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CS21M037

Tutorial 5

2. Update rule for perceptron is,

$$w_{t+1} = w_t + x_i y_i$$

$$= (0.1 \ 0.2 \ -0.1) + (-1 \ 3 \ 3)(-1)$$

$$= (0.1 \ 0.2 \ -0.1) - (-1 \ 3 \ 3)$$

$$= (1.1 \ -2.8 \ -3.1)$$

4. From the diagram, we can see that the 2 features are <u>not</u> independent and so it doesnt satisfy naive bayes assumption.

5. 14 datapoints

$\therefore P(yes) = \frac{9}{14}$ $\quad P(no) = \frac{5}{14}$

For yes,

$$P(outlook / yes) = \begin{cases} \frac{2}{9} & Sunny \\ 4/9 & Overcast \\ 3/9 & Rainy \end{cases}$$

$$P(windy / yes) = \begin{cases} 3/9 & Yes \\ 6/9 & No \end{cases}$$

Temp $\Rightarrow \mu_t = 73$, $\sigma_t^2 = 38$

$$P(temp / yes) = \frac{1}{\sqrt{2\pi\sigma_t^2}} e^{\left(-\frac{(temp - \mu_t)^2}{2\sigma_t^2}\right)}$$

Humidity $\Rightarrow \mu_h = 79.1$, $\sigma_h^2 = 10.21$

For no,

$$P(outlook/no) = \begin{cases} 3/5 & \text{Sunny} \\ 0 & \text{Overcast} \\ 2/5 & \text{Rainy} \end{cases}$$

$$P(windy/no) = \begin{cases} 3/5 & \text{Yes} \\ 2/5 & \text{No} \end{cases}$$

~~Humidity~~ ~~Temp~~ Humidity $\Rightarrow$ $\mu_h = 86.2$ $\sigma_h^2 = 9.73$

~~Humidity~~ Temp $\Rightarrow$ $\mu_t = 74.6$ $\sigma_t^2 = 7.89$

For input pt,

$x \Rightarrow$ (outlook = Sunny, temp = 66, hum = 90, W = Yes)

$$P(temp = 66 / yes) = \frac{1}{\sqrt{2\pi \times 38}} e^{\left(-\frac{(66-73)^2}{2 \times 38}\right)}$$

$$\simeq 0.034$$

$$P(hum = 90 / yes) = \frac{1}{\sqrt{2\pi \times 104.36}} e^{-\left(\frac{(79.1+90)^2}{2 \times 104.36}\right)}$$

$$\simeq 0.0221$$

$$P(yes/x) = P(x/yes)\, P(yes)$$

$$= \frac{2}{9} \times 0.034 \times 0.0221 \times \frac{3}{9} \times \frac{9}{14}$$

$$\simeq 3.57 \times 10^{-5}$$

Similarly,

$$P(temp = 66 / no) = \frac{1}{\sqrt{2\pi \times 62.3}} e^{\left(\frac{(66-74.6)^2}{2 \times 62.3}\right)}$$

$$\simeq 0.0279$$

$$P(hum = 90 / no) = \frac{1}{\sqrt{2\pi \times 94.7}} e^{-\frac{(90-86.2)^2}{2 \times 94.7}}$$

$$\simeq 0.038$$

$$P(no/x) = P(x/no) \cdot P(no)$$

$$= \frac{3}{5} \times 0.0279 \times 0.038 \times \frac{3}{5} \times \frac{5}{14}$$

$$\simeq 1.363 \times 10^{-4}$$

as $P(no/x) > P(yes/x)$,

we predict, that student will not play.