

Apriori Algorithm

6.2.2 Generating Association Rules from Frequent itemset

$$\text{Confidence } (A \Rightarrow B) = P(B|A) = \frac{\text{Support}(A \cup B)}{\text{Support}(A)}$$

Example

Apply ARM to get association rules with min support of 2 and confidence of 50%.

Customer	List of item
C1	1, 2, 5
C2	2, 4
C3	2, 3
C4	1, 2, 4
C5	1, 3
C6	2, 3
C7	1, 3
C8	1, 2, 3, 5
C9	1, 2, 3

S-1	1-Item	frequency
	L1	6
	L2	7
	L3	6
	L4	2
	L5	2

S-2	2-item set	freq
	L1, L2	4
	1, 3	4 ✓
	1, 4	1
	1, 5	2
	2, 3	4
	2, 4	2
	2, 5	2
	3, 4	0
	3, 5	1
	4, 5	0

<u>3-items set</u>	<u>freq</u>
1, 2, 3	2 ✓
1, 2, 4	1
1, 2, 5	2 ✓
1, 3, 4	0
1, 3, 5	1
1, 4, 5	0
2, 3, 4	0
2, 3, 5	1
2, 4, 5	0
3, 4, 5	0

Frequency - 3 item sets are

1 \Rightarrow {1, 2, 3} 2 {1, 2, 5}

Non-empty sub sets are

{ {1}, {2}, {3}, {1, 2}, {1, 3}, {2, 3} }

{ {1}, {2}, {5}, {1, 2} }

C-1 freq. 3-set $I \rightarrow$ {1, 2, 3}

Rule-1 {1} \rightarrow {2, 3}

Support = $2/9 = 22.2\%$

confidence = $\text{Support}(1, 2, 3) / \text{Sup}(1)$

$$= \frac{2/9}{6/9} = \frac{2}{6} < 50\%$$

(invalid rule)

Rule-2 {2} \rightarrow {1, 3}

$$C = \text{Sup} \{1, 2, 3\} / \text{Sup} \{2\} = \frac{2/9}{7/9} < 50\%$$

Rule-3 $\{3\} \rightarrow \{1, 2\}$

$$S = 2/9$$

$$C = 2/6$$

R-4 $\{1, 2\} \rightarrow \{3\}$

$$S = \frac{2}{9} = 22.2\%$$

$$C = S\{1, 2, 3\} / S\{1, 2\} = \frac{2/9}{4/9} = 50\%$$

valid rule

R-5 $\{1, 3\} \rightarrow \{2\}$

$$S = 2/9$$

$$C = \frac{2/9}{4/9} = \frac{2}{4} = 50\%$$

valid

R-6 $\{2, 3\} \rightarrow \{1\}$

$$S = 2/9, \quad C = \frac{2/9}{4/9} = 50\%$$

C-2 frequent 3-item set $I \Rightarrow \{1, 2, 5\}$

non-empty subset are

$\{1\}, \{2\}, \{5\}, \{1, 2\}, \{1, 5\}, \{2, 5\}$

Rule-1 $\{1\} \rightarrow \{2, 5\}$

$$S = 2/9$$

$$C = S\{1, 2, 5\} / S(1) = \frac{2/9}{6/9} = 33.3\%$$

(invalid)

$$\underline{R-3} \quad \{5\} \rightarrow \{1, 2\}$$

(valid)

$$S = 2/9$$

$$C = \frac{2/9}{2/9} = 100\% \quad \gamma \quad 50\%$$

$$\underline{R-4} \quad \{1, 2\} \rightarrow \{5\}$$

$$S = 2/9$$

$$C = S(1, 2, 5) / S(5, 2) = \frac{2/9}{4/9} = 50\%$$

$$\underline{R-5} \quad \{1, 5\} \rightarrow \{2\}$$

$$C = \frac{2/9}{2/9} = 100\%$$

$$\underline{R-6} \quad \{2, 5\} \rightarrow \{1\}$$

$$C = S(1, 2, 5) / S(2, 5) = \frac{2/9}{2/9} = 100\% \quad \gamma$$