

Contents

1	Challenges and Trends	1
1.1	Introduction	1
1.2	KDD Evolution	2
1.3	Challenges and Issues	3
1.3.1	Issues of Traditional Data Mining Studies	4
1.3.2	Related Efforts on Tackling Traditional Data Mining Issues	6
1.3.3	Overlooking Ubiquitous Intelligence	7
1.3.4	Organizational and Social Factors	8
1.3.5	Human Involvement	9
1.3.6	Domain Factors	9
1.3.7	Knowledge Decision Power	10
1.3.8	Decision-Support Knowledge Delivery	10
1.4	KDD Paradigm Shift	11
1.4.1	Data-Centered Interesting Pattern Mining	11
1.4.2	From Data Mining to Knowledge Discovery	12
1.4.3	Multi-Dimensional Requirements on Actionable Knowledge Delivery	13
1.4.4	From Data-Centered Hidden Knowledge Discovery to Domain Driven Actionable Knowledge Delivery	15
1.4.5	D^3M : Domain Driven Actionable Knowledge Delivery	16
1.5	Towards Domain Driven Data Mining	17
1.5.1	The D^3M Methodology	18
1.5.2	Problem: Domain-Free vs. Domain-Specific	19
1.5.3	KDD Context: Unconstrained vs. Constrained	20
1.5.4	Interestingness: Technical vs. Business	22
1.5.5	Pattern: General vs. Actionable	23
1.5.6	Infrastructure: Automated vs. Human-Mining-Cooperated	24
1.6	Summary	25

2	<i>D</i>³<i>M</i> Methodology	27
2.1	Introduction	27
2.2	<i>D</i> ³ <i>M</i> Methodology Concept Map	27
2.3	<i>D</i> ³ <i>M</i> Key Components	28
2.3.1	Constrained Knowledge Delivery Environment	29
2.3.2	Considering Ubiquitous Intelligence	31
2.3.3	Cooperation between Human and KDD Systems	33
2.3.4	Interactive and Parallel KDD Support	34
2.3.5	Mining In-Depth Patterns	35
2.3.6	Enhancing Knowledge Actionability	36
2.3.7	Reference Model	37
2.3.8	Qualitative Research	38
2.3.9	Closed-Loop and Iterative Refinement	38
2.4	<i>D</i> ³ <i>M</i> Methodological Framework	40
2.4.1	Theoretical Underpinnings	40
2.4.2	Process Model	41
2.4.3	<i>D</i> ³ <i>M</i> Evaluation System	44
2.4.4	<i>D</i> ³ <i>M</i> Delivery System	46
2.5	Summary	47
3	Ubiquitous Intelligence	49
3.1	Introduction	49
3.2	Data Intelligence	49
3.2.1	What is data intelligence	49
3.2.2	Aims of involving data intelligence	50
3.2.3	Aspects of data intelligence	50
3.2.4	Techniques disclosing data intelligence	51
3.2.5	An example	52
3.3	Domain Intelligence	55
3.3.1	What is domain intelligence	55
3.3.2	Aims of involving domain intelligence	56
3.3.3	Aspects of domain intelligence	56
3.3.4	Techniques involving domain intelligence	57
3.3.5	Ontology-Based Domain Knowledge Involvement	57
3.4	Network Intelligence	59
3.4.1	What is network intelligence	59
3.4.2	Aims of involving network intelligence	59
3.4.3	Aspects of network intelligence	60
3.4.4	Techniques for involving network intelligence	60
3.4.5	An example of involving network intelligence	61
3.5	Human Intelligence	62
3.5.1	What is human intelligence	62
3.5.2	Aims of involving human intelligence	62
3.5.3	Aspects of human intelligence	63
3.5.4	Techniques for involving human intelligence	64

3.5.5	An example	64
3.6	Organizational Intelligence	65
3.6.1	What is organizational intelligence	65
3.6.2	Aims of involving organizational intelligence	66
3.6.3	Aspects of organizational intelligence	66
3.6.4	Techniques for involving organizational intelligence	67
3.7	Social Intelligence	67
3.7.1	What is social intelligence	67
3.7.2	Aims of involving social intelligence	68
3.7.3	Aspects of social intelligence	68
3.7.4	Techniques for involving social intelligence	69
3.8	Involving ubiquitous intelligence	69
3.8.1	The way of involving ubiquitous intelligence	69
3.8.2	Methodologies for involving ubiquitous intelligence	70
3.8.3	Intelligence Meta-synthesis of ubiquitous intelligence	71
3.9	Summary	72
4	Knowledge Actionability	75
4.1	Introduction	75
4.2	Why Knowledge Actionability	76
4.3	Related Work	77
4.4	Knowledge Actionability Framework	78
4.4.1	From Technical Significance to Knowledge Actionability ...	79
4.4.2	Measuring Knowledge Actionability	81
4.4.3	Pattern Conflict of Interest	83
4.4.4	Developing Business Interestingness	85
4.5	Aggregating Technical and Business Interestingness	87
4.6	Summary	90
5	<i>D</i>³<i>M</i> AKD Frameworks	93
5.1	Introduction	93
5.2	Why AKD Frameworks	94
5.3	Related Work	96
5.4	A System View of Actionable Knowledge Discovery	97
5.5	Actionable Knowledge Discovery Frameworks	101
5.5.1	Post Analysis Based AKD: PA-AKD	101
5.5.2	Unified Interestingness Based AKD: UI-AKD	102
5.5.3	Combined Mining Based AKD: CM-AKD	104
5.5.4	Multi-Source + Combined Mining Based AKD: MSCM-AKD	107
5.6	Case Studies	109
5.7	Discussions	110
5.8	Summary	112

