What a Long, Strange Trip It´s Been*: Past, Present and Future Perspectives on Software Testing Research

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Abstract. Over the past 25 years the Brazilian Symposium on Software Engineering (SBES) has evolved to become the most important event on software engineering in Brazil. Throughout these years, SBES has gathered a large body of studies in software testing. Aimed at providing an insightful understanding of what has already been published in such event, we synthesized its rich 25-year history of research on software testing. Using information drawn from this overview we attempted to highlight which types of study have been the most applied for conveying software testing efforts. We also devised a co-authorship network to obtain a bird's-eye view of which research groups and scholars have been the most prolific ones. Moreover, by performing a citation analysis of the selected studies we set out to ascertain the importance of SBES in a wider scenario. Finally, borne out by the information extracted from the studies, we shed some light on the state-of-the-art of software testing in Brazil and provide an outlook on its foreseeable future.

Systematic Mapping Process

Mapping studies follow a fivefold process:

(i) definition of research questions
(ii) conducting the search for primary studies
(iii) screening of papers
(iv) keywording of abstracts, and
(v) data extraction and mapping

RQ1: which test techniques have been most investigated?

RQ2: who are the most prolific researchers (i.e., who are the main researchers according to the number and relevance of contributions)?

RQ3: what are the sorts of studies (e.g., empirical studies and experience reports) that have been published?

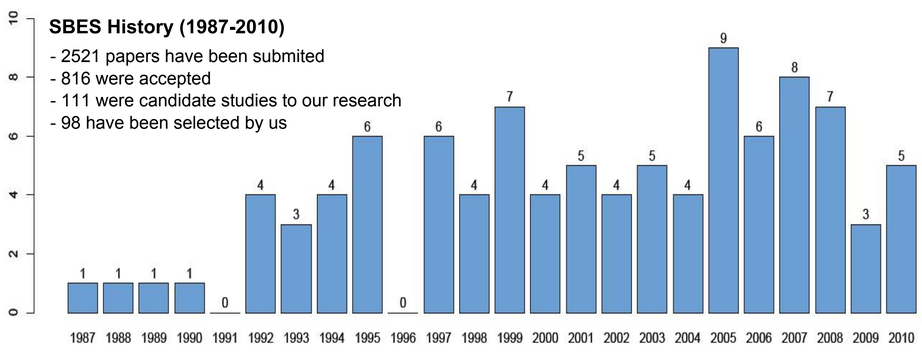
Inclusion criteria

– Any paper that described one or more study regarding software testing was subjected to be included.

Exclusion criteria

– Papers that do not present studies related to software testing (e.g., papers describing research on any of the other SE topics) were excluded.

– Papers that report on insightful proposals for prospective software testing research but do not apply it to define a test-related technology (e.g., oracle, process, and technique) were excluded.



Classification According to Study Type

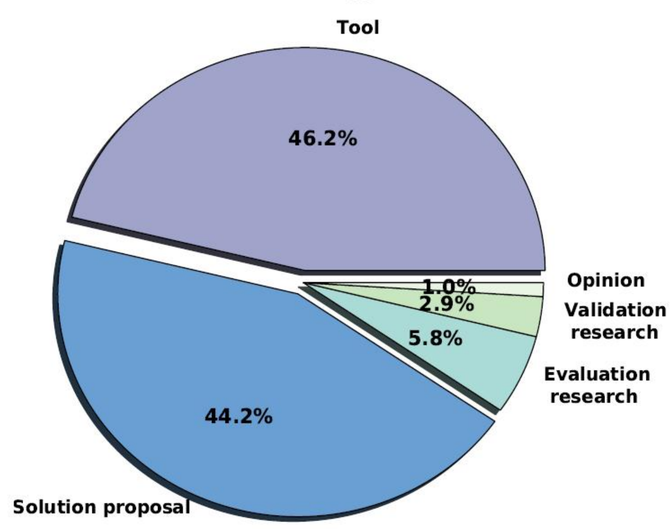
Solution proposal: studies that report on a solution technique and argues for its usefulness, effectiveness, and relevance. The described solution technique is either novel or an extension of an existing technique. Studies in this category do not usually present in-depth validation of the described solution technique, but tend towards describing a proof-of-concept by means of an example, a running prototype, or even a sound argument.

