CIB W78 - LDAC 2021:
Workshop on
BIM-based
Model Checking

Natural Language Processing for Building Code Interpretation: A Systematic Literature Review

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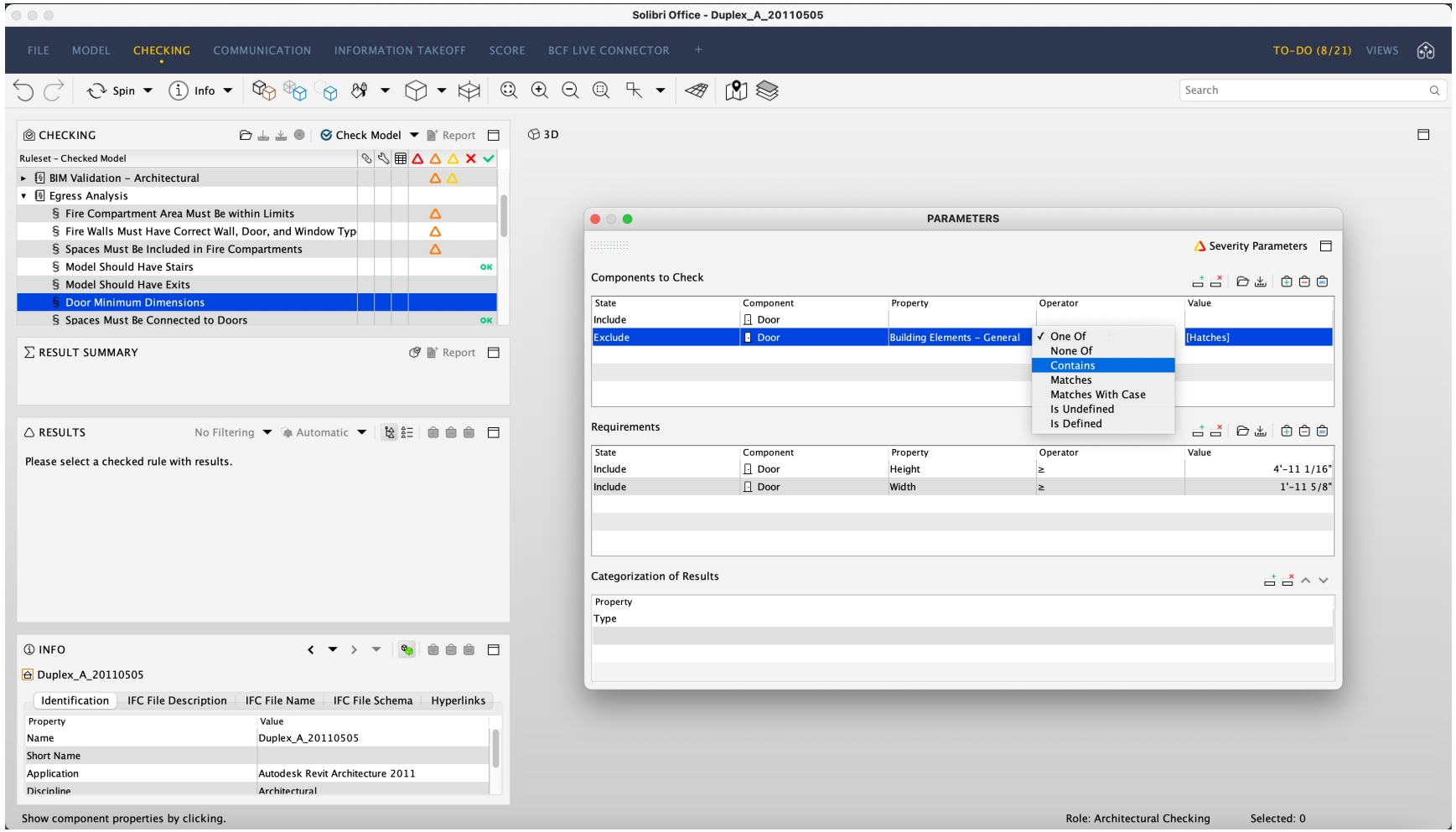
Building code compliance

- A – General Provisions
- B – Stability
- C – Protection from fire
- D – Access
- E – Moisture
- F – Safety of users
- G – Services and facilities
- H – Energy efficiency

