Test Case Selection Strategies IV

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Contents

- Adaptive Random Testing (ART)

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Random Testing

A popular and important test case selection method

- Advantages
- Disadvantages

3

Random Testing (continued)

- Advantages
  - Intuitively simple
  - Allows statistical quantitative estimation of the software's reliability
- Disadvantage
  - Ineffective (not using any information to guide the selection of test cases)

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Random Testing (continued)

- With replacement
  - Previously selected inputs could be selected again
- Without replacement
  - Previously selected inputs could not be selected again

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How to improve random testing?

- Any common information or characteristics to all faulty programs?

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How to improve random testing? (continued)

- Any common information or characteristics to all faulty programs?

failure-causing inputs

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Patterns of Failure-Causing Inputs

- Strip Pattern
- Block Pattern
- Point Pattern

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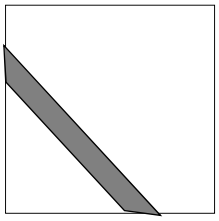
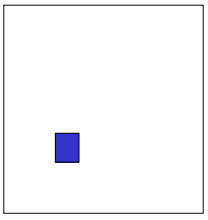
Types of Failure Patterns

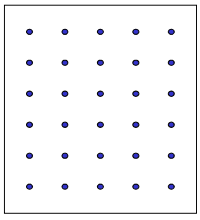
Strip Pattern



Block Pattern



Point Pattern



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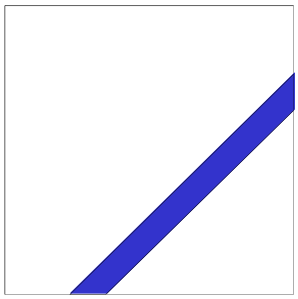
Strip Pattern

Two Dimensional Input Domain



```
If (2*x – y > 10)
/* the correct statement is
 If (2*x – y > 20) */
   z = x/2 *y;
else
   z := x*y;
```

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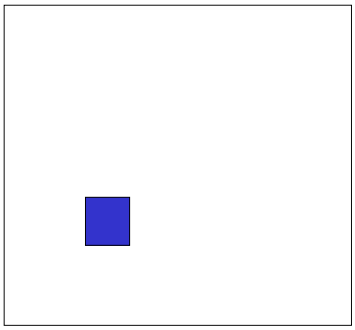
Block Pattern

Two Dimensional Input Domain



```
If (x >= 4 and x <=6)
   and
   (y >= 4 and y <= 6)
    z := x + y;
/* the correct statement is
   z := x - y; */
else
    z := 100;
```

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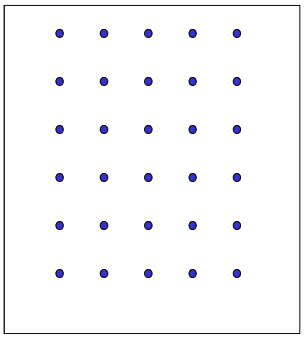
Point Pattern

Two Dimensional Input Domain



```
If ((x mod 10) = 0)
    and
   ((y mod 10) = 0)
    and
   ( x > 2) then
    z:= f(x, y);
/* should be
   z:=  g(x,y); */
else
    z := f(x, y);
```

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Which pattern occurs more frequently?

block and strip patterns

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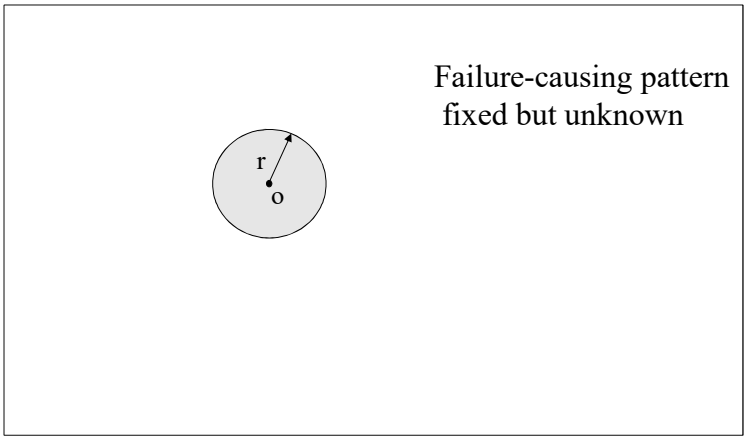
Intuition of ART



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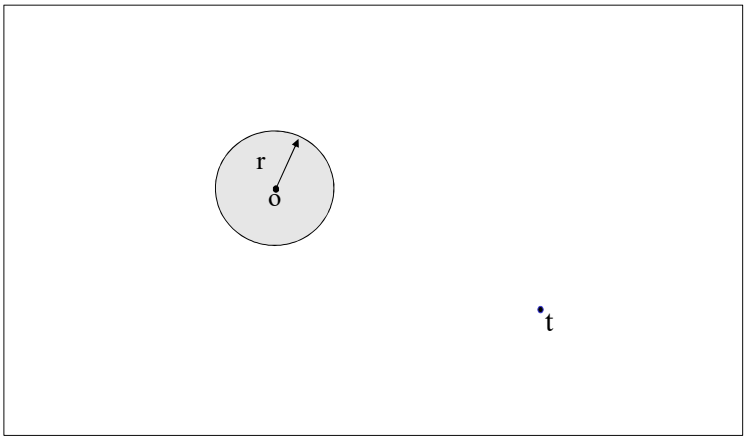
Intuition of ART



