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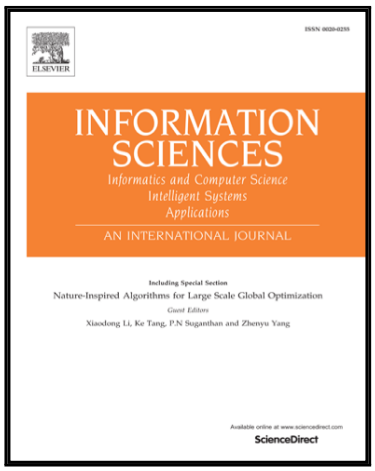

Bi-directional Dominance for Measure Modeled Uncertainty

Ronald R. Yager

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Bi-directional Dominance for Measure Modeled Uncertainty

Ronald R. Yager

Machine Intelligence Institute, Iona College, New Rochelle, NY 10801

yager@panix.com

ABSTRACT

Our objective here is to provide a formulation for dominance relationship between variables having uncertain values represented by measures which can be used for ordering these uncertain values. We first discuss the use of monotonic set functions, fuzzy measures, for the representation of uncertain information. We consider the issue of comparing and ordering variables whose values are uncertain and represented via a measure and we suggest the use of bi-directional dominance, which can be seen as a generalization of stochastic dominance that is used to order probability distributions. We note the establishment of a dominance relationship between uncertain values is often not possible. In order to circumvent this we introduce the idea of surrogates for bi-directional dominance, here we associate with each uncertain value, measure, a scalar value that provides an ordering between all uncertain values. These surrogates are defined so that they maintain any relationship between measures that can be established with the use of bi-directional dominance.

Keywords: Ordering Uncertainty, Fuzzy Measure, Surrogate, Stochastic Dominance, Decision Making with Uncertainty

1. Introduction

A monotonic measure μ provides a very general structure for the representation of variables having uncertain values [9, 20, 23]. Here we use the measure of a set to provide the anticipation that the value of the variable lies in the set. Probability and possibility distributions can very naturally be modeled using these structures. One difficult task with uncertain information is the ordering of uncertain values with regard to which of two values is bigger. No natural ordering exists, as is the case with scalar values, we must select some reasonable methodology for ordering uncertain information. One commonly accepted approach for ordering probability distributions is stochastic dominance [2, 5, 15, 19]. Here we say probability

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