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PROBABILITY THEORY IS AS A MAIN FIELD IN CERTAIN SUBJECTS

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ABSTRACT

Mathematicians that study probability theory look at the likelihoods connected to random events. Multiple outcomes are possible for a random phenomenon. Probability theory uses specific formal ideas to express the likelihood of a given result. To determine the chance that an event will occur, probability theory uses a few basic concepts including sample space, probability distributions, random variables, etc. We shall examine probability theory's concept, foundations, formulae, examples, and applications in this article.

Key words

probability theory, statistical subject, outcome, experiment random variables.

Introduction

Probability distributions and random variables are used in probability theory to evaluate uncertain situations scientifically. The idea of probability is employed in probability theory to give the possibility of an event occurring a numerical representation. The number of favorable outcomes divided by the total number of possible outcomes of an event is the definition of probability.

Determining the probabilities connected to random occurrences is the focus of the mathematical and statistical subject of probability theory. There are two primary methods for studying probability theory. The two types of probability are experimental and theoretical. Without doing tests, theoretical probability is ascertained by logical reasoning. Conversely, experimental probability is ascertained by repeated trials based on historical data.

Assume that it is necessary to determine the likelihood of getting a number 4 while rolling a fair dice. There is just one favorable result. The dice have the following possible outcomes: {1, 2, 3, 4, 5, 6}. This suggests that there are six possible outcomes in all. Accordingly, one can calculate the chance of rolling four on a dice roll using probability theory as follows: 1 / 6 = 0.167.

Main part

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Fundamentals of Probability Theory

The knowledge of probability theory is aided by a few fundamental terms related to this branch of mathematics.

Unplanned Trial

According to probability theory, a random experiment is a trial that is carried out repeatedly with the goal of obtaining a well-defined collection of probable outcomes. One instance of a random experiment is flipping a coin.

Example Area

The collection of all potential results from running a random experiment is known as the sample space. When flipping a fair coin, for instance, the sample space is {heads, tails}.

Situation

An event, according to probability theory, is a collection of experiment results that make up a portion of the sample space. The following is a list of the many event types:

Occurrences that are independent are those that are not impacted by other occurrences.

Dependent events: Dependent events are those that are impacted by other occurrences.

Events that are mutually exclusive are those that are not possible to occur simultaneously.

Events that are equally likely to occur are defined as two or more occurrences with an equal probability of happening.

Occurrences that match the sample space of an experiment are considered exhaustive occurrences.

Arbitrary variable

A variable in probability theory that takes the value of every potential experiment outcome is called a random variable. As listed below, there are two categories of random variables.

A discrete random variable is one that may have a precise countable value, such 0, 1, 2... The probability mass function and the cumulative distribution function may both be used to explain it.

Continuous Random Variable: A continuous random variable is one that has an endless range of possible values. This variable's properties are defined by the probability density function and cumulative distribution function.

Chance

According to probability theory, probability is the numerical chance that an event will occur. There is always a range between 0 and 1 for the likelihood of an

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event occurring. This is due to the fact that the total number of outcomes from an event can never be greater than the number of targeted results.

Probability theory uses both empirical and theoretical probability to calculate the likelihood that an event will occur.

Probability with Conditions

Conditional probability is the process of estimating the probability of an event given that another event has previously occurred. The notation for it is P(A | B). This is the conditional probability that event A will occur in the case that event B has already happened.

Anticipation

The average value of the results of an experiment when it is repeated is known as the expectation of a random variable, X. It has the notation E[X]. It is sometimes referred to as the random variable mean.

Disturbance

The measure of dispersion that illustrates how a random variable's distribution fluctuates in relation to the mean is called variance. The average of the squared deviations from the random variable's mean can be used to characterize it. Var[X] is a notation for variance.

Distribution Function in Probability Theory

A function known as the probability distribution, or cumulative distribution function, uses a random variable to simulate every potential value of an experiment together with their probabilities distribution.

Discrete probability distributions in probability theory include the binomial and Bernoulli distributions. One type of continuous probability distribution is the normal distribution.

Mass Function of Probability

The likelihood that a discrete random variable would precisely equal a given value is known as the probability mass function.

Function of Probability Density

The likelihood that a continuous random variable will take on a range of potential values is known as the probability density function.

Formulas for Probability Theory

In probability theory, there are several formulae that may be used to calculate the different probabilities connected to occurrences. The following is a collection of the key formulae in probability theory.

- Theoretical probability: Number of favorable outcomes / Number of possible outcomes.
- Empirical probability: Number of times an event occurs / Total number of trials.

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• Addition Rule: P (A ∪ B) = P (A) + P (B) - P (A∩B), where A and B are events.

• Complementary Rule: P (A') = 1 - P (A). P (A') denotes the probability of an event not happening.

• Independent events: P(A∩B) = P(A) · P(B)

• Conditional probability: P(A | B) = P(A∩B) / P(B)

• Bayes' Theorem: P(A | B) = P(B | A) · P(A) / P(B)

• Probability mass function: f(x) = P(X = x)

• Probability density function: p(x) = p(x) = dF(x)dxdF(x)dx = F'(x), where F(x) is the cumulative distribution function.

• Expectation of a continuous random variable: ∫xf(x)dx∫xf(x)dx, where f(x) is the pdf.

• Expectation of a discrete random variable: ∑xp(x)∑xp(x), where p(x) is the pmf.

• Variance: Var(X) = $E[X^2] - (E[X])^2$

Conclusion

Every area uses probability theory to evaluate the risk involved with a given choice. The following is a list of some significant uses for probability theory:

Probability theory is used in finance to build mathematical models of the stock market that forecast future trends. This assists investors in choosing the least hazardous investment that yields the highest profits. Probability theory is used by the consumer business to lower the likelihood that a product's design would fail. Probability theory is used by casinos to create profitable games of chance.

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