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Search-Based Fault Localization

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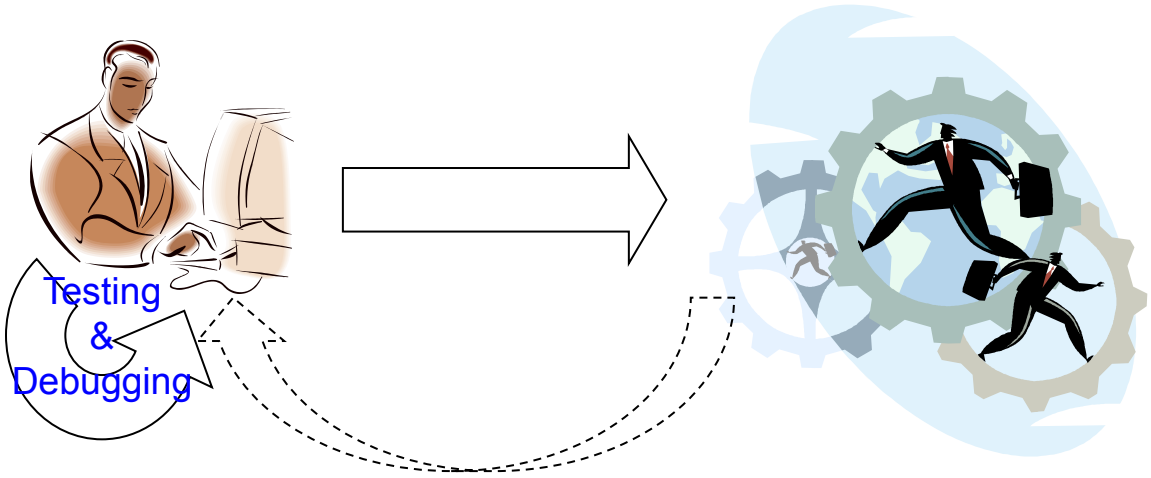
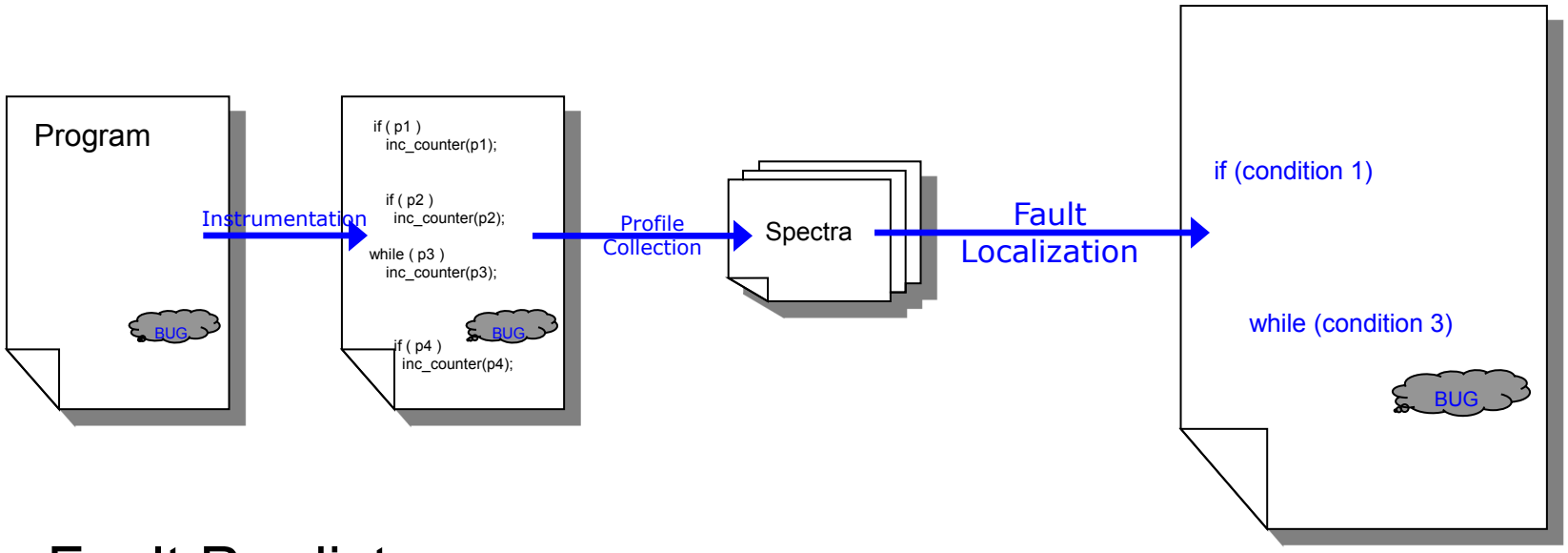
Automated Debugging