Conventional Model Checking



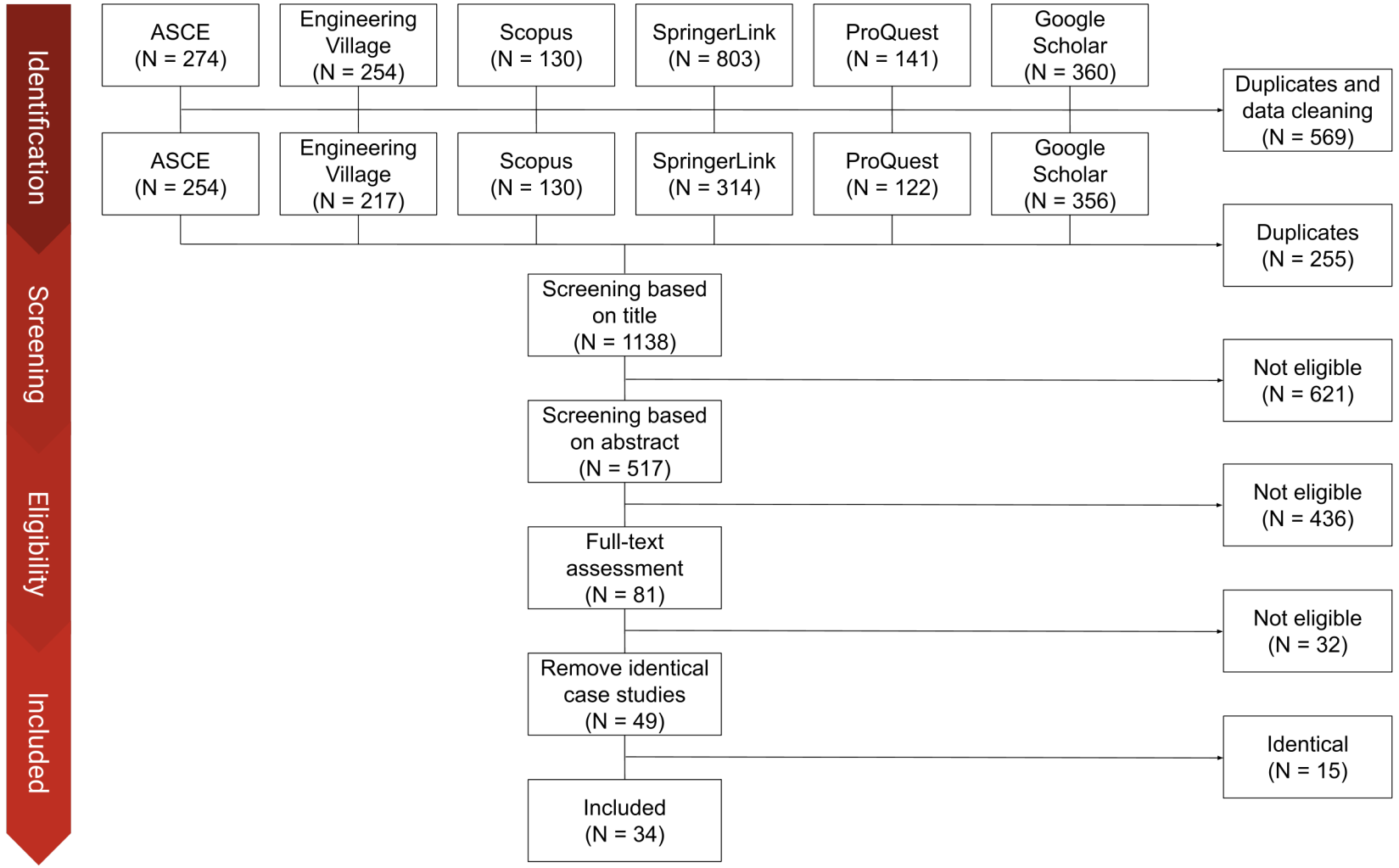
Compliance checking and rule parameters in Solibri (2021)

Research questions

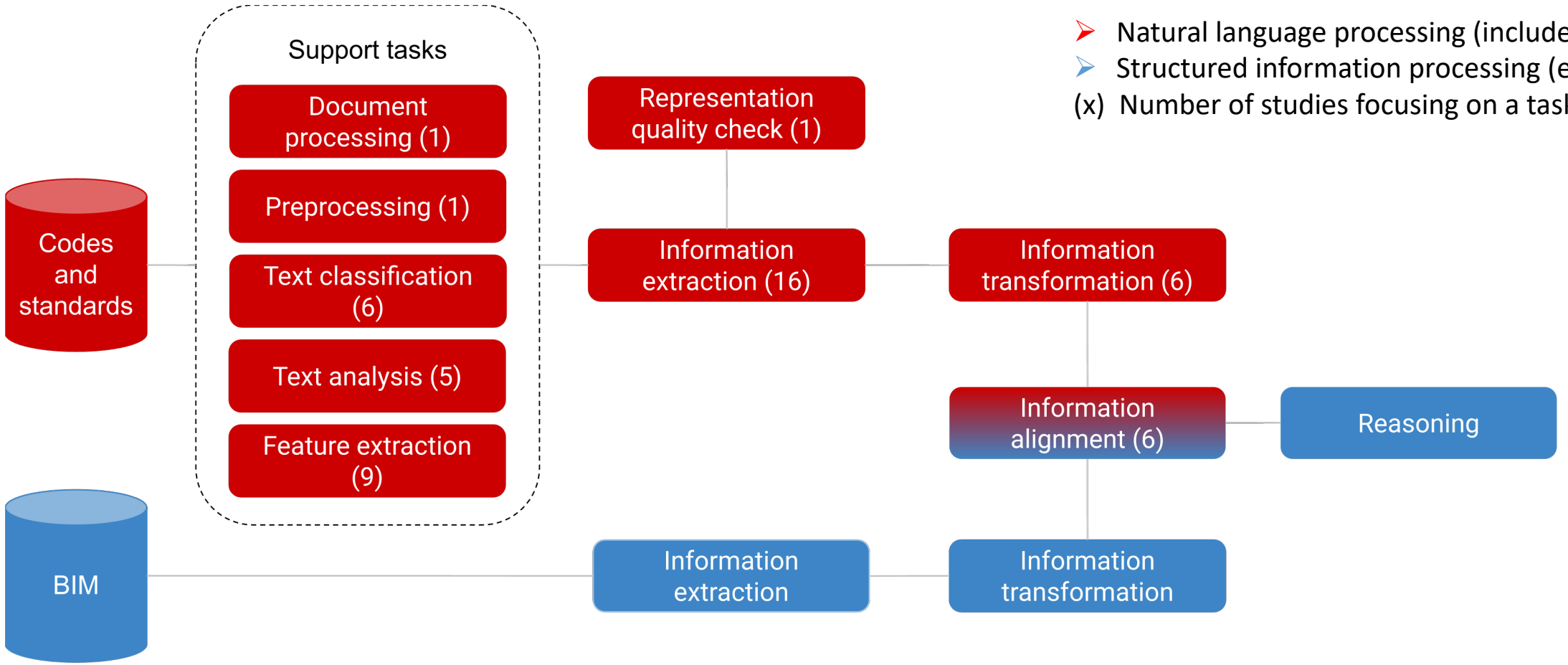
1. How can NLP technologies support or automate the interpretation of building regulations?
2. What technologies were used for the interpretation tasks and how well did they perform?
3. What level of automation can be achieved for the computerisation of building regulations?

