van den Berg, Birthe; Schrijvers, Tom

A functional account of probabilistic programming with possible worlds. Declarative pearl. (English) Zbl 07570121


Summary: While there has been much cross-fertilization between functional and logic programming – e.g., leading to functional models of many Prolog features – this appears to be much less the case regarding probabilistic programming, even though this is an area of mutual interest. Whereas functional programming often focuses on modeling probabilistic processes, logic programming typically focuses on modeling possible worlds. These worlds are made up of facts that each carry a probability and together give rise to a distribution semantics. The latter approach appears to be little-known in the functional programming community. This paper aims to remedy this situation by presenting a functional account of the distribution semantics of probabilistic logic programming that is based on possible worlds. We present a term monad for the monadic syntax of queries together with a natural interpretation in terms of boolean algebras. Then we explain that, because probabilities do not form a boolean algebra, they – and other interpretations in terms of commutative semirings – can only be computed after query normalisation to deterministic, decomposable negation normal form (d-DNNF). While computing the possible worlds readily gives such a normal form, it suffers from exponential blow-up. Using heuristic algorithms yields much better results in practice.

For the entire collection see [Zbl 1492.68018].

MSC:
68N17 Logic programming
68N18 Functional programming and lambda calculus

Keywords:
possible worlds; monad; functional programming; probabilistic programming; logic programming

Software:
Hakaru; Church; miniKanren; TOY; PITA; Haskell; Mercury; Datafun; PFLP; Dsharp

Full Text: DOI

References:

Edited by FIZ Karlsruhe, the European Mathematical Society and the Heidelberg Academy of Sciences and Humanities
© 2023 FIZ Karlsruhe GmbH


[38] Spivey, JM, Algebras for combinatorial search, J. Funct. Program., 19, 3-4, 469-487 (2009) · Zbl 1191.68454 · doi:10.1017/S0956796809007321


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.