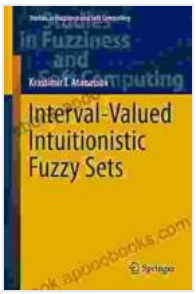
Interval Valued Intuitionistic Fuzzy Sets: A Comprehensive Guide

Interval valued intuitionistic fuzzy sets (IVIFSs) are a type of fuzzy set that can be used to model uncertainty and vagueness in various fields. They are an extension of intuitionistic fuzzy sets (IFSs),which were introduced by Atanassov in 1986. IVIFSs were first introduced by Atanassov and Gargov in 1989.



Interval-Valued Intuitionistic Fuzzy Sets (Studies in Fuzziness and Soft Computing Book 388)

by Krassimir T. Atanassov

★★★★★ 5 out of 5

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An IVIFS is characterized by three functions: a membership function, a non-membership function, and a hesitation function. The membership function maps elements of the universe of discourse to an interval of values in the unit interval [0, 1]. The non-membership function maps elements of the universe of discourse to an interval of values in the unit interval [0, 1]. The hesitation function is the difference between the membership function and the non-membership function.

IVIFSs have been used in a variety of applications, including:

- Decision making
- Pattern recognition
- Image processing
- Medical diagnosis
- Financial forecasting

In this article, we will provide a comprehensive to IVIFSs. We will cover their definition, operations, and applications. We will also provide some examples of how IVIFSs can be used to solve real-world problems.

Definition of Interval Valued Intuitionistic Fuzzy Sets

An interval valued intuitionistic fuzzy set (IVIFS) on a universe of discourse X is characterized by three functions:

- A membership function $\mu_A(x)$: $X \rightarrow [0, 1]$
- A non-membership function $v_A(x)$: $X \rightarrow [0, 1]$
- A hesitation function $\pi_A(x)$: $X \rightarrow [0, 1]$

The membership function $\mu_A(x)$ maps each element x of X to an interval of values in the unit interval [0, 1]. The non-membership function $v_A(x)$ maps each element x of X to an interval of values in the unit interval [0, 1]. The hesitation function $\pi_A(x)$ is the difference between the membership function and the non-membership function, i.e., $\pi_A(x) = \mu_A(x) - v_A(x)$.

The following conditions must be satisfied for an IVIFS to be valid:

- $0 \leq \mu_A(x) + v_A(x) \leq 1$ for all $x \in X$
- $0 \leq \pi_A(x) \leq 1$ for all $x \in X$

The first condition ensures that the sum of the membership and non-membership degrees is always less than or equal to 1. The second condition ensures that the hesitation degree is always less than or equal to 1.

Operations on Interval Valued Intuitionistic Fuzzy Sets

There are a number of operations that can be performed on IVIFSs. These operations include:

- Union
- Intersection
- Complement
- Scalar multiplication
- Fuzzy implication

The union of two IVIFSs A and B is an IVIFS C such that:

- $\mu_C(x) = [\max(\mu_A(x),\mu_B(x)),\min(\mu_A(x),\mu_B(x))]$
- $v_C(x) = [\min(v_A(x),v_B(x)),\max(v_A(x),v_B(x))]$
- $\pi_C(x) = [\min(\pi_A(x),\pi_B(x)),\max(\pi_A(x),\pi_B(x))]$

The intersection of two IVIFSs A and B is an IVIFS C such that:

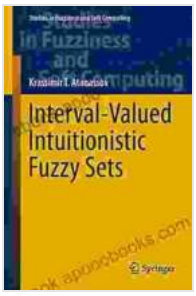
- $\mu_C(x) = [\min(\mu_A(x),\mu_B(x)),\max(\mu_A(x),\mu_B(x))]$
- $v_C(x) = [\max(v_A(x),v_B(x)),\min(v_A(x),v_B(x))]$
- $\pi_C(x) = [\max(\pi_A(x),\pi_B(x)),\min(\pi_A(x),\pi_B(x))]$

The complement of an IVIFS A is an IVIFS B such that:

- $\mu_B(x) = [1 - v_A(x),1 - \mu_A(x)]$
- $v_B(x) = [1 - \mu_A(x),1 - v_A(x)]$
- $\pi_B(x) = [\pi_A(x),\pi_A(x)]$

The scalar multiplication of an IVIFS A by a scalar α is an IVIFS B such that:

- $\mu_B(x) = [\alpha\mu_A(x),\alpha\mu_A(x)]$
- $v_B(x) = [\alpha v_A(x),\alpha v_A(x)]$
- $\pi_B(x) = [1 - \alpha$



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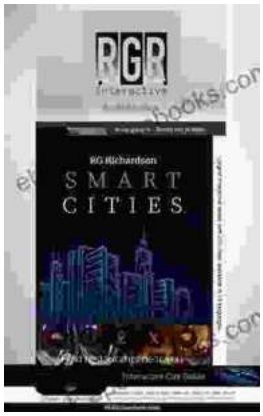

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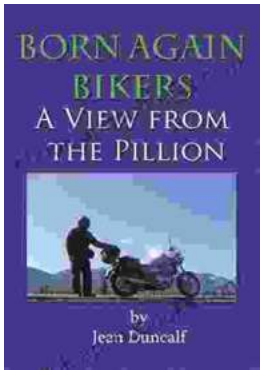

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