Naive Bayes

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Given feature vector $x = (x_1, \dots, x_D) \in \mathbb{R}^D$
we attempt a classification problem:

$\hat{y} \in \{0, 1, \dots, c\}$

$P(y=k|x) = \frac{P(x|y=k)\,P(y=k)}{P(x)}$.

Assume features are independent ⇝ naive

$P(y=k|x) = \frac{P(x_1|y=k) \cdot \dots \cdot P(x_D|y=k)\,P(y=k)}{P(x)}$

We choose

$\hat{y} = \underset{y}{\operatorname{argmax}}\ P(x_1|y) \cdot \dots \cdot P(x_D|y)\,P(y)$

$= \underset{y}{\operatorname{argmax}} \sum_i \log P(x_i|y) + \log P(y)$

$P(x_i|y)$ we can model by Gaussian distribution