
Web-Mining Agents

Deep Relational Learning

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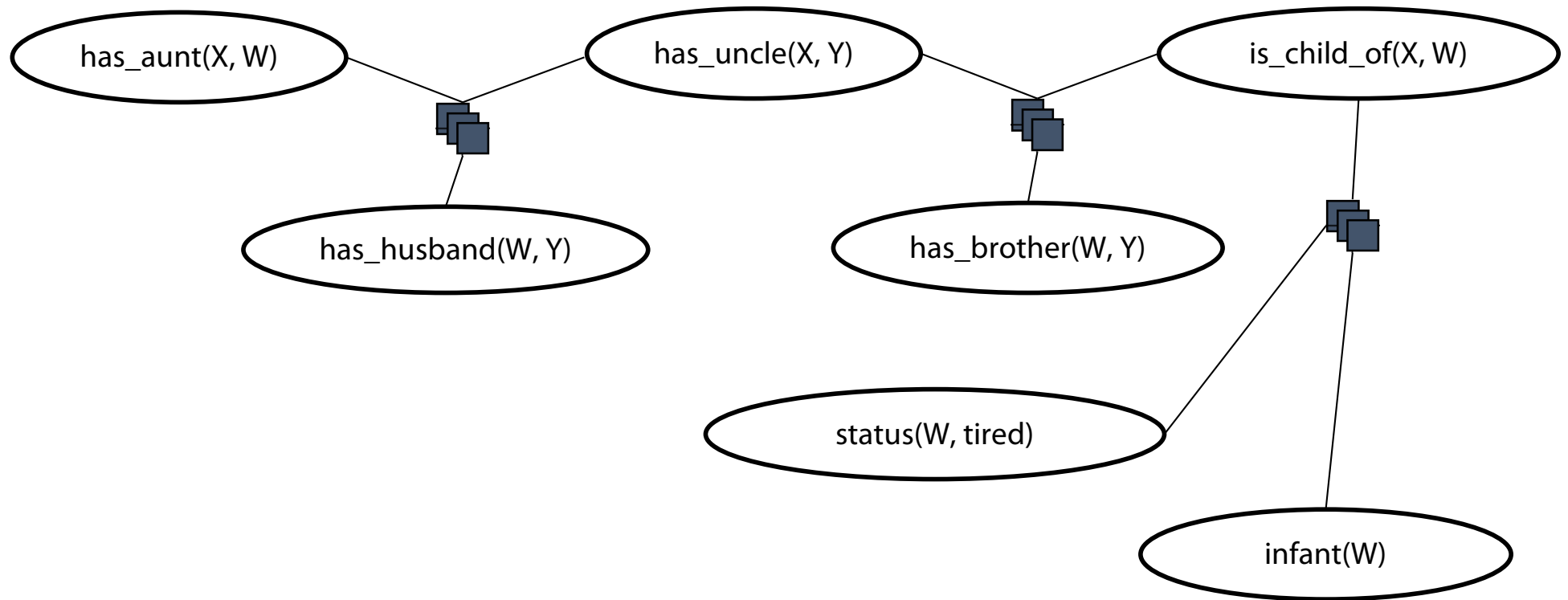
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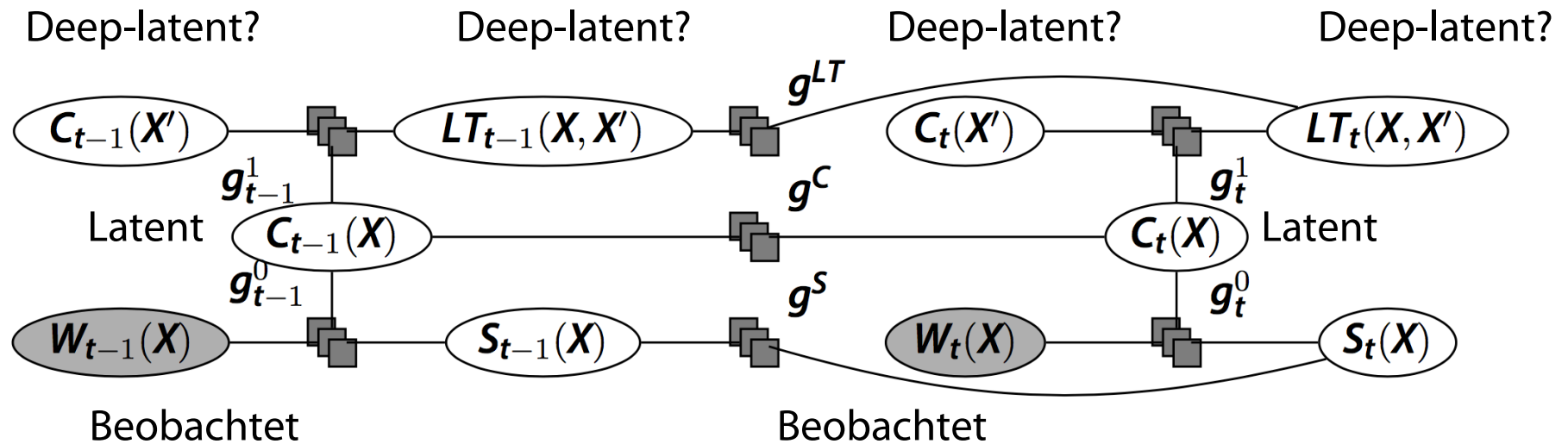