Methodology

Initial database records:	1,962
Relevant database articles:	34
Backwards snowballing:	2
Author search:	5
Included articles:	**41**



Literature analysis



Literature analysis

Codes and standards

BIM

Text

Text

Featu

extraction

transformation

2.2 Width

2.2.1 The clear width of an *accessible route* shall be no less than 1200 mm.

COMMENT:
Handrails and other minor obstructions complying with Paragraphs 1.5.1 and 1.5.2 are permitted to intrude into this width.

2.3 Protection from falling

2.3.1 Where the surface of an *accessible route* is more than 25 mm above the adjacent ground, protection is to be provided by either a 75 mm upstand (kerb) or a low barrier rail.

5.2 Step-type ladders

5.2.1 Step-type ladders (see Figure 19) shall have:

a) **A slope** of between 60° and 70° from the horizontal,

b) **Treads** no less than 100 mm wide and spaced evenly at between 200 mm and 250 mm centres,

c) **A width** between stiles of no less than 450 mm,

d) **A height** between landings of no more than 6.0 m,

e) **Clearances** of at least:

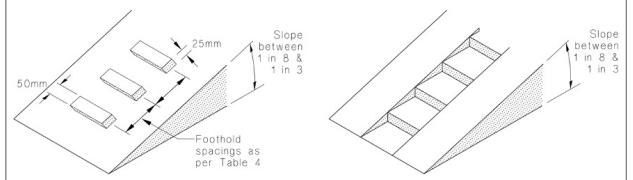
i) 50 mm for hand movement along the *handrail*,

ii) 50 mm between the treads and any solid objects behind the ladder,

Table 4: Foothold Spacing for Service Ramps
Paragraph 3.1.2

Ramp slope	Spacing (mm)	
	Goods carried	No goods carried
1:6	360	460
1:5	330	430
1:4	300	400
1:3	280	380

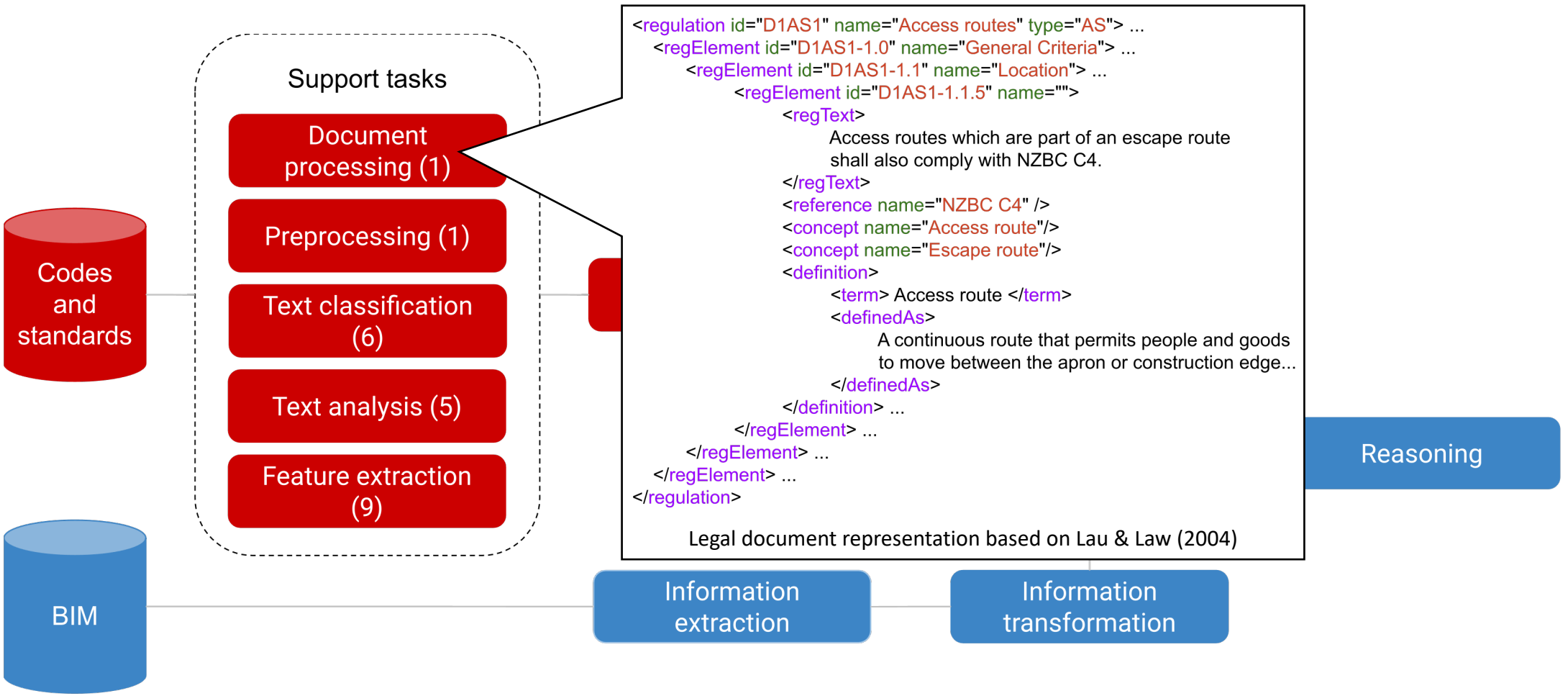
Figure 8: Service Ramps Footholds
Paragraph 3.1.2



