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EXANT: EXPLORING NLP AI SYSTEMS FOR REQUIREMENTS DEVELOPMENT

Abstract

Modern spacecraft are developed according customer provided requirements (e.g. industry, agency, academia...). These initial requirements are refined during a subsequent engineering process translating to finer granularity requirements specific to spacecraft subsystems and operational capabilities. In most cases the list of requirements is dynamic, as the engineering process requires or the customer needs change over time. Maintaining quality, keeping track and accurately interpreting changing requirements is a challenge for individual engineers which is amplified by team size as well as number of organizations involved in a project. The results are increased development time to clear occurring confusions, increased costs for redevelopment as well as the risk of false implementation of requirements.

The project ExANT (Extraction of Requirements from Natural Language Texts) explores methods of supporting and automating the requirement development process by applying natural language processing (NLP) artificial intelligence (AI) systems. The final aim is to develop a reliable AI assistance systems that is capable to automatically analyse requirement texts, give an indication on requirement quality and ideally yield suggestions for quality enhancements.

In this paper the current progress of applying commercially available tools (i.e. IBM Watson) and comparisons to the performance of open-source tools (i.e.spaCy) to process and analyse software requirements are given. The project is focusing on spacecraft development related software requirements to narrow the domain knowledge that an NLP AI system needs to learn. This input is provided in the form of obfuscated real-world industry software requirements supplied by the OHB System, a European Large System Integrator. Additionally, the input data set is enriched, by artificially generated software requirements by using the OpenAI bot ChatGPT to increase the number of data points for training the NLP system.

To process the available software requirement texts, human annotation is initially required to allow for supervised training of named entity recognition (NER). A set of relevant entity types (labels) has been developed collaboratively and respective annotation guidelines have been established. By providing annotation data AI system can be trained to recognize entities in arbitrary similar requirement texts. Patterns, quantities, and relations of the extracted entities allow to derive a pipeline that can be used to obtain requirement quality.

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