Evaluation research: studies focusing on evaluating a problem or an implemented solution in practice or realsettings. To this end, these studies include case studies, controlled experiments, etc.

Validation research: studies that investigate proposed solutions which have not yet been implemented in practice. Such investigations are performed systematically by means of experiments, prototyping, etc.

Opinion: also known as position papers, such studies contain the authors' point of view. In most cases they are not accompanied by evidence in support of their claims.

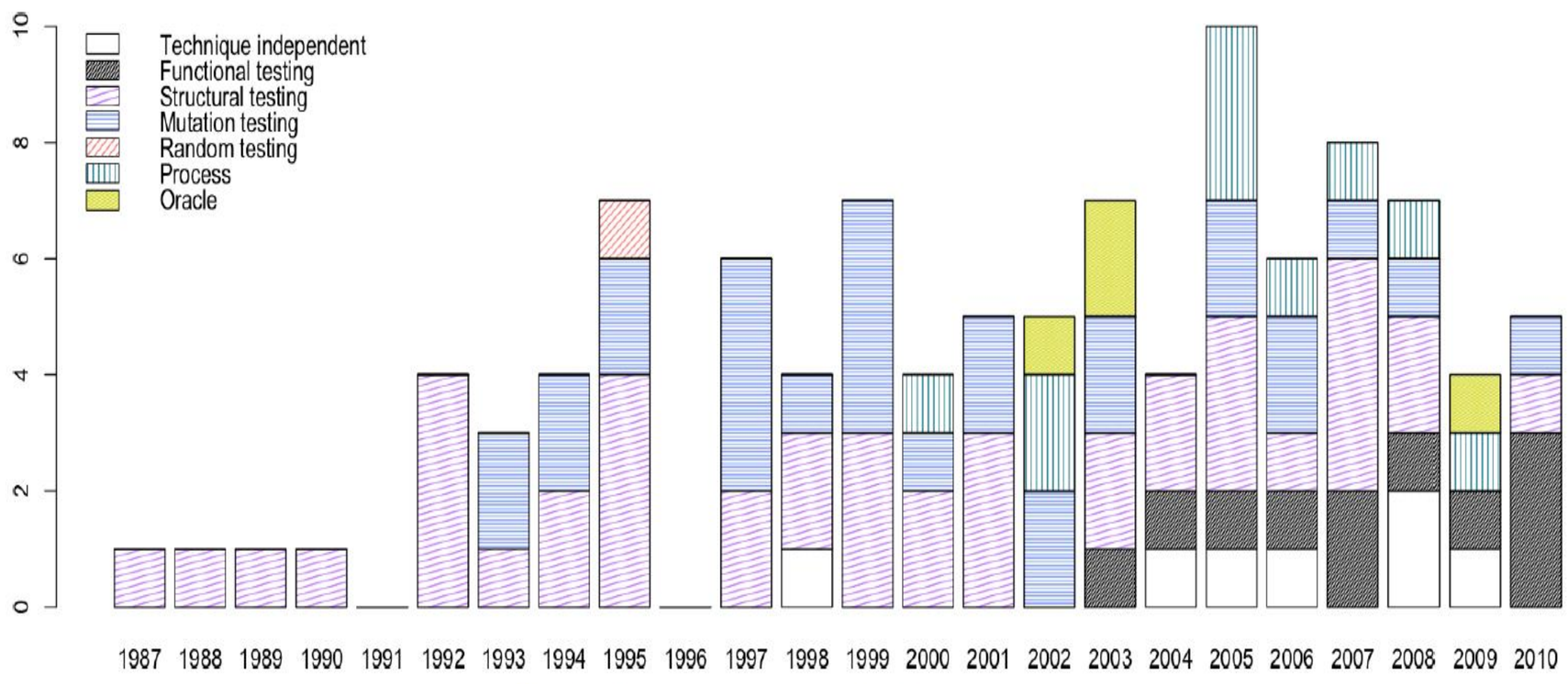
Tool: studies whose main contribution is outlining a tool (often in the form of a research prototype) that automates one or several software testing activities.