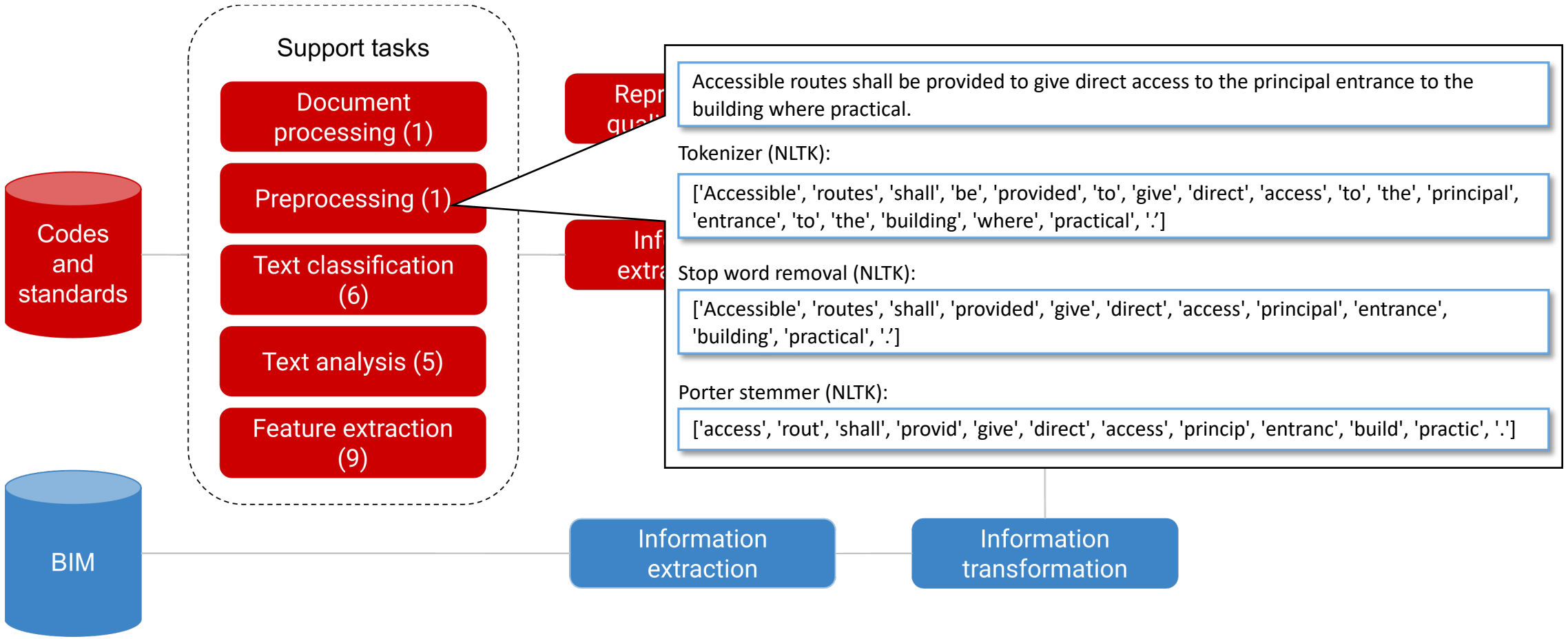
(a) Cleats (b) Steps

Acceptable Solutions and Verification Methods For New Zealand Building Code Clause D1 Access Routes (Ministry of Business, Innovation and Employment, 2017)

