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Tin-Chih Toly Chen · Katsuhiko Honda

Fuzzy Collaborative Forecasting and Clustering

Methodology, System Architecture,
and Applications

 Springer

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Preface

Fuzzy systems have been successfully applied to various problems with uncertainty, including clustering, system control, decision making, and forecasting. However, most of these applications are based on a single fuzzy approach/system that is chosen in a subjective way. In addition, with the widespread of Internet applications, dealing with disparate data sources is becoming increasingly popular. Furthermore, due to technical limitations, security or privacy considerations, the integral access to a number of sources is often limited. For these reasons, the concepts of collaborative computing intelligence and collaborative fuzzy modeling have been proposed; the so-called fuzzy collaborative system have been developed. So far, several studies have argued that for certain problems, a fuzzy collaborative intelligence approach is more precise, accurate, efficient, safe, and private than typical approaches. Although there have been some literature about fuzzy collaborative intelligence and systems, considerable room for development still exists in this field. For example, a crisp method or system needs to be fuzzified to meet the requirements of a fuzzy collaborative intelligence method or system; the collaboration among the participating decision makers needs to be facilitated; and the views of, and the results by, the decision makers have to be aggregated.

So far, most existing fuzzy collaboration systems have been used for clustering, filtering, and forecasting. This book is dedicated to two interesting topics in fuzzy collaborative intelligence and systems, i.e., fuzzy collaborative forecasting and fuzzy collaborative clustering. Both fuzzy collaborative forecasting and fuzzy collaborative clustering are major types of fuzzy collaborative intelligence and systems. However, fuzzy collaborative forecasting is supervised learning because the actual value exists, while fuzzy collaborative clustering is unsupervised learning because there is no absolute clustering result.

It is necessary to acquire a general knowledge of the most useful fuzzy collaborative intelligence and systems in order to be able to apply them efficiently in real-life situations. To this end, six chapters have been provided in this book that belongs to the SpringerBriefs in Applied Sciences and Technology series.

Chapter 1 gives the definitions of fuzzy collaborative intelligence and fuzzy collaborative systems. Then, some existing fuzzy intelligence and systems are classified. The operation procedure of a fuzzy collaborative system is also detailed.

Chapter 2 introduces some linear fuzzy collaborative forecasting methods or models. Then, the steps in operating a fuzzy collaborative forecasting system, including collaboration, aggregation, and defuzzification, are detailed. How to assess the effectiveness of a fuzzy collaborative forecasting method and how to measure the quality of collaboration are also discussed.

Chapter 3 introduces several nonlinear fuzzy collaborative forecasting methods. In addition, a special application of nonlinear fuzzy collaborative forecasting, the collaborative fuzzy analytic hierarchy process, is also described in this chapter.

Chapter 4 reviews fuzzy *c*-Means (FCM) and its variants, which are the fundamental methods for unsupervised data classification. Then, fuzzy co-clustering, that are prevalent in cooccurrence information analysis, is introduced.

Chapter 5 reviews several collaborative clustering models and introduces a collaborative framework of fuzzy co-clustering. Two types of distributed databases, i.e., vertically distributed databases and horizontally distributed databases, can then be handled with different security concepts.

Chapter 6 reviews three-mode fuzzy co-clustering that reveals the intrinsic co-cluster structures from three-mode cooccurrence information. In addition, a framework for securely applying three-mode fuzzy co-clustering is also developed, when cooccurrence information is stored in different organizations.

The purpose of the book is not to be exhaustive in the list of methods and algorithms that exist in the relevant literature. It is intended to provide technical details of the development of fuzzy collaborative intelligence and systems and the corresponding applications. These details will hold great interest for researchers in information engineering, information management, artificial intelligence, and computational intelligence, as well as for practicing managers and engineers.

