

# Contents

<b>1. Introduction</b>	1
1.1 What Is Data Mining?	1
1.2 Why Do We Need Data Mining?	2
1.3 Knowledge Discovery in Databases (KDD)	4
1.3.1 Processing Steps of KDD	4
1.3.2 Feature Selection	6
1.3.3 Applications of Knowledge Discovery in Databases	7
1.4 Data Mining Task	7
1.5 Data Mining Techniques	9
1.5.1 Clustering	9
1.5.2 Classification	10
1.5.3 Conceptual Clustering and Classification	14
1.5.4 Dependency Modeling	15
1.5.5 Summarization	15
1.5.6 Regression	16
1.5.7 Case-Based Learning	16
1.5.8 Mining Time-Series Data	17
1.6 Data Mining and Marketing	17
1.7 Solving Real-World Problems by Data Mining	18
1.8 Summary	21
1.8.1 Trends of Data Mining	21
1.8.2 Outline	22
<b>2. Association Rule</b>	25
2.1 Basic Concepts	25
2.2 Measurement of Association Rules	30
2.2.1 Support-Confidence Framework	30
2.2.2 Three Established Measurements	31
2.3 Searching Frequent Itemsets	33
2.3.1 The Apriori Algorithm	33
2.3.2 Identifying Itemsets of Interest	36
2.4 Research into Mining Association Rules	39
2.4.1 Chi-squared Test Method	40
2.4.2 The FP-tree Based Model	43

2.4.3	OPUS Based Algorithm . . . . .	44
2.5	Summary . . . . .	46
<b>3.</b>	<b>Negative Association Rule . . . . .</b>	<b>47</b>
3.1	Introduction . . . . .	47
3.2	Focusing on Itemsets of Interest . . . . .	51
3.3	Effectiveness of Focusing on Infrequent Itemsets of Interest . .	53
3.4	Itemsets of Interest . . . . .	55
3.4.1	Positive Itemsets of Interest . . . . .	55
3.4.2	Negative Itemsets of Interest . . . . .	58
3.5	Searching Interesting Itemsets . . . . .	59
3.5.1	Procedure . . . . .	59
3.5.2	An Example . . . . .	62
3.5.3	A Twice-Pruning Approach . . . . .	65
3.6	Negative Association Rules of Interest . . . . .	66
3.6.1	Measurement . . . . .	66
3.6.2	Examples . . . . .	71
3.7	Algorithms Design . . . . .	73
3.8	Identifying Reliable Exceptions . . . . .	75
3.8.1	Confidence Based Interestingness . . . . .	75
3.8.2	Support Based Interestingness . . . . .	77
3.8.3	Searching Reliable Exceptions . . . . .	78
3.9	Comparisons . . . . .	80
3.9.1	Comparison with Support-Confidence Framework . . . . .	80
3.9.2	Comparison with Interest Models . . . . .	80
3.9.3	Comparison with Exception Mining Model . . . . .	81
3.9.4	Comparison with Strong Negative Association Model . . . . .	82
3.10	Summary . . . . .	83
<b>4.</b>	<b>Causality in Databases . . . . .</b>	<b>85</b>
4.1	Introduction . . . . .	85
4.2	Basic Definitions . . . . .	87
4.3	Data Partitioning . . . . .	90
4.3.1	Partitioning Domains of Attributes . . . . .	90
4.3.2	Quantitative Items . . . . .	92
4.3.3	Decomposition and Composition of Quantitative Items . . . . .	93
4.3.4	Item Variables . . . . .	95
4.3.5	Decomposition and Composition for Item Variables . . . . .	96
4.3.6	Procedure of Partitioning . . . . .	98
4.4	Dependency among Variables . . . . .	99
4.4.1	Conditional Probabilities . . . . .	100
4.4.2	Causal Rules of Interest . . . . .	101
4.4.3	Algorithm Design . . . . .	103
4.5	Causality in Probabilistic Databases . . . . .	105
4.5.1	Problem Statement . . . . .	105

