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Descriptive Analytics

Descriptive analytics is the interpretation of historical data to better understand changes that have occurred in a business. Descriptive analytics describes the use of a range of historic data to draw comparisons. Most commonly reported financial metrics are a product of descriptive analytics, for example, year-over-year pricing changes, month-over-month sales growth, the number of users, or the total revenue per subscriber. These measures all describe what has occurred in a business during a set period.

- Descriptive analytics is the process of parsing historical data to better understand the changes that have occurred in a business.
- Using a range of historic data and benchmarking, decision-makers obtain a holistic view of performance and trends on which to base business strategy.
- Descriptive analytics can help to identify the areas of strength and weakness in an organization.
- Examples of metrics used in descriptive analytics include year-over-year pricing changes, month-over-month sales growth, the number of users, or the total revenue per subscriber.
- Descriptive analytics is now being used in conjunction with newer analytics, such as predictive and prescriptive analytics.
- In its simplest form, descriptive analytics answers the question, "What happened?"

Descriptive analytics takes raw data and parses that data to draw conclusions that are useful and understandable by managers, investors, and other stakeholders. A report showing sales of $1 million may sound impressive, but it lacks context. If that figure represents a 20% month-over-month decline, it is a concern. If it is a 40% year-over-year increase, then it suggests something is going right with the sales strategy. However, the larger context including targeted growth is required to obtain an informed view of the company's sales performance. Descriptive analytics uses a full range of data to give an accurate picture of what has happened in a business and how that differs from other comparable periods. These performance metrics can be used to flag areas of strength and weakness to inform management strategies. The two main methods in which data is collected for descriptive analytics are data aggregation and data mining. Before data can be

made sense of it must first be gathered and then parsed into manageable information. This information can then be meaningfully used by management to comprehend where the business stands. Descriptive analytics is an important component of performance analysis so that managers can make informed strategic business decisions based on historical data. Descriptive analytics is one of the most basic pieces of business intelligence a company will use. Although descriptive analytics can be industry-specific, such as the seasonal variation in shipment completion times, analytics use broadly accepted measures common throughout the financial industry. Return on invested capital (ROIC) is a descriptive analytic created by taking three data points—net income, dividends, and total capital—and turning those data points into an easy-to-understand percentage that can be used to compare one company's performance to others. Generally speaking, the larger and more complex a company is, the more descriptive analytics it will use to measure its performance.

Descriptive analytics provides important information in an easy-to-grasp format. There will always be a need for descriptive analytics. However, more effort is going towards newer fields of analytics such as predictive and prescriptive analytics. These types of analytics use descriptive analytics and integrate additional data from diverse sources to model likely outcomes in the near term. These forward-looking analytics go beyond providing information to assisting in decision-making. These types of analytics can also suggest courses of action that can maximize positive outcomes and minimize negative ones.

Descriptive Statistics

- **Central Tendency of Data**

  Mean – Median - Mode

- **Dispersion of Data**

  Inter Quartile Range (IQR) – Range - Standard Deviation - Variance

- **Shape of the Data**

  Symmetric – Skewness - Kurtosis

Once we have collected the data, what will we do with it? Data can be analyzed and used in various methods and formats. There are two types of statistical methods widely used for analyzing data.

1. Descriptive statistics

2. Inferential statistics

While analyzing a dataset, We use statistical methods to arrive at a conclusion. Data-driven decision-making also depends on how efficiently we use these methods.

Descriptive statistics

The study of numerical and graphical ways to describe and display your data is called descriptive statistics. It describes the data and helps us understand the features of the data by summarizing the given sample set or population of data. In descriptive statistics, we usually take the sample into account. We can describe these data in various dimensions. Various dimensions of describing data are

1. Central Tendency of Data

2. Dispersion of Data

3. Shape of the Data

1. Central Tendency Of Data

This is the center of the distribution of data. It describes the location of data and concentrates where the data is located.

The three most widely used measures of the "**center**" of the data are

Mean

Median

Mode

Mean

The "Mean" is the average of the data.

Average can be identified by summing up all the numbers and then dividing them by the number of observation.

