Commentary

Probability Theory

Abstract

Probability Theory is a more of a game of chance. It has the condition of likely and unlikely certainties. This theory plays much in human life, in financial institutions, banking, education, governance, insurance, etc. Governments apply probabilistic methods in environmental regulation, entitlement analysis, and financial regulation. Meteorologists, for instance, use weather patterns to predict the probability of rain. In epidemiology, probability theory is used to understand the relationship between exposures and the risk of health effects. Probability is widely used in all sectors in daily life like sports, weather reports, blood samples, predicting the sex of the baby in the womb, congenital disabilities, statics, and many. In short, probability theory is about randomness; how will probability be applied in life and be enjoyed? Much needs to be done in inculcating it more in our day-to-day activities. We do more to make life a reality. Probability theory is a multifaceted discipline or art of which every life activity revolves around it.

Keywords: event, forecasting, game of chance, impossibility, possibility, possible outcome, probability, probability theory, randomness, uncertainty, unforeseen circumstances

1. Introduction

In life, there are uncertainties, there are unforeseen circumstances, among others. All these call for Probability Theory view. The chapter talks about probability theory view, uses

and importance of probability theory at the work place, the insurance and banking institutions, the classroom, the game of play.

2. Views about probability theory

Probability theory, an aspect of mathematics concerned with the analysis of random occurrence. The outcome of a random event cannot be determined before it occurs, but it may be any one of several possible outcomes. The actual outcome is considered to be determined by chance.

Although there are several different probability interpretations, probability theory treats the concept in a rigorous mathematical manner by expressing it through a set of axioms. Typically, these axioms formalize probability in terms of a probability space, which assigns a measure taking values between 0 and 1, termed the "Probability Measure", to a set of outcomes called the "Sample Space". Any specified subset of the sample space is called an "Event".

Central subjects in probability theory include discrete and continuous random variables, probability distributions, and stochastic processes, which provide mathematical abstractions of non-deterministic or uncertain processes or measured quantities that may either be single occurrences or evolve over time in a random fashion. Although it is not possible to perfectly predict random events, much can be said about their behavior. Two major results in probability theory describing such behavior are the Law of Large Numbers and the Central Limit Theorem

3. Uses of Probability Theory in the world of work

As a mathematical basis for statistics, probability theory is used in many real-life activities that involves quantitative analysis of data. Probability theory could be useful in the

aspect of work such as business, banking, insurance, governance, sports, social media, weather reports, etc.

In the aspect of business, probability theory is used to make improved decision-making in the face of uncertainties. It helps decision-making objective and data-driven rather than based on instinct. For example, cheese sales of at beach shop is dependent upon two things - good weather and a high number of visitors. So, a week from now if the probability of good weather is 84% and expected visitor rate is 26%, then the probability of expected sales is $Probability\ (weather) \times Probability\ (expected\ visitors) = 0.84 \times 0.26 = 21.85\%$. That number alone can improve the decision of the owner on how many employees to schedule for that day.

The introduction of probability theory into the school curriculum has encountered some difficulties. Also, property insurance companies use probability theory to calculate the odds of insurance claims from a segment of customers and decide on premiums to be charged. Similarly, life insurance companies use probability to estimate expected lifetime of customers to set premiums.

In health, probability theory is used in the application of simple urn models in clinical trials designed to determine whether a new treatment for a disease, a new drug, or a new surgical procedure is better than a standard treatment. In the simple case in which treatment can be regarded as either success or failure, the goal of the clinical trial is to discover whether the new treatment more frequently leads to success than the standard treatment. Patients with the disease can be identified with balls in an urn. The red balls are those patients who are cured by the new treatment, and the black balls are those not cured. Usually there is a control group, who receive the standard treatment. They are represented by a second urn with a possibly different fraction of red balls. The goal of the experiment of drawing some

number of balls from each urn is to discover on the basis of the sample which urn has the larger fraction of red balls.

A variation of this idea can be used to test the efficacy of a new vaccine. Perhaps the largest and most famous example was the test of the Salk vaccine for poliomyelitis conducted in 1954. It was organized by the U.S. Public Health Service and involved almost two million children. Its success has led to the almost complete elimination of polio as a health problem in the industrialized parts of the world. Strictly speaking, these applications are problems of statistics, for which the foundations are provided by probability theory.