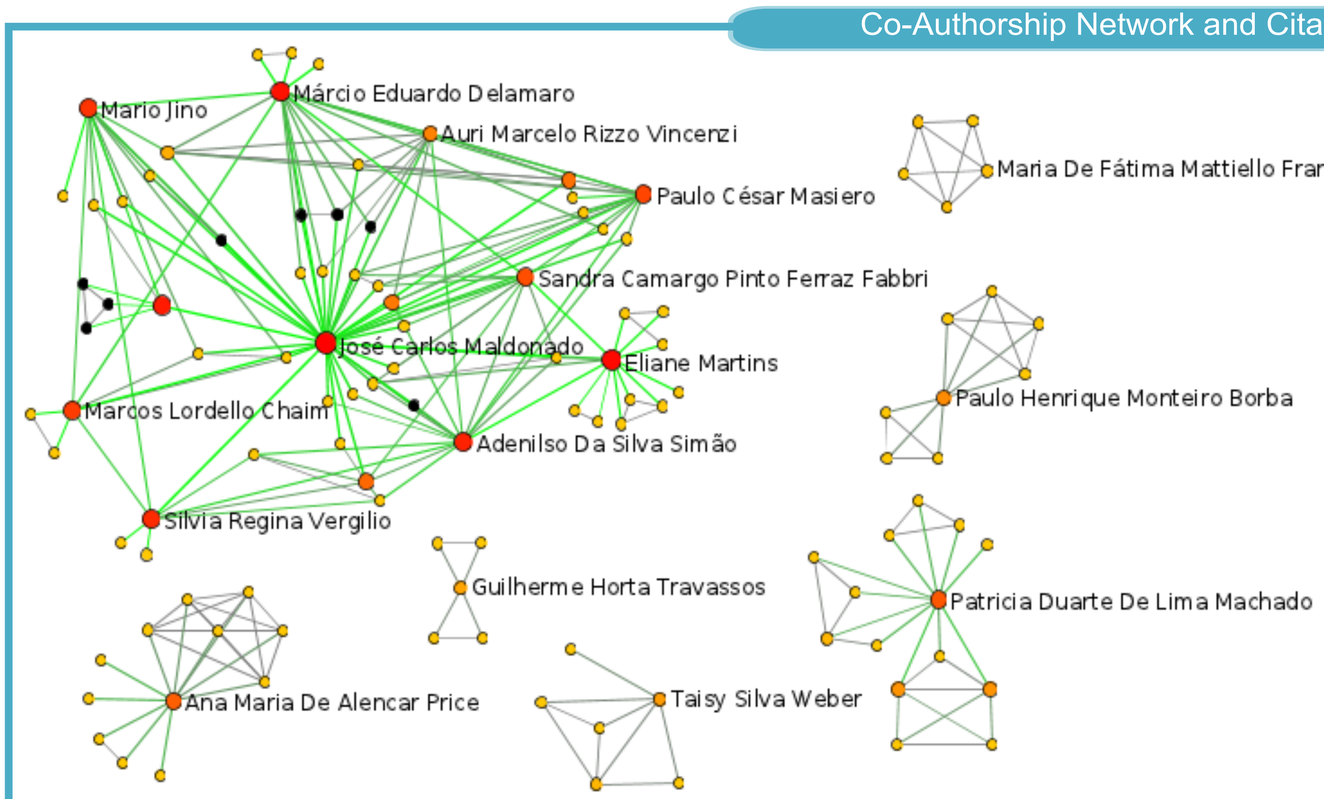
Research Type	Frequency	Percentage
Tool	48	46.2%
Solution proposal	46	44.2%
Evaluation research	6	5.8%
Validation research	3	2.9%
Opinion	1	1.0%