Mean = $X_1 + X_2 + X_3 + \ldots + X_n / n$

Example:

Data – 10,20,30,40,50 and Number of observations = 5

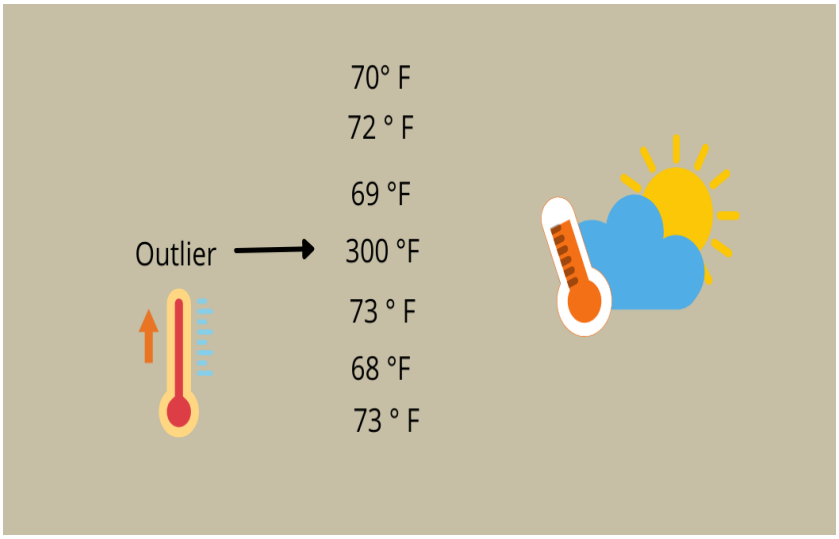
Mean = [10+20+30+40+50] / 5

Mean = 30

Outliers influence the central tendency of the data.

What are Outliers?

Outliers are extreme behaviours. An outlier is a data point that differs significantly from other observations. It can cause serious problems in analysis.



Example :

Data – 10,20,30,40,200

Mean = [10+20+30+40+200] / 5

Mean = 60

Solution for Outliers problem

Removing the outliers while taking average will give us good results.

Median

Median is the 50%th percentile of the data. It is exactly the center point of the data.

Median can be identified by ordering the data and splits the data into two equal parts and find the number. It is the best way to find the center of the data.

Because the central tendency of the data is not affected by outliers. Outliers don't influence the data.

Example:

Odd number of Data – 10,20,30,40,50

Median is 30.

Even number of data – 10,20,30,40,50,60

Find the middle 2 data and take the mean of that two values.

Here 30 and 40 are middle values.

30+40 / 2 =35

Median is 35

Mode

Mode is frequently occurring data or elements.

If an element occurs the highest number of times, it is the mode of that data. If no number in the data is repeated, then there is no mode for that data. There can be more than one mode in a dataset if two values have the same frequency and also the highest frequency.

Outliers don't influence the data.

The mode can be calculated for both quantitative and qualitative data.

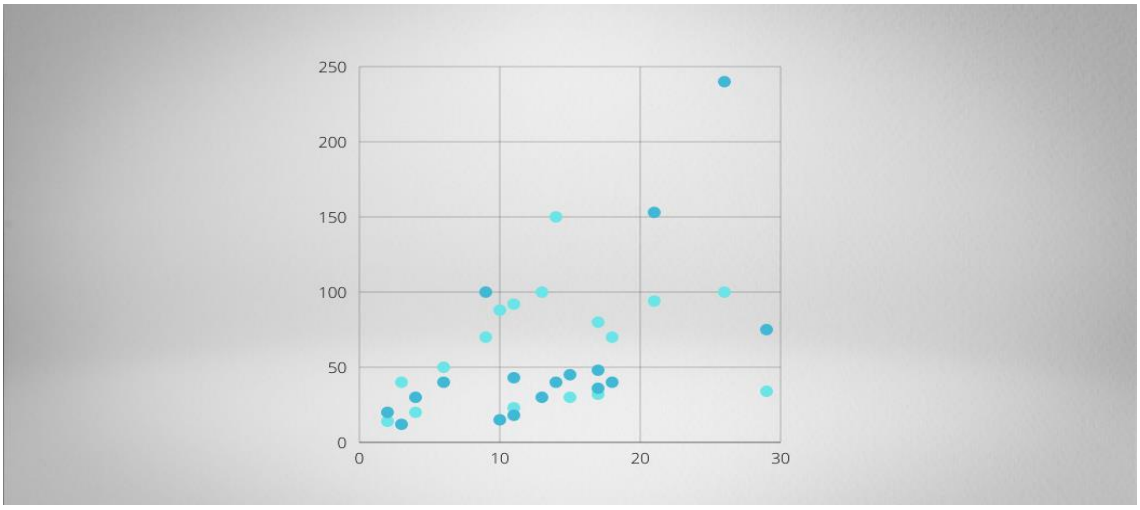
Example

Data – 1,3,4,6,7,3,3,5,10, 3

Mode is 3

because 3 has the highest frequency (4 times)

Dispersion of Data



The dispersion is the **“Spread of the data”.** It measures how far the data is spread.

