CS345 Notes for Lecture 9/25/96

Applying Rules ("Naive Evaluation")

Given an EDB:

1. Start with all IDB relations empty.
2. Instantiate (with constants) variables of all rules in all possible ways. If all subgoals become true, then infer that the head is true.
3. Repeat (2) in "rounds," as long as new IDB facts can be inferred.

- (2) makes sense as long as rules are *safe* = each variable of head appears somewhere in body.
- Limit of (1)–(3) = Minimum (or *least*) fixpoint of the rules and EDB.
- redundant computation: each "round" recomputes all elements of previous round.
- Monotonicity.

Seminaive Evaluation

- More efficient approach to evaluating rules.
- Based on principle that if at round i a fact is inferred for the first time, then we must have used a rule in which one or more subgoals were instantiated to facts that were inferred on round $i-1$.
- Thus, for each IDB predicate p, keep both relation P and relation ΔP; the latter represents the new facts for p inferred on the most recent round.

Outline of SNE Algorithm

1. Initialize IDB relations by using only those rules without IDB subgoals.
2. Initialize the Δ-IDB relations to be equal to the corresponding IDB relations.

3. In one round, for each IDB predicate p:
   a) Compute new ΔP by applying each rule for p, but with *one* subgoal treated as a Δ-IDB relation and the others treated as the correct IDB or EDB relation. (Do for *all* possible choices of the Δ-subgoal.)
   b) Remove from new ΔP all facts that are already in P.
   c) $P := P \cup \Delta P$.
4. Repeat (3) until no changes to any IDB relation.

Function Symbols

Terms built from

1. Constants.
2. Variables.
3. Function symbols applied to terms as arguments.

Example: $addr\big(street(maple), number(101)\big)$.

Example: Binary trees defined by

```
isTree(null)
isTree(node(L,T1,T2)) :-
        label(L) &
        isTree(T1) &
        isTree(T2)
```

If $label(a)$ and $label(b)$ are true, infers facts like

$$isTree\big(node(a, null, null)\big)$$
$$isTree\Big(node\big(b, null, node(a, null, null)\big)\Big)$$

- Application of rules as for datalog: make all possible instantiations of variables and infer head if all subgoals are true.
- Least fixpoint is still the minimum model.
- But LFP may be reached only after an infinite number of rounds.