

The Evolution of Extant Software

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Outline

Introduction

- Software as an Evolved System

Software Mutational Robustness

- Empirical Evaluation

- Diversity and Proactive Bug Repair

Program Repair

- Fixing Bugs for \$8 a Bug

- Embedded Repair

- NETGEAR Repair

Program Optimization

Future Work

- Heterologous Crossover

- Evaluation Extensions

Conclusion

Main Points

Extant Software is

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1. Evolved

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2. Mutationally Robust

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1. Evolved
2. Mutationally Robust
3. Amenable to Genetic Programming (GP)

Main Points

Extant Software is

1. Evolved
2. Mutationally Robust
3. Amenable to Genetic Programming (GP)
 - ▶ automated diversity and proactive bug repair
 - ▶ automated bug repair
 - ▶ defects in off the shelf software
 - ▶ bug repair in embedded systems
 - ▶ security exploits in stripped binaries
 - ▶ automated optimization

Software is an Evolved System

- ▶ 50 years of development
- ▶ **TODO**: example; robust → flourish
- ▶ **TODO**: example; brittle → perish
- ▶ developer are agents of mutation, reproduction, selection
- ▶ copy paste coding

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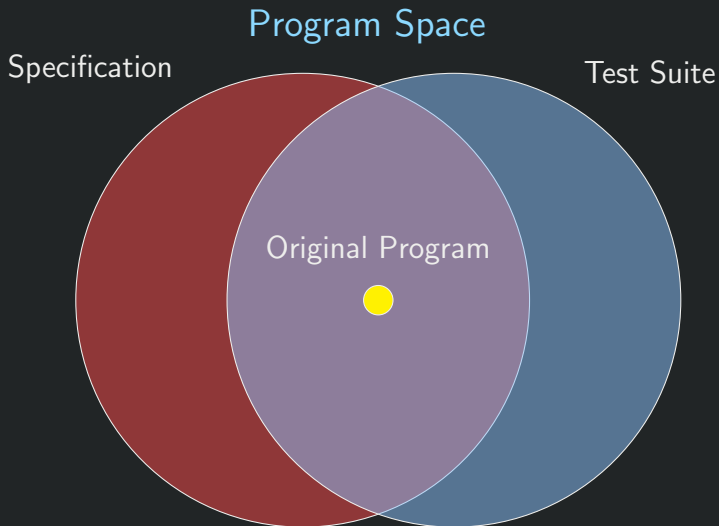
Software Mutational Robustness

Definition

P	program
T	test suite
M	mutation operators

$$MutRB(P, T, M) = \frac{|\{P' \mid m \in M. P' \leftarrow m(P) \wedge T(P')\}|}{|\{P' \mid m \in M. P' \leftarrow m(P)\}|}$$

Software Mutational Robustness



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Questions?

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BACKUP SLIDES

Reproducible Research

Physical Evolutionary Computation