INTERPRETING DEEP LEARNING MODELS FINE-TUNED FOR DETECTING VULNERABILITIES RELATED TO MISSING CODE

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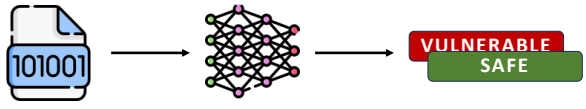
CIÊNCIA 2024

MOTIVATION

BACKGROUND. LEARNING-BASED VULNERABILITY DETECTION IS TYPICALLY TREATED AS A BINARY CLASSIFICATION PROBLEM.

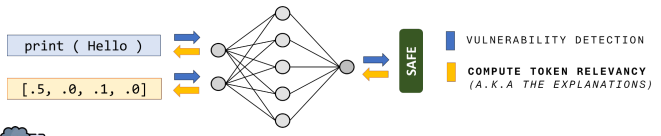


Function, code slice or file — Neural network — Binary label

PROBLEM 1. MODEL'S HIGH ACCURACY DOES NOT ENSURE REAL-WORLD EFFECTIVENESS

*IF THE 101001 HAS > 500 LoC, **HOW CAN WE FIND AND FIX THE VULNERABILITY?***

EXPLAINABLE AI (xAI) HELPS DEVELOPERS INTERPRET MODEL OUTPUTS BY ASSIGNING RELEVANCY SCORES TO INPUT TOKENS.

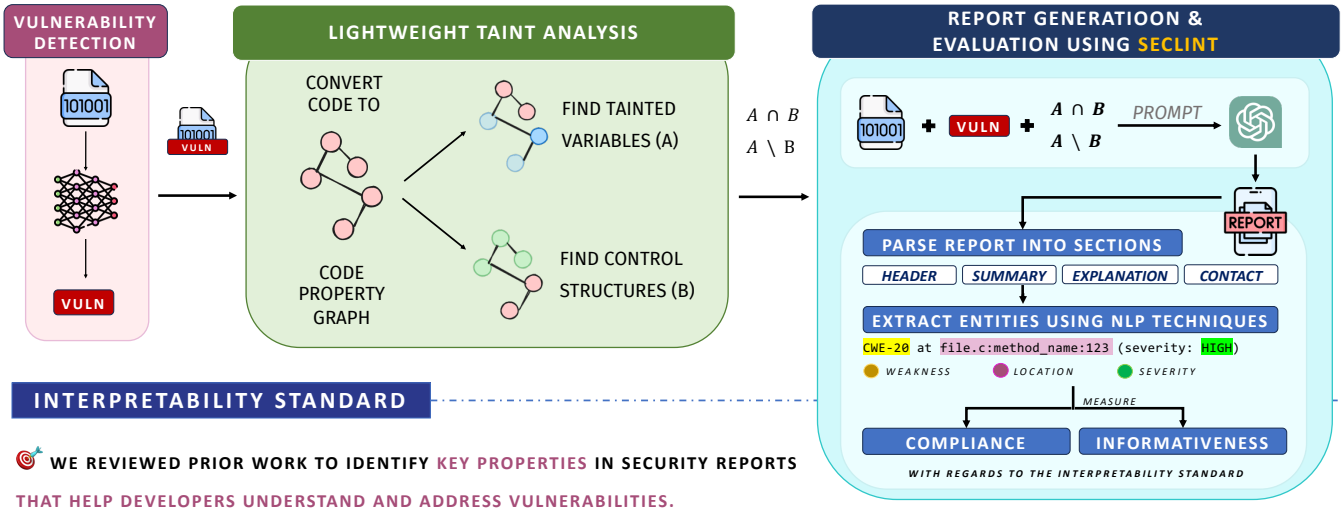


PROBLEM 2. EXISTING xAI METHODS ONLY EXPLAIN TOKENS PRESENT IN THE INPUT

HOW CAN WE EXPLAIN VULNERABILITIES ARISING FROM THE ABSENCE OF CODE?

IN VULNERABILITY DETECTION, xAI MAY HELP US LOCATE VULNERABILITIES.

METHODOLOGY



INTERPRETABILITY STANDARD

WE REVIEWED PRIOR WORK TO IDENTIFY KEY PROPERTIES IN SECURITY REPORTS THAT HELP DEVELOPERS UNDERSTAND AND ADDRESS VULNERABILITIES.

```
1. !VULN-DETECT: <WEAKNESS NAME/ID> AT <LOCATION> (SEVERITY: <LEVEL>)
2. !WHAT:        DESCRIBE THE WEAKNESS/PROBLEM
3. !WHY:         DESCRIBE ITS IMPACT
4. !HOW:         DESCRIBE HOW THE WEAKNESS CAN BE TRIGGERED
5. !WHEN:        DESCRIBE WHEN THE PROBLEM WAS FOUND
6. !WHERE:       DESCRIBE WHERE THE PROBLEM IS LOCATED
(…)
```

! – MANDATORY FIELDS ? – OPTIONAL FIELDS

FUTURE WORK

WE ARE STILL REFINING THE INTERPRETABILITY STANDARD

CHECK OUT THE QR CODE BELOW FOR THE UPDATED VERSION & GIVE US FEEDBACK !