Literature analysis



Literature analysis



Literature analysis

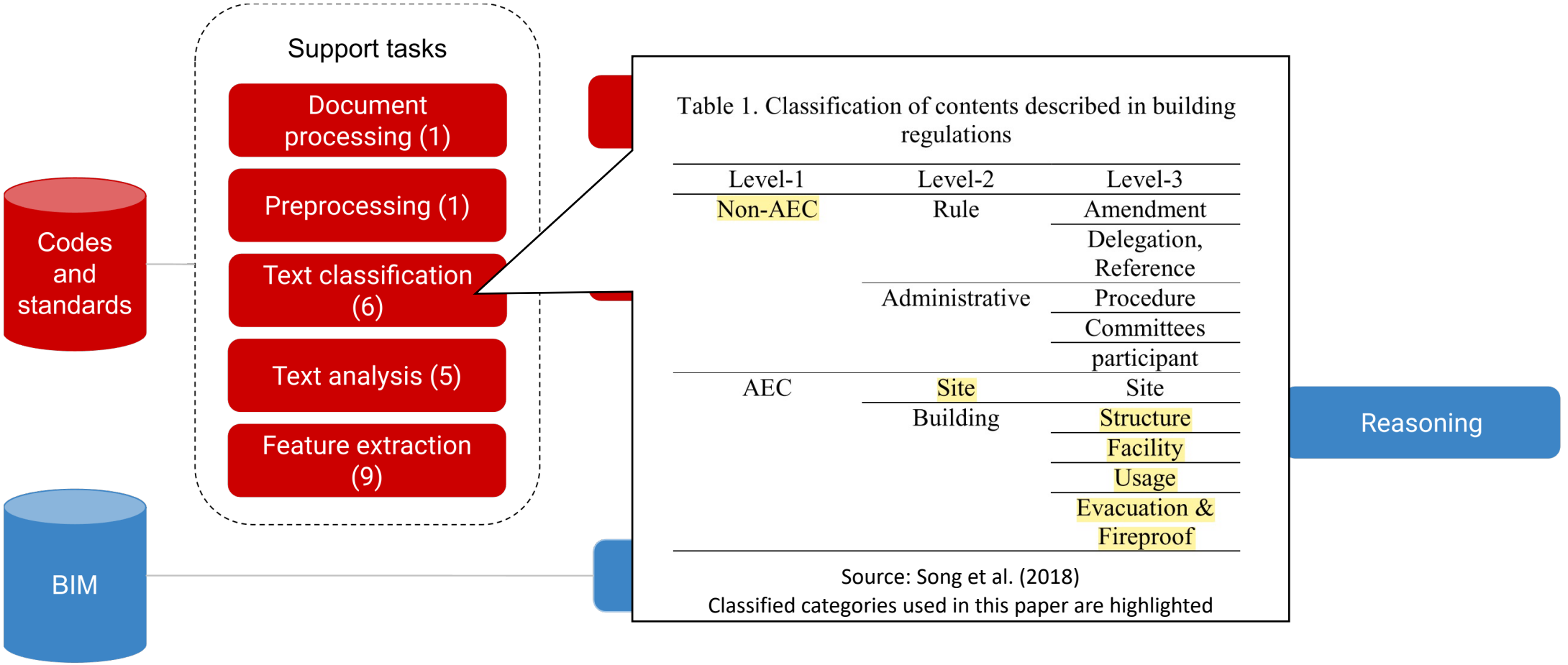
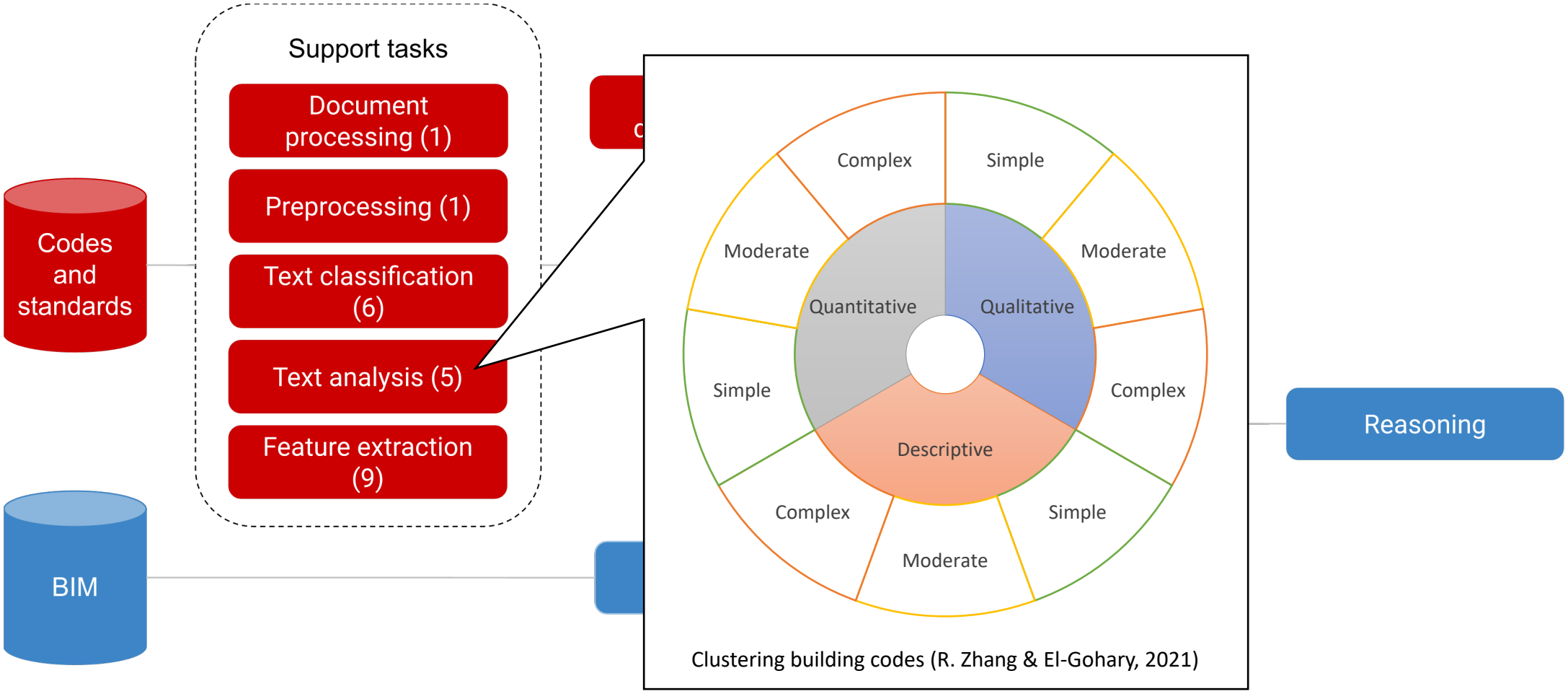


