

Preface

The concept of intuitionistic fuzzy set (IFS) was originally introduced by Atanassov (1983) to extend the concept of the traditional fuzzy set. Each element in an IFS is expressed by an ordered pair which is called an intuitionistic fuzzy value (IFV) (or intuitionistic fuzzy number (IFN)), and each IFV is characterized by a membership degree, a nonmembership degree, and a hesitancy degree. The sum of the membership degree, the nonmembership degree, and the hesitancy degree of each IFV is equal to one. IFVs can describe the fuzzy characters of things comprehensively, and thus are a powerful and effective tool in expressing uncertain or fuzzy information in actual applications. Recently, a lot of research work has been done on the aggregation and cluster analysis. Since 2006, my research group has been focusing on the investigation of these interesting and important topics, and achieved fruitful research results which have been published in some well-known peer-reviewed professional journals.

This book offers a systematic introduction to the latest research work of my group on information aggregation and cluster analysis under intuitionistic fuzzy environments, including the various algorithms for clustering intuitionistic fuzzy information and the intuitionistic fuzzy aggregation techniques, and their applications in multi-attribute decision making, such as supply chain management, military system performance evaluation, project management, venture capital, information system selection, building materials classification, and operational plan assessment, and so on. We organized this book as below:

Chapter 1 introduces the intuitionistic fuzzy aggregation techniques. We first give a survey of the existing methods for ranking IFVs, and then introduce various operational laws of IFVs. On the basis of these ranking methods and operational laws, we present varieties of the intuitionistic fuzzy power aggregation operators, the intuitionistic fuzzy geometric Bonferroni means, the intuitionistic fuzzy aggregation operators based on Archimedean t-conorm and t-norm, the generalized intuitionistic fuzzy aggregation operators based on Hamacher t-conorm and t-norm, the generalized intuitionistic fuzzy point aggregation operators, and their generalizations in interval-valued intuitionistic fuzzy environments and the applications in multi-attribute decision making.

Chapter 2 introduces the clustering algorithms of IFSs. The chapter first defines the concept of intuitionistic fuzzy similarity degree, and constructs the intuitionistic fuzzy similarity matrix and the intuitionistic fuzzy equivalence matrix. Then, the chapter defines the compound operational law of intuitionistic fuzzy similarity matrix, and gives an approach to transforming the intuitionistic fuzzy similarity matrices into the intuitionistic fuzzy equivalence matrices. After that, the chapter defines the λ -cutting matrices of the intuitionistic fuzzy similarity matrix and the intuitionistic fuzzy equivalence matrix, based on which an approach is presented for clustering IFSs. Moreover, the chapter defines the concept of association and equivalent association matrix, and introduces some methods for calculating the association coefficients of IFSs. Then, based on the association matrix, the chapter introduces a clustering algorithm for IFSs, and extends the algorithm to cluster interval-valued IFSs. Additionally, some other clustering algorithms, such as the intuitionistic fuzzy hierarchical clustering algorithms, the intuitionistic fuzzy orthogonal clustering algorithm, the intuitionistic fuzzy C-means clustering algorithms, the intuitionistic fuzzy minimum spanning tree (MST) clustering algorithm, the intuitionistic fuzzy clustering algorithm based on Boole matrix and association measure, the intuitionistic fuzzy netting clustering method, and the direct cluster analysis based on intuitionistic fuzzy implication are also introduced.

This book can be used as a reference for researchers and practitioners working in the fields of fuzzy mathematics, operations research, information science, management science and engineering, and so on. It can also be used as a textbook for postgraduate and senior undergraduate students.

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