Detecting False Alarms from Automatic Static Analysis Tools: How Far are We?

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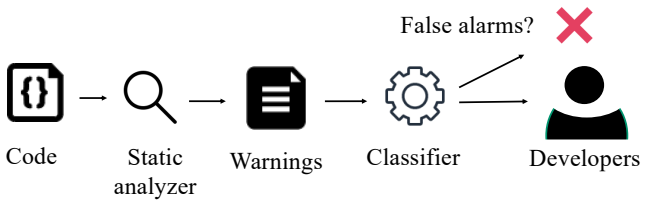
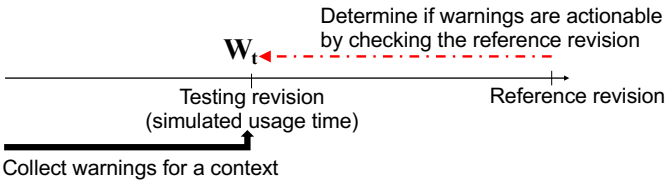
Motivation

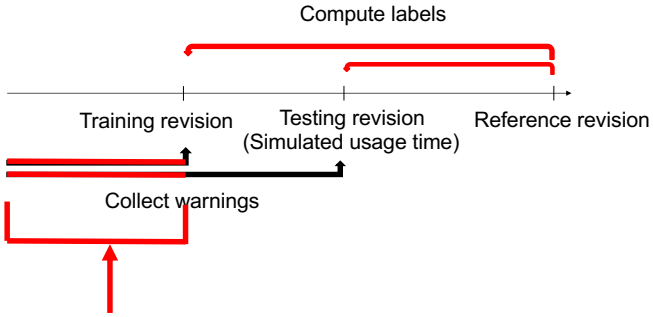
- **No guarantees** that the warnings from Static Analyzers are real bugs
- Prior work [A] has identified the Golden Features, the **most important features** from the literature
- We conduct a **replication study** to better understand the features



Data leakage and duplication



Data Leakage. In computing features capturing the proportion of actionable warnings in a context, the ground-truth labels were leaked.
The computation of these features require the status of warnings in the **future.**

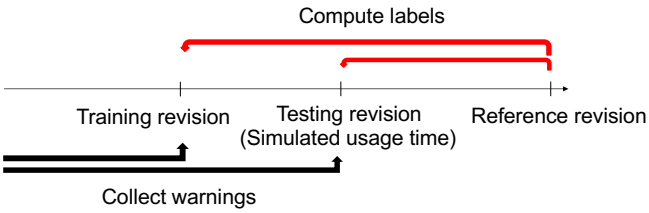


Duplication. Some warnings appear in **both** the training and testing dataset.
Intuition: a warning may be present before the training revision and is still present at the testing revision

These issues are **subtle** and hard to detect, but have a **significant** impact.

Technique	Precision	Recall	F1
Golden Features SVM	0.84	0.94	0.88
- leaked features	0.26	0.70	0.38
- data duplication	0.27	0.57	0.31
+ reimplemented leaked features	0.32	0.57	0.38

Low agreement between heuristically-determined labels and human labels



An **open warning** is present at the reference revision
A **closed warning** is no longer present at the reference revision (but the source file is still present)
Heuristic: **open** warnings are **false alarms**
closed warnings are **actionable**

However, we find that only 47% of closed warnings were actionable. Many were only closed *incidentally*.

Roadmap

[A] Wang et al. (2018)
- Data collection
- Identified the golden features

[B,C] Yang et al. (2021)
- Active Learning
- Discovered that the data is low dimensional

[D] Our work (2022)
- Investigated issues with the features
- Investigated issues with the dataset
- Features were still predictive! (AUC > 0.5)
- Motivates more work on new techniques and the need to address the lack of labelled data

[E] Yedida et al. (submitted to TSE, preprint available)
- "*How to Find Actionable Static Analysis Warnings*"
- **"reflect more on that data"**
- Open and collaboration science

References

[A] Wang et al. "Is there a "golden" feature set for static warning identification? an experimental evaluation." ESEM 2018
[B] Yang et al. "Learning to recognize actionable static code warnings (is intrinsically easy)." EMSE 2021
[C] Yang et al. "Understanding static code warnings: An incremental AI approach." ESA 2021
[D] Kang et al. "Detecting False Alarms from Automatic Static Analysis Tools: How Far are We?" ICSE 2022
[E] Yedida et al. "How to Find Actionable Static Analysis Warnings" arxiv (currently under review)