

PROBABILITY

Conditional Probability

Conditional Probability is the likelihood of an event or outcome occurring based on the occurrence of a previous event or outcome. It simply depends on any event in the past which has already taken place.

If E and F are two events with the same sample space of a random experiment, then the conditional probability of the event E given that F has occurred, i.e. $P(E|F)$ is,

$$P(E|F) = P(E \cap F)/P(F), \text{ provided } P(F) \neq 0$$

Properties of Conditional Probability

Let E and F be events of a sample space S of an experiment, then;

Property 1: $P(S|F) = P(F|F) = 1$

Property 2: If A and B are two events in a sample space S and F is an event of S, such that $P(F) \neq 0$, then ; $P((A \cup B)|F) = P(A|F) + P(B|F) - P((A \cap B)|F)$

Property 3: $P(E'|F) = 1 - P(E|F)$

Multiplication Rule

Let E and F be two events associated with a sample space S. Clearly, the set $E \cap F$ denotes the event that both E and F have occurred. In other words, $E \cap F$ denotes the simultaneous occurrence of the events E and F. The event $E \cap F$ is also written as EF. According to this rule, if E and F are the events in a sample space, then;

$$P(E \cap F) = P(E) P(F|E) = P(F) P(E|F)$$

where $P(E) \neq 0$ and $P(F) \neq 0$

Independent Events

Two experiments are said to be independent if for every pair of events E and F, where E is associated with the first experiment and F with the second experiment, the probability of the simultaneous occurrence of the events E and F when the two experiments are performed is the product of $P(E)$ and $P(F)$ calculated separately on the basis of two experiments, i.e.,

$$P(E \cap F) = P(E) \cdot P(F)$$

Baye's Theorem

Let S be the sample space and let $E_1, E_2, \dots, E_n$, be n mutually exclusive and exhaustive events associated With a random experiment. If A is any event which occurs with E_1 or E_2 or ... or E_n then probability of occurrence of E_i , when A occurred,

$$P(E_i / A) = \frac{P(E_i)P(A / E_i)}{\sum_{i=1}^n P(E_i)P(A / E_i)}, i = 1, 2, \dots, n$$

where, $P(E_i)$, $i = 1, 2, \dots, n$ are known as the priori probabilities

$P(E_i / A)$, $i = 1, 2, \dots, n$ are called the posteriori probabilities

Random Variables and its probability distributions:

A random variable is a real valued function whose domain is the sample space of a random experiment.

The probability distribution of a random variable X is the system of numbers

X :	X_1	X_2		X_n
P(X) :	P_1	P_2		P_n

where $P_i > 0$, $i=1$ to n and $P_1+P_2+P_3+ \dots + P_n = 1$

Mean and Variance of a Random variable:

Let X be a random variable assuming values $X_1, X_2, \dots, X_n$ with probabilities $P_1, P_2, \dots, P_n$, respectively such that $P_i \geq 0$,

$$\sum_{i=1}^n P_i = 1$$

Mean of X, denoted by μ [or expected value of X denoted by $E(X)$] is defined as:

$$\mu = E(X) = \sum_{i=1}^n X_i P_i$$

and variance denoted by σ^2 , is defined as

$$\sigma^2 = E(X)^2 - (E(X))^2$$