Acknowledgments: This work was partially funded by Fundação para a Ciência e a Tecnologia under the scope of the CMU Portugal Program

Carnegie Mellon Portugal — fct Fundação para a Ciência e a Tecnologia — U.PORTO FEUP Faculdade de Engenharia Universidade do Porto — S3D Software and Societal Systems Department

LEARN MORE ABOUT THIS RESEARCH

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Title Example 1

Title

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Name

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Affiliation

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MOTIVATION

Introduction

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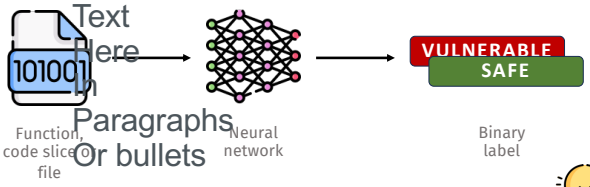


Methods

PROBLEM 1. MODEL'S HIGH ACCURACY DOES NOT ENSURE REAL-WORLD EFFECTIVENESS

IF THE HAS > 500 LoC, HOW CAN WE FIND AND FIX THE VULNERABILITY?

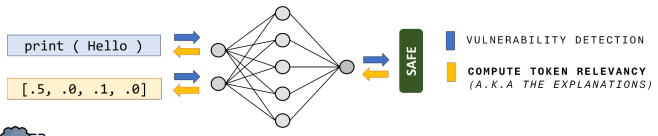
Text Here In Paragraphs Or bullets

EXPLAINABLE AI (xAI) HELPS DEVELOPERS INTERPRET MODEL OUTPUTS BY ASSIGNING RELEVANCY SCORES TO INPUT TOKENS.

Results

PROBLEM 2. EXISTING xAI METHODS ONLY EXPLAIN CODE PRESENT IN THE INPUT

HOW CAN WE EXPLAIN VULNERABILITIES ARISING FROM THE ABSENCE OF CODE?



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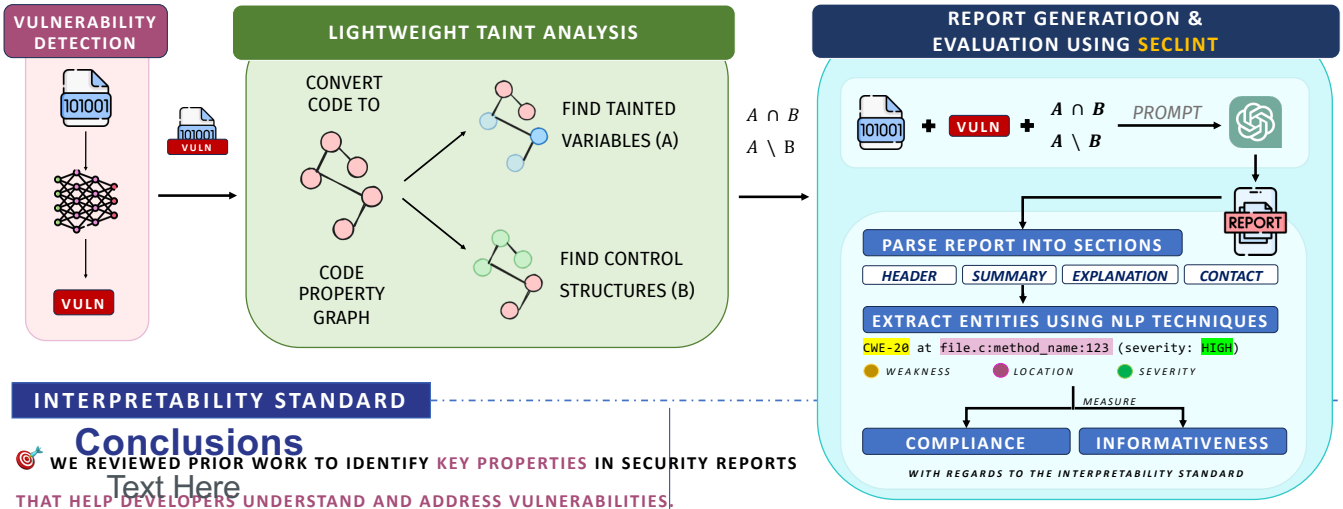
METHODOLOGY



INTERPRETABILITY STANDARD

Conclusions

WE REVIEWED PRIOR WORK TO IDENTIFY KEY PROPERTIES IN SECURITY REPORTS THAT HELP DEVELOPERS UNDERSTAND AND ADDRESS VULNERABILITIES.

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Acknowledgements

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FUTURE WORK

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