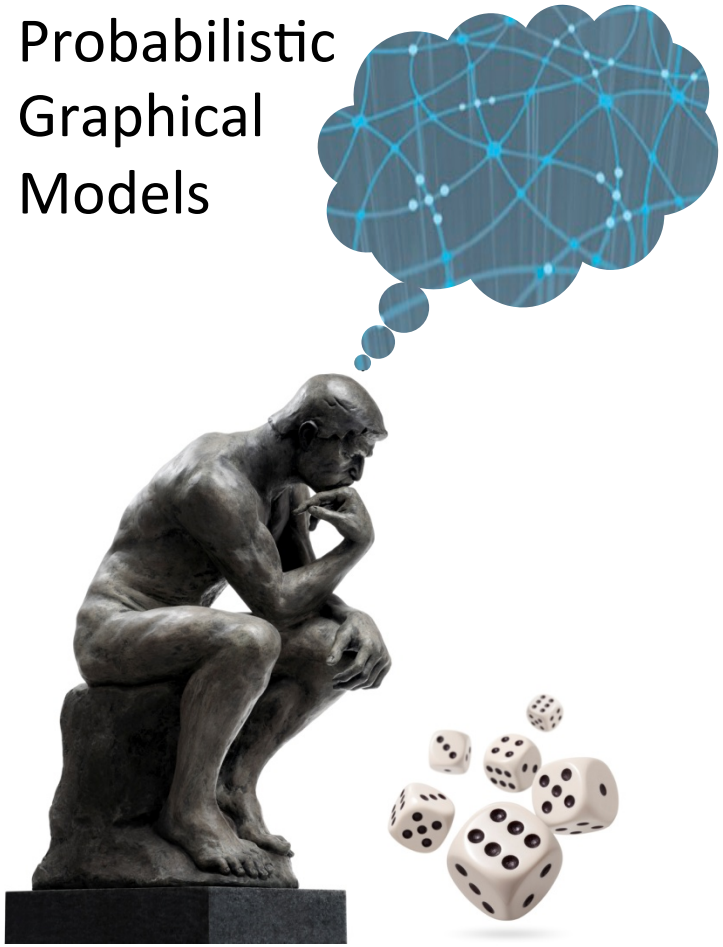
Probabilistic Graphical Models

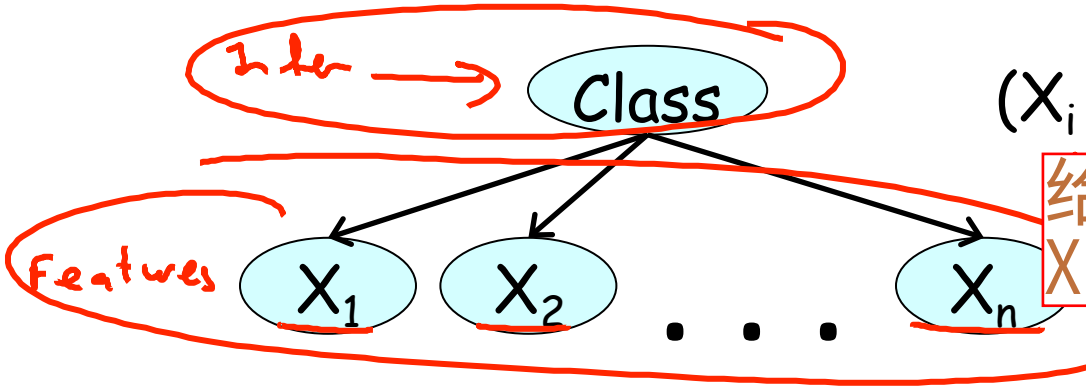


Representation

Bayesian Networks

Naïve Bayes

Naïve Bayes Model

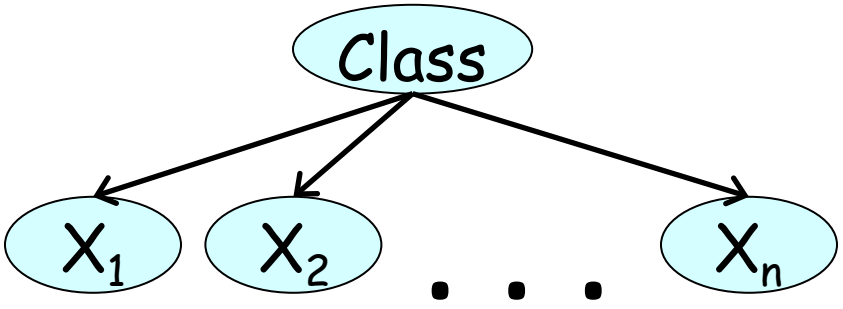


$(X_i \perp X_j \mid C)$ for all X_i, X_j

给定Class，则所有的Xi和Xj都条件独立

$$P(C, X_1, \ldots, X_n) = P(C) \prod_{i=1}^{n} P(X_i \mid C)$$

Naïve Bayes Classifier



理解Naive Bayes分类器的公式

$$\frac{P(C = c^1 \mid x_1, \ldots, x_n)}{P(C = c^2 \mid x_1, \ldots, x_n)} = \frac{P(C = c^1)}{P(C = c^2)} \prod_{i=1}^{n} \frac{P(x_i \mid C = c^1)}{P(x_i \mid C = c^2)}$$