Exploiting Foil Results in PRMs



`has_uncle(X, Y) :- is_child_of(X, W), has_brother(W, X).`
`has_uncle(X, Y) :- has_aunt(X, W), has_husband(W, Y).`
`status(X, tired) :- is_child_of(W, X), infant(W).`

Deep Relational Learning

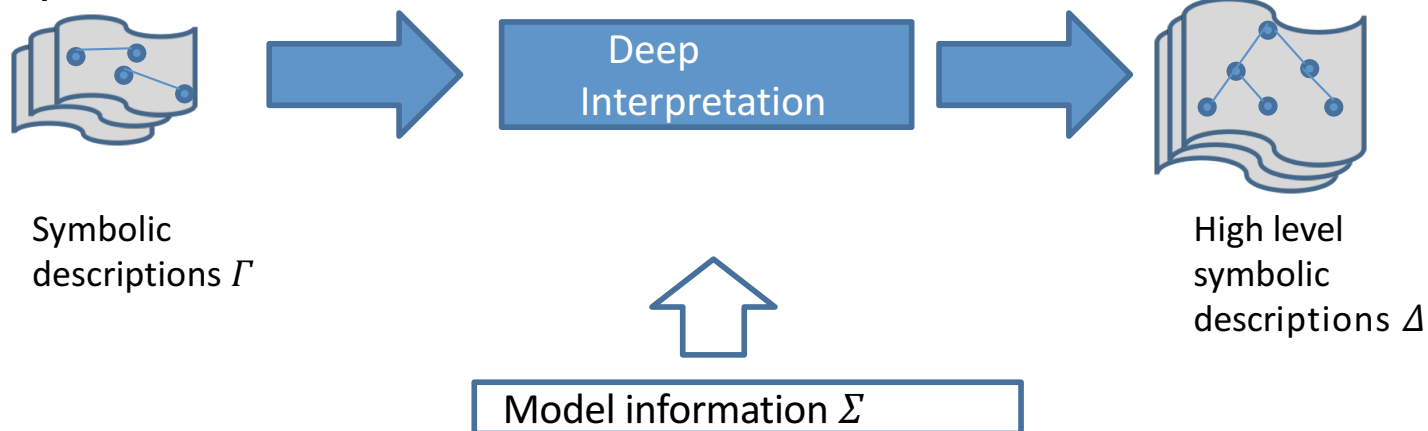


- Marginal distribution query: $P(A_{\pi}^i | E_{0:t})$ w.r.t. the model
- Prediction: $\pi > t$ (the condition of my patient in x day)
- Filtering: $\pi = t$ (the condition of my patient today)
- Smoothing: $\pi < t$ (the condition of my patient x days ago)

Deep Interpretation

Extend annotations with new domain objects (and not only relations)