In most of the dataset, the data values are closely located near the mean. On some other dataset, the values are widely spread out of the mean. These dispersions of data can be measured by

Inter Quartile Range (IQR)

Range

Standard Deviation

Variance

Inter Quartile Range (IQR)

Quartiles are special percentiles.

1st Quartile Q1 is the same as the 25th percentile.

2nd Quartile Q2 is the same as 50th percentile.

3rd Quratile Q3 is same as 75th percentile

Steps to find quartile and percentile

–The data should sorted and ordered from the smallest to the largest.

–For Quartiles, ordered data is divided into 4 equal parts.

–For Percentiles, ordered data is divided into 100 equal parts.

Inter Quartile Range is the difference between the third quartile(Q3) and the first Quartile (Q1)

IQR = Q3- Q1

Inter Quartile range

It is the spread of the middle half(50%) of the data

Range

The range is the difference between the largest and the smallest value in the data.

Max – Min = Range

Standard Deviation

The most common measure of spread is the standard deviation.

The Standard deviation is the measure of how far the data deviates from the mean value.

The standard deviation formula varies for population and sample. Both formulas are similar, but not the same.

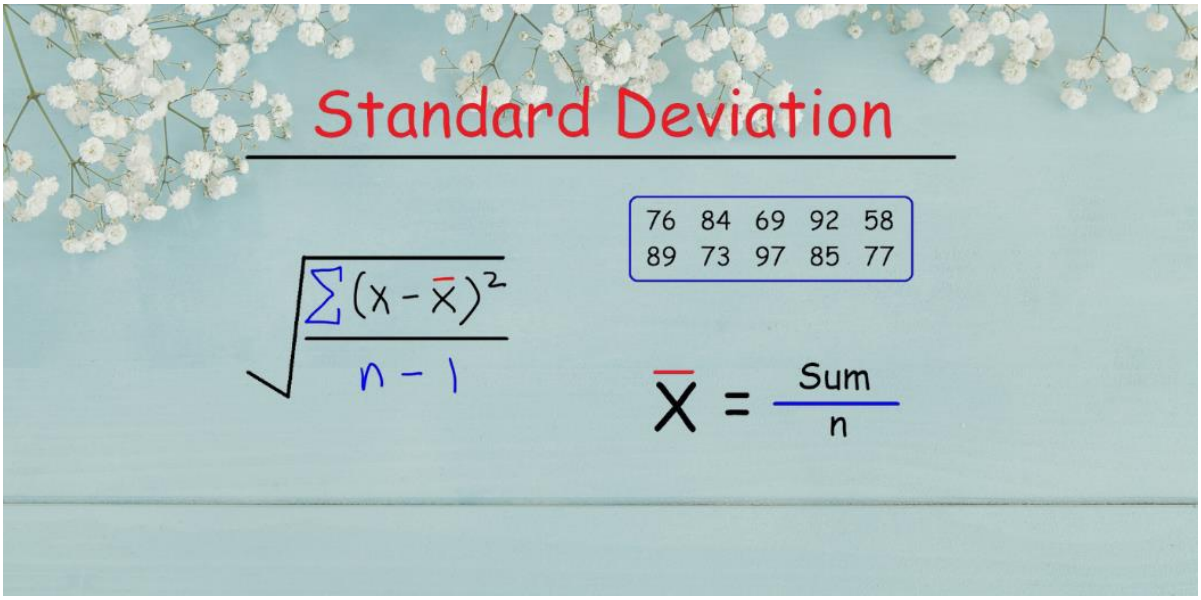
- **Symbol used for Sample Standard Deviation – "s" (lowercase)**
- **Symbol used for Population Standard Deviation – "σ" (sigma, lower case)**

Steps to find Standard deviation

If x is a number, then the difference "x – mean" is its deviation. The deviations are used to calculate the standard deviation.

