

Naive Bayes

- It comes under supervised learning
- It comes under classification with an "assumption of independence among input variable".
 ↳ [no high correlation b/w input]
- Naive bayes is based on bayes equation

$$\underset{\substack{\uparrow \\ \text{(Probability)}}}{P(c|x)} = \frac{P(x|c) \cdot P(c)}{P(x)}$$

$P(c|x) \rightarrow$ Posterior probability of class given x .

$P(c|x) \rightarrow$ It tells us for a given input data it will tell to which class does that input variable belong.

$P(x|c) \rightarrow$ probability of predictor given class.

$P(c) \rightarrow$ class prior probability.

$P(x) \rightarrow$ predictor prior probability.

→ How Naive Bayes Works?

- It convert data into frequency table
- create likelihood table by finding probabilities.

- Use Naïve Bayes Equation to find posterior probability for each class.
- The class with highest posterior probability will be considered as output.

Ex: 4

| Weather | Play |
|-------------------|------|
| Sunny | NO |
| overcast | Yes |
| Rainy | Yes |
| Sunny | Yes |
| sunny | Yes |
| overcast | Yes |
| Rainy | NO |
| Rainy | NO |
| Sunny | Yes |
| Rainy | Yes |
| Sunny | NO |
| overcast | Yes |
| Overcast | Yes |
| Rainy | NO |
| Total: 14 records | |

Q) If weather is sunny can child play cricket or not?

Solution:Step 1: frequency table

| Weather | yes | no |
|----------|-----|----|
| sunny | 3 | 2 |
| rainy | 2 | 3 |
| overcast | 4 | 0 |

Step 2: Create likelihood table

| Weather | yes | no | |
|----------|-------------------------|------------------------|-----------------------------|
| sunny | 3 | 2 | $P(\text{sunny}) = 5/14$ |
| rainy | 2 | 3 | $P(\text{rainy}) = 5/14$ |
| overcast | 4 | 0 | $P(\text{overcast}) = 4/14$ |
| | $P(\text{yes})$ 9/14 | $P(\text{no})$ 5/14 | |

Step 3: use Naïve Bayes Equation

$$P(c/x) = \frac{P(x/c) \cdot P(c)}{P(x)}$$

$$P(\text{yes/sunny}) = \frac{P(\text{sunny/yes}) \cdot P(\text{yes})}{P(\text{sunny})}$$

$$[? \rightarrow P(\text{sunny/yes})] = \frac{\text{no of yes in sunny}}{\text{Total number of yes}} = \frac{3}{9}$$

$$P(\text{yes/sunny}) = \frac{(3/9) \cdot (9/14)}{(5/14)}$$

$$P(\text{yes/sunny}) = \underline{\underline{0.60}}$$

$$\bullet P(\text{no/sunny}) = \frac{P(\text{sunny/no}) \cdot P(\text{no})}{P(\text{sunny})}$$

$$\rightarrow P(\text{sunny/no}) = ?$$

$$P(\text{sunny/no}) = \frac{\text{no no in sunny}}{\text{total no no}}$$

$$= \frac{2}{5}$$

$$P(\text{no/sunny}) = \frac{(2/5) (5/14)}{(5/14)} = \underline{\underline{0.40}}$$

According to the values, 0.60 belongs to yes, where 0.40 belongs to no.

60% \rightarrow Yes & 40% \rightarrow No

so more percentage has yes.
so child can play.