Naive Bayes in Action

Suzie is about to go on a blind date. Her friends want to help her to distinguish good from bad guys. Suzie's friends train a Naïve Bayes classifier to predict if someone is good or bad. As training data, they collect six people who they know are definitely good (Batman, Superman, Spiderman) or bad (Riddler, Penguin, Joker). Suzie's friends define the following features and labels:

Binary features:

C = "Guy wears a cape."

M = "Guy wears a mask."

U = "Guy wears his underwear outside his pants"

Labels:

G = "Guy is good"

B = "Guy is bad"

Features	Spiderman	Superman	Batman	Joker	Penguin	Riddler
Cape (C)	F	T	T	F	T	F
Mask (M)	T	T	F	F	F	T
Underwear outside of pants (U)	F	T	T	F	F	F
Label	**G**	**G**	**G**	**B**	**B**	**B**

Recall these definitions from previous sections:

$$\mathrm{P}(y=c)=\frac{\sum_{i=1}^{n} I(y_i=c)}{n}=\hat{\pi}_c$$

$$\mathrm{P}(x=j|y=c)=\frac{\#\text{ of samples with label } c \text{ that have feature } \alpha \text{ with value } j}{\#\text{ of samples with label } c}$$

Fill in the following probabilities based on the data from the table above. The format of your input should be a decimal to the hundredths place (e.g., 0.65)

Class Prior Probabilites

P(G) 0.5 ✔

P(B) 0.5 ✔

Probabilities of Features for "Good" Class

P(C|G) 0.67 ✔

P(M|G) 0.67 ✔

P(U|G) 0.67 ✔

Probabilities of Features for "Bad" Class

P(C|B) 0.33 ✔

P(M|B) 0.33 ✔

P(U|B) 0.00 ✔

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Hint: P(M,C|G)

0.25

✔ 0.44

The Naïve Bayes assumption says that the joint probability of features given label is independent, and thus equal to the probabilities of each feature given label multiplied.
Therefore, $P(M,C \mid G)=P(M \mid G)\cdot P(C \mid G)=0.66\cdot 0.66=0.44$.

0.66

0.33

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