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# Statistics and Its Applications

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**Abstract**

*Statistics is an old scientific discipline, Statistics is a branch of mathematics that deals with the collection, analysis, interpretation and presentation of data. Increased computing power had a huge impact on the popularisation of the practice of statistical science. With new technologies such as the internet of things, we start to collect data from various sources like web server logs, online transaction records, tweet streams, social media, data from all kinds of sensors. With increased access to big data, there is a need for professionals with applied statistics knowledge who can visualize and analyze data, make sense of it, and use it to solve real complex problems. Applied statistics is the root of data analysis, and the practice of applied statistics involves analyzing data to help define and determine organizational needs. Today we can find applied statistics in various fields such as medicine, information technology, engineering, finance, marketing, accounting, business, etc. The goal of this paper is to clarify the applied statistics, its principles and to present its application in various fields.*

## Applied Statistics: Basic Principles and Application

### 1. Introduction

Math is a big part of all of our lives especially statistics. Statistics is the branch of mathematics that deals with the collection, analysis, interpretation and representation of data. We use statistics to analyze what is happening in the world around us. It is a combination of methods which permit us to make reasonable optimal decisions in cases of uncertainty (Sachs, 2012). Statistics compare data through mean, median and mode. We live in the information age and most of the daily information is determined mathematically using statistics. With the help of statistics we can know what happened in the past and what may occur in the future. Properly analyzed data could be used to prevent disease, to collect important demographic information and test potential life-saving pharmaceutical products. It could be also used to increase the efficiency and profitability of an organization.

The goals of the paper are: (i) to present definition and principles of applied statistics; (ii) to elaborate similarities and differences between Descriptive and Interferential statistics, (iii) to give an overview of the most used statistical tools, (iv) to outline the benefits of proper statistical interpretation of data and (v) to point out various applications of statistics. (Vasanthy and Jeganathan 2007, Vasanthy et.al., 2008, Raajasubramanian et.al., 2011, Jeganathan et.al., 2012, 2014,Sridhar et.al., 2012, Gunaselvi et.al., 2014, Premalatha et.al., 2015, Seshadri et.al., 2015, Shakila et.al., 2015, Ashok et.al., 2016, Satheesh Kumar et.al., 2016).

## 2. Statistics

Statistics is a brench of science which deals with: collection of data, organizing and sumerizing the data, analyses of data and making inferences, or decissions and predictions. There are two major types of statistics: Descriptive Statistics and Inferential Statistics. Descriptive statistics utilize numerical and graphical methods to look for patterns in a data set, to summarize the information revealed in a data set, and to present the information in a convenient form that individuals can use to make decisions. The main goal of descriptive statistics is to describe a data set. Thus, the class of descriptive statistics includes both numerical measures (e.g. the mean or the median) and graphical displays of data (e.g. pie charts or bar graphs).

Inferential statistics utilizes sample data to make estimates, decisions, predictions, or other generalizations about a larger set of data. The main goal of inferential statistics is to make a conclusion about a population based off of a sample of data from that population. One of the most commonly used inferential techniques is hypothesis testing. Statistical hypothesis is an educated guess about the relationship between two (or more) variables.

Simililarities and difference between Descriptive and Inferential statistical problem

| **Elements of a Descriptive Statistical Problem** | **Elements of an Inferential Statistical Problem** |
|---|---|
| Define the population of interest | Define the population of interest |
| Select the variables that are going to be investigated | Select the variables that are going to be investigated |
| Select the tables, graphs, or numerical summary tools. | Select a sample of the population units |
| Identify patterns in the data. | Run the statistical test on the sample. |
| | Generalize the result to your population and draw conclusions. |

Here are two most common examples of application of interferential statistics.

In the pharmaceutical industry, it is impossible to test a new medicine on every single person that may require it. Statistics can help them to create a sample of individuals and administer the medicine to them. After that, the statistician can analyze the effects of the drug on the sample and generalize their findings to the population.

In financial institutions, in order to measure credit card risk, managers often recruit statisticians to build statistical models that predict the chances a person will default on paying their bill. The manager can then apply the model to potential customers to determine their risk and that information can be used to decide whether or not to offer them a financial product.

We can also divide statistical analysis in three major parts: descriptive, moderate and advanced.

## 3. Principles of Applied Statistics

It is difficult to give a simple statement of the main principles of applied statistics because of its variety of applications. Statistical analysis of data is not a highly specific particular field of study.

