

Logical Models



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What are Logical Models 什么是逻辑模型

- The 'logical' models are defined in terms of easily interpretable logical expressions, or can be easily translated into rules that are understandable by humans.

“逻辑”模型被定义为**易于解释的逻辑表达式**，或者**易于转换成人类能够理解的规则**。

Typical Logical Models 典型的逻辑模型

- | | | |
|-------------------|---|------|
| First-order logic | □ | 一阶逻辑 |
| Association rules | □ | 关联规则 |
| Decision tree | □ | 决策树 |

Case Study: Association Rule 关联规则

- It is a method for discovering interesting relations between variables in databases.
是一种用于在大型数据库中变量之间发现有趣关系的方法。
- It is intended to identify *strong rules* discovered in databases using different measures of interestingness.
它采用差异趣味性度量方式，旨在识别数据库中发现的强规则。
- It can be used for discovering regularities between products in supermarkets, called **Market Basket Analysis**.
可用于发现超市产品之间的规律，称之为**购物篮分析**。
$$\{\text{onions, potatoes}\} \Rightarrow \{\text{burger}\}$$
- It is also applicable to other application domain such as: bioinformatics, medical diagnosis, Web mining, and scientific data analysis.
还可以用于其它应用领域，例如：生物信息学、医学诊断、Web挖掘、以及科学数据分析。

Case Study: Association Rule 关联规则

□ Definition 定义

- $I = \{i_1, i_2, \dots, i_n\},$

a set of n attributes called *items*. 称之为项的 n 个属性集。

- $T = \{t_1, t_2, \dots, t_m\},$

a set of transactions called transactions database. 称之为转换数据库的转换集

- Each t_i is a *subset* of the items in I , i.e., 每个 t_i 是 I 中项的子集

$$t_i \subseteq I.$$

- $X \Rightarrow Y,$

an *association rule*, 一个关联规则

where $X, Y \subseteq I$, and $X \cap Y = \emptyset$.

Case Study: Association Rule 关联规则

□ Example 举例

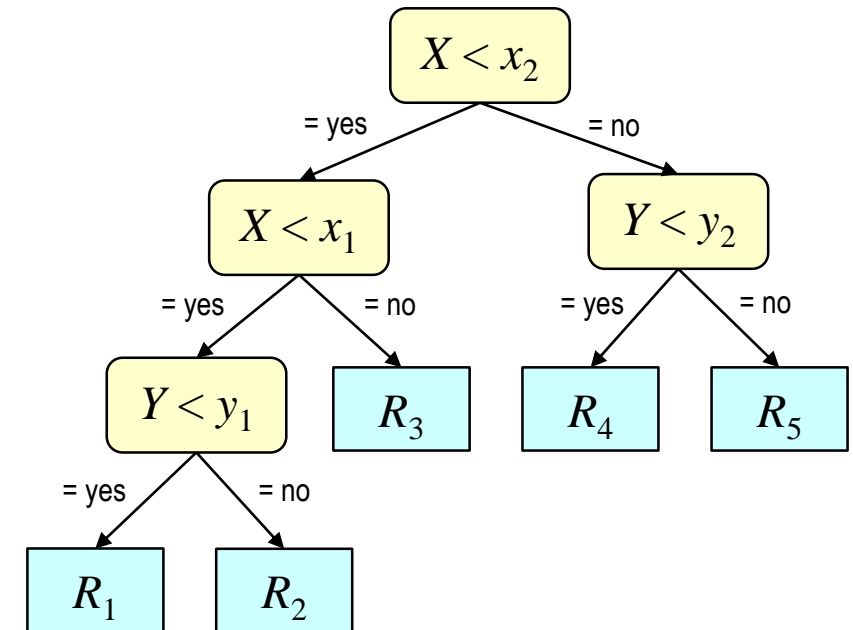
■ $I = \{\text{bread, cheese, milk, apple, eggs, salt, yogurt, biscuit, butter, beer, peanut}\}$

■ $i_1 = \{\text{bread, cheese, milk}\},$
 $i_2 = \{\text{apple, eggs, salt, yogurt}\},$
.....,
 $i_n = \{\text{beer, peanuts, eggs, milk}\}.$

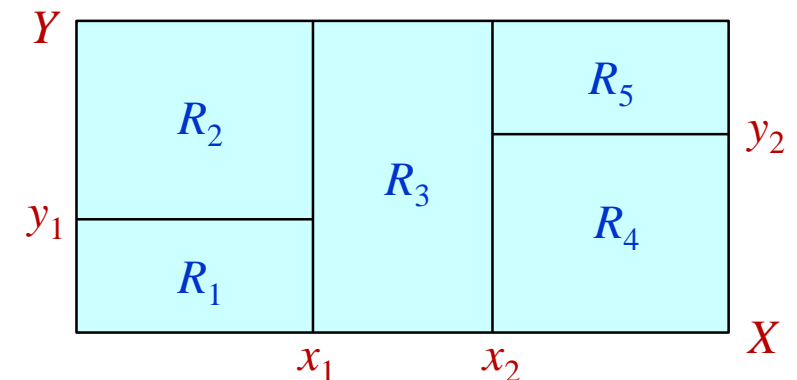
■ $X \Rightarrow Y$
 $\{\text{butter, bread}\} \Rightarrow \{\text{milk}\}$

Case Study: Decision Tree 决策树

- It uses a decision tree as a **predictive model** which maps observations about an item to conclusions about the item's target value.
使用决策树作为**预测模型**，将项的观察结果映射到关于项的目标值。
- Tree models where target variable can take a finite set of values are called **classification trees**; where leaves represent class labels, branches represent conjunctions of features that lead to those class labels.
目标变量可以取一组有限值的树模型称为**分类树**；其中叶节点表示类标签，分支表示通往这些类标签的特征连接。



A decision tree



Thank you for your attention!

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