Fuzzy Sets, Uncertainty and Information

by

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This book is devoted to a thorough discussion of the concept of uncertainty in connexion with the ideas of information and complexity, and to the modelling of uncertainty in terms of fuzzy sets, of probabilities or of Shafer's basic assignments (which can be viewed as random sets). It corresponds to a graduate level course which has been taught for some years at the authors' University.

The book cover the following topics. Chapter 1 introduces the basic concepts of fuzzy sets. Chapter 2 deals with the extension of set-theoretic operations to fuzzy sets and with other aggregation operations which can be defined on these generalized sets. Chapter 3 is devoted to fuzzy relations, in particular to similarity relations, fuzzy orderings and to fuzzy relation equations. Chapter 4 presents Shafer's belief and plausibility measures, probability measures, and possibility and necessity measures in a unified mathematical framework. Chapter 5 discusses measures of uncertainty : both classical ones, such as Shannon or Hartley measures, and new ones recently introduced in possibility theory and in Shafer's framework, a research topic in which one of the authors has been very active. This chapter is augmented by a technical appendix. Chapter 6 offers a sample of applications of fuzzy set theory ; in particular, two examples of fuzzy logic controllers, a medical diagnosis system, decision making with fuzzy goals and criteria, an approach to fuzzy relational databases based on similarity relations, a decision-support system with fuzzy expert rules, identification and reconstruction problems in systems science, a fuzzy approach to a pattern classification problem and the determination of

membership functions are reviewed. The book is equipped with a useful selected bibliography as well as name and subject indexes.

Each chapter is extremely well-written, in a very pedagogical way. Many examples are given to the reader and each chapter covers its topic in a comprehensive but very understandable manner. At the end of each chapter a note section provides entries to a very rich bibliographical information and to some theoretical complements. Moreover each chapter ends with a collection of exercises.

However it must be clear that this book does not provide a complete coverage of all the basic issues related to fuzzy sets and possibility theory. Especially fuzzy numbers and approximate reasoning are just mentioned, but not dealt with in the book in so far as it exists an extensive literature on these topics. More fundamentally, the extension principle which is a tool playing a basic rôle in several applications (computation with fuzzy numbers, approximate reasoning and others) is only briefly presented and would perhaps deserve a more extensive discussion and exemplification. Besides, Chapter 6 offers only a sample of applications which is too small for being fully representative of fuzzy set applications, particularly in such fields as information or knowledge-based systems ; this is probably unavoidable in the compass of a small number of pages.

On the whole, this book should be considered as an authoritative and genuine textbook for introducing to many basic concepts of fuzzy set theory in relation to other uncertainty models. It gives the impression that fuzzy set theory should no longer be viewed as a stand-alone island of research, and that is very important for eventually reaching a general consensus among scientists about the relevance and usefulness of this field of investigation.

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