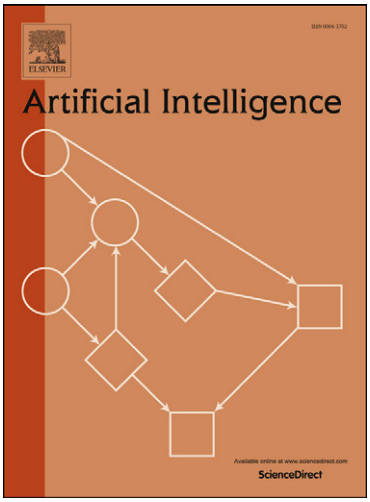
Accepted Manuscript



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PII: S0004-3702(15)00101-0
DOI: http://dx.doi.org/10.1016/j.artint.2015.06.009
Reference: ARTINT 2864

To appear in: *Artificial Intelligence*

Received date: 27 April 2014
Revised date: 25 June 2015
Accepted date: 28 June 2015

Please cite this article in press as: K. Kersting et al., Relational linear programming, *Artificial Intelligence* (2015), http://dx.doi.org/10.1016/j.artint.2015.06.009

Relational Linear Programming

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Abstract

We propose relational linear programming, a simple framework for combining linear programs (LPs) and logic programs. A relational linear program (RLP) is a declarative LP template defining the objective and the constraints through the logical concepts of objects, relations, and quantified variables. This allows one to express the LP objective and constraints relationally for a varying number of individuals and relations among them without enumerating them. Together with a logical knowledge base, effectively a logic program consisting of logical facts and rules, it induces a ground LP. This ground LP is solved using lifted linear programming. That is, symmetries within the ground LP are employed to reduce its dimensionality, if possible, and the reduced program is solved using any off-the-shelf LP solver. In contrast to mainstream LP template languages such as AMPL, which features a mixture of declarative and imperative programming styles, RLP's relational nature allows a more intuitive representation of optimization problems, in particular over relational domains. We illustrate this empirically by experiments on approximate inference in Markov logic networks using LP relaxations, on solving Markov decision processes, and on collective inference using LP

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