



Bayes' Theorem

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It is used in Naive Bayes' (Supervised Learning Classification) Algorithm. (E.g. Gmail uses it to classify the spam emails)

Shows the relation between one conditional probability and its inverse

$P(B|A)$ is referred to as *likelihood ratio* which measures the probability (given event A) of occurrence of B

$P(A)$ is referred to as *Prior* which represents the actual probability distribution of A

$$P(A|B) = \frac{P(B|A) P(A)}{P(B)}$$

$P(A|B)$ is referred to as *posterior* which means the probability of occurrence of A given B

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Let A_1, A_2, \dots, A_K be a collection of K mutually exclusive and exhaustive events with probability $P(A_i)$ $i = 1, 2, \dots, K$

Then for any event B for which $P(B) > 0$,

$$\begin{aligned} P(A_j \cap B) &= \frac{P(A_j | B)}{P(B)} \\ &= \frac{P(B | A_j) P(A_j)}{\sum P(B | A_j) P(A_j)} \end{aligned}$$