UiO : University of Oslo

LDK 2021

Towards Scope Detection of Textual Requirements

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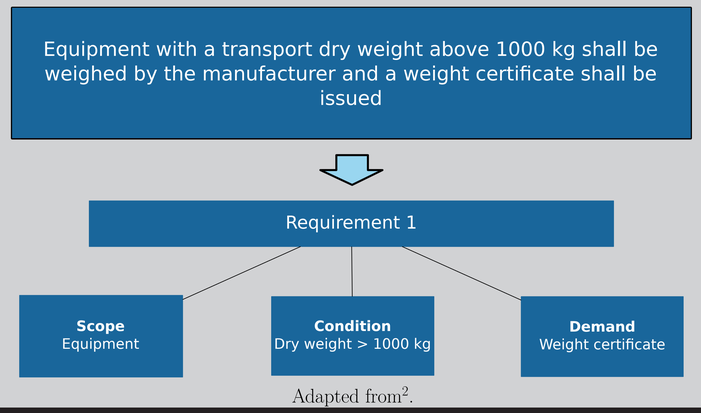
Motivation

- Most of the requirements that are used in industry today are available only in textual format
- Numerous challenges:
  - Organization of the requirements
  - Find relevant requirements
  - Duplicate, overlapping, and even conflicting requirements.
  - The revision cycle time of requirements

The problem

- **Scope detection is** the task of detecting a given requirement sentence's subject matter, i.e., the scope of the requirement.
- We look at a binary classification task where a sentence is classified as **containing a scope** (**SCOPE**) or as **not containing a scope** (**NOT SCOPE**).
- We limit the task to the detection of a scope that is a piece of equipment, an assembly of pieces of equipment or refinement of equipment.



Adapted from[2].

Has scope?

- *Test pieces for transverse weld (cross weld) tensile shall be rectangular and in accordance with [B.2.3.3]* **SCOPE**
- *Detection of a leakage shall result in immediate closure of all valves required to contain it* **NOT SCOPE**

Method

- We apply a pipeline of 5 major components as shown in the figure below.
- We used data programming to create labelled training data
- The classifier uses **BERT** pretrained contextual embeddings with a fully connected layer for classification.

Evaluation

- We created a **labelling guideline** for scope detection describing the task, the limiting conditions and example labelling of confusing cases.
- Manually labelled 200 requirements sentences for development
- Divided the 300 sentences into three Excel sheets and asked ontology experts from DNV GL to annotate these sheets. Three annotators were selected for each sheet, and they were given the same annotation guidelines that we used.

Results

Dataset	Class	Precision	Recall	F1	Support
RU-SHIP and ST-F101	**NOT SCOPE**	0.87	0.64	0.74	92
Acc: 0.79	**SCOPE**	0.75	0.92	0.83	108
OS-E101	**NOT SCOPE**	0.80	0.47	0.60	76
Acc: 0.76	**SCOPE**	0.74	0.93	0.82	124
RU-FD	**NOT SCOPE**	0.60	0.46	0.52	68
Acc: 0.68	**SCOPE**	0.71	0.81	0.76	112
Equinor TR3032	**NOT SCOPE**	0.76	0.52	0.61	66
Acc: 0.79	**SCOPE**	0.79	0.92	0.85	134

Conclusion

- The model shows good performance in separating sentences without a scope from sentences with scope with an accuracy of 0.79 on manually labelled sentences.
- The model also shows promising results on documents from other related domains and a document from another company.
- The performance of the model is, however, shifted toward a high recall of 0.92 for sentences with scope as opposed to a recall of 0.64 for sentences without scope.

Acknowledgements: This research is funded by the SIRIUS centre: Norwegian Research Council project number 237898. Co-funded by partner companies including DNV GL and Equinor.

[2] https://readi-jip.org/wp-content/uploads/2019/11/Introduction-to-semantic-technology-and-ontologies-WebPage-November.pdf