“Robustness is the degree to which a system or component can function correctly in the presence of invalid inputs or stressful environmental conditions.”

Flavours of Robustness

Software Mutational Robustness
Flavours of Robustness

Software Mutational Robustness

Correctness attraction
Flavours of Robustness

Software Mutational Robustness

Correctness attraction

Failed error propagation

Antifragile software

Coincidental correctness

Code plasticity

Other..
Failed Disruption Propagation
Failed Disruption Propagation

Specification

Implementation

disruption
program
chop

state at source
state at sink

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Failed Disruption Propagation

Observed property: identity $\alpha$

$$\alpha(t) = \alpha(t') = t = t'$$
“Robustness is the degree to which a system or component can function correctly in the presence of invalid inputs or stressful environmental conditions.”

Failed Disruption Propagation

In Defects4J automated program repair benchmark:

Failed Disruption Propagation is prevalent

[Assi et al., 2019]

Failed Disruption Propagation is negligible

[Jahangirova et al., 2020]
Entropy

Entropy is a statistic of a probability distribution that measures how disordered the distribution is.

A, B : random variables

Entropy:

\[ H(A) = - \sum_{x \in A} p(x) \log(p(x)) \]

Entropy loss (Conditional entropy):

\[ H(A \mid B) = H(A) - H(B) \]
Entropy Loss Region

- Program
- Code region where failed disruption propagation occurs
- Execution path
- Robust region
- Entropy loss region
- Observation point
- Inputs
- Outputs

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Prospects

Model for Failed Disruption Propagation unifies differently named phenomena for software robustness

Entropy-based predictive model for Failed Disruption Propagation:

- can help software testers find failed error propagation

- can help find robust regions for code improvement

- other..

“HyperGI: Automated Detection and Repair of Information Flow Leakage” by Mesecan et al. [ASE-NIER, 2021]