Latent-Class Statistical Relational Learning from Formal Knowledge

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Abstract. We propose a learning approach for integrating formal knowledge into statistical inference by exploiting ontologies as a semantically rich and fully formal representation of prior knowledge. The logical constraints deduced from ontologies can be utilized to enhance and control the learning task by enforcing description logic satisfiability in a latent multi-relational graphical model. To demonstrate the feasibility of our approach we provide experiments using real world social network data in form of a $\mathcal{SHOIN}(D)$ ontology. $\mathcal{SHOIN}(D)$ or OWL DL is one of the knowledge representation languages endorsed by the World Wide Web Consortium as a basic technology for the Semantic Web. Our results illustrate two main practical advancements: First, entities and entity relationships can be analyzed via the latent model structure. Second, enforcing the ontological constraints guarantees that the learned model does not predict inconsistent relations. In our experiments, this leads to an improved predictive performance.