- In-house during development
- Post-deployment in the field



Spectrum-Based Fault Localization



- Fault Predictors
  - Which program elements are more likely related with failures

Fault Localization Measures
(Lucia et al, ICSM 2010)

Tarantula (Jones et al., ASE 2005)
Ochiai (Abreu et al., TAICPART-MUTATION 2007)

Association Measures		Association Measures	
1	Coefficient	11	Conviction
2	Odd Ratio	12	Interest
3	Yule's Q	13	Cosine
4	Yule 's Y	14	Piatetsky-Shapiro
5	Kappa	15	Certainty Factor
6	J-Measure	16	Added Value
7	Gini Index	17	Collective Strength
8	Support	18	Jaccard
9	Confidence	19	Klosgen
10	Laplace	20	Information Gain

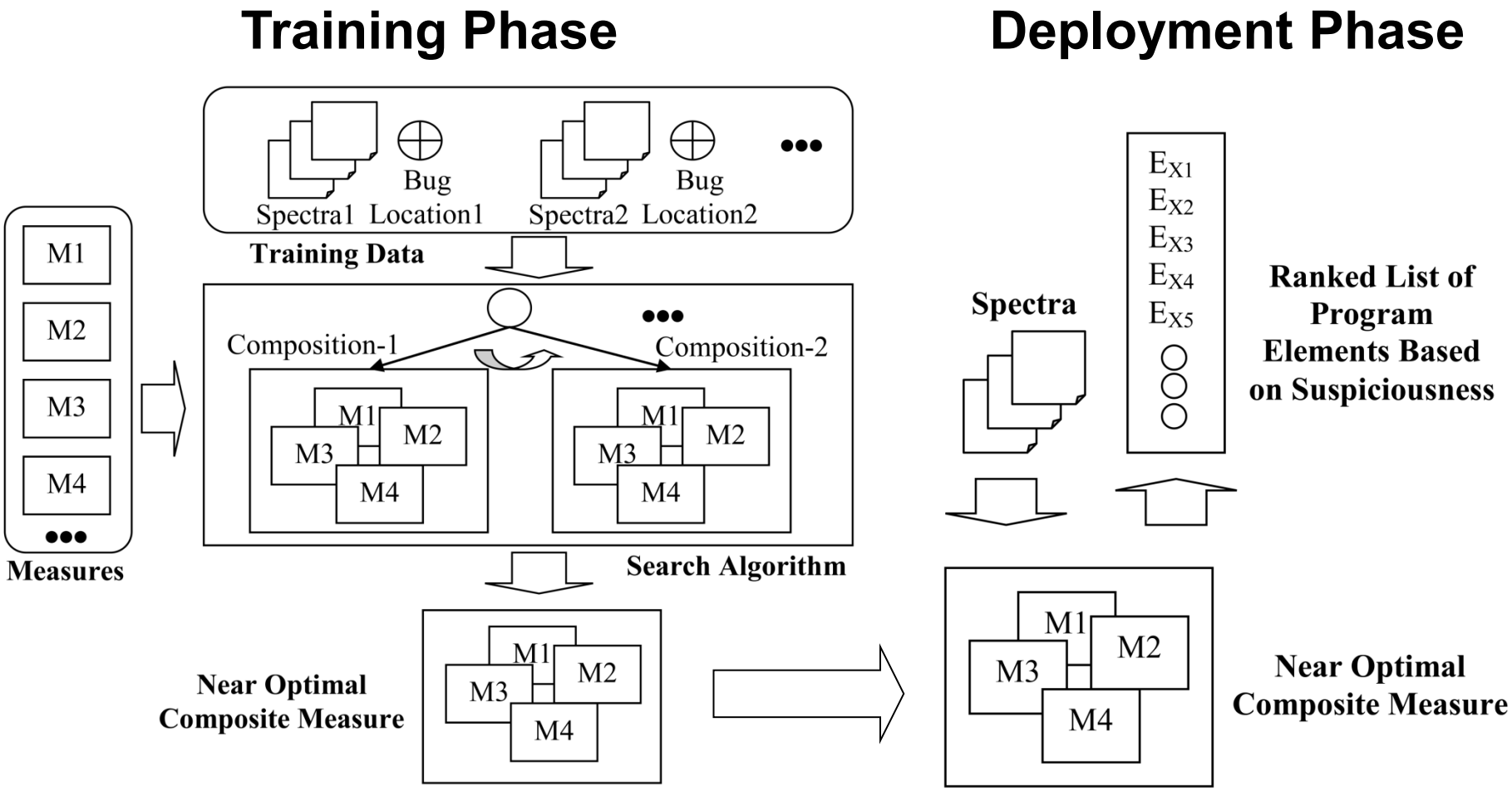
Composite Fault Localization (1/2)

