

Lifting Queries for Lifted Inference

Highlight Paper at ECAI 2020
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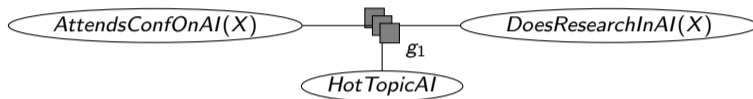
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Lifted Inference

Model G : $P_G = \frac{1}{Z} \prod_{f \in gr(G)} f$ (grounding semantics²)



- Query answering: Lifted variable elimination (LVE)¹
 - Query for probability distributions, e.g., $P(\textit{AttendsConfOnAI}(\textit{eve}))$
 - Shattering: Split off constants occurring in query, e.g., *eve*
 - Elimination: \sum over range values of random variables not in query
 - Lifting: Eliminate once and account for interchangeable instances

¹Poole (2003); de Salvo Braz et al. (2005); Milch et al. (2008); Apsel and Brafman (2011); Taghipour et al. (2013)

²Sato (1995); Fuhr (1995)

Lifting Queries for Lifted Inference

$P(A(\text{alice}), A(\text{eve}), A(\text{bob}))$

Problem: Grounding Queries

- Large query size
 - Interchangeable query terms
- Inefficiencies in query answering
 - Identical computations, large intermediate results
- Large result representation
 - Exponential in number of query terms

$A = \text{AttendsConfOnAI}$

Lifting Queries for Lifted Inference

$$P(A(\text{alice}), A(\text{eve}), A(\text{bob}))$$

$$P(A(X'))_{|X' \in \{\text{alice}, \text{eve}, \text{bob}\}}$$

Problem: Grounding Queries

- Large query size
 - Interchangeable query terms
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 - Exponential in number of query terms

Solution: Lifted Queries

- Compact query representation
 - Using logical variables
- Lifted query answering with LVE
 - Exploiting count conversions from LVE
- Compact result representation
 - Using counting random variables (polynomial in size)

$$A = \textit{AttendsConfOnAI}$$