CS 8725: Report for assignment 2

Chanmann Lim

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1. Parameters list:

$P(Y)$
$P(X_1|Y=y), \quad y \in \{T, F\}$
$P(X_i|Y=y) \sim N(\mu_{y_i}, \sigma^2_{y_i}), \quad y \in \{T, F\},\ 2 \leq i \leq d$
The total number of parameters $= 1 + 2 + 2 \times 2 \times (d-1) = 4d - 1$.

$$P(Y|X) = \frac{P(X|Y) \cdot P(Y)}{P(X)} \tag{1}$$

$$= \frac{P(X_1|Y) \cdot \prod_{i=2}^{d} N(\mu_i, \sigma_i^2) \cdot P(Y)}{P(X)} \tag{2}$$

2. (a)

$$f_{NB} = \underset{Y}{\operatorname{argmax}}\, P(Sunny|Y) \cdot P(Windy|Y) \cdot P(Y) \tag{3}$$

Where $Y \in \{Hike, \neg Hike\}$ and

$$P(Hike) = P(\neg Hike) = 0.5$$

$$f_{NB}(Sunny, Windy) = \underset{Y}{\operatorname{argmax}}\, P(Sunny|Y) \cdot P(Windy|Y) \tag{4}$$

(b)

$$P(Sunny, Windy, Hike) = P(Sunny, Windy|Hike) \cdot P(Hike) \tag{5}$$

$$= P(Sunny|Hike) \cdot P(Windy|Hike) \cdot P(Hike) \tag{6}$$

$$= 0.8 \times 0.4 \times 0.5 \tag{7}$$

$$= 0.16 \tag{8}$$

Similarly,

$$P(Sunny, Windy, \neg Hike) = P(Sunny|\neg Hike) \cdot P(Windy|\neg Hike) \cdot P(\neg Hike) \tag{9}$$

$$= 0.7 \times 0.5 \times 0.5 \tag{10}$$

$$= 0.175 \tag{11}$$

And the probability of error:

$$P(error|Sunny, Windy) = 1 - P(Correct) \tag{12}$$

$$= 1 - \sum_y P(Sunny, Windy, y) \tag{13}$$

$$= 1 - \sum_y P(Sunny, Windy|y) \cdot P(y) \tag{14}$$

$$= 1 - (0.16 + 0.175) \tag{15}$$

$$= 0.665 \tag{16}$$