

Next-Generation Extended Intuitionistic Fuzzy Systems: Logarithmic, Exponential, Complex, and Linguistic Models

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Abstract: The theory of fuzzy sets, introduced by Lotfi A. Zadeh and later extended to intuitionistic fuzzy sets by Krassimir T. Atanassov, provides an effective framework for handling uncertainty in complex systems. In this study, advanced extensions of intuitionistic fuzzy sets, including complex, exponential, logarithmic, and linguistic models, are examined to enhance their representational capability. These models integrate mathematical transformations with linguistic variables to more effectively capture uncertainty and variability in real-world scenarios. Furthermore, hybrid structures and normalization techniques are incorporated to improve consistency, accuracy, and interpretability. The proposed framework finds applications in decision-making, clustering, and artificial intelligence. The authors introduce several definitions, key applications across various fields, illustrative examples, and graphical representations to provide a clear and comprehensive understanding of the concepts.

Keywords: Intuitionistic Fuzzy Sets, Complex Fuzzy sets, Exponential Fuzzy Sets, Logarithmic Fuzzy Sets, Linguistic Variables, Normalization Techniques.

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