

Detection of Defective Requirements Using Rule-Based Scripts

Project Description

Badly written requirements can be misleading, redundant or lack information. Therefore, they should be scrutinized before further use. An automatic way to do so is desirable, though, since requirements should save rather than cost work.

We considered a rule-based approach promising, because those rules are easy to maintain and the narrow linguistic variation in requirements should allow good results.

We consulted the literature and identified ten defects to be relevant for our purposes. We then wrote the rule-script solely on the description of the defects in the literature.

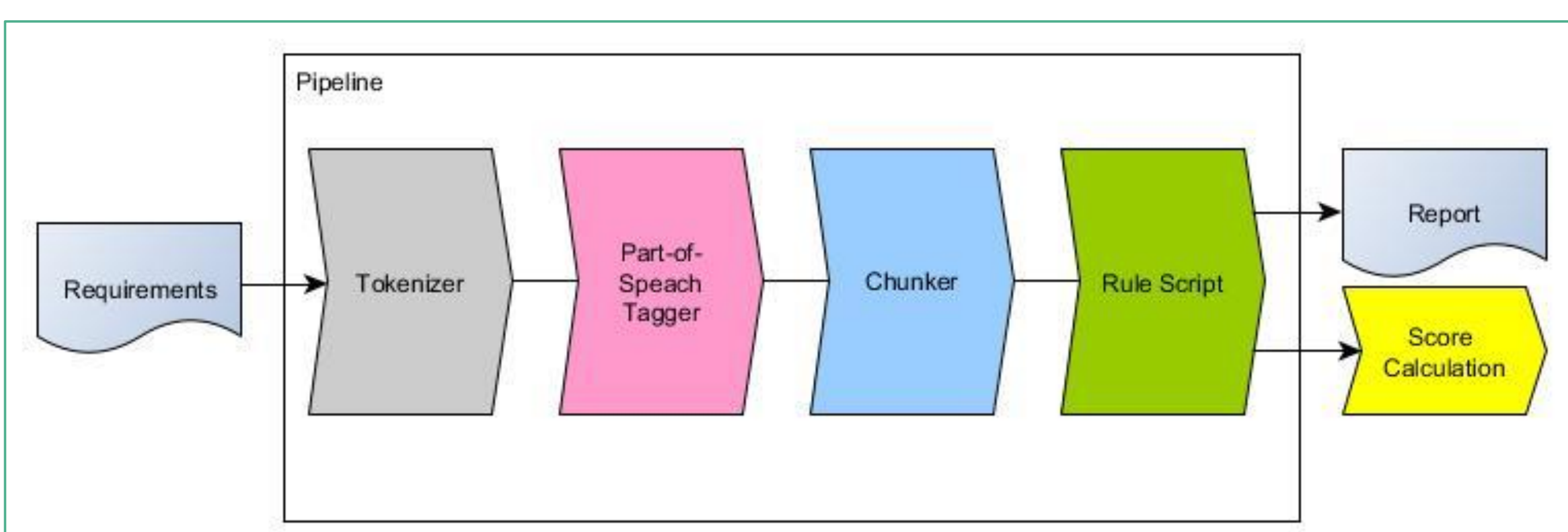
After the rule script has been written, a test corpus consisting of 100 randomly picked requirements out of a stock for information technology systems for command and control, has been built, to check which defects occur how often, and also to evaluate the rule script.

The Defects and why they are considered as such

Defects and their occurrences in the Test Corpus

Defect	Example	Concern	Occurrence per 100
Empty Verbphrase	"The system should perform a data transfer regularly."	The action should be expressed through the main verb.	35
Incomplete Condition	" In a state of emergency , the system needs to transfer data via radio."	How should data be transferred normally?	4
No Atomicity	"The application should transmit data via radio and run on every operating system."	This should be two requirements.	78
Passive	"The system should be updated ."	Doesn't specify who's responsible.	17
Quantor	" All users should have access to the database."	Should really all the users have access?	4
Vague Adjective	"The system should transmit data quickly ."	How quick is considered <i>quickly</i> ?	8
Indefinite Article	" Ein Soldat muss das System bedienen können."	In German, the indefinite article and the numeral <i>one</i> are homonymous.	0
Temporal Clause	" While the system is booting up, data musn't be sent."	What is actually meant is a condition.	0
Redundant Clause	"The administrator needs to change data at any time in order to help the user with his problems ."	No need to justify a requirement at this place.	0
Incomplete Comparison	"The system needs to be faster ."	Faster than what?	0

Basic System Architecture



Example: Passive

The rule to annotate passive makes use of the strict German word-order, which has to be followed in requirements. Requirements always use a modal verb, e.g. *should*. In German, this pushes the other verbs to the end of the sentence with the past participle preceding the auxiliary. The sentence in the picture translates as "A QOS-Model should be built for the system".

Der Administrator muss ständig Zu Past Participle	Main Verb as	<ul style="list-style-type: none"> VagueAdjective IncompleteCondition NoAtomicity Passive EmptyVerbPhrase Specification
Das System muss Daten mit 1000 MB/s übertragen.	↓	
Für das System muss ein QOS-Modell erstellt werden.	↑	
Der Administrator muss das System warten.	↑	
Das System nModal Verb üfung der Daten e Auxiliary in the Infinitive Form		

Example: Empty Verbphrase

An empty verbphrase consists of a verb with very broad meaning and a noun that expresses the actual process. It is considered a defect because the main verb of the requirement should express the process. The sentence in the picture translates as "The system should perform a transmission."

Der Administrator muss ständig Verb f haben.	Empty	<ul style="list-style-type: none"> VagueAdjective IncompleteCondition NoAtomicity Passive EmptyVerbPhrase Specification
Das System muss Daten mit 1000 3/s übertragen.	↓	
Das System soll eine Übertragung vornehmen.	↑	
Der Administrator muss d System warten.	↑	
Das System muss die Nominalized Daten ermöglichen	Verb	

Evaluation of the Rules Script

	True Positive	False Positive	False Negative	Precision	Recall	F1
Total	108	40	38	0.73	0.74	0.753
Empty Verbphrase	23	13	12	0.639	0.657	0.648
Incomplete Condition	0	5	4	0.0	0.0	0.0
No Atomicity	66	22	12	0.75	0.846	0.795
Passive	17	0	0	1.0	1.0	1.0
Quantor	1	0	3	1.0	0.25	0.4
Vague Adjective	1	0	7	1.0	0.125	0.222

Conclusion

- The rules did good on the most common defects
- Several defects mentioned in the literature didn't occur at all in our corpus
- Slight rule adjustments will lead to better results

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