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ASH: A New Tool for Automated and Full-Text Search in Systematic Literature Reviews

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1. Motivation
2. Automated Search Helper
3. Automated Search Helper capabilities

Motivation

Topic

Systematic Literature Review of Mutation testing in C and C++

Search query

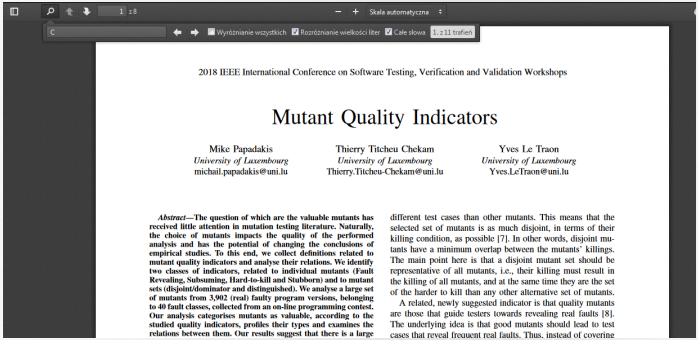
("mutation testing" of "mutation analysis") AND ("C" OR "C++")

Problem

Not all articles were found by the query.

Motivation

Problem description



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Mutant Quality Indicators

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***Abstract*—The question of which are the valuable mutants has received little attention in mutation testing literature. Naturally, the choice of mutants impacts the quality of the performed analysis and has the potential of changing the conclusions of empirical studies. To this end, we collect definitions related to mutant quality indicators and analyse their relations. We identify two classes of indicators, related to individual mutants (Fault Revealing, Subsuming, Hard-to-kill and Stubborn) and to mutant sets (disjoint/dominator and distinguished). We analyse a large set of mutants from 3,902 (real) faulty program versions, belonging to 40 fault classes, collected from an on-line programming contest. Our analysis categorises mutants as valuable, according to the studied quality indicators, profiles their types and examines the relations between them. Our results suggest that there is a large**

different test cases than other mutants. This means that the selected set of mutants is as much disjoint, in terms of their killing condition, as possible [7]. In other words, disjoint mutants have a minimum overlap between the mutants' killings. The main point here is that a disjoint mutant set should be representative of all mutants, i.e., their killing must result in the killing of all mutants, and at the same time they are the set of the harder to kill than any other alternative set of mutants.

A related, newly suggested indicator is that quality mutants are those that guide testers towards revealing real faults [8]. The underlying idea is that good mutants should lead to test cases that reveal frequent real faults. Thus, instead of coverine

Figure: Not found article example

Motivation

Problem description

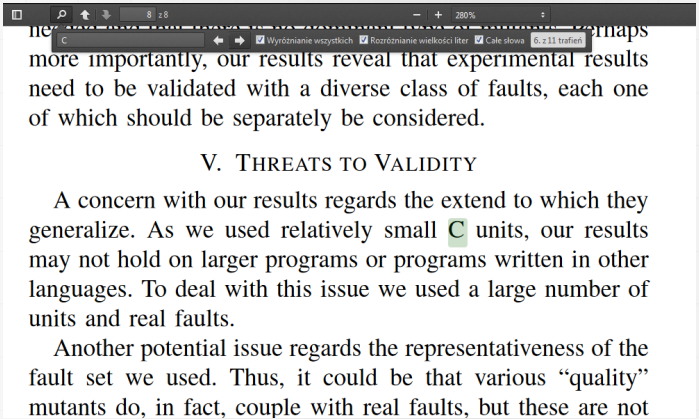


Figure: "C" missed in Digital Library search

Motivation

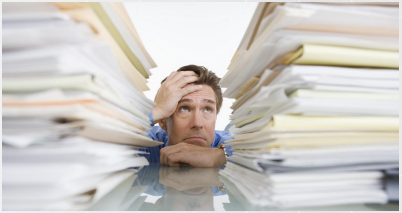
Solution

Wider search query

"mutation testing" or "mutation analysis"

Problem

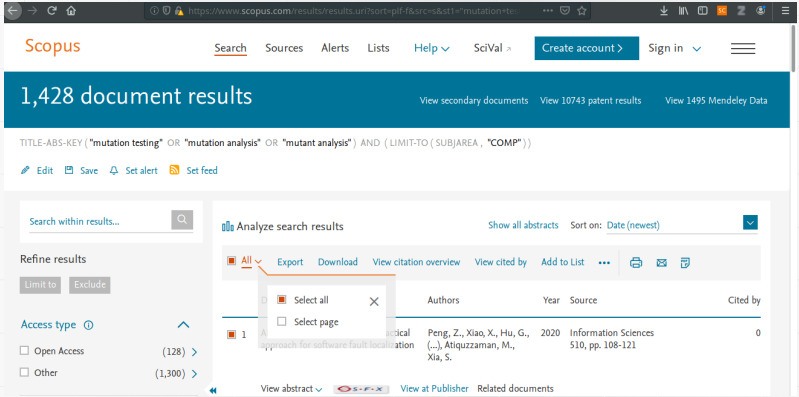
Too many articles to handle manually, each articles had to be opened and analyzed.



