



Fuzzy Description Logics

Exercise Sheet 2

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Exercise 1

Can the following statements in natural language be expressed in \mathcal{EL} ? If possible, give an \mathcal{EL} -axiom that captures their meaning.

- Superheroes that wear bat-costumes have sidekicks.
- Someone whose opponent is a superhero is a supervillain.
- Only superheroes and supervillains can have superpowers.

Exercise 2

Prove the following statement for the Gödel semantics. Let $\alpha, \beta, \gamma, q_1, q_2 \in [0, 1]$. If

$$(\alpha \Rightarrow \beta) \geq q_1$$

and

$$(\beta \Rightarrow \gamma) \geq q_2$$

then

$$(\alpha \Rightarrow \gamma) \geq \min(q_1, q_2).$$

Exercise 3

Consider the fuzzy ABox

$$\mathcal{A} = \{\langle A(a), 0.5 \rangle, \langle r(a, b), 0.9 \rangle, \langle r(a, c), 0.7 \rangle\}$$

and the fuzzy TBox

$$\mathcal{T} = \{\langle A \sqsubseteq \forall r.(A \sqcup \neg B), 0.8 \rangle, \\ \langle A \sqsubseteq \exists r.\neg B, 0.9 \rangle\}$$

Present a non-crisp model of \mathcal{A} and \mathcal{T} .

Exercise 4

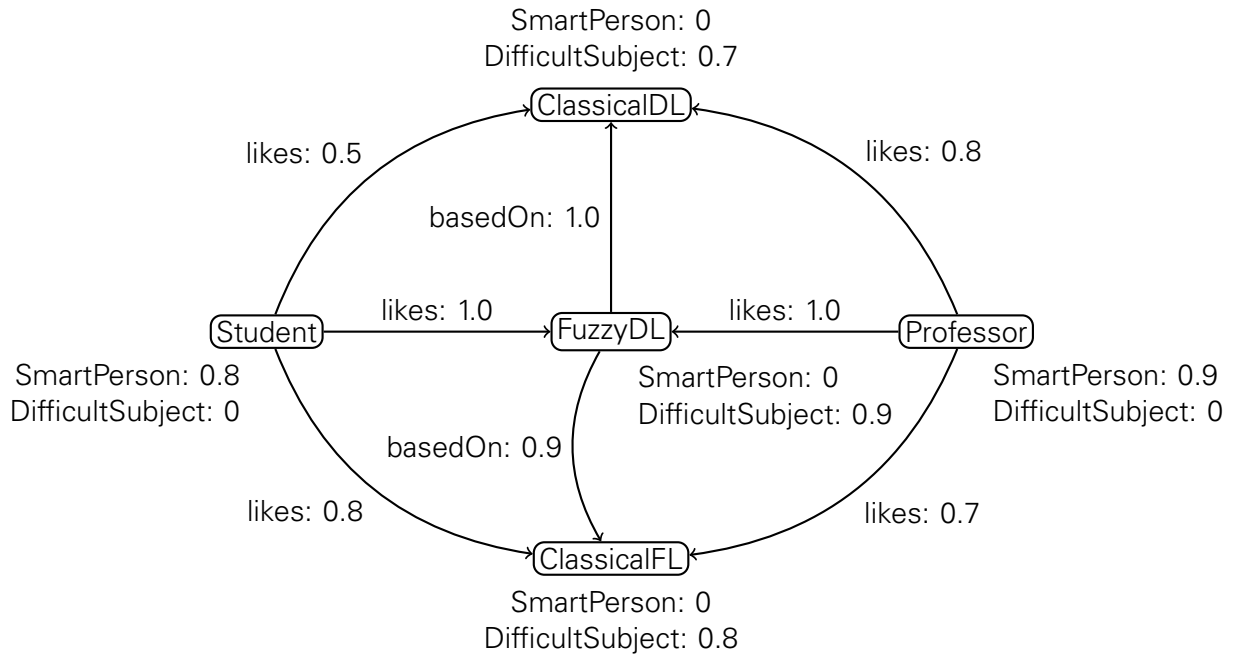
Consider a set of concept names

$$\mathcal{N}_C = \{\text{DifficultSubject}, \text{SmartPerson}\}$$

and a set of role names

$$\mathcal{N}_R = \{\text{likes}, \text{basedOn}\}.$$

Let a fuzzy interpretation be given by the following graphical representation (absent edges are meant to be read as 0, e.g. in this example $\text{likes}^{\mathcal{I}}(\text{Student}, \text{Professor}) = 0$).



Give the interpretations of the following concept descriptions.

- $\text{SmartPerson} \sqcap \exists \text{likes} . \text{DifficultSubject}$
- $\forall \text{likes} . \exists \text{basedOn} . \text{DifficultSubject}$
- $\exists \text{likes} . \forall \text{basedOn} . \text{DifficultSubject}$