Table 1. Classification of contents described in building regulations

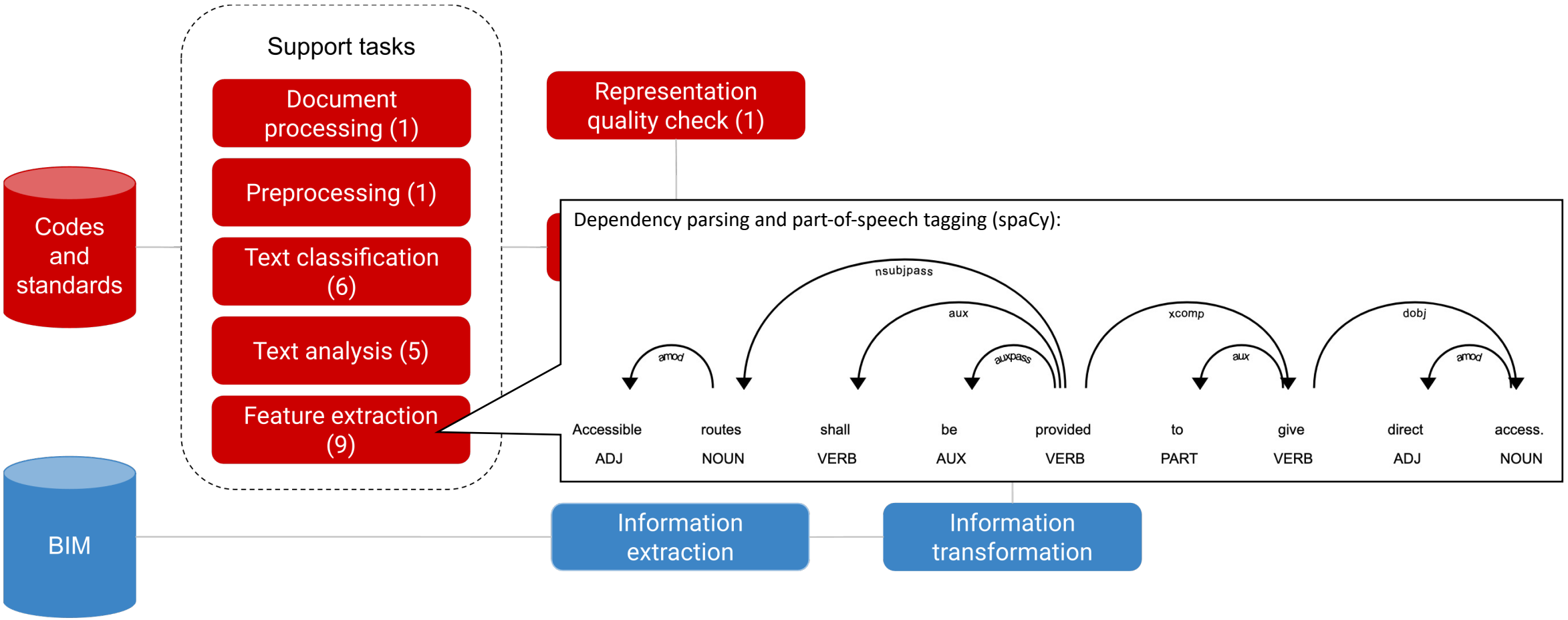
Level-1	Level-2	Level-3
Non-AEC	Rule	Amendment
		Delegation, Reference
	Administrative	Procedure
		Committees
		participant
AEC	Site	Site
	Building	Structure
		Facility
		Usage
		Evacuation & Fireproof

Source: Song et al. (2018)
Classified categories used in this paper are highlighted

