B4M36SMU

Inductive Logic Programming
Learning from Interpretations

Monday 10th April, 2017

Basics of Logic

- constant, variable, function, term
- predicate, atom, literal
- quantifiers, logical connectives
- ground, interpretation, model
- substitution, unification, subsumption

Notation in this Course

$o \models \beta$

- holds iff an interpretation o is a model of β, meaning that β is true in the interpretation

$\alpha \vdash \beta$

- α entails β if any model of α is also a model of β

Subsumption (Propositional Logic)

DNF

- $\alpha \subseteq \beta \implies \alpha \vdash \beta$
- $\{a\} \subseteq \{a, b\} \implies a \vdash a \vee b$

CNF

- $\alpha \supseteq \beta \implies \alpha \vdash \beta$
- $\{a, b\} \supseteq \{a\} \implies a \wedge b \vdash a$

Herbrand's Interpretation

- Herbrand universe
- Herbrand base
- Herbrand model

Clauses

- *st*-clause – at most s literals, each of them contains at most t occurrences of predicate, variable and function symbols
- *range-restricted* clause – each variable of a positive literal occurs in at least one negative literal

Generalizing Agent

- Γ – set of all possible range-restricted st-clauses
- $\phi = \{\wedge_{i \subseteq I} \gamma_i | I \subseteq [0 : |\Gamma|]\}$
- start with ϕ hypothesis
- for each $o \in O$ do:
  - delete$(\bigwedge_{i \in I} \gamma_i, o) = \bigwedge_{i \in I, o \models \gamma_i} \gamma_i$

$o \models \gamma$ does not hold if and only if there is a ground instance $\gamma\theta$ of γ such that:

- atoms of all negative literals of $\gamma\theta$ are in o, and
- no positive literal of $\gamma\theta$ is in o

use tree search to find all ground substitutions (lecture)

Lab's Task

- implement generalizing agent in *agent.GeneralizingAgent* (grounding tree search, $\models$ operator)
- take the example from tutorial 3 (mamals) and create a dataset for FOL agent
- create a dataset where each negative sample cannot be described by a clause, which contains only variables