total}}$$
Mutation Testing

\[ MS_T = \frac{\text{Killed}}{\text{Total}} \]
Mutation Testing

\[ MS_T = \frac{\text{Killed}}{\text{Total}} \]

\[ MS_T \in [0, 1] \]
Mutation Testing

\[ MS_T = \frac{\text{Killed}}{\text{Total}} \]

\[ MS_T \in [0, 1] \]

HIB
Mutation Testing

Silver Bullet?
Mutation Testing

Limitations
Mutation Testing

\[ T = \langle t_1, t_2, \ldots, t_n \rangle \]

Weak
Strong
Redundant
Mutation Testing

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Mutation Testing

Still . . .
Mutation Testing

Still ... limitations
Mutation Testing
Mutation Testing

Understand system intricacies
Mutation Testing

Understand system intricacies
Mutation Testing

Retrospective

Mutant

Reduction
Mutation Testing
Retrospective
Mutant
Reduction
mrstudyr
mrstudyr

mccurdyc/mrstudyr

Data
mrstudyryr

Data  Reduce  Remove
Input

Database
Schema Mutants
Demonstration

Demonstration!

Play
Motivation

Random Sampling
## Output

<table>
<thead>
<tr>
<th>Percent</th>
<th>Correlation</th>
<th>MAE</th>
<th>RMSE</th>
</tr>
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Conclusion

Program Quality
Conclusion

Program Quality

Regression Test Suite
Conclusion

Program Quality

Regression Test Suite

Mutation Testing
Conclusion

Program Quality

Regression Test Suite

Mutation Testing

Reduction Techniques
Conclusion

Program Quality

Regression Test Suite

Mutation Testing

Reduction Techniques

mrstudyr
Conclusion

Reduced
Conclusion

Reduced 10%
Conclusion

Reduced 10%