

① Problem Description

```
if n2 < n1:
    raise ValueError('Total internal
        reflection impossible for n1 < n2')
```

Condition $\Rightarrow n2 < n1$... I
 Exception message $\Rightarrow n2 > n1$... II
 Statement I **contradicts** statement II

Contradiction/Inconsistency

Definition. An if-condition-raise statement (c, e) is consistent if and only if $c \Leftrightarrow e$, i.e., the condition c logically implies the exception e , and vice versa. In turn, we say that an if-condition-raise statement is inconsistent if either of the two implications does not hold.

② Goals and Contributions

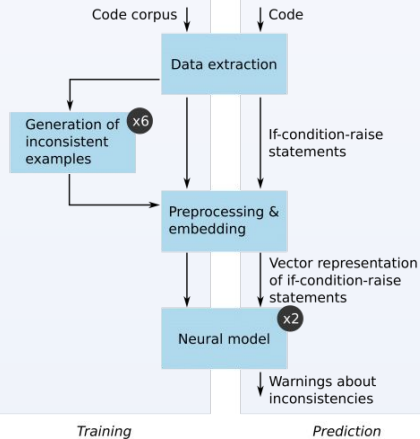
➤ Address the problem of **detecting inconsistent if-condition-raise statements**

➤ Implement **six techniques** for **generating** a large and diverse set of likely **inconsistent statements** to be used as training data.

➤ Train **two neural models** that formulate the inconsistency detection problem in orthogonal and complementary ways.

➤ Provide **empirical evidence** that the approach is effective at **finding bugs fixed in the past** and **reveals previously unknown bugs** in widely used code.

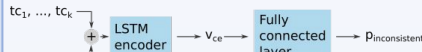
③ Approach



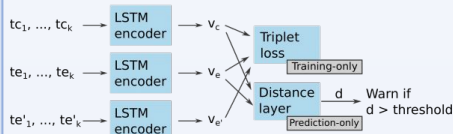
- **Collect consistent** instances from GitHub
- **Generate inconsistent** instances
 - Random recombination
 - Operator mutation
 - Message mutation
 - Pattern-based mutation
 - Embedding-based mutation
 - Codex-based Autocompletion
- **Prepare the data** for **sequence classification**
- **Train a neural network** on **binary classification**

④ Models' Architecture

Binary classification:

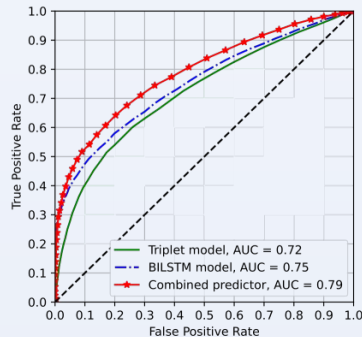


Distance-based approach trained with triplet loss:

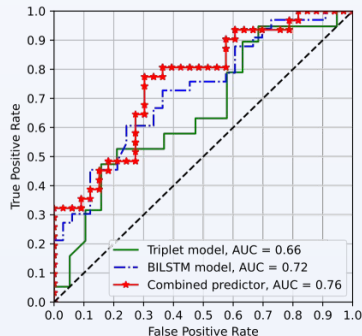


⑤ Evaluation

➤ Evaluation on Synthetic Data



➤ Evaluation on Past Bug Fixes



➤ Real World Projects: 30 new bugs

From Azure project

```
if not (parsed_uri.scheme and
    parsed_uri.hostname):
    raise ValueError("{}{} is not not
        a valid ID".format(source_id))
```

From TensorFlow project

```
if isinstance(model, Sequential):
    raise ValueError('Expected `model`
        argument to be a functional `Model`
        instance', model)
```

From Sympy project

```
if not isinstance(p2, PolyElement):
    raise ValueError('p1 and p2 must
        have the same ring')
```