# CS 8725: Report for assignment 2

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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)**

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

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:

$$P_e = 1 - P(Correct) \tag{12}$$
$$= 1 - P(Y|Sunny, Windy) \tag{13}$$
$$= 1 - \frac{P(Sunny, Windy, Y) \cdot P(Y)}{P(Sunny, Windy)} \tag{14}$$

For the case when the weather is sunny and windy the error probability:

$$P_e(Hike|Sunny, Windy) = 1 - \frac{0.16}{0.16 + 0.175} \tag{15}$$
$$= 1 - 0.48 \tag{16}$$
$$= 0.52 \tag{17}$$