

Association Rules

Mining Massive Datasets

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Topic 12

Sources

- Data Mining, The Textbook (2015) by Charu Aggarwal (Chapters 4, 5) – [slides by Lijun Zhang](#)
- Mining of Massive Datasets 2nd edition (2014) by Leskovec et al. ([Chapter 6](#)) - [slides](#)
- Data Mining Concepts and Techniques, 3rd edition (2011) by Han et al. (Chapter 6)
- Introduction to Data Mining 2nd edition (2019) by Tan et al. (Chapters 5, 6) – [slides ch5](#), [slides ch6](#)

What is a rule

- A rule is of the form $X \Rightarrow Y$
X and Y are itemsets
- X is the antecedent, Y is the consequent
- The **confidence** of the rule is:

$$\text{conf}(X \Rightarrow Y) = \frac{\text{sup}(X \cup Y)}{\text{sup}(X)}$$

Confidence of a rule

- The **confidence** of the rule $X \Rightarrow Y$ is:

$$\text{conf}(X \Rightarrow Y) = \frac{\text{sup}(X \cup Y)}{\text{sup}(X)}$$

- This is the conditional probability of $X \cup Y$ occurring in a transaction, given that X occurs in the transaction

Confidence of a rule (cont.)

tid	Set of items
1	Bread, Jam, Juice
2	Tofu, Juice, Tomatoes
3	Bread, Strawberries, Tofu, Juice
4	Tofu, Juice, Tomatoes
5	Strawberries, Juice, Tomatoes

$\text{conf}(\{\text{tofu, juice}\} \Rightarrow \{\text{tomatoes}\}) = ?$

Lift of a rule

- The **lift** of the rule $X \Rightarrow Y$ is:

$$\text{lift}(X \Rightarrow Y) = \frac{\text{sup}(X \cup Y)}{\text{sup}(X) \text{sup}(Y)}$$

- This is the ratio between the observed support and the expected support if X and Y were independent

Exercise



$$\text{conf}(X \Rightarrow Y) = \frac{\text{sup}(X \cup Y)}{\text{sup}(X)}$$

$$\text{lift}(X \Rightarrow Y) = \frac{\text{sup}(X \cup Y)}{\text{sup}(X) \text{sup}(Y)}$$

Answer in
Nearpod draw-it
Code to be given in class

Rule	Support $\text{sup}(X \cup Y)$	Confidence	Lift
$A \Rightarrow D$			
$C \Rightarrow A$			
$A \Rightarrow C$			
$B \& C \Rightarrow D$			

Association rule (minsup, minconf)

- Let X, Y be two itemsets; the rule $X \Rightarrow Y$ is an **association rule** of minimum support **minsup** and minimum confidence **minconf** if:

$$\text{sup}(X \Rightarrow Y) \geq \text{minsup}$$

and

$$\text{conf}(X \Rightarrow Y) \geq \text{minconf}$$

Summary

Things to remember

- Association rule of minsup and minconf
- The concepts of **confidence** and **lift**

Exercises for TT11-TT12

- Data Mining, The Textbook (2015) by Charu Aggarwal
 - Exercises 4.9 → 1-3, 5, 7-8
 - Exercises 5.7 → 1-5
- Mining of Massive Datasets 2nd edition (2014) by Leskovec et al.
 - Exercises 6.1.5 → 6.1.1-6.1.7
- Introduction to Data Mining 2nd edition (2019) by Tan et al.
 - Exercises 5.10 → 2-7