- formulating and explaining specific research questions relevant to the subject
- creating solutions that provide a secure answer and open up new possibilities
- development of efficient and reliable measurement procedures
- development of analytical methods with suitable software following the primary research problem
- effective presentation and visualization of conclusions
- structured analysis to facilitate their interpretation in terms of subjects and their relationship to the knowledge base of the field

The main goal of applied statistics is to develop suitable concepts and methods that will help in solving the tasks listed above.

There are four main phases in statistical analysis. First, there is data collection and data

**4. Statistical tools**

There are various tools that can analyze statistical data, some of them are simple, some complicated, and often very specific for certain purposes. Basic analyses can be easily computed, while more advanced methods require a solid understanding of advanced statistics as well as specialized computer software.Statistical tools are useful in collecting, presentation and analysis of statistical data to make decisions. We can say that importance of statistical tools lies in the following reasons:

- helps to understand various economic and other problems and to find the right policy to solve such problems
- helps in converting raw data into summarized form so that it becomes easy to understand.
- makes decision making process easier by providing relevant information.

No matter which method of statistical analysis is chosen, it is important to be aware of each potential downside. The choice of method depends on the type of collected data as well as the type of problem to be solved.

**5. Application of statistics**

Statistics is used in every aspect of life and statistical analyses are needed for almost every project. It is used to solve problems in different fields and we will mention some of them

**Health care:**

Statisticians participate in all stages of developing new medicine: discovery, testing, approval and marketing. Statistics is a tool that can be used to measure the spread of certain diseases and the pressure created by it on the health care system. It can be used to predict the number of future cases and how many beds, doctors, hospitals, etc., will be needed to control the situation. It can also predict the possible timeline of vaccine manufacturing and the number of deaths that can be incurred in the meantime. Statistical graphs can also be used to develop a strategy of containing the viruses by feeding real data in models for future projections.

**Government:**

Many national policies are decided using statistical methods, and administrative decisions are made on the basis of their data. Statistics provides the most accurate data, which helps the government to make budgets and estimate expenditures and revenues. It is also used to revise the pay scale of employees in case the cost of living is rising. Statistic surveys are very important because they can open big questions like salary discrepancies, disease clusters. Statistic is used to evaluate the effectiveness of fraud and crime strategies and tactics.

**Finance:**

Statistics play a major role in the financial industry, especially in banking and investment. Banks use statistics to reduce risk in their loans, analyze the financial market and predict the impact of the economic crisis. Investors use statistics to understand the risks and potential of certain stocks.

**Marketing:**

Another big application of statistics is in marketing especialy in social media and advertising. In social media, they analiye data to increase number of followers and in advertising, they analiye data to optimize campaign's performance.

Economics: There are so many concepts of economics that are completely dependent on statistics. All the data collected to find out the national income, employment, inflation, the theory of demand and supply, the relationship between exports and imports etc., are interpreted through it.

**Politics:**

Statistics are crucial in a political campaign. It helps the politicians to have an idea about how many chances they have to win an election in a particular area. Statistic is used to target specific voter demographics and predict the winner of the election.

Data Science: A data scientist uses different statistical techniques to study the collected data, such as Classification, Hypothesis testing, Regression, Time series analysis, and much more. Statistics is one of the helpful measures for data scientists to obtain the relevant outputs of the sample space.

**Robotics:**

Statistics is an important parameter that is used in robotics. The robot always senses the present state by estimating the probability density function value. With the help of new input sensories, the robots continuously update themselves and give priority to the current actions. With the application of statistics in computer science and machine learning, algorithms' efficiency can be increased significantly.

**Research:**

Statistics is essential for all sections of science, as it is amazingly beneficial for decision making and examining the correctness of the choices that one has made. The uses of statistics play an essential role in the work of researchers. It is highly used to design surveys and present results in research papers.

There are many other uses of statistics in different fields related to daily human activities such as weather forecasting and sports. (Manikandan et.al., 2016, Sethuraman et.al., 2016, Senthil Thambi et.al., 2016, Ashok et.al., 2018, Senthilkumar et.al., 2018).

**Conclusion**

We can summarise that applied statistic is crucial to solve problems in various fields such as engineering, law, medicine, finance, business, etc. It has to develop statistical model using different mathematical and statistical theories and techniques, analyze and interpret data and report conclusions. Statistic is the science of data, it involves collecting, classifying, summarizing, organizing, analyzing, and interpreting numerical information. Applied statistics is a collection of applicable statistical methods and the application of these methods. Without the use of statistics it would be very difficult to make decisions based on any data collected. Like any other tool, statistics can be used or misused. In this paper, we wanted to point out the importance of statistics and its application in almost every aspect of our lives. Although, there are numerous statistical software packages for analysing data, we need to know the basics of statistics to be able to correctly interpret the data we encounter on a daily basis.

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