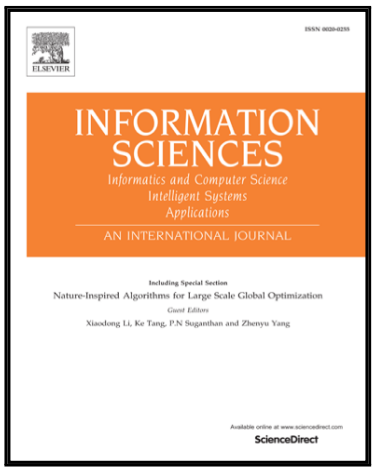

L-concept lattices with positive and negative attributes: Modeling uncertainty and reduction of size

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L-concept lattices with positive and negative attributes: Modeling uncertainty and reduction of size

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Abstract

In our previous works, we introduced an extension of formal fuzzy concept analysis where attributes were considered as a positive and negative information based on user input. In the present paper, we show that the extension is naturally capable to model uncertainty and we describe a general method to increase that uncertainty in a parametric way. Furthermore, we demonstrate that two methods of concept lattice size reduction, which were thoroughly studied in formal fuzzy concept analysis, become instances of the general method when adapted to our extension.

Keywords: Fuzzy logic, formal concept analysis, negative information, uncertainty, linguistic hedges, factorization by similarity.

1. Introduction

Dubois & Prade [21] directly call for possibilistic approaches in formal fuzzy concept analysis. We demonstrate, that our recently proposed extension of formal concept analysis [4] is naturally capable for modeling uncertainty of object-attribute incidences and, consequently, uncertainty of concepts. Specifically, the extension assumes two truth degrees for each incidence—in what degree the incidence is sure (positive information) and in what degree the incidence is possible (negative information). The uncertainty of the incidence is represented by an interval between the two truth degrees. This is in accordance with possibility theory as the operators which handle the two kinds of truth degrees correspond with fuzzy necessity and fuzzy possibility measures [9, 20, 35, 36].

Furthermore, we argue that increasing uncertainty naturally leads to a reduction of the size of the concept lattice, as its formal concepts become less

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