

Bayes Statistics (Bayes Theorem)

Bayesian statistics is an approach to data analysis and parameter estimation based on **Bayes' theorem**.

Baye's Theorem

Probability $\begin{cases} \rightarrow \text{Independent Events} \rightarrow \text{one outcome not affecting others} \\ \rightarrow \text{Dependent Events} \rightarrow \text{affecting} \end{cases}$

① Independent Events

Eg: Rolling a dice
 $\{1, 2, 3, 4, 5, 6\}$

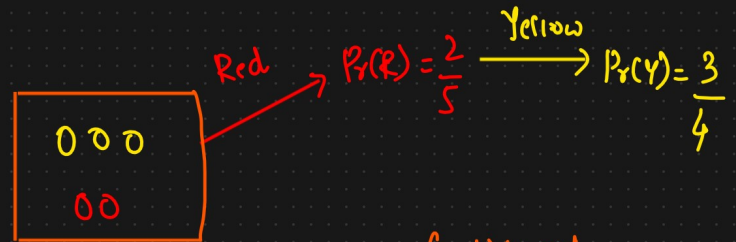
$$Pr(1) = \frac{1}{6} \quad Pr(2) = \frac{1}{6} \quad \dots$$

e.g. Tossing a coin

$$Pr(H) = 0.5 \quad Pr(T) = 0.5$$

② Dependent Event

uses conditional probability



$$Pr(R \text{ and } Y) = Pr(R) * \boxed{Pr(Y/R)}$$

\Rightarrow Conditional probability

$$= \frac{2}{5} * \frac{3}{4} = \frac{6}{20} //$$

prop of yellow when red has occurred

Y occurs after R

Generalised :

$$Pr(A \text{ and } B) = Pr(B \text{ and } A)$$

$$Pr(A) * Pr(B/A) = Pr(B) * Pr(A/B)$$

$$\boxed{Pr(B/A) = \frac{Pr(B) * Pr(A/B)}{Pr(A)}} \Rightarrow \text{Bayes' theorem}$$



$$Pr(A/B) = \frac{Pr(A) * Pr(B/A)}{Pr(B)}$$

$A, B = \text{events}$

$Pr(A/B) = \text{Probability of A given B is true}$

$Pr(B/A) = \text{" B " A is true}$

$Pr(A), Pr(B) = \text{Independent probabilities of A and B}$

DATASET

↑↑ Independent

↑↑ o/p / dependent

Size of
House

No. of Rooms

Location

Price

x_1

x_2

x_3

y

$$Pr(y/x_1, x_2, x_3) = \frac{Pr(y) * Pr(x_1, x_2, x_3/y)}{Pr(x_1, x_2, x_3)}$$



Bayes Theorem