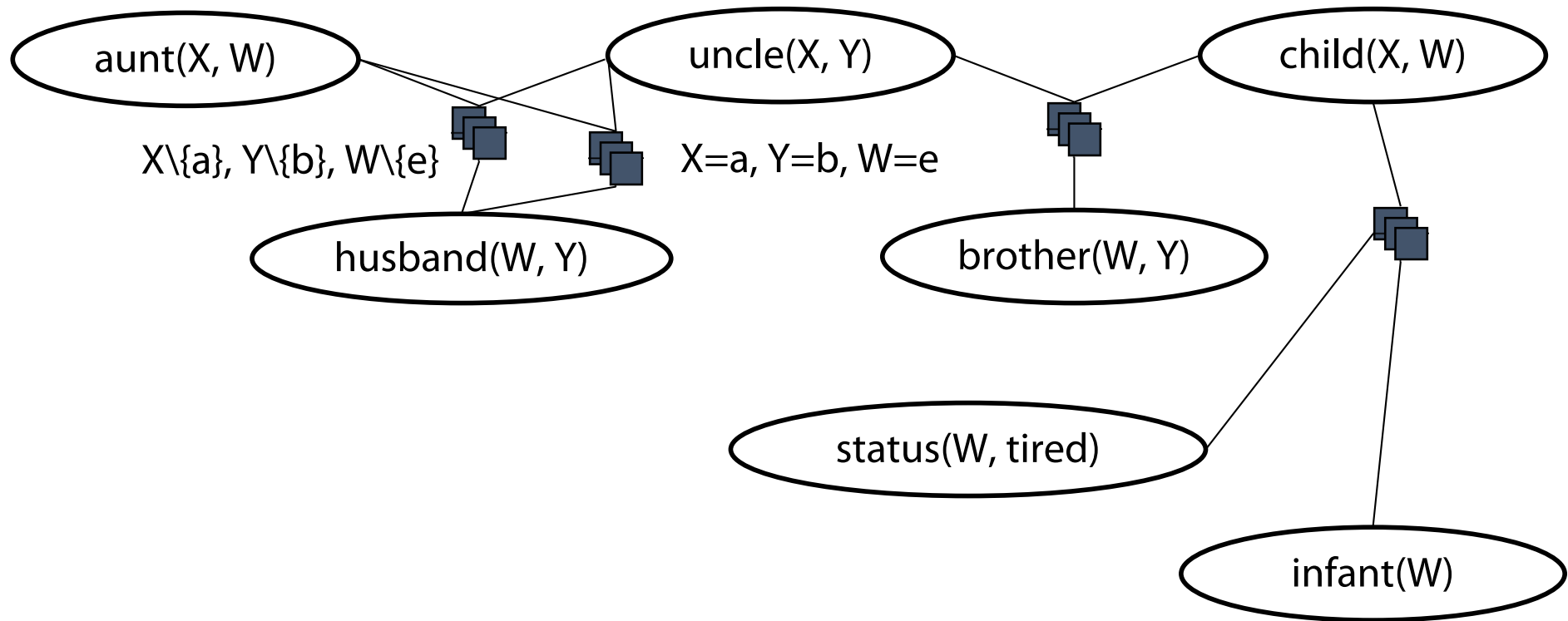
Analysis results



$$\Sigma \cup \Delta \models \Gamma$$

- Hypothesis space for possible explanations Δ
- Δ -Score: Probability Ranking Principle

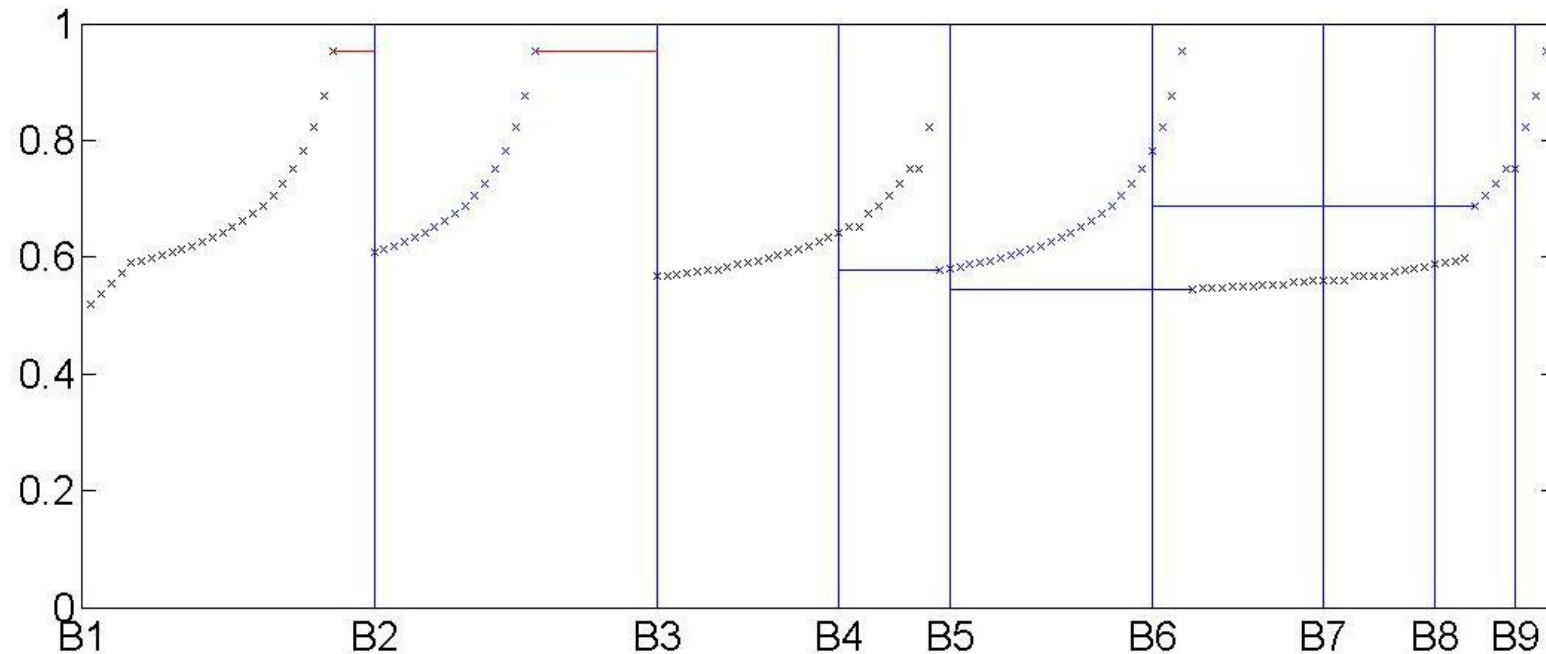
Abduction in PRMs



1. `uncle(X, Y) :- child(X, W), brother(W, Y).`
2. `uncle(X, Y) :- aunt(X, W), husband(W, Y).`
3. `status(X, tired) :- child(W, X), infant(W).`