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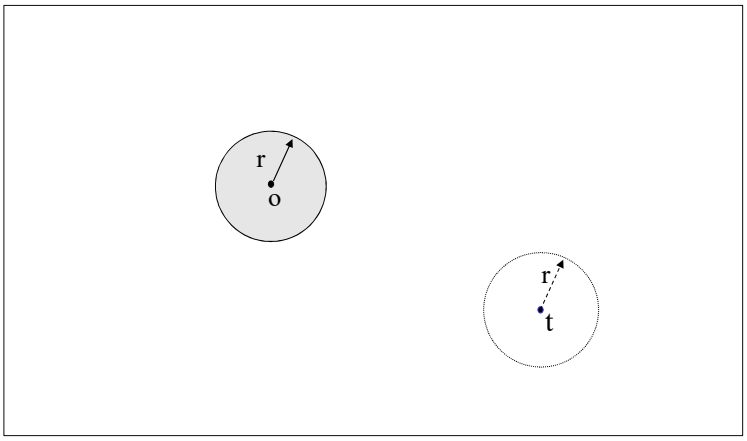
Intuition of ART



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Adaptive Random Testing

for non-point failure patterns –

an even spread of random test cases will enhance the fault detection capabilities

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Fixed-Size-Candidate-Set ART

- Generate a fixed size set of random candidates
- For each candidate, find its nearest already executed test case
- Select the candidate with the greatest distance to its nearest already executed test case, as the next test case

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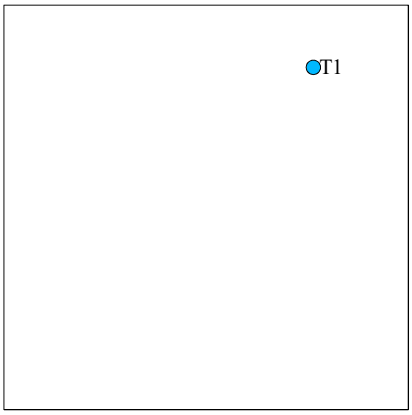
FSCS-ART



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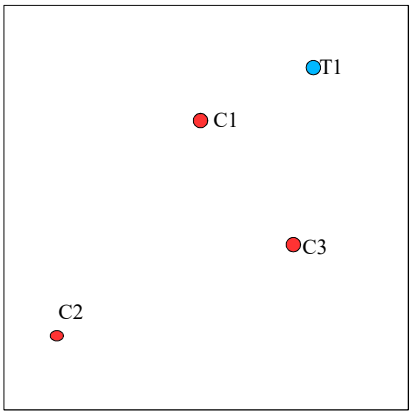
FSCS-ART



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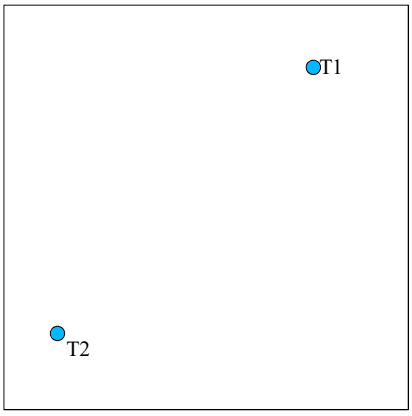

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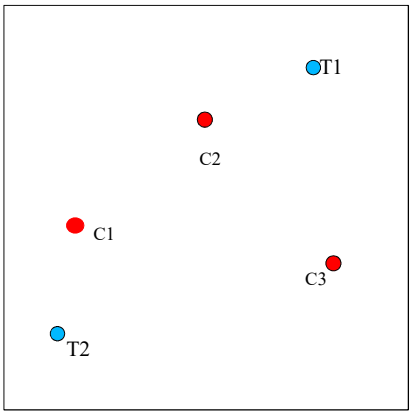

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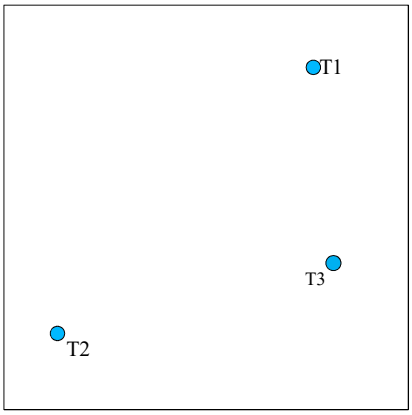

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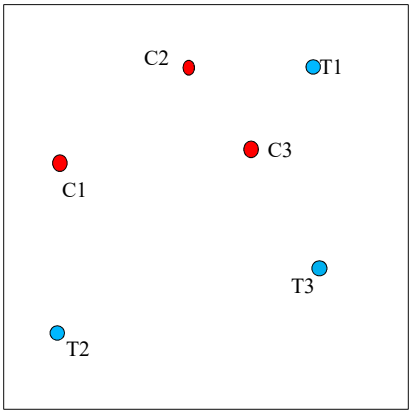

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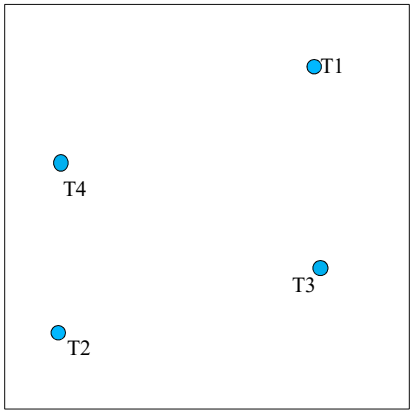
FSCS-ART



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Summary

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References

- R. Huang, W. Sun, Y. Xu, H. Chen, D. Towey and X. Xia, A Survey on Adaptive Random Testing, IEEE Transactions on Software Engineering, in press.
- Z. Zhang, Y. Wang, Z. Wang and J. Qian, How to Effectively Reduce Tens of Millions of Tests: An Industrial Case Study on Adaptive Random Testing, IEEE Transactions on Reliability, Vol..68(4), 1429-1443, 2019.

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