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Contents

1	Introduction to Fuzzy Collaborative Forecasting Systems	1
1.1	Fuzzy Collaborative Intelligence and Systems	1
1.2	Classification of Fuzzy Collaborative Intelligence and Systems	5
1.3	Operating Procedure of a Fuzzy Collaborative System	6
	References	7
2	Linear Fuzzy Collaborative Forecasting Methods	9
2.1	Linear Fuzzy Forecasting Methods	9
2.2	The Fuzzy Linear Regression (FLR) Method	11
2.3	The Operational Procedure of a Fuzzy Collaborative Forecasting System	13
2.4	A Linear Fuzzy Collaborative Forecasting Method	14
2.5	Collaboration Mechanisms	18
2.6	Aggregation Mechanism	19
2.6.1	Fuzzy Intersection	20
2.6.2	Partial-Consensus Fuzzy Intersection (PCFI)	20
2.7	Defuzzification Mechanism	21
2.8	Performance Evaluation in Fuzzy Collaborative Forecasting	24
2.9	Quality of Collaboration Evaluation	25
	References	26
3	Nonlinear Fuzzy Collaborative Forecasting Methods	27
3.1	Nonlinear Fuzzy Forecasting Methods	27
3.2	A Modified Back-Propagation Network (BPN) Approach for Generating Fuzzy Forecasts	28
3.3	A Fuzzy Back-Propagation Network (FBPN) Approach	33
3.4	A Simplified Calculation Technique	35
3.5	A Fuzzy Collaborative Forecasting Method Based on Fuzzy Back-propagation Networks (FBPNs)	35
3.6	A Collaborative Fuzzy Analytic Hierarchy Process (FAHP) Approach	37

3.6.1	Fuzzy Geometric Mean (FGM) for Estimating the Fuzzy Priorities	37
3.6.2	Finding Out the Overall Consensus Using Fuzzy Intersection (FI).	40
3.6.3	Finding Out the Partial Consensus Using Partial-Consensus Fuzzy Intersection (PCFI)	41
3.6.4	Defuzzifying the Aggregation Result Using the Center of Gravity (COG) Method	42
	References	43
4	Fuzzy Clustering and Fuzzy Co-clustering	45
4.1	Introduction	45
4.2	FCM-Type Fuzzy Clustering	46
4.2.1	k -Means Family	46
4.2.2	Fuzzy c -Means	47
4.2.3	FCM Variants with Other Nonlinearity Concepts.	47
4.2.4	FCM Variants with Non-point Prototypes	48
4.2.5	Examples of FCM Implementation	49
4.3	FCM-Type Fuzzy Co-clustering	51
4.3.1	Cooccurrence Information Analysis	51
4.3.2	FCCM and Fuzzy CoDoK	52
4.3.3	Fuzzy Co-clustering with Statistical Concepts	53
4.3.4	Examples of FCCM Implementation	54
4.4	Summary	56
	References	56
5	Collaborative Framework for Fuzzy Co-clustering	59
5.1	Introduction	59
5.2	Collaborative Framework for k -Means-Type Clustering Process.	60
5.2.1	Vertically Distributed Databases	61
5.2.2	Horizontally Distributed Databases	62
5.3	Collaborative Framework for FCCM of Vertically Partitioned Cooccurrence Information	63
5.4	Collaborative Framework for FCCM of Horizontally Partitioned Cooccurrence Information	66
5.5	Examples of FCCM Implementation with Distributed Cooccurrence Information	68
	References	72
6	Three-Mode Fuzzy Co-clustering and Collaborative Framework	73
6.1	Introduction	73
6.2	Extension of FCM-Type Co-clustering to Three-Mode Cooccurrence Data Analysis	74

- 6.2.1 Three-Mode Extension of FCCM 76
- 6.2.2 Examples of 3FCCM Implementation with Three-Mode
Cooccurrence Information Data 78
- 6.3 Collaborative Framework for Three-Mode Fuzzy Co-clustering 82
 - 6.3.1 Collaborative Three-Mode FCCM 82
 - 6.3.2 Examples of Implementation of Collaborative Framework
for 3FCCM 85
- References 87
- Index** 89