Research on NLP for RE at the FBK-SE research unit: A Report

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NLP4RE @ REFSQ 2019
FBK-SE Research Unit

- One of the research unit of the biggest Research Institute of FBK, the ICT-Information and Communication Technology research center (https://ict.fbk.eu/), founded ~ 35 years ago as an AI-research center
- Two main research areas: Requirements Engineering and Testing
- Part of the Smart Digital Industry High Impact Initiative at the ICT research institute
Past Research on NLP for RE

- Manual analysis of **unstructured textual** specification at support of **formal** specification
- Automated analysis of **online discussions**: speech-act based analysis
Example from the “Movement Authority” section of the Specifications

1.2. For each section composing the Movement Authority the following information shall be given;

1.2.1 Length of the section

1.2.2 Optionally, Section time-out value and distance from beginning of section to Section Time-out stop location

... 

7.8.4.1.1 The End Section timer shall be started on-board when the train passes the End Section danger location given by its front end.
Methodology for the analysis and validation of requirements specifications

1. Identification of categories by looking at linguistic patterns (manual analysis)
   - E.g. glossary term; functionality
2. Formalization into Linear Temporal Logic formulae
3. Verification and validation via model-checking

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Speech-act based analysis technique*

- **Speech-acts**\(^1\) (when we speak we affect the behaviour of the audience)

- Example:
  - “I have a problem when saving the document, please check it”

- NLP tools support the analysis of text to discover speech-acts
  - Part-Of-Speech taggers, key words
  - speech-act categories (ref. *illocutionary act*): e.g. informative, responsive, requestive and assertive, etc.
  - 142 lexico-syntactic rules for each speech-act category

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\(^1\)Austin (1962), Searle (1969), Bach and Harnish (1979)

* Itzel Morales-Ramirez  PHD Thesis / Morales-Ramirez, Perini, Ceccato CAISE-forum14
Automated analysis of online discussions
Using SA-based analysis technique

Morales-Ramirez, Kifetew, Perini, CAISE17 and IS journal 2018
Automated analysis of online discussions

RQ: Can the speech-acts be used as parameters to classify defect reports, and feature or enhancement requests?

AOO: Using the 43 parameters.

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AOO: using 25 parameters (no speech acts).

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• Apache Open Office (AOO) dataset
  • user feedback gathered from the AOO issue tracking system
  • 161K textual comments (2001-2017)

• Parameters
  • E.g. number of informative / responsive / requestive and assertive expressions, attach / logFile / urlLink

• 3 ML algorithms in WEKA
  • Random Forest
  • J48
  • SMO

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1https://www.cs.waikato.ac.nz/ml/weka/
* Morales-Ramirez, Kifetew, Perini, IS journal 2018. Speech-acts based analysis for requirements discovery from online discussions
Ongoing

• User-feedback driven Issue Prioritization
• App review analysis at support of RE decisions
  • Jacek Dabrowski, Emmanuel Letier, Anna Perini, and Angelo Susi. Finding and analyzing app reviews related to specific features: A research preview. (REFSQ 2019, on Thursday 9:30)
User-feedback driven Issue Prioritization

a) Associating feedback to issues (bug/feature requests)
   - e.g. term-based similarity technique, like cosine similarity
     (properties: features, topics)

b) Extract properties of feedback

c) Infer issue rankings based on associated feedback’s properties
   - Calculating aggregate function, e.g. sentiment/severity about the related issues, by mean of the set of values of the derived properties

* Based on RE:NEXT 2017 paper
Concluding Remarks

• FBK-SE experience:
  • Type of data
    • NL textual document in **highly technical** domains (e.g. Railways domain)
    • NL textual messages in **online discussion** about **software use and development**
    • NL textual messages in **online user feedback**

• Objective/Tasks:
  • Formal specification of system requirements for the purpose of **automated requirements verification**
  • **Automated classification** of online discussion into **issue type** (e.g. bug, new or enhanced functionalities)
  • Automated **support** to software developers / **requirements engineers**

• FBK-SE Future:
  • Combining **model-driven** and **data-driven** engineering
  • Preferred application domain: Smart Industry
Thank you for your attention
Questions?