Learning to Describe Solutions for Bug Reports Based on Developer Discussions

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Bug Report Discussions

Title: Incorrect distance

Utterance #1
Seeing negative distance when using 1D grid.

Utterance #2
Probably a bug in `getL1Distance(int x1, int x2)`

Utterance #3
We do `x1 - x2`, which will be negative if `x1 < x2`.

Utterance #4
We should compute its absolute value.

dev007 added a commit that referenced this issue

1) User reports bug

When a bug is reported, developers engage in a dialogue to collaboratively understand it and ultimately resolve it.

2) Developers engage in the discussion
(understand problem, diagnose cause, propose solution)

3) Bug is resolved with code changes

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NL Solution Description
Compute absolute value of `x1 - x2` in `getL1Distance`

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Task: Generate concise natural language description of the solution by synthesizing relevant content in the discussion when it emerges in real-time

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Commit message/PR title

Time step of commit/PR

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Data: 12K bug reports reports for open-source Java projects from GitHub Issues which are linked to a commit/PR
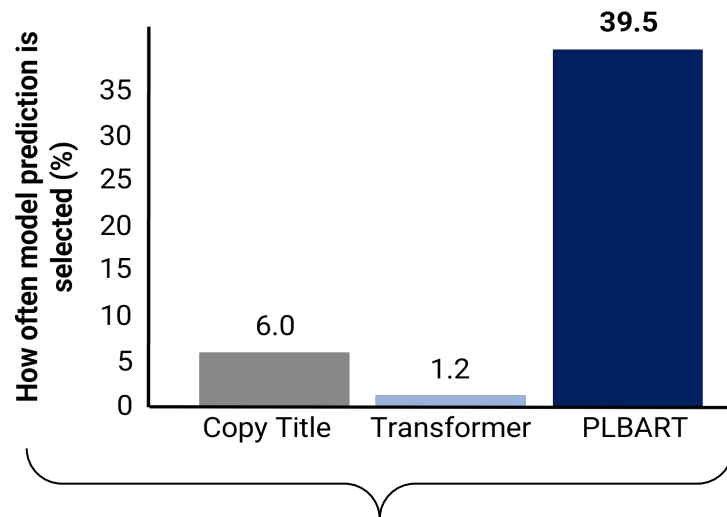
Results: Generating Solution Descriptions

■ Copy Title   ■ Transformer   ■ PLBART

PLBART [Ahmad et al., 2021]

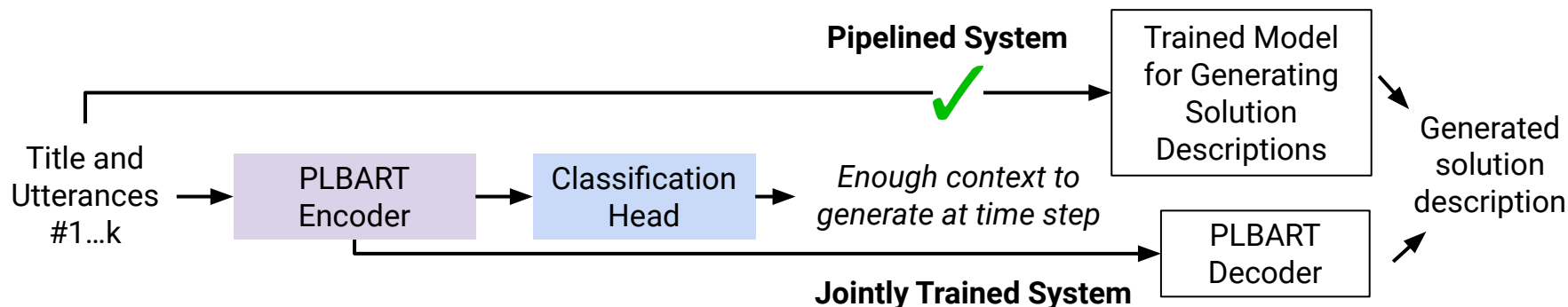# **Results:** Generating Solution Descriptions
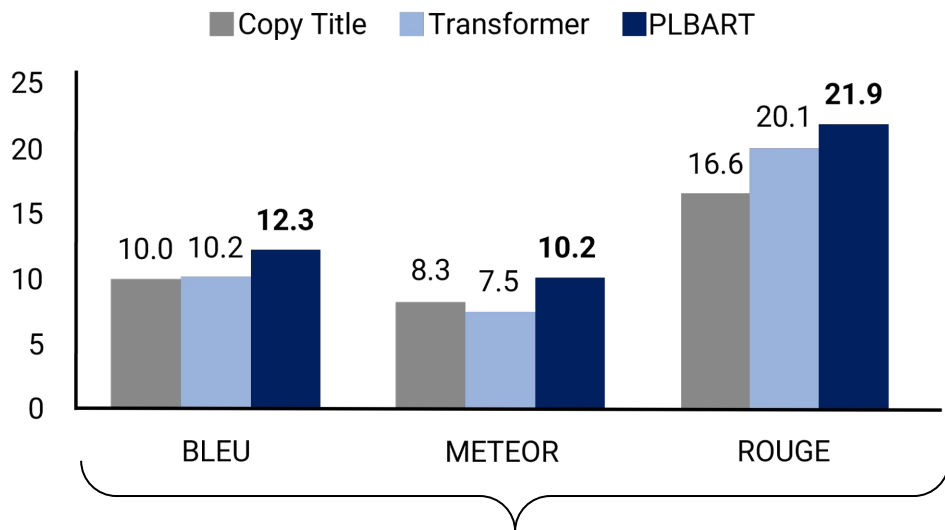
Automated metrics

Based on automated metrics and human evaluation, PLBART outperforms baselines.

Human evaluation
"Select the most <u>informative</u> generated description(s)"

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Generating Solution Descriptions in Real-Time

Pipelined System ✓

Trained Model for Generating Solution Descriptions

Title and Utterances #1...k → PLBART Encoder → Classification Head → *Enough context to generate at time step*

Generated solution description

Jointly Trained System

PLBART Decoder

System generates at time step k

- *Is there sufficient context about the solution at time step k?*

- *Rate the __informativeness__ of the generated description:*
    - *1 - Incomprehensible, completely incorrect, irrelevant*
    - *2 - Generic, rephrasing the problem*
    - *3 - Includes some useful information but does not capture the solution*
    - *4 - Partially captures solution*
    - *5 - Completely captures solution*

Pipelined System — **39.0%**

Jointly Trained System — 33.8%

3.3

When sufficient context is available, system output is useful

Summary

- Proposed new task of generating solution descriptions based on ongoing bug report discussions
- Collected and released new dataset of more than 12K examples to study the task
- Benchmarked various models for generating solution descriptions
- Demonstrated that PLBART generates informative descriptions
- Investigated generating solution descriptions in real-time with two different approaches for incorporating a classifier that determines when to perform generation

Thank you!

Code and data: https://github.com/panthap2/describing-bug-report-solutions
Contact: Sheena Panthaplackel <spantha@cs.utexas.edu>