
A Tutorial Summary of Description Logic and Hybrid Rules

Jing Mei, Harold Boley
October, 2005

Description Logics

- DL: Family of (decidable) sublanguages of First-Order Logic

- Concept

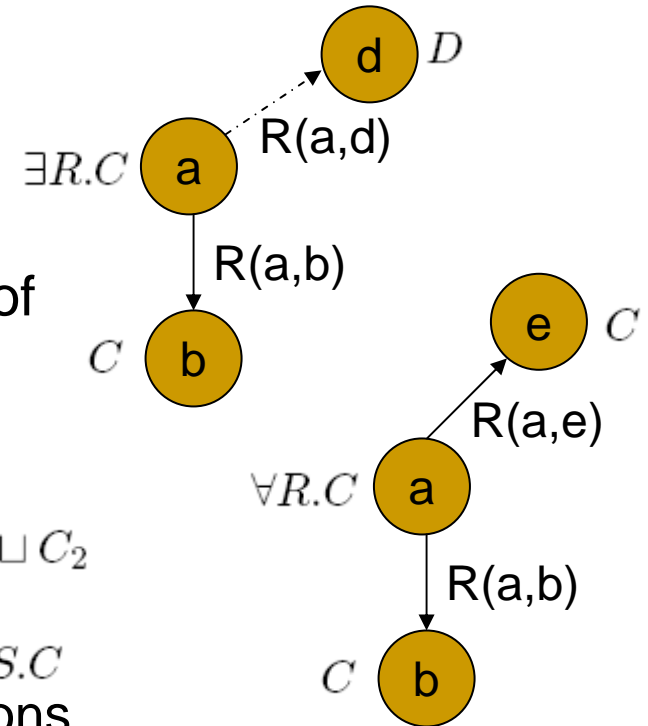
- Atomic concepts: C, C_1, C_2, D
- Boolean combinations: $\neg C \mid C_1 \sqcap C_2 \mid C_1 \sqcup C_2$
negation, intersection, union
- Restrictions: $\exists R.C \mid \forall R.C \mid \bowtie n S.C$
existential, universal, number qualifications

- Role

- Atomic roles: R, S
- Property: transitive, symmetric, functional, inverse-functional

- Axiom

- TBox: subsumption $C \sqsubseteq D \quad (R \sqsubseteq S)$
- ABox: assertion $C(a), \quad R(b,c).$



Rules

■ Language

- term: constant, variable, function symbol
- atom: predicate symbol applied to terms
- literal: atom + *negative* atom
- extended literal: literal + *negation as failure* literal

■ Head \leftarrow Body

- Without function symbols in atoms H and B_i
 - Datalog: $H \leftarrow B_1 \wedge \dots \wedge B_m$
 - Datalog ^{\vee} : $H_1 \vee \dots \vee H_n \leftarrow B_1 \wedge \dots \wedge B_m$
 - Datalog ^{$\neg\vee$} : $H_1 \vee \dots \vee H_n \leftarrow [\text{naf}] B_1 \wedge \dots \wedge [\text{naf}] B_m$
- With function symbols in atoms H and B_i
 - Horn programs: $H \leftarrow B_1 \wedge \dots \wedge B_m$
 - Normal programs: $H \leftarrow [\text{naf}] B_1 \wedge \dots \wedge [\text{naf}] B_m$
 - Extended programs:
$$H_1 \vee \dots \vee H_n \leftarrow [\text{naf}][\text{neg}] B_1 \wedge \dots \wedge [\text{naf}][\text{neg}] B_m$$

Hybrid Knowledge Base

- Hybrid KB: $K = (S, R)$
 - S: a finite set of DL axioms in the ontology language
 - R: a finite set of hybrid rules
- Hybrid Rules:
$$H \leftarrow B_1 \wedge \dots \wedge B_m \ \& \ Q_1 \wedge \dots \wedge Q_n$$
 - H, B_i are ordinary atoms for rules
 - Q_j are queries to the DL component S