4.5.2	Required Concepts . . . . .	108
4.5.3	Preprocess of Data . . . . .	108
4.5.4	Probabilistic Dependency . . . . .	110
4.5.5	Improvements . . . . .	115
4.6	Summary . . . . .	119
<b>5.</b>	<b>Causal Rule Analysis . . . . .</b>	<b>121</b>
5.1	Introduction . . . . .	121
5.2	Problem Statement . . . . .	122
5.2.1	Related Concepts . . . . .	124
5.3	Optimizing Causal Rules . . . . .	126
5.3.1	Unnecessary Information . . . . .	126
5.3.2	Merging Unnecessary Information . . . . .	127
5.3.3	Merging Items with Identical Properties . . . . .	130
5.4	Polynomial Function for Causality . . . . .	131
5.4.1	Causal Relationship . . . . .	132
5.4.2	Binary Linear Causality . . . . .	132
5.4.3	N-ary Linear Propagating Model . . . . .	137
5.4.4	Examples . . . . .	139
5.5	Functions for General Causality . . . . .	143
5.6	Approximating Causality by Fitting . . . . .	149
5.6.1	Preprocessing of Data . . . . .	149
5.6.2	Constructing the Polynomial Function . . . . .	150
5.6.3	Algorithm Design . . . . .	155
5.6.4	Examples . . . . .	156
5.7	Summary . . . . .	159
<b>6.</b>	<b>Association Rules in Very Large Databases . . . . .</b>	<b>161</b>
6.1	Introduction . . . . .	161
6.2	Instance Selection . . . . .	164
6.2.1	Evaluating the Size of Instance Sets . . . . .	164
6.2.2	Generating Instance Set . . . . .	167
6.3	Estimation of Association Rules . . . . .	169
6.3.1	Identifying Approximate Frequent Itemsets . . . . .	169
6.3.2	Measuring Association Rules of Interest . . . . .	171
6.3.3	Algorithm Designing . . . . .	172
6.4	Searching True Association Rules Based on Approximations . . . . .	173
6.5	Incremental Mining . . . . .	179
6.5.1	Promising Itemsets . . . . .	180
6.5.2	Searching Procedure . . . . .	182
6.5.3	Competitive Set Method . . . . .	187
6.5.4	Assigning Weights . . . . .	188
6.5.5	Algorithm of Incremental Mining . . . . .	190
6.6	Improvement of Incremental Mining . . . . .	193
6.6.1	Conditions of Termination . . . . .	193

6.6.2	Anytime Search Algorithm .....	194
6.7	Summary .....	197
<b>7.</b>	<b>Association Rules in Small Databases</b> .....	<b>199</b>
7.1	Introduction .....	200
7.2	Problem Statement .....	201
7.2.1	Problems Faced by Utilizing External Data .....	201
7.2.2	Our Approach .....	203
7.3	External Data Collecting .....	204
7.3.1	Available Tools .....	204
7.3.2	Indexing by a Conditional Associated Semantic .....	206
7.3.3	Procedures for Similarity .....	208
7.4	A Data Preprocessing Framework .....	209
7.4.1	Pre-analysis: Selecting Relevant and Uncontradictable Collected Data-Sources .....	209
7.4.2	Post-analysis: Summarizing Historical Data .....	212
7.4.3	Algorithm Designing .....	214
7.5	Synthesizing Selected Rules .....	217
7.5.1	Assigning Weights .....	218
7.5.2	Algorithm Design .....	221
7.6	Refining Rules Mined in Small Databases .....	222
7.7	Summary .....	223
<b>8.</b>	<b>Conclusion and Future Work</b> .....	<b>225</b>
8.1	Conclusion .....	225
8.2	Future Work .....	226
	<b>References</b> .....	<b>229</b>
	<b>Subject Index</b> .....	<b>237</b>



<http://www.springer.com/978-3-540-43533-4>

Association Rule Mining  
Models and Algorithms  
Zhang, C.; Zhang, S.  
2002, XII, 244 p., Softcover  
ISBN: 978-3-540-43533-4