Towards Understanding and Analyzing Rationale in Commit Messages using a Knowledge Graph*

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Context
• Extracting rationale from commit messages is useful [1].
  • But it is difficult (rationale is embedded in natural text) [2].
  • Ongoing work on the Kantara pipeline for end-to-end rationale reconstruction to extract, structure and analyze rationale [3].

• Main contribution: Showcasing the practicality of Kantara for a real-world software project.

Dataset Creation
• A labelled dataset of 180 commit messages for the Out-of-Memory component of the Linux kernel:
  • 3 annotators
  • Codebook (Table 1).
  • Fleiss Kappa ~ 0.69.
  • Sentence-based labelling
  • Multi-labels (Figure 1).

Rationale Extraction
• Widely-used models for sentence classification
  • Binary classification
    • Low recall
    • The Decision Tree algorithm gave the best results.
  • Decision classification better than Supporting Facts classification.
  • Low performance for Rationale classification

• Multi-label classification
  • For XGBoost, the Decision classification was better than Supporting Facts classification. Rationale classification was the worst.

Rationale Structuring
• An ontologically-based knowledge graph (Figure 2)
  • For concrete implementation, the openCAESAR framework [5]

Rationale Analysis
Leverage ontological semantics for
• Additional reasoning
• Graph queries
• Interactive visualizations (Figure 3).

Challenges and Future Work
1. Expanding the Rationale Ontology
2. Subjective labeling
3. Classification performance
4. Generality

Figure 1. Distribution of the labelled sentences

Table 1. Codebook.

<table>
<thead>
<tr>
<th>Label</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision</td>
<td>An action or a change that has been made, including a description of the patch behaviour.</td>
</tr>
<tr>
<td>Rationale</td>
<td>Reason for a decision or a value judgment</td>
</tr>
<tr>
<td>Supporting Facts</td>
<td>A narration of facts used to support a decision</td>
</tr>
<tr>
<td>Inapplicable</td>
<td>Pre-processing error or bad sentences (i.e., does not contain English sentences)</td>
</tr>
</tbody>
</table>

Figure 2. Decision/Rationale Graph

Figure 3. Interactive visualization of authors, their commits, and commit sentence text

References


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