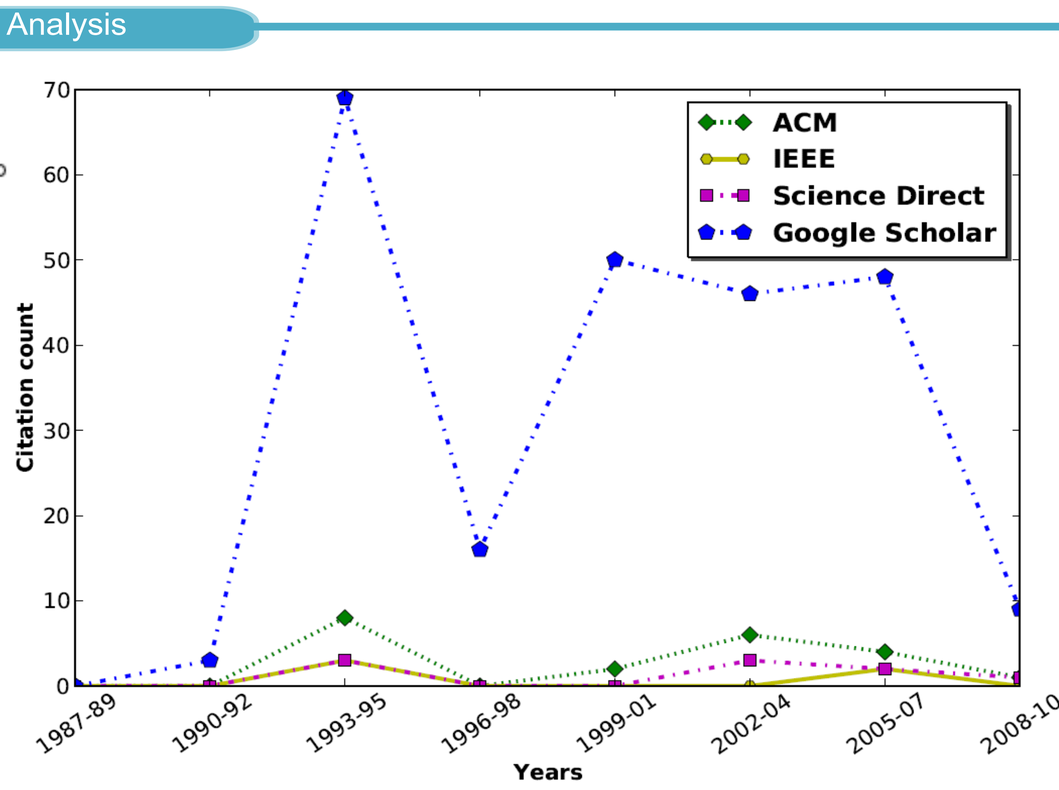
Classification Regarding Software Testing

Source of information	- code based (40,8%) - models (27,5%) - fault-based (17,3%) - specification (5,1%) - digital images (1,0%)
Test phase	- unit (61,2%) - integration (24,2%) - system-level (13,3%) - regression (1,0%)
Testing technique	- random testing (1) - funcional testing (11) - structural testing (42) - mutation testing (29) - independent technique (7)
Oracle	- support of mutation (1) - test assertion (1) - verification of specifications (1) - systens with GUIs (1)
Process	- agile process (10,2%)



Co-Authorship Network and Citation Analysis





*What a Long, Strange Trip It's Been, by Grateful Dead, is arguably one of the most famous lines in rock and roll. This snippet has entitled several books and articles since the song's release. Since it evokes a lifespan of constant changes, we argue that it fits perfectly to describe SBES and the myriad ofefforts on software testing that have been published in such event.

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