Probability theory can be used for smarter social media marketing by calculating probabilities that will help you make better marketing decisions. Marketing strategies are dynamic and marketing decisions must be made with probability in mind to ensure you're reaching your target audience at the right time. The more data collected on a particular subject, such as social media marketing, the easier it becomes for marketers to predict what might happen next. For example, email marketing software can help calculate the probabilities of subscribers opening up or clicking through a specific message based on their previous interactions with that company's emails or products. Social networking sites have also become popular ways for marketing teams to collect information about customer preferences - these algorithms gather insights from users' posts and photos which allow them to make predictions about who they are, what they are interested in, and what their desires are.

In sports, analyses are conducted with the help of probability theory to understand the strengths and weaknesses of a particular team or player. Analysts use probability and odds to foretell outcomes regarding the team’s performance and members in the sport. Coaches use probability theory as a tool to determine in what areas their team is strong enough and in which all areas, they have to work to attain victory. Trainers even use probability to gauge the

capacity of a particular player in his team and when to allow him to play and against whom. For example, a cricket coach evaluates a player's batting and bowling capability by taking his average performances in previous matches before placing him in the lineup.

In politics, diplomats and politicians use probability theory to analyze any situation of conflict between individuals, companies, states, and political parties. It is also used in war strategies, political voting, and political affairs.

Answering the term “probability” is one of the most difficult things to do. However, in our daily life we are faced with several words or statements which involve probability. For example, in throwing of coin, tossing of die, games, weather forecasts, sports strategies, insurance options, recreational activities, making business and so on. Probability can be described as the basis or foundation of statistical theories and its applications.

Though [1] described probability as “as an abstract concept that cannot be directly measured”. However, [2] defined it as the mathematical study of random behavior, and it employs specific and accurate mathematical methods to uncover trends in disorganized and unpredictable scenarios governed by possibility. [3] also explains the probability concept as the occurrence or realization of mathematical value of anything. Though many scholars have come out with several definition of it, however there is a thing line which cut across it. That is the term “probability” is described as the mathematics of uncertainty (that is “event” occurring) or the chances obtained of an event among a large number of possibilities or the mathematical chance that something might happen.

Many countries have imbedded in their mathematics curriculum the probability concept to help shape the independent creative skills as a mechanism in helping making the right decision as well as playing a key role in the socio-economic field ([3] & [4]). Indeed, due to the recommendations of the National Council of Mathematics Teachers in the United States

[5], probability is now one of the aspects of knowledge in the curriculum for Pre-Primary, Primary, Secondary, and High Schools [6]. This means that knowing and understanding probability theory or theories plays a crucial role in our daily lives and must be look at it with importance. Probability theory is an aspect of mathematics that studies random phenomena where the random event's outcome cannot be predicted before it occurs, but it could be any of several possible outcomes. Therefore, the actual result is thought to be determined by chance. Probability theory is a vital subject that can be studied at several mathematical levels.

According to [7], curriculum developers should include probability theory concept into the curriculum in the basic school, Basic 5. Classroom teachers should as well introduce the elements of it by making connections with world around them. Also, students at that tender age do not need excessive mathematical formalism so need to illustrate materials with cognitively engaging and memorable examples. In addition, teachers should avoid tasks and activities which are no longer relevant to today's society.

Probability theory is used in everyday life, such as risk management and trading on financial markets. Mostly large insurance companies based their entire business strategy on probability for example car insurance companies. They mostly base your premiums on your likelihood of being involved in a car accident. To do so, they use data on the frequency of car accidents by gender, age, car type, and number of kilometers driven each year to estimate an individual's probability (or risk) of being involved in a motor vehicle accident. Also, reliability is another important application of probability theory in everyday life. In real life, probability and the ability to analyze and estimate the likelihood of any different combination of outcomes vis a vis one another are extremely important. It is also used to control traffic flow via a highway system, a telephone exchange, or a computer processor. Meteorologists, for example, use weather patterns to forecast the likelihood of rain. Probability theory is used in

epidemiology to study the relationship between exposures and the risk of adverse health effects.

