

Table of Contents

Table of Contents	6
List of Illustrations.....	8
List of Tables.....	10
1. Introduction.....	11
2. Literature review.....	14
2.1. Association rule	14
2.1.1. Definition of association rules	15
2.1.2. Mining association rules	16
2.1.3. Entropy function & application.....	17
2.1.4. Mining association algorithm.....	18
2.2. Multi-dimension association rule.....	20
2.2.1. Quantitative association rules	20
2.2.2. Relationship graph.....	22
2.2.3. Association rule clustering system (ARCS)	24
2.3. Calendar-based temporal association rules	27
2.3.1. Calendar schema and calendar pattern	27
2.3.2. Calendar-based temporal association rules	28
2.4. Concept hierarchy.....	29
3. Problem definition.....	32
3.1. Multi-dimension transaction database.....	32
3.2. A dimension in MD	33
3.2.1. Dimension atom.....	34
3.2.2. Dimension compound	35
3.2.3. Concept hierarchy with lattice structure	36
3.3. Multi-dimension pattern	36
3.3.1. Element patterns and generalized patterns.....	37
3.3.2. Element segmentations	38
3.3.3. Combination segmentations.....	39
3.4. Multi-dimension association rules	40
3.4.1. Multi-dimension association rule w.r.t full match.....	40
3.4.2. Multi-dimension association rule w.r.t relaxed match	41
4. Algorithm.....	42
4.1. Generate all patterns and pattern table.....	43
4.2. Update process.....	45
4.3. Rules output.....	47
5. Experiments.....	48
5.1. A whole selling example.....	48
5.1.1. Experiment scenario	48

5.1.2.	Data generation	49
5.1.3.	Experiment result	51
5.2.	A financial example	55
5.2.1.	Experiment scenario	55
5.2.2.	Data generation	56
5.2.3.	Experiment result	56
6.	Conclusion and future works	58
6.1.	Conclusion	58
6.2.	Future works	61
	Appendix A. Counting strategy	62
	Appendix B. Proof sketches	64
	Reference	65



List of Illustrations

Figure 2.1 transaction database D.....	15
Figure 2.2 Initial candidate space for the circuit example.....	16
Figure 2.3 Association rules mining algorithm.....	18
Figure 2.4 Example of a customer table.....	21
Figure 2.5 Mapping to Boolean association rules problem.....	21
Figure 2.6 Part of quantitative association mining result.....	21
Figure 2.7 Example of transaction and customer database.....	22
Figure 2.8 Example of relationship graph.....	23
Figure 2.9 Algorithm of relationship graph.....	24
Figure 2.10 An example of BinArray.....	25
Figure 2.11 An example of marked BinArray.....	26
Figure 2.12 Result and output rules.....	26
Figure 2.13 An example of calendar schema and calendar patterns.....	28
Figure 2.14 Outline of algorithm in calendar-based temporal association rules.....	29
Figure 2.15 An example of temporal hierarchy.....	30
Figure 2.16 Hierarchical and lattice structures of attributes in warehouse dimensions.....	31
Figure 2.17 An example of salary hierarchy.....	31
Figure 3.1 Multi-dimension transaction database MD.....	32
Figure 3.2 A transaction in MD.....	33
Figure 3.3 CH_1 for dimension “Date”.....	33
Figure 3.4 Example of dimension atom in dimension “Date”.....	34
Figure 3.5 An example of dimension compound in dimension “Date”.....	35
Figure 3.6 An example of lattice structure concept hierarchy.....	36
Figure 3.7 Hyper-cubes diced by dimension atoms.....	38
Figure 3.8 An example of element segmentation.....	39
Figure 3.9 A combination segmentation is composed of element segmentations....	40
Figure 4.1 Outline of our algorithm.....	42
Figure 4.2 Two given concept hierarchy.....	44
Figure 4.3 belonging relationships between patterns.....	44
Figure 4.4 A pattern table for concept hierarchies in Fig. 4.2.....	45
Figure 4.5 Update algorithm for full match.....	45
Figure 4.6 An example of update for full match.....	46
Figure 4.7 Update algorithm for relaxed match.....	46
Figure 4.8 An example of update for relaxed match.....	47
Figure 5.1. MD of scenario.....	48
Figure 5.2. Concept hierarchies of scenario.....	49

Figure 5.3. Scalability experiment	51
Figure 5.4. Effects of minimum support on efficient.....	52
Figure 5.5. Effects of number of element patterns on efficient.	52
Figure 5.6. Effects of minsup on discrete large itemsets ratio.....	53
Figure 5.7. Effects of match ratio on discrete large itemsets ratio.....	54
Figure 5.8. Effects of match ratio on lost large itemsets.....	54
Figure 5.9. Concept hierarchies in the example.....	56
Figure 5.10. Scalability experiment	56
Figure 6.1. Example concept hierarchy I	59
Figure 6.2. Example concept hierarchy II.....	59
Figure 6.3 incremental mining	60



List of Tables

Table 1. Three types of data set.....	50
Table 2. Parameters and default values of data sets.....	51
Table 3. Definition of funds	55
Table 4. Symbol definitions	62