Sample Standard Deviation, s = Square root of sample variance

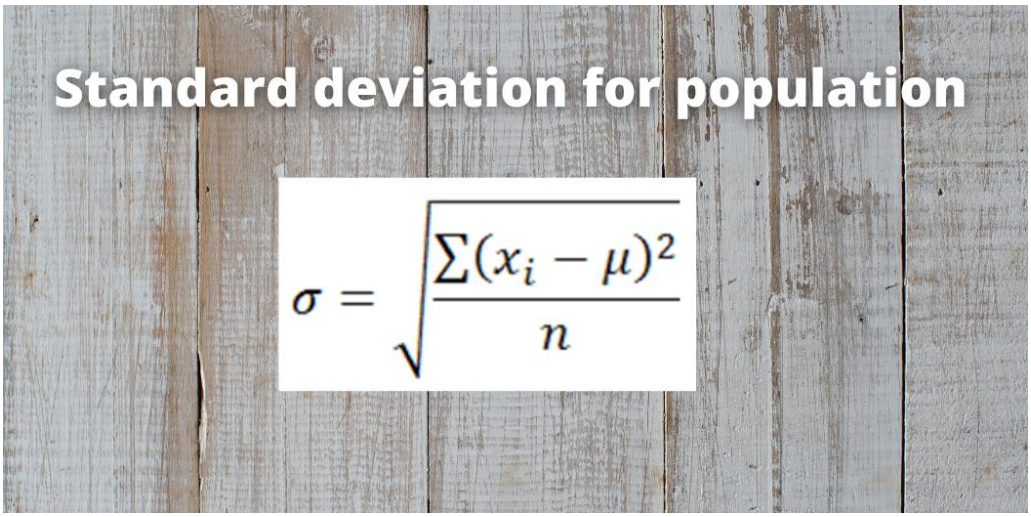
Sample Standard Deviation, s = Square root of $[\Sigma(x - \bar{x})^2/ n-1]$ **where** $\bar{x}$ **is average and n is no. of samples**



Standard Deviation for sample

Population Standard Deviation, σ = Square root of population variance

Population Standard Deviation, σ = Square root of [$\Sigma(x - \mu)^2$ / N] where μ is Mean and N is no.of population.



The standard deviation for population

The standard deviation is always positive or zero. It will be large when the data values are spread out from the mean.

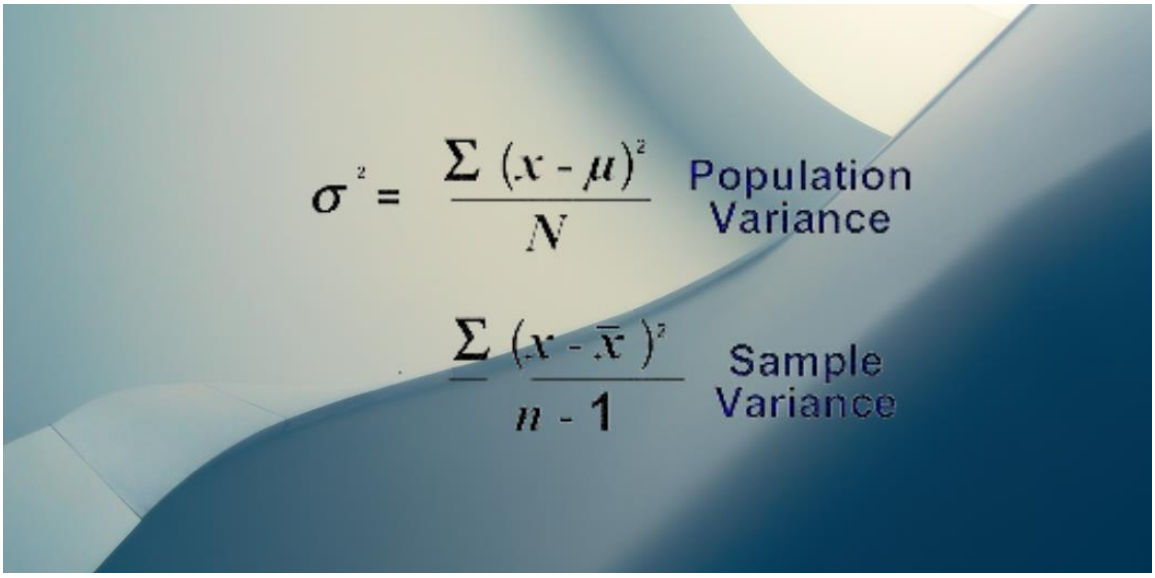
Variance

The variance is a measure of variability. It is the average squared deviation from the mean.

