

Naive Bayes (continued)*(find and work with a partner)*

- Continuing the example from Handout 11, say we have a new data point $\mathbf{x}_{\text{test}} = [\text{neg}, \text{pos}]$. Our goal is to predict the class label based on the Naive Bayes posterior probability. In practice, we will compute this probability for each class k , based on our estimates (θ_k and $\theta_{k,j,v}$ terms). Then we will assign this data point the class label with maximum probability:

$$\hat{y} = \arg \max_{k \in \{1, 2, \dots, K\}} p(y = k | \mathbf{x}) = \arg \max_{k \in \{1, 2, \dots, K\}} p(y = k) \prod_{j=1}^p p(x_j | y = k).$$

For this \mathbf{x}_{test} , compute $p(y = 1 | \mathbf{x}_{\text{test}})$ and $p(y = 2 | \mathbf{x}_{\text{test}})$ and then assign a prediction label \hat{y} .

- For the tennis example below, fill in the $\theta_{k,j,v}$ terms (thinking about how this could be implemented using dictionaries).

Day	Outlook	Temperature	Humidity	Wind	PlayTennis (y)
\mathbf{x}_1	Sunny	Hot	High	Weak	No
\mathbf{x}_2	Sunny	Hot	High	Strong	No
\mathbf{x}_3	Overcast	Hot	High	Weak	Yes
\mathbf{x}_4	Rain	Mild	High	Weak	Yes
\mathbf{x}_5	Rain	Cool	Normal	Weak	Yes
\mathbf{x}_6	Rain	Cool	Normal	Strong	No
\mathbf{x}_7	Overcast	Cool	Normal	Strong	Yes
\mathbf{x}_8	Sunny	Mild	High	Weak	No
\mathbf{x}_9	Sunny	Cool	Normal	Weak	Yes
\mathbf{x}_{10}	Rain	Mild	Normal	Weak	Yes
\mathbf{x}_{11}	Sunny	Mild	Normal	Strong	Yes
\mathbf{x}_{12}	Overcast	Mild	High	Strong	Yes
\mathbf{x}_{13}	Overcast	Hot	Normal	Weak	Yes
\mathbf{x}_{14}	Rain	Mild	High	Strong	No

y=No (0)

outlook	Sunny:	Overcast:	Rain:
temperature	Cool:	Mild:	Hot:
humidity	Normal:	High:	
wind	Weak:	Strong:	

y=Yes (1)

outlook	Sunny:	Overcast:	Rain:
temperature	Cool:	Mild:	Hot:
humidity	Normal:	High:	
wind	Weak:	Strong:	