odds ratios

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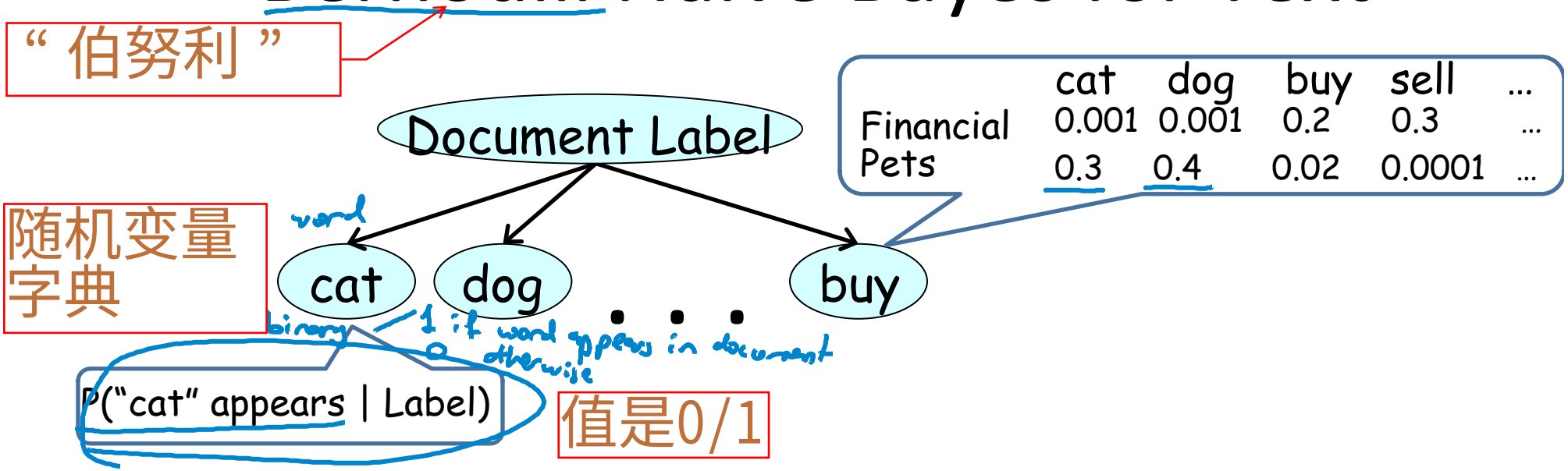
Bernoulli Naïve Bayes for Text



$$\frac{P(C = c^1 \mid x_1, \ldots, x_n)}{P(C = c^2 \mid x_1, \ldots, x_n)} = \frac{P(C = c^1)}{P(C = c^2)} \prod_{i=1}^{n} \frac{P(x_i \mid C = c^1)}{P(x_i \mid C = c^2)}$$

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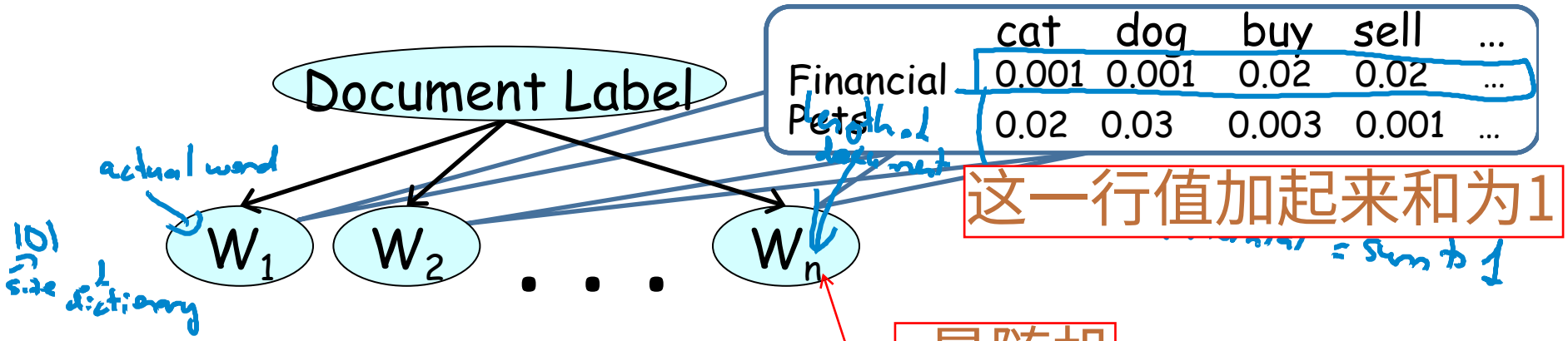
多项式分布的

Multinomial Naïve Bayes for Text



这里的随机变量不表示具体的类型。

n是随机变量的个数

$$\frac{P(C = c^1 \mid x_1, \ldots, x_n)}{P(C = c^2 \mid x_1, \ldots, x_n)} = \frac{P(C = c^1)}{P(C = c^2)} \prod_{i=1}^{n} \frac{P(x_i \mid C = c^1)}{P(x_i \mid C = c^2)}$$

Daphne Koller

Summary

- Simple approach for classification
  - Computationally efficient
  - Easy to construct
- Surprisingly effective in domains with many weakly relevant features
- Strong independence assumptions reduce performance when many features are strongly correlated