

Bayes Statistics (Bayes Theorem)

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

Bayes' Theorem

Probability $\begin{cases} \rightarrow \text{Independent Events} \\ \rightarrow \text{Dependent Events} \end{cases}$

① Independent Events

Eg: Rolling a dice

$$\{1, 2, 3, 4, 5, 6\}$$

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

Tossing a coin

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

② Dependent Event

$$\begin{array}{c} \text{Red} \rightarrow Pr(R) = \frac{2}{5} \xrightarrow{\text{Yellow}} Pr(Y) = \frac{3}{4} \\ \boxed{000} \\ 00 \end{array}$$

$$\boxed{Pr(R \text{ and } Y) = Pr(R) * \boxed{Pr(Y|R)}} \xrightarrow{\text{Conditional probability}}$$

provided R-->event already occurred

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

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

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

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



$$P_{\delta}(A|B) = \frac{P_{\gamma}(A) * P_{\gamma}(B|A)}{P_{\gamma}(B)}$$

A, B = events

$P_{\gamma}(A|B)$ = Probability of A given B is true

$P_{\delta}(B|A)$ = " " " B " " A is true

$P_{\gamma}(A), P_{\gamma}(B)$ = Independent probabilities of A and B

<u>DATASET</u>		\uparrow Independent	\uparrow O/p /dependent
Size of Movie	No. of Rooms	location	Price
x_1	x_2	x_3	y

$$P_{\gamma}(y|x_1, x_2, x_3) = \frac{P_{\gamma}(y) * P_{\gamma}(x_1, x_2, x_3|y)}{P_{\gamma}(x_1, x_2, x_3)}$$



Bayes' Theorem