Towards Explainable RE Tools

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Automation and AI in RE

Problems

- Categorization
- Traceability
- Prioritization
- Quality Assurance

Technologies

- Natural Language Processing
- Information Retrieval
- Machine Learning
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Problems

- Categorization
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The Machine

Why?

Consequences?

Technologies

- Natural Language Processing
- Information Retrieval
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The Requirements Engineer
We need more research towards explainable and actionable RE tools.
Working Definition

**Explainable:** The tool provides hints or indication on the rationale *why* the tool made a decision.

**Actionable:** The tool provides hints or indication on how the user can *influence* the decision by changing the processed data.
Example: Automated Trace Link Recovery

High-level

Low-level

The Machine

Precision: 40%
Recall: 85%

J. Hayes, A. Dekhtyar, and J. Osborne: “Improving requirements tracing via information retrieval,” RE’03
Example: Automated Trace Link Recovery

High-level

Req 1

Low-level

- Req 1
- Req 2
- Req 3
- Req 4
- Req 5
- Req 6
- Req 7
- Req 8
- Req 9
- Req 10
- Req 11

RE: Why is Req 2 related?
Tool: ...
→ Not explainable

RE: Why is Req 11 not in the list?
What can I do to change that?
Tool: ...
→ Not actionable
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Smell Name: Comparatives
Entity: Adverb, Adjective
Explanation: Comparatives are used in requirements that express a relation of the system to specific other systems or previous situations.
Example: The display (...) contains the fields A, B, and C, as well as more exact build infos.

Femmer et al.: “Rapid Quality Assurance with Requirements Smells”, JSS, 2014
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• Scout Video
The component conditionally drives an external fan. This fan is required for active ventilation of the headlight.

The duration until the switch is recognized as hanging must be a configurable parameter.

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• LHAna Video
Beyond Explaining: Insights through Tools

Using deep recurrent neural networks to learn and generate jokes (based on 11,000 unchanged jokes from the Internet)

Q: What do you call a car that feels married?
A: A cat that is a beer!

Bacciu et al.: “LOL: An investigation into cybernetic humor, or: Can machines laugh?” FUN’16
Beyond Explaining: Insights through Tools

Using Deep Convolutional Neural Networks to manipulate input data

Original  Reconstruction  Pose (Elevation) varied

What kind of interpretable features would such a network learn on RE artifacts?

What use could we imagine for generated artifacts obtained by manipulating specific features?

Summary and Conclusions

More research is needed towards explainable and actionable RE tools.