- Linear composition to construct a composite model that can outperform individual comprising techniques

$$M_{Composite}(e) = w_1 \times M_1(e) + w_2 \times M_2(e) + \ldots + w_{22} \times M_{22}(e)$$

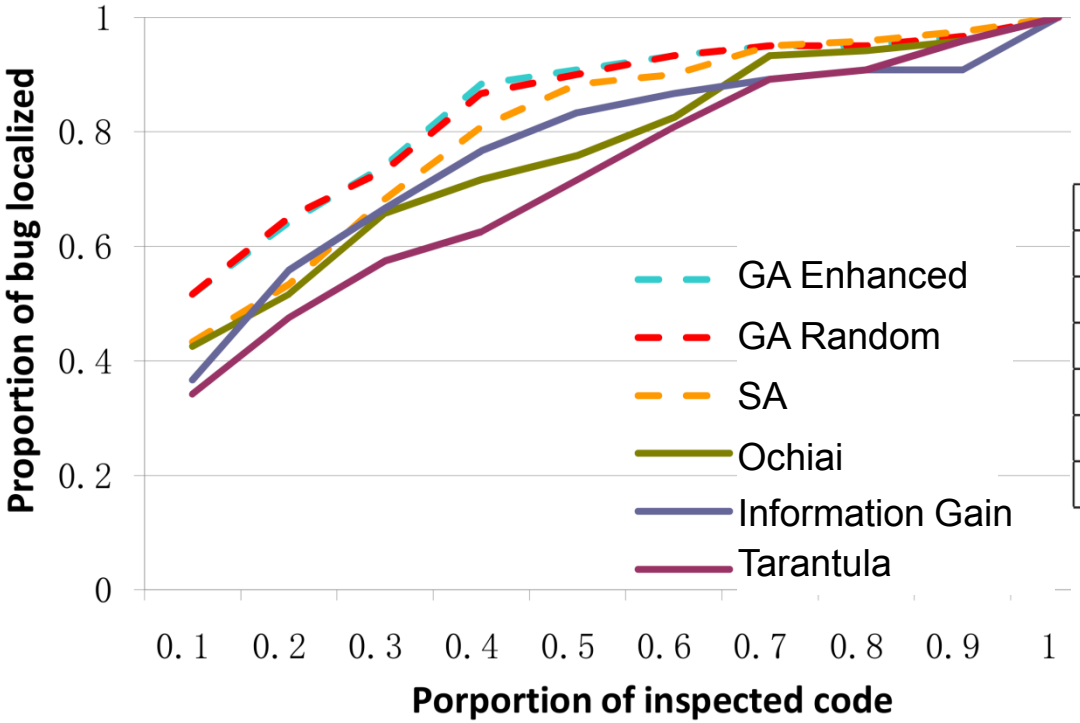
- Search algorithms to look for optimal weights in the linear model
  - Genetic algorithms
  - Simulated annealing

Composite Fault Localization (2/2)



Empirical Evaluation

- On the Siemens test suite
  - http://www.cc.gatech.edu/aristotle/Tools/subjects/



Techniques	Mean	Standard Dev.
$GA_{Enhanced}$	20.0%	23.2%
GA_{Random}	20.0%	23.4%
SA	23.6%	24.2%
Ochiai	27.6%	27.9%
Information Gain	27.7%	28.6%
Tarantula	31.8%	29.1%

Conclusion

- A *search-based, composite* fault localization technique that can consistently outperform individual techniques

Thank you!

Questions?

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