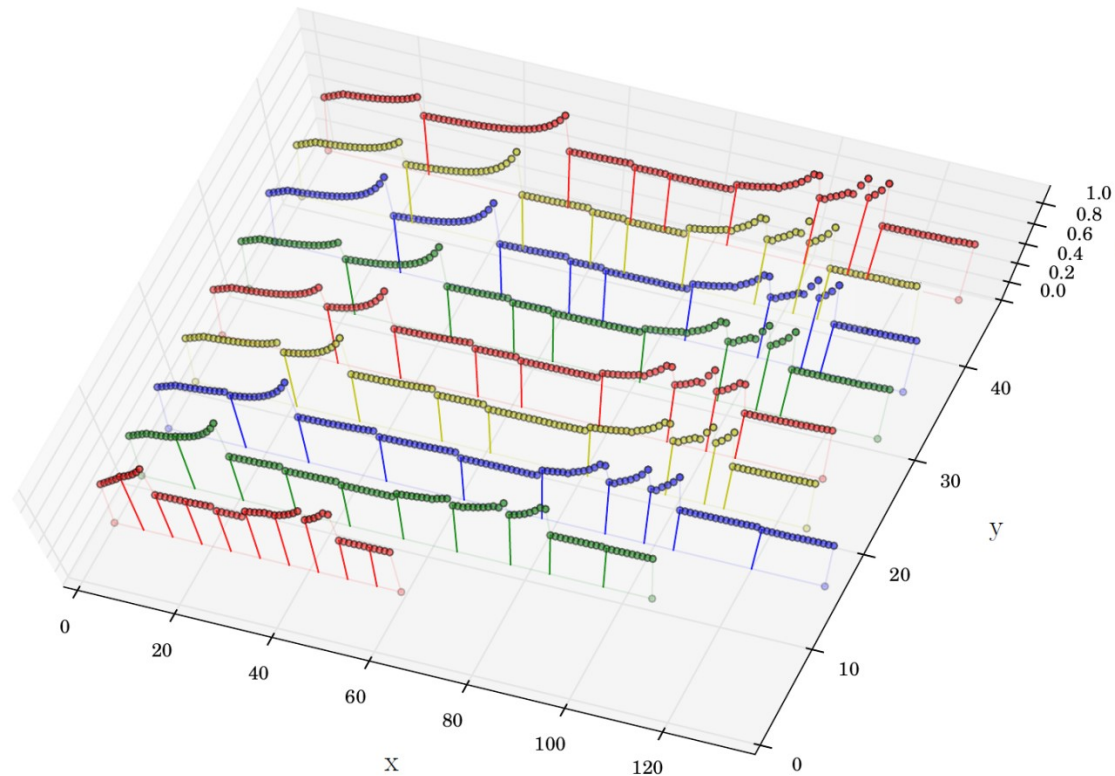
`uncle(a, b)`

Increasing the Score by Explaining Observations



x = time axis indicated with arrival time of bunch of data
y = scoring value of the interpretation

Increasing the Score by Explaining Observations



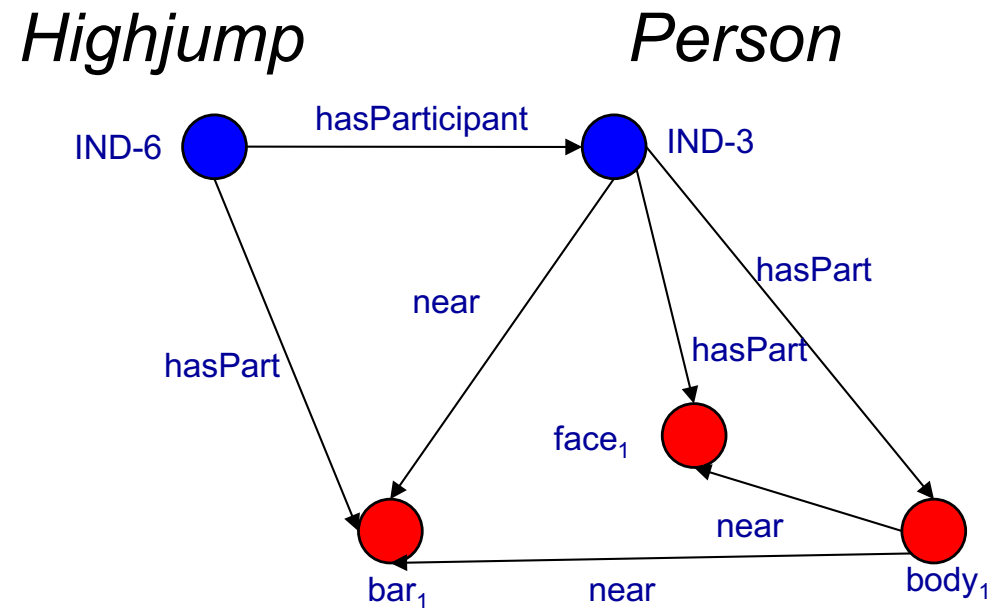
x = time spent for explaining observations

y = number of observations to be explained in a bunch

z = scoring value

Example: Image modality

- Abduction constructs relational structures
- Tbox causes new knowledge to be inferred



