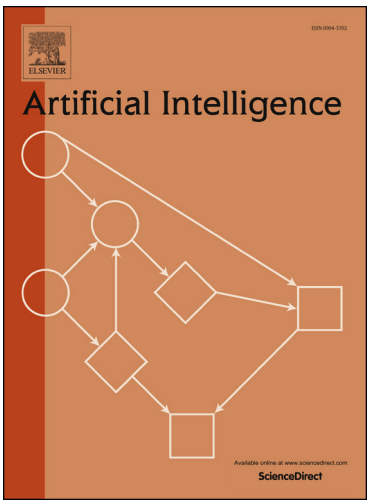
Accepted Manuscript



Localising iceberg inconsistencies

Glauber De Bona, Anthony Hunter

PII: S0004-3702(17)30025-5
DOI: http://dx.doi.org/10.1016/j.artint.2017.02.005
Reference: ARTINT 3000

To appear in: *Artificial Intelligence*

Received date: 3 August 2016
Revised date: 16 February 2017
Accepted date: 19 February 2017

Please cite this article in press as: G. De Bona, A. Hunter, Localising iceberg inconsistencies, *Artif. Intell.* (2017), http://dx.doi.org/10.1016/j.artint.2017.02.005

Localising Iceberg Inconsistencies

Glauber De Bona and Anthony Hunter

Department of Computer Science
University College London, WC1E 6BT, UK

Abstract

In artificial intelligence, it is important to handle and analyse inconsistency in knowledge bases. Inconsistent pieces of information suggest questions like "where is the inconsistency?" and "how severe is it?". Inconsistency measures have been proposed to tackle the latter issue, but the former seems underdeveloped and is the focus of this paper. Minimal inconsistent sets have been the main tool to localise inconsistency, but we argue that they are like the exposed part of an iceberg, failing to capture contradictions hidden under the water. Using classical propositional logic, we develop methods to characterise when a formula is contributing to the inconsistency in a knowledge base and when a set of formulas can be regarded as a primitive conflict. To achieve this, we employ an abstract consequence operation to "look beneath the water level", generalising the minimal inconsistent set concept and the related free formula notion. We apply the framework presented to the problem of measuring inconsistency in knowledge bases, putting forward relaxed forms for two debatable postulates for inconsistency measures. Finally, we discuss the computational complexity issues related to the introduced concepts.

Keywords: Propositional logic, Inconsistency management, Inconsistency analysis, Inconsistency localisation

1. Introduction

The occurrence of inconsistencies in data and knowledge is an important issue for the application of knowledge representation and reasoning technologies that are based on standard logics. To develop ways of dealing with an inconsistent set of formulas, it is important to understand the inconsistency, analysing its properties. Given an inconsistent knowledge base (a set of formulas), natural questions that arise are "where is the inconsistency?" and "how severe is it?". To answer the second question in a qualitative way, inconsistent knowledge bases were classified by the severity of their inconsistency [17]. Recently, to numerically quantify the extent to which a knowledge base is inconsistent, many inconsistency measures have been proposed [29, 24, 25, 19, 28, 27, 20, 42, 43]. In contrast, the first question appears quite underdeveloped, and it is the subject of the present work.