Source: www.globalstewards.org/images/fbshare/paperless-office.jpg

Automated Search Helper

User input - Digital libraries search



Exporting input from Scopus

Automated Search Helper

User input - Search query

Example Query

```
AND(
    OR(
      PARTIAL_WORD("mutation testing"),
      PARTIAL_WORD("mutation analysis"),
    OR(
      EXACT_WORD(C, caseSensitive=True),
      EXACT_WORD(C++, caseSensitive=True)))
```

Automated Search Helper

Articles processing

Articles collection

Download and text extraction

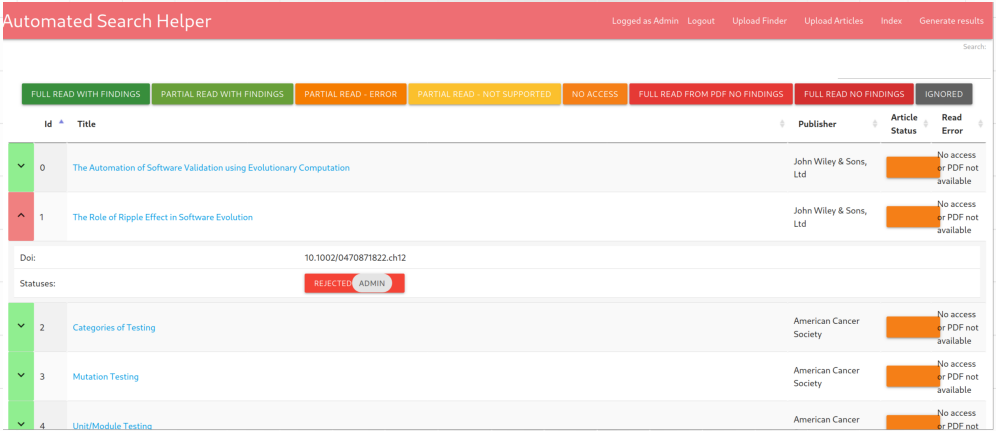
Text processing

Search using query

Results presentation

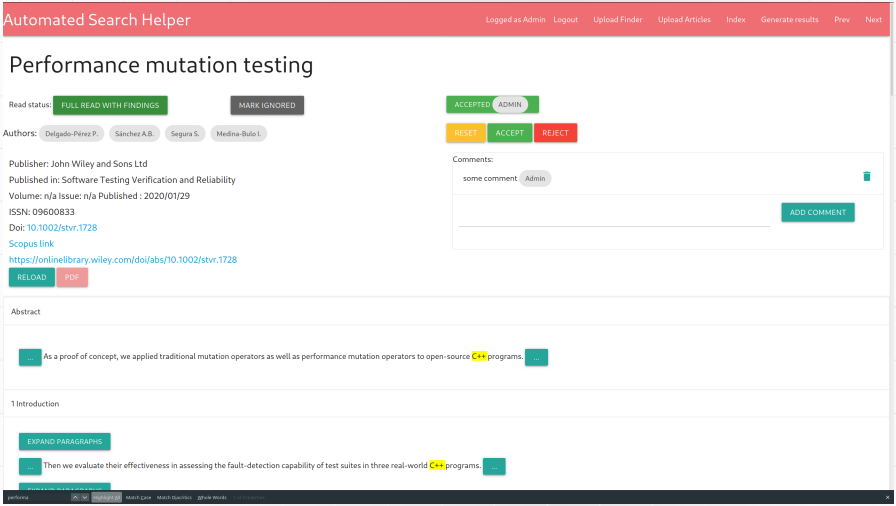
Automated Search Helper

UI - List of articles



Automated Search Helper

UI - single article



Supported digital libraries

- IEEE (ieeexplore.ieee.org)
- Science Direct (www.sciencedirect.com)
- Wiley Digital Library (onlinelibrary.wiley.com)
- ACM (dl.acm.org)
- Springer (link.springer.com)
- Scopus* (scopus.com)

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Example evaluation results

Results of downloading articles for "Mutation Testing"

- All articles have abstract and bibliographic information downloaded.
- 95% of articles from fully supported Digital libraries downloaded with full text.
- 70% of articles from Scopus downloaded with full text.
- 20% of articles from input were detected as duplicates.

Details of the evaluation are published in Github wiki:
`github.com/LechMadeyski/AutomatedSearchHelper/wiki/Evaluation`

Application status

- Open source, can be found under `https://github.com/LechMadeyski/AutomatedSearchHelper`
- Tested on Windows and Linux,
- No security features - application is intended to work on personal computers or private networks,
- More digital libraries can be added if needed,
- UI was not tested on many users, it can evolve depending on users feedback.

https://www.humanskills.pl/wp-content/uploads/2020/02/Szkolenie-z-udzielania-feedbacku.jpg

Summary

- Sometimes we need full text search which is not supported by all Digital Libraries.
- ASH can help solve some problems in search phase of SLR process.
- ASH provides an unified way of searching articles from across multiple digital libraries.
- ASH can be used as a personal database for articles.
- Currently most of digital libraries publishing Computer Science are supported.
- Waiting for your feedback.

Acknowledgement
The authors thank Prof. Barbara Kitchenham for reviewing this paper before submission.