Nodes are somehow associated with media objects

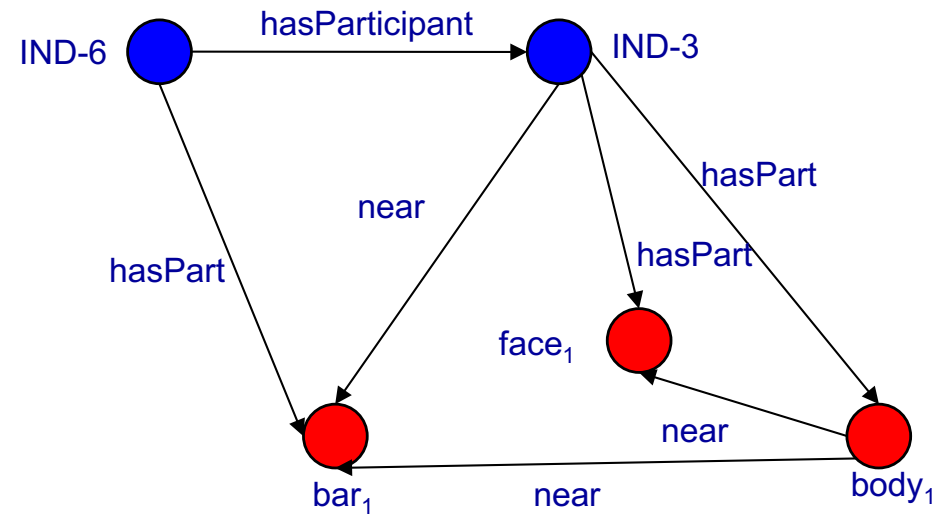
Example: Image modality

- Abduction constructs relational structures
- Tbox causes new knowledge to be inferred