Moreover, researchers can also predict the likelihood of developing specific types of cancer at different ages using the idea of probability theory and hence there are numerous examples of how probability is used in society. In the classroom, [8], solving non-standard mathematical problems is an element of probability theory that helps arouse interest, motivate students, and place them in an active cognitive position by solving problem situations in the pedagogical interaction in mathematics in primary school. Some foreign countries such as England and Wales devote considerable amount of time to study and teach probability theory in their classroom [7]. Section of probability theory and statistics is studied from primary classes and throughout the entire course of mathematics in secondary schools. For a number of years, elements of probabilistic and statistical knowledge have been included in the school mathematics course.

4. Some importance of probability theory

In everyday life, the concept of probability is extremely important. This important concept serves as the foundation for statistical analysis. Probability, in fact, serves as a substitute for certainty in modern science. The following are some of the importance:

i. Probability theory is extremely useful for making predictions. Estimates and predictions are critical components of research investigation. We make estimates for further analysis using statistical methods. As a result, statistical methods are heavily reliant on probability theory.

ii. It is also extremely important in decision making.

iii. It is concerned with planning and controlling, as well as the occurrence of various types of accidents.

iv. It is an indispensable tool for all types of formal studies involving uncertainty.

v. The concept of probability is used in more than just business and commerce; it is also used in scientific research and everyday life.

vi. Before learning about statistical decision procedures, one must first understand probability theory.

In modelling, the basic concern of Probability Theory is to model experiments involving randomness, that is, experiments with the nondetermined outcome, shortly called random experiments. Probability theory is a branch of mathematics focusing on the analysis of random phenomena. Probability plays a vital role in many areas of scientific research. Researchers can integrate uncertainty into their research models as a way of describing their findings. A probability model is a mathematical representation of a random phenomenon. It is defined by its sample space, events within the sample space, and probabilities associated with each event.

5. Perspectives

Four perspectives on probability are commonly used: Classical, Empirical, Subjective, and Axiomatic. Classical an approach to the understanding of probability based on the assumptions that any random process has a given set of possible outcomes and that each possible outcome is equally likely to occur**.** Empirical probability uses the number of occurrences of an outcome within a sample set as a basis for determining the probability of that outcome. The number of times event “X" happens out of 100 trials will be the probability of event “X” happening. Subjective probability is a type of probability derived from an individual's personal judgment or own experience about whether a specific outcome is likely to occur. It contains no formal calculations and only reflects the subject's opinions and past

experience rather than on data or computation. Axiomatic Probability is just another way of describing the probability of an event. As, the word itself says, in this approach, some axioms are predefined before assigning probabilities. This is done to quantize the event and hence to ease the calculation of occurrence or non-occurrence of the event.

Probability provides information about the likelihood that something will happen. Meteorologists, for instance, use weather patterns to predict the probability of rain. In epidemiology, probability theory is used to understand the relationship between exposures and the risk of health effects. In the business sector, the key role of probability is to improve decision-making in the face of uncertainties. It helps in decision-making and data-driven rather than based on instinct.

Hence it is important for citizens to understand how probability assessments are made and how they contribute to decisions. However, the probability of an event occurring is a number between 0 and 1, where 0 indicates the event's impossibility and 1 indicates certainty. In conclusion Probability is extremely important in everyday life. Weather forecasting, sports and gaming strategies, buying or selling insurance, online shopping and online games, blood group determination, and political strategy analysis.

6. Conclusion

At present, the situation in society has changed fundamentally, and this suggests that the skills and knowledge formed by probabilistic material will be necessary for a wide range of people and will become, along with computer literacy, an integral part of the general cultural training of a modern person. A developed society places quite high demands on its members to be able to analyze random factors, evaluate chances, put forward hypotheses, predict the development of a situation and, finally, make a decision in situations that have a probabilistic nature, in situations of uncertainty.

In conclusion, probability theory plays a vital role in the day-to-day life. In weather forecast, sports and gaming strategies, buying or selling insurance, online shopping and online games, determining blood groups, and analyzing political strategies. Probability theory is a multifaceted discipline or art of which every life activity revolves around it.

Acronyms

NCTM: National Council of Teachers of Mathematics

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