

CS 8725: Report for assignment 2

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1. Parameters list:

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

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

$$\propto P(X|Y) \cdot P(Y) \quad (2)$$

$$= P(X_1|Y) \cdot \prod_{i=2}^d N(\mu_{iY}, \sigma_{iY}^2) \cdot P(Y) \quad (3)$$

2. (a)

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

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

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

$$f_{NB}(Sunny, Windy) = \operatorname{argmax}_Y P(Sunny|Y) \cdot P(Windy|Y) \quad (5)$$

(b)

$$P(Sunny, Windy, Hike) = P(Sunny, Windy|Hike) \cdot P(Hike) \quad (6)$$

$$= P(Sunny|Hike) \cdot P(Windy|Hike) \cdot P(Hike) \quad (7)$$

$$= 0.8 \times 0.4 \times 0.5 \quad (8)$$

$$= 0.16 \quad (9)$$

Similarly,

$$P(Sunny, Windy, \neg Hike) = P(Sunny|\neg Hike) \cdot P(Windy|\neg Hike) \cdot P(\neg Hike) \quad (10)$$

$$= 0.7 \times 0.5 \times 0.5 \quad (11)$$

$$= 0.175 \quad (12)$$

And the probability of error:

$$P_e = 1 - P(\text{Correct}) \quad (13)$$

$$= 1 - P(Y|Sunny, Windy) \quad (14)$$

$$= 1 - \frac{P(Sunny, Windy, Y) \cdot P(Y)}{P(Sunny, Windy)} \quad (15)$$

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

$$P_e(Hike|Sunny, Windy) = 1 - \frac{0.16}{0.16 + 0.175} \quad (16)$$

$$= 1 - 0.48 \quad (17)$$

$$= 0.52 \quad (18)$$