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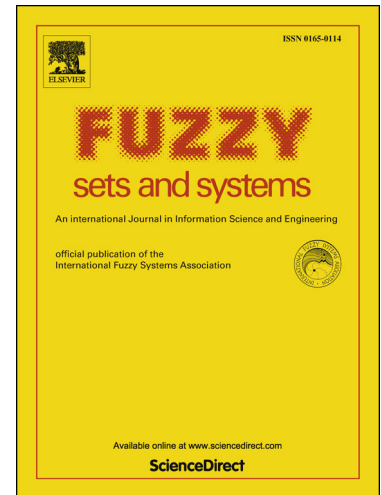
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Textures and Fuzzy Unit Operations in Rough Set Theory: An Approach to Fuzzy Rough Set Models

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Abstract

In this paper, an approach for the fuzzy rough set models is presented using textures and a fuzzy version of the unit operations of Wybraniec-Skardowska. First, a fuzzy unit operation and fuzzy unit co-operation on fuzzy lattices are defined. It is proved that the well-known fuzzy rough set upper approximations as the approximation of Dubois and Prade are fuzzy unit operation. Using fuzzy direlations, an axiomatic system for fuzzy unit operations is studied and it is shown that fuzzy rough set systems obtained by different fuzzy logical connectives as Kleene-Dienes and Gödel implicators can be generated by the same textural fuzzy direlation. Finally, it is observed that the approximations of two different fuzzy rough set models together constitute two different Galois connections.

Keywords: Fuzzy rough set, fuzzy unit operation, textural fuzzy direlation, texture, implicator, disjunction, conjunction

1. Introduction

The studies on fuzzy rough sets started with the paper of Dubois and Prade in 1990 [18]. Later on, many researchers discussed the generalizations of fuzzy rough set models based on conjunctive and implicative. For instance, Radzikowska and Kerre [30] observed that the approximations of Dubois and Prade can be described by the conjunctive t-norm and the implicative based on t-conorm and standard negator. They discussed the fuzzy rough sets in a more general setting considering fuzzy logical connectives. De Cock et al. [6] used a t-norm, while Morsi and Yakut [28], Mi and Zang [27], Yeung et al. [38], Hu et al. [23] used a left continuous t-norm. Wu and Zhang presented constructive and axiomatic approaches of fuzzy rough sets defined by conjunctive and implicative [35]. On the other hand, L. D'eer et al. also presented a general implicative-conjunctive based model for the lower and upper approximation of a fuzzy set using fuzzy logical extensions of the Boolean implication and conjunction [7]. The approach of L. D'eer et al. unifies the various lower and upper approximations in the literature of fuzzy rough set theory with the minimal restrictions on the approximations.

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