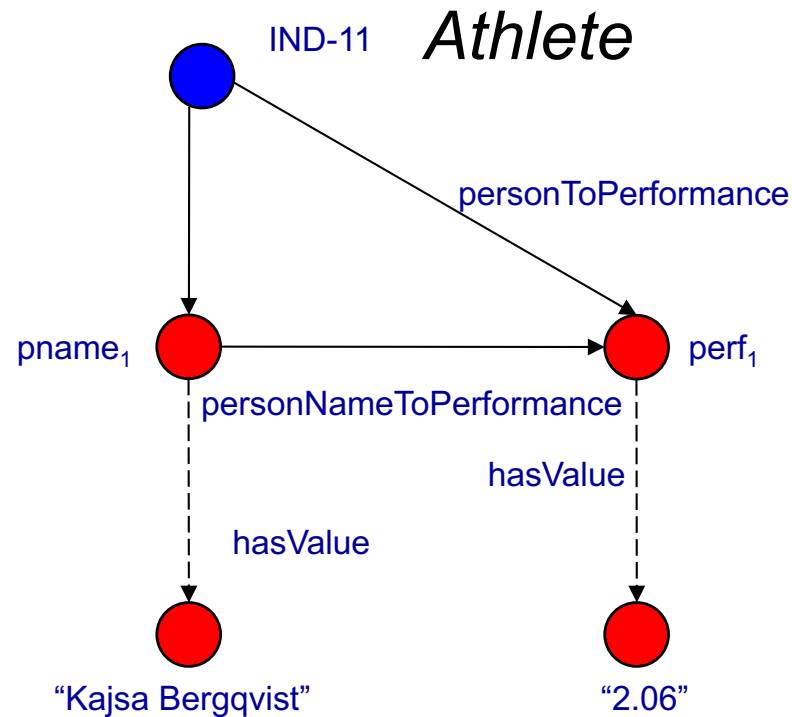
Highjump

Jumper



Example: Text modality

Kajsa Bergqvist clears 2:06 in Eberstadt



Fusion

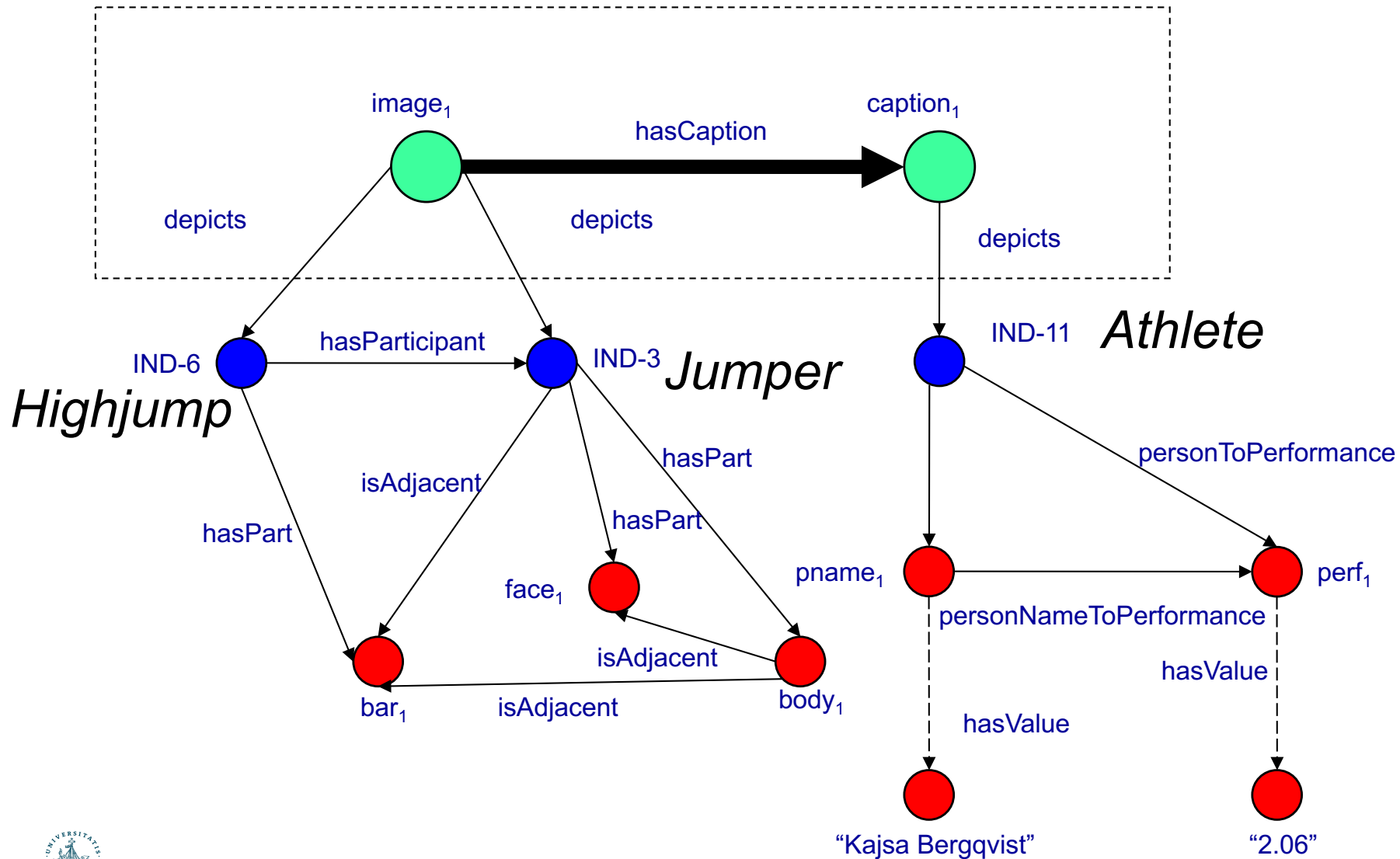
- Goals:
 - Desambiguation
 - Rule out possible interpretations
- Information accumulation (for better query answering)



