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Fuzzy Clustering Models and Applications

Physica–Verlag, Studies in Fuzziness and Soft Computing Series.
Physica–Verlag, Heidelberg – New York 1997.
ix + 122 pages, 80 figures, 39 tables.
ISBN 3–7908–1026–6.

In the classical deterministic clustering the clusters form a disjoint partition of a basic set into subsets of somehow similar objects. The real clusters in various practical situations are usually much more complex phenomena and the belongingness of objects to them is more or less vague. It means that such clusters are rather fuzzy subsets of the basic set than its crisp parts. The referred book contributes to the existing works on the fuzzy clustering by an overview of some approaches to the problem and by their creative synthesis.

The text is divided into five main chapters. The first one, the *Introduction to Fuzzy Clustering* is extremally short and it offers a brief heuristic introduction to the problem. The following four chapters deal with different, gradually more generalized, approaches to fuzzy clustering as to the construction of the membership functions of fuzzy clusters and also mutual relations between various similarity structures. Chapter *Fuzzy Clustering for 3-way Data* is oriented to multicriteria optimization respecting objects, attributes and situations. The following *Additive Clustering Model* is focused to the finding the similarities between pairs of objects, and in *General Fuzzy Clustering Model Using Aggregation Operators* the aggregation operators are used to determine the degree of simultaneous belongingness of a pair of objects to a cluster. The last chapter is the most extensive one. It is titled *Fuzzy Clustering of Asymmetric Similarity* and it generalizes the previous approaches by introducing the similarity between clusters and by extending the aggregation operators to asymmetric aggregation operators. A significant part of this chapter is devoted to the relation between artificial neural networks and generalized fuzzy clustering. The volume is completed by a representative (62 items) bibliography.

The referred book offers a good survey of contemporary knowledge in the fuzzy clustering theory. The particular topics are well presented and completed by illustrative examples. It can be recommended for everybody wishing to find an introduction to the fuzzy clustering problems and a representative view on its solutions.

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Signal Processing in Electronic Communications

Horwood Publishing, Chichester, Great Britain 1997.
296 pages.
ISBN 1-898563-23-3.

Signal Processing in Electronic Communications is a comprehensive book dealing with mathematical concepts and the techniques of communication theory. Most of the forms of communication used in daily life (e.g. internet, television, telephone ...) are conducted by the transmission of electronic signals using an appropriate method. The book concentrates on the description of signals and the systems which may be used to process them. As a field of applied mathematics, Control Theory deals with the control of 'processes', mostly by investigating signals as linear systems. The processes discussed in this book are related

to communication by electronic means. Most other books devoted to this topic focus predominantly on engineering applications and provide only secondary attention to the mathematical background. This book provides readers with mathematical explanation of the communication processes. The style of the book corresponds to that of textbooks in other areas of applied mathematics. In its avoidance of the theorem style, the book is highly readable but not at the expense of mathematical rigour.

The book elegantly demonstrates the use of mathematics as a design or synthesis tool. After reading this text, readers should acquire an understanding of the underlying mathematics, enabling them to produce systems or to create network designs of their own.

Signal Processing in Electronic Communications assumes a knowledge of elementary calculus. It consists of 9 chapters and 2 appendices. Each chapter is enhanced with about 10 exercises with solutions in the Appendix to test the reader's understanding of the material. Many diagrams and figures contribute to the clarity of the material.

Chapter 1 presents the introduction of the concepts of signals and linear systems. Useful ideas and insight are obtained from simulation diagrams representing circuits, which are discussed for the time domain. Chapters 2 and 3 present techniques and analytical experience necessary for later chapters, namely system responses and harmonic decomposition of signals by the use of the Fourier transform. The first section of Chapter 2 looks at factors which govern some important aspects of response behaviour. Particular responses are discussed which serve to characterise a linear system and a discussion of response as viewed in the frequency domain is presented. Chapter 3 examines a frequency-domain decomposition of signals which allows to make full use of the frequency response concept in understanding the frequency-domain view of signal processing. Design and analogue filters which operate on continuous-time signals to produce continuous-time signals as output are discussed in Chapter 4. Chapters 5 to 7 deal with discrete time signals and systems in detail. Using the knowledge from the previous chapters, Chapter 8 brings together many of the ideas of the earlier chapters to discuss the process of design of digital filters. It shows how digital filters can be designed either to emulate the designs of Chapter 4, or from the initial basis. Infinite-impulse and finite-impulse response designs are developed. In Chapter 9, some of the work of the previous chapters is applied to the processing of speech signals, the important part of Communication Theory. This chapter is a treatment on several specific topics: speech production model, linear predictive filters, and cepstral analysis, with application to recognition of non-nasal voiced speech and formant estimation. The 9 chapters are followed by two technical appendices and by the appendix with answers to the exercises. References of the related work are listed in the end of the book.

The book thanks to its systematic structure, excellent elaboration of the material discussed should be of great interest to academic/industrial researchers and MSc students. It should be useful to both engineers interested in mathematical theory of signal processing and to mathematicians interested in applications in signal processing.

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