

Accepted Manuscript

Generalized possibilistic logic: Foundations and applications to qualitative reasoning about uncertainty

Didier Dubois, Henri Prade, Steven Schockaert

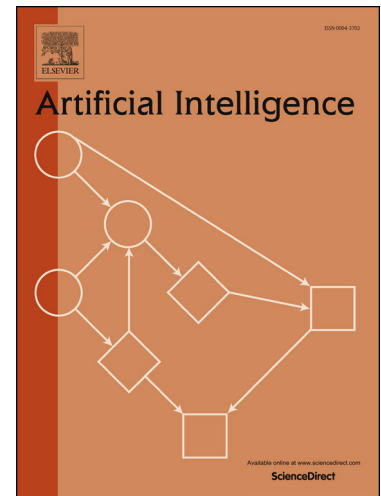
PII: S0004-3702(17)30087-5
DOI: <http://dx.doi.org/10.1016/j.artint.2017.08.001>
Reference: ARTINT 3026

To appear in: *Artificial Intelligence*

Received date: 21 May 2016
Revised date: 14 July 2017
Accepted date: 2 August 2017

Please cite this article in press as: D. Dubois et al., Generalized possibilistic logic: Foundations and applications to qualitative reasoning about uncertainty, *Artif. Intell.* (2017), <http://dx.doi.org/10.1016/j.artint.2017.08.001>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Generalized Possibilistic Logic: Foundations and Applications to Qualitative Reasoning about Uncertainty

Didier Dubois^a, Henri Prade^a, Steven Schockaert^b

^a*Toulouse University, Université Paul Sabatier, IRIT, CNRS, 118 Route de Narbonne, 31062 Toulouse Cedex 09, France*

^b*Cardiff University, School of Computer Science & Informatics, 5 The Parade, Cardiff CF24 3AA, UK*

Abstract

This paper introduces generalized possibilistic logic (GPL), a logic for epistemic reasoning based on possibility theory. Formulas in GPL correspond to propositional combinations of assertions such as “it is certain to degree λ that the propositional formula α is true”. As its name suggests, the logic generalizes possibilistic logic (PL), which at the syntactic level only allows conjunctions of the aforementioned type of assertions. At the semantic level, PL can only encode sets of epistemic states encompassed by a single least informed one, whereas GPL can encode any set of epistemic states. This feature makes GPL particularly suitable for reasoning about what an agent knows about the beliefs of another agent, e.g., allowing the former to draw conclusions about what the other agent does not know. We introduce an axiomatization for GPL and show its soundness and completeness w.r.t. possibilistic semantics. Subsequently, we highlight the usefulness of GPL as a powerful unifying framework for various knowledge representation formalisms. Among others, we show how comparative uncertainty and ignorance can be modelled in GPL. We also exhibit a close connection between GPL and various existing formalisms, including possibilistic logic with partially ordered formulas, a logic of conditional assertions in the style of Kraus, Lehmann and Magidor, answer set programming and a fragment of the logic of minimal belief and negation as failure. Finally, we analyse the computational complexity of reasoning in GPL, identifying decision problems at the first, second, third and fourth level of the polynomial hierarchy.

Keywords: Possibilistic logic, Epistemic reasoning, Non-monotonic reasoning

1. Introduction

Possibilistic logic [1] (PL) is a logic for reasoning with uncertain propositional formulas. Formulas in PL take the form (α, λ) where α is a propositional formula and λ is a certainty degree taken from the unit interval, or from another linear scale. Contrary to probabilistic logics, possibilistic logic models accepted beliefs in the sense that if two propositions are believed to a certain level, so is their conjunction. In many applications, a PL knowledge

Email addresses: dubois@irit.fr (Didier Dubois), prade@irit.fr (Henri Prade), schockaerts1@cardiff.ac.uk (Steven Schockaert)

Download English Version:

<https://daneshyari.com/en/article/4942032>

Download Persian Version:

<https://daneshyari.com/article/4942032>

[Daneshyari.com](https://daneshyari.com)