

Book Review:

Aggregation Functions: A Guide for Practitioners

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This book is a comprehensive and accurate introduction to aggregation functions, addressing the need of reaching a wider audience of practitioners and researchers, and making them familiar with the large set of aggregation functions and with the state of the art techniques in their application.

The first chapter is devoted to introducing the notion of an aggregation function, highlighting its basic properties and providing a first overview of most important examples of aggregation functions, such as means, ordered weighted averaging (OWA) functions, Choquet integrals, triangular norms and conorms, uninorms and nullnorms. After, the problem of choosing properly an aggregation function in an application is addressed, and techniques for identifying and interpolating aggregation functions from empirical data are introduced. Both problems are more deeply discussed in the following chapters.

The central section of the book (Chapters 2-4) is dedicated to a detailed discussion of the main classes of aggregation functions, describing their properties and providing several examples. In particular, Chapter 2 deals with averaging functions, that are characterized by providing an aggregated value bounded by the minimum and the maximum input values. Chapter 3 presents the classes of conjunctive and disjunctive functions, in particular triangular norms, that provide an aggregated value below the minimum input value (conjunctive functions) or above the maximum input value (disjunctive functions). Chapter 4 discusses mixed functions, combining the compensatory behavior of averaging function with the reinforcement behavior of conjunctive and disjunctive functions.

The following section (Chapter 5-6) concerns with the problem of identifying the aggregation functions when empirical data are given. In Chapter 5, the authors introduce the problem of fitting chosen aggregation functions to empirical data. The problem is addressed in terms of mathematical programming

problems, whose solution provides the best aggregation function from a given class which fits the data. Therefore, the problem is regarded as identification of parameters that make the function fit the data best. Also, this chapter considers the evaluation of suitability of such functions and consistency with the data. In Chapter 6, the function identification is dealt with as an interpolation problem. In this case, functions are directly built from the data by using interpolation or approximation processes. Although, the resulting functions may lack certain interpretability, they are much more flexible in modeling the desired behavior of a function. More details on techniques used in these chapters can be found in Appendix A.

The final Chapter 7 outlines a few classes of aggregation functions not covered elsewhere in the book, and presents various additional properties that may be useful for specific applications. This chapter also provides pointers to the literature where these issues are discussed in more details.

One of the main positive aspects of this book is in being oriented to practitioners, more than to the field specialists. The language adopted by authors is able to smoothly introduce the novice reader to the complex domain of aggregation functions, and to guide him to fully understand basic properties of the most investigated classes, but still keeping the rigorousness of mathematics in providing definitions and describing properties.

Engineers, computer scientists, economists, and in general anyone interested in the topic of aggregation functions, will find in this book a valuable guide to the topic, not only in studying their own advanced theoretical aspects, but also in choosing and building properly the aggregation functions that best fit problems they are concerning with. The reader is not required to undertake the detailed study of mathematical literature. Instead s/he can use this book as a catalog of off-the-shelf solutions when the problem is related to how to combine different values into one single output value. All chapters include examples able to better clarify the concepts presented. The book comes with a software package AOTool, that implements most of the methods described in the book for fitting aggregation functions to empirical data. The spreadsheet-like interface allows the non-technical user to experience the identification of aggregation functions to real-world problems.

The introductory nature of this book, makes it also suitable for graduate students of Computer Science, Economics and Engineering, developing curricula in fuzzy logic, computational intelligence and knowledge engineering. The topic is introduced in such a way that does not require specific mathematical background. The book contains all the relevant notions necessary to fully understand the notions presented, and avoids going into discussions involving advanced algebraic structures or pathological examples. The interested reader will find a large bibliography for further readings. The book keeps its focus on quick applicability of techniques presented. The book provides in appendix with some problems aimed to test the understanding of the topic.

In conclusion, this book is a readable but still accurate guide to aggregation functions, presenting the latest advances in this research field to the wider au-

dience of practitioners and researchers interested to experiment the state of the art of aggregation functions to the problems they face in their everyday work. I would strongly suggest to read this book to everyone who got interest in aggregation functions but also got scared by the mathematical nature of this topic. There is no doubt this book is a relevant contribution to make more people familiar with aggregation functions.

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