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Learning Stochastic Logic Programs

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Abstract

Stochastic Logic Programs (SLPs) have been shown to be a generalization of Hidden Markov Models (HMMs), stochastic context-free grammars, and directed Bayes' nets. A stochastic logic program consists of a set of labelled clauses p:C where p is in the interval [0:1] and C is a first-order range-restricted definite clause. This paper summarizes the syntax, distributional semantics and proof techniques for SLPs and then discusses how a standard Inductive Logic Programming (ILP) system, Progol, has been modified to support learning of SLPs. The resulting system 1) finds an SLP with uniform probability labels on each definition and near-maximal Bayes posterior probability and then 2) alters the probability labels to furhter increase the posterior probability. Stage 1) is implemented iwth CProgol4.5, which differs form previous versions of Progol by allowing user-defined evaluation functions written in Prolog. It is shown that maximising the Bayesian posterior function involves finding SLPs with short derivations of the examples. Search pruning with the Bayesian evaluation function is carried out in the same way as in previous versions of CProgol. The system is demonstrated with worked examples involving the learning of probability distributions over sequences as well as the learning of simple forms of uncertain knowledge.

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