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IM FOCUS DAS LEBEN

Explicitly represent the document structure

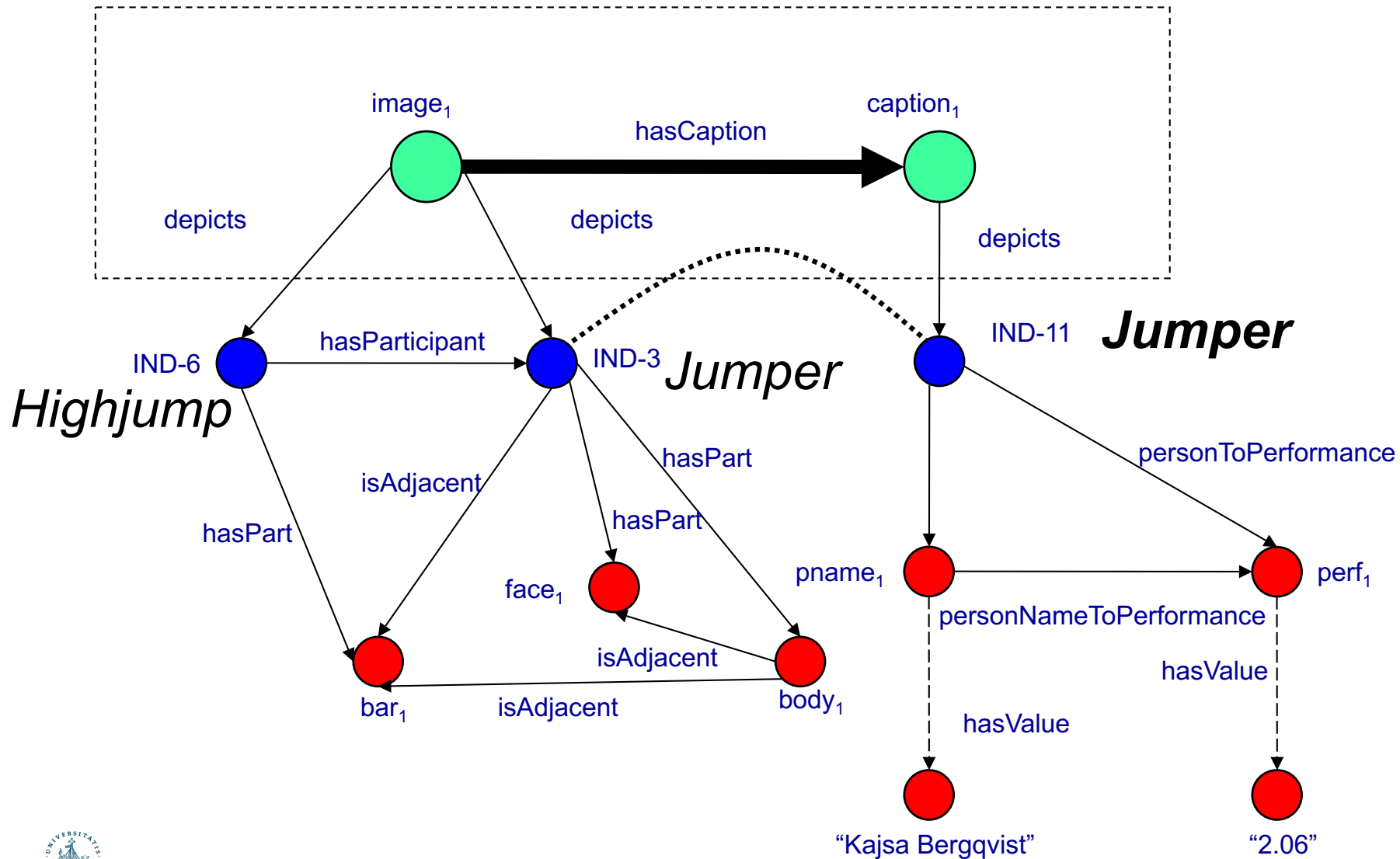


Exploit the document structure

- Abduction is used to find explanations for the relations between the multimedia objects
- We assume the following rule

```
hasCaption (X, A) ←  
  Image (X) ,  
  depicts (X, Y) ,  
  Caption (A) ,  
  depicts (A, B) ,  
  same-as (Y, B)
```