6	Combined Mining	113
6.1	Introduction	113
6.2	Why Combined Mining	114
6.3	Problem Statement	117
6.3.1	An Example	117
6.3.2	Mining Combined Patterns	120
6.4	The Concept of Combined Mining	121
6.4.1	Basic Concepts	121
6.4.2	Basic Paradigms	123
6.4.3	Basic Process	124
6.5	Multi-Feature Combined Mining	126
6.5.1	Multi-Feature Combined Patterns	126
6.5.2	Pair Pattern	128
6.5.3	Cluster Pattern	129
6.5.4	Incremental Pair Pattern	129
6.5.5	Incremental Cluster Pattern	130
6.5.6	Procedure for Generating Multi-Feature Combined Patterns	131
6.6	Multi-Method Combined Mining	132
6.6.1	Basic Frameworks	132
6.6.2	Parallel Multi-Method Combined Mining	133
6.6.3	Serial Multi-Method Combined Mining	134
6.6.4	Closed-Loop Multi-Method Combined Mining	134
6.6.5	Closed-Loop Sequence Classification	136
6.7	Case Study: Mining Combined Patterns in E-Government Service Data	139
6.8	Related Work	139
6.9	Summary	142
7	Agent-Driven Data Mining	145
7.1	Introduction	145
7.2	Complementation between Agents and Data Mining	145
7.3	The Field of Agent Mining	147
7.4	Why Agent-Driven Data Mining	150
7.5	What Can Agents Do for Data Mining?	152
7.6	Agent-Driven Distributed Data Mining	154
7.6.1	The Challenges of Distributed Data Mining	154
7.6.2	What Can Agents Do for Distributed Data Mining?	154
7.6.3	Related Work	156
7.7	Research Issues in Agent Driven Data Mining	159
7.8	Case Study 1: F-Trade – An Agent-Mining Symbiont for Financial Services	160
7.9	Case Study 2: Agent-based Multi-source Data Mining	161
7.10	Case Study 3: Agent-based Adaptive Behavior Pattern Mining by HMM	162
7.10.1	System Framework	162

7.10.2	Agent-Based Adaptive CHMM	165
7.11	Research Resources on Agent Mining	167
7.11.1	The AMII Special Interest Group	167
7.11.2	Related References	168
7.12	Summary	168
8	Post Mining	171
8.1	Introduction	171
8.2	Interestingness Measures	172
8.3	Filtering and Pruning	174
8.4	Visualisation	176
8.5	Summarization and Representation	177
8.6	Post-Analysis	178
8.7	Maintenance	179
8.8	Summary	180
9	Mining Actionable Knowledge on Capital Market Data	181
9.1	Case Study 1: Extracting Actionable Trading Strategies	181
9.1.1	Related Work	181
9.1.2	What Is Actionable Trading Strategy?	182
9.1.3	Constraints on Actionable Trading Strategy Development	185
9.1.4	Methods for Developing Actionable Trading Strategies	189
9.2	Case Study 2: Mining Actionable Market Microstructure Behavior Patterns	196
9.2.1	Market Microstructure Behavior in Capital Markets	196
9.2.2	Modeling Market Microstructure Behavior to Construct Microstructure Behavioral Data	196
9.2.3	Mining Microstructure Behavior Patterns	199
9.2.4	Experiments	201
10	Mining Actionable Knowledge on Social Security Data	203
10.1	Case Study: Mining Actionable Combined Associations	203
10.1.1	Overview	203
10.1.2	Combined Associations and Association Clusters	203
10.1.3	Selecting Interesting Combined Associations and Association Clusters	205
10.2	Experiments: Mining Actionable Combined Patterns	207
10.2.1	Mining Multi-Feature Combined Patterns	208
10.2.2	Mining Closed-Loop Sequence Classifiers	213
10.3	Summary	215
11	Open Issues and Prospects	217
11.1	Open Issues	217
11.2	Trends and Prospects	218

12 Reading Materials	221
12.1 Activities on D^3M	221
12.2 References on D^3M	222
12.3 References on Agent Mining	223
12.4 References on Post-analysis and Post-mining	223
Glossary	225
Reference	233
References	233
Index	245



<http://www.springer.com/978-1-4419-5736-8>

Domain Driven Data Mining

Cao, L.; Yu, P.S.; Zhang, C.; Zhao, Y.

2010, XVI, 248 p., Hardcover

ISBN: 978-1-4419-5736-8