Survey of Approaches for Handling Static Analysis Alarms

Tukaram Muske, Alexander Serebrenik

TRDDC, Tata Consultancy Services, India
Eindhoven University of Technology, The Netherlands

Friday 5th May, 2017
Motivation

- Manual inspection of alarms
- Handling of alarms (HoA)
  - postprocessing of alarms
  - manual inspections of alarms
  - exclude improving analysis precision
- Approaches for HoA
  - differ greatly
  - not studied comprehensively before
- Research question
  - What are possible approaches for handling the static analysis alarms?
Literature Search

- Identifying relevant papers
  - Keywords-based Database Search (KDS) + Snowballing

- Inclusion criteria
  - a technique/method/approach to process the alarms
  - a method/tool-support for systematic manual inspections
  - an approach to report lesser number of alarms

- Exclusion criteria
  - improving precision of underlined analysis
  - fault prediction or error/bug report triaging
  - mining of bugs repositories (software maintenance/evolution)
  - study of economics or benefits of usage of static analysis tools
  - evaluation/comparison/benchmarking of precision/tools
Keywords-based Database Search

- inspired by systematic literature reviews (SLRs)\(^1\)

Table: Keywords used in database search

<table>
<thead>
<tr>
<th></th>
<th>1) elimination, 2) reduction, 3) simplification, 4) ranking, 5) classification, 6) reviewing, 7) inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>1) static analysis, 2) automated code analysis, 3) source code analysis, 4) automated defects detection</td>
</tr>
<tr>
<td>III</td>
<td>1) alarm, 2) warning, 3) alert</td>
</tr>
</tbody>
</table>

- Google Scholar
  - \(84 = 7 \times 4 \times 3\) different search strings.
  - 150 top results (total 12600 papers)
  - 49 papers relevant to HoA

---

\(^1\) Barbara Kitchenham and Stuart Charters. “Guidelines for performing systematic literature reviews in software engineering”. In: EBSE Technical Report, Ver. 2.3 EBSE-2007-001 (2007).
Snowballing

- Snowballing\(^2\) after the KDS
  - incomplete search strings in KDS
  - snowballing is effective and efficient

- Snowballing details
  - Start set with 49 papers
  - 2 iterations
  - found 30 new relevant papers

- \(49 + 30 = 79\) relevant papers

- KDS + Snowballing helped each other

---

Extracted data
- approaches for HoA
- techniques and artifacts used
- tools and programming languages
- available @
  https://sites.google.com/site/scam2016paper/home/download

Classifying the approaches for HoA
- open tagging
- one approach per paper
Classification of Approaches

Handling of alarms (79)

A. Clustering (8)
B. Ranking (14)
C. Pruning (12)
D. False positives elimination (FPE) (11)
E. Static dynamic combinations (SDC) (12)
F. Simplifying manual inspections (17)
G. Design of LSATs (5)
Classification of Approaches

Handling of alarms (79)

A. Clustering (8)
- Sound (3)
- Unsound (5)

B. Ranking (14)
- Statistical analysis (2)
- History-aware (3)
- Feedback-based (3)
- Others (6)

C. Pruning (12)
- Delta alarms (4)
- Machine learning (4)
- Others (4)

D. FPE (11)
- Scalability (5)
- Performance (3)

E. SDC (12)
- Others (3)

F. Simplifying manual inspections (17)
- Semi-automatic diagnosis (5)
- User-feedback (2)
- Checklists (2)
- UI and navigation tools (5)
- Others (3)

G. Design of LSATs (5)
Year-wise Distribution

Figure: Number of the relevant papers published year- and category-wise
Discussion

- Approaches having merits and demerits
  - complementary approaches

- Combinations of the approaches possible
  - examples
    - clustering $\rightarrow$ ranking $\rightarrow$ FPE
    - clustering $\rightarrow$ pruning
  - ordering of the approaches
    - Pruning $\rightarrow$ FPE or FPE $\rightarrow$ Pruning?
      - based on requirements in practice
  - parallelization of the approaches
    - to enhance the confidence
  - performance penalty to be studied
**Motivation**
- What are possible approaches for handling the static analysis alarms?

**Literature Search**
- Keywords-based Database Search (KDS) + Snowballing
- 79 relevant papers identified

**Data Extraction**
- Seven categories of HoA
- Several sub-categories of the approaches

**Take-away Message**
- Complementary approaches, and their combinations are possible and to be studied