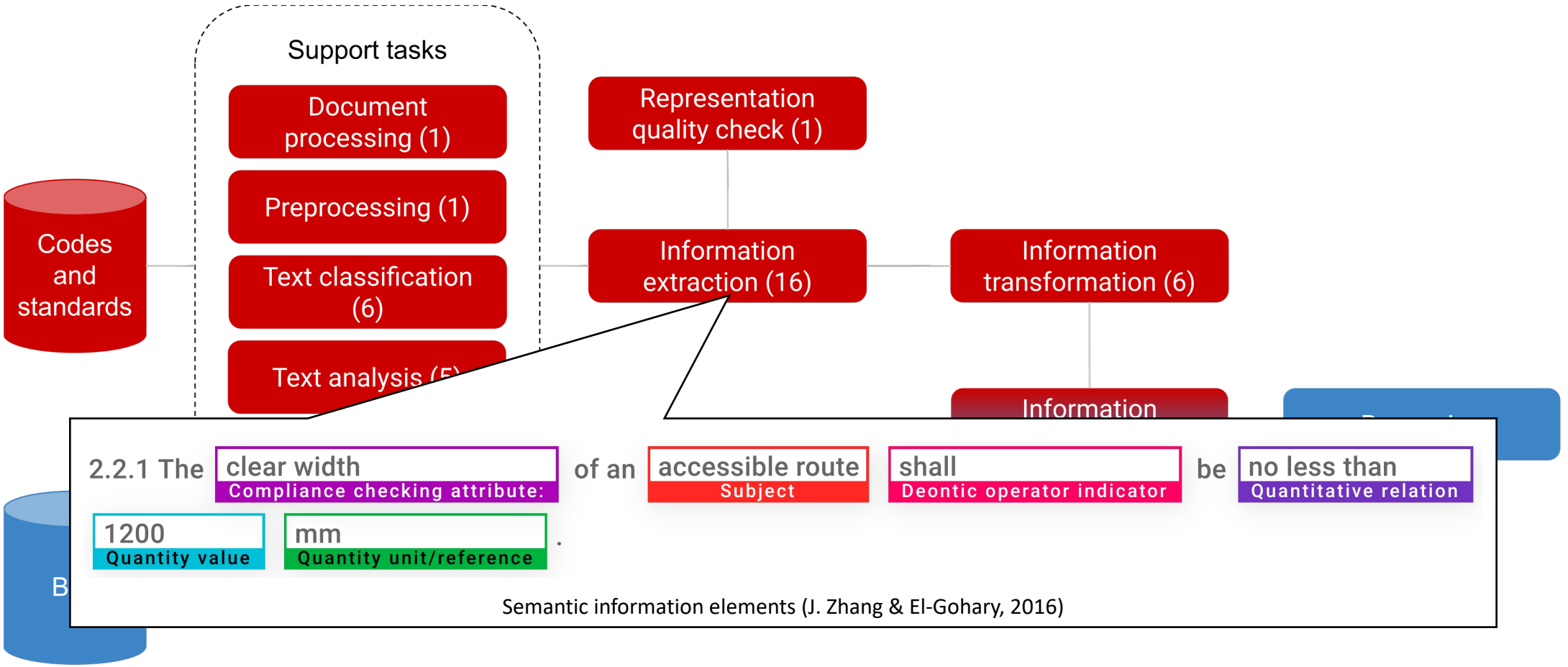
Literature analysis



Literature analysis

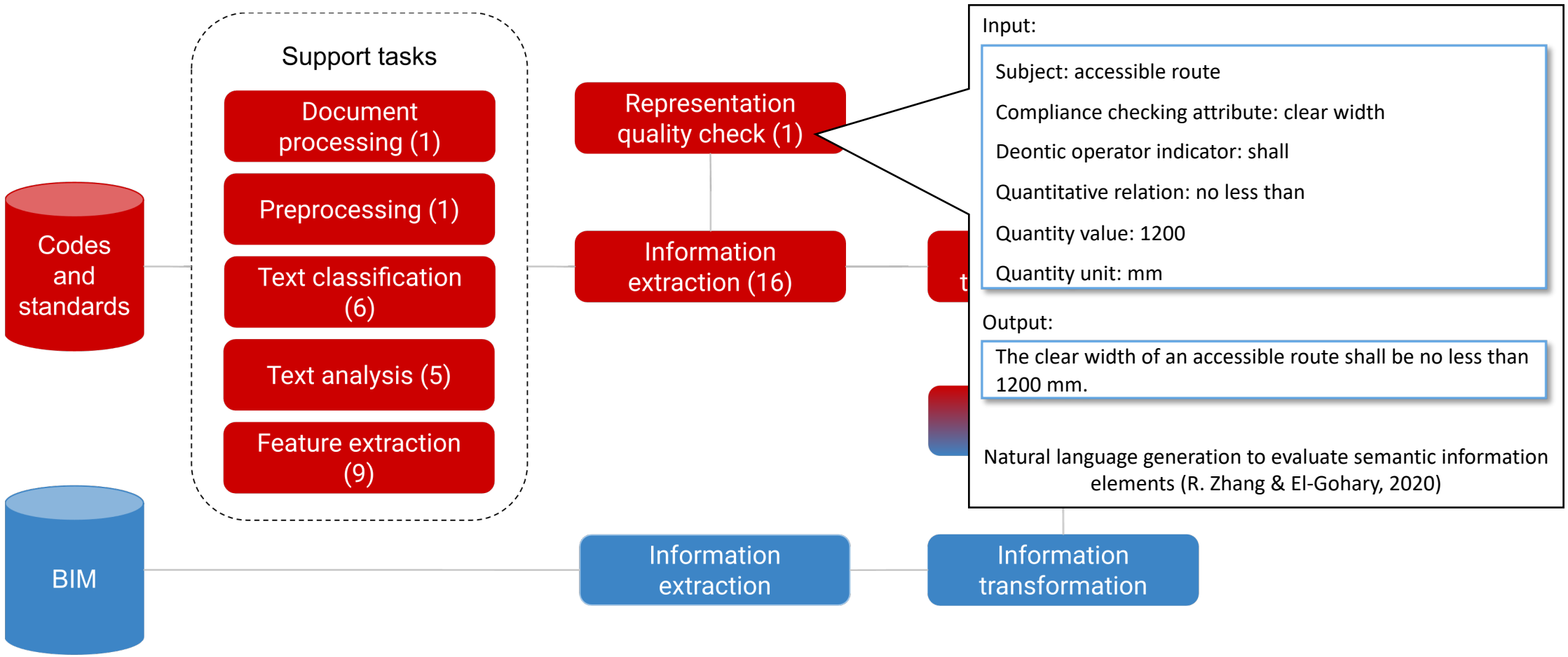


Literature analysis



Semantic information elements (J. Zhang & El-Gohary, 2016)