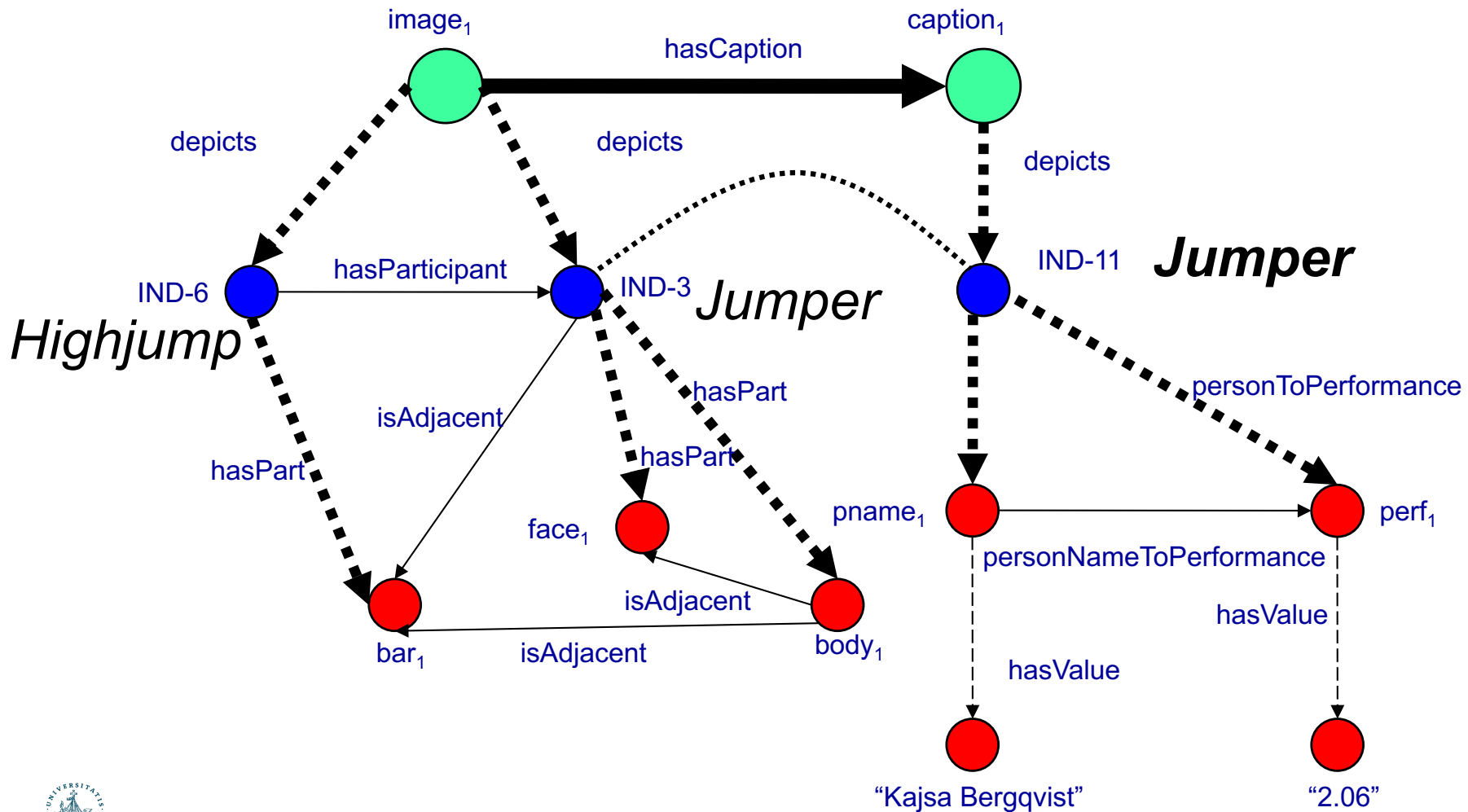
Structure identification



Causality

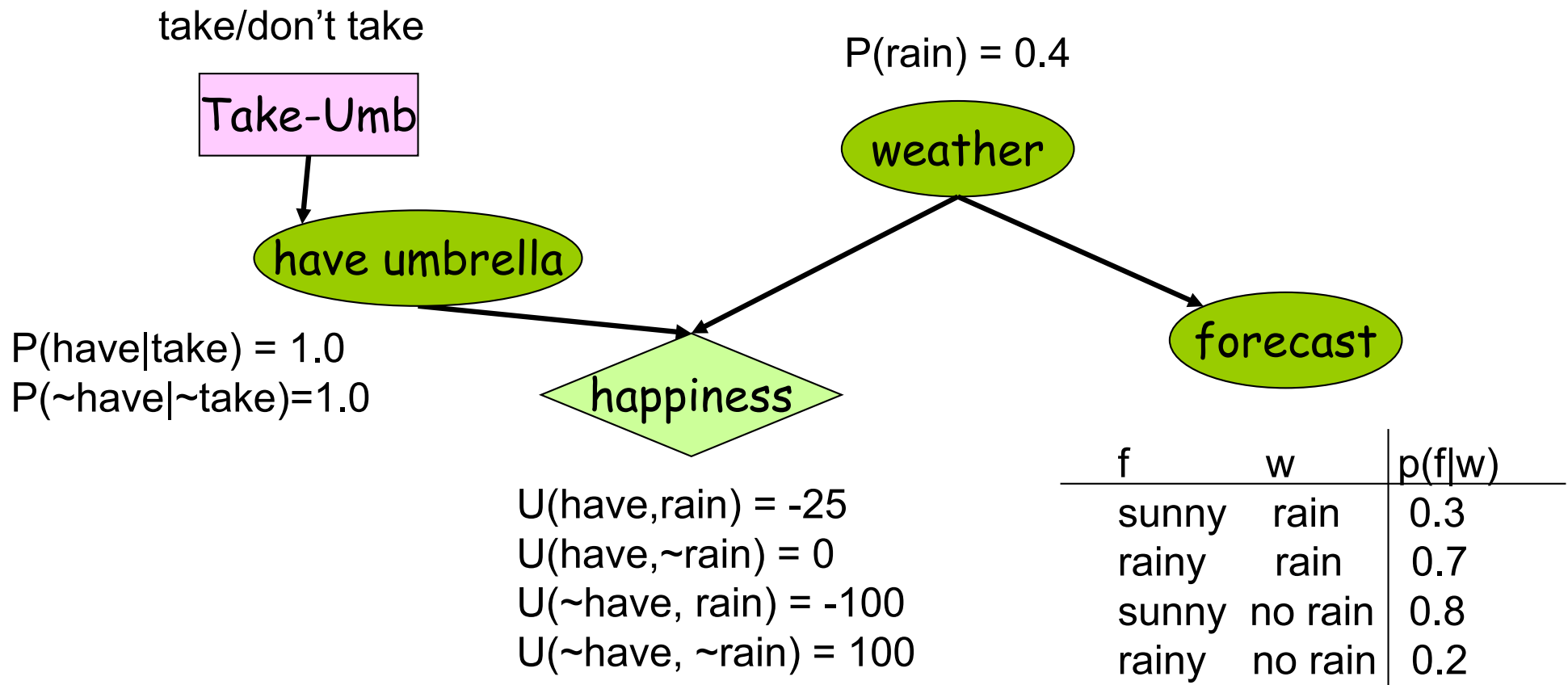
Reasoning about representations:

Intervention (Backdoor, Frontdoor), Counterfactuals, Instruments, ...



Decision Making: Propositional

Should I take my umbrella??



First-Order Decision Making

Should I take my $X \in \{Umb, Raincoat, Taxi, \dots\}$?