Literature analysis



Literature analysis

```
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            </ruleml:Expr>
        </ruleml:if>
        <ruleml:then>
            <ruleml:Expr>
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                </ruleml:Atom>
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                </ruleml:Data>
            </ruleml:Expr>
        </ruleml:then>
    </ruleml:Rule>
</lrml:PrescriptiveStatement>
```
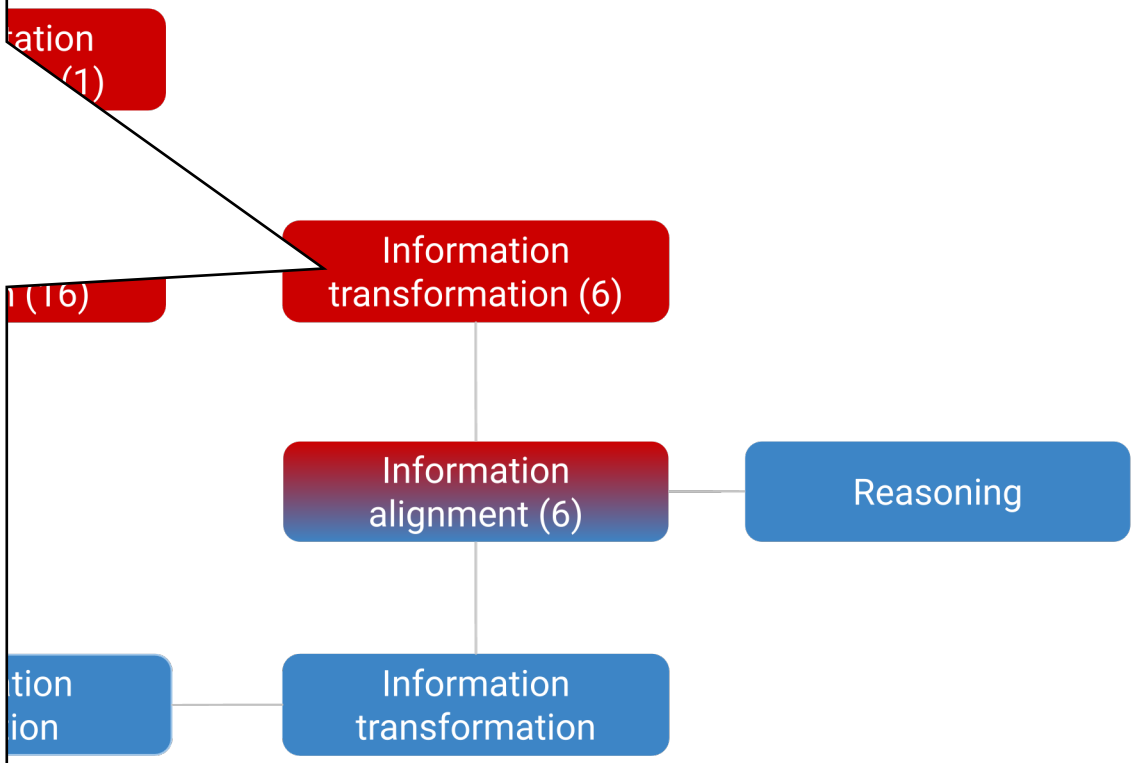
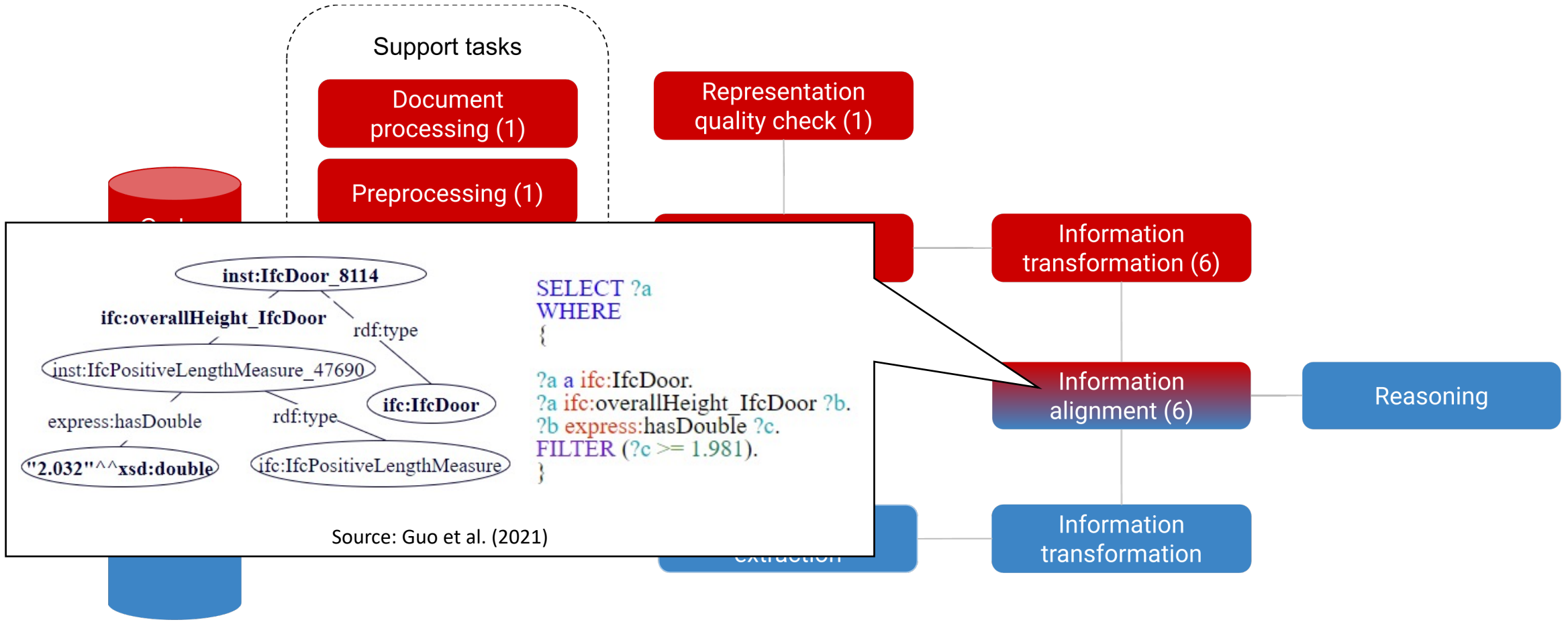

LegalRuleML example based on Dimyadi et al. (2020)



Literature analysis



Source: Guo et al. (2021)

Gaps in research

Insufficient regulation context

No public data sets

Scalability vs accuracy

Expanding beyond quantitative textual requirements

Standardising quality assurance

Natural Language Processing for Building Code Interpretation

Thank you very much
for your
time and attention

References

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