The symbol σ^2 represents the population variance and the symbol for s^2 represents sample variance.

Population variance $\sigma^2 = [\ \Sigma(x - \mu)^2 / N\ ]$

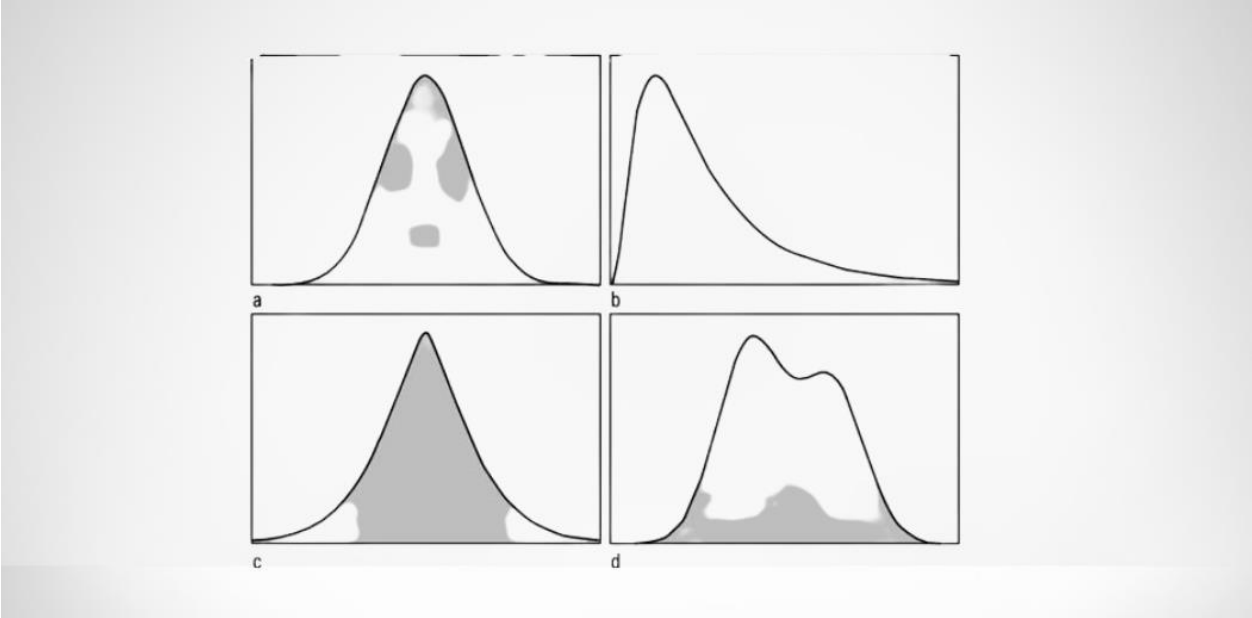
Sample Variance $s^2 = [\ \Sigma(x - \bar{x})^2 / n-1\ ]$



Shape of the Data

The shape describes the **type of the graph.**

The shape of the data is important because making a decision about the probability of data is based on its shape.



The shape of the data can be measured by two methodologies.

Symmetric

Skewness

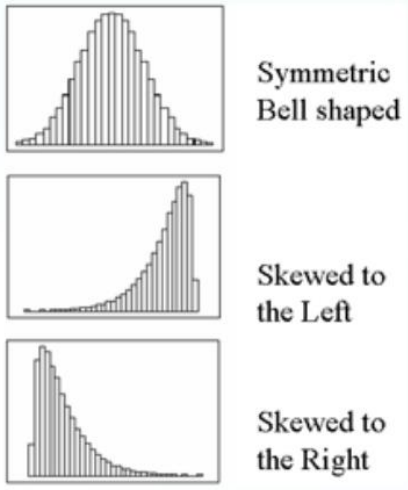
Kurtosis

Let us discuss in detail,

Symmetric

In the symmetric shape of the graph, the data is distributed the same on both sides.

In symmetric data, the mean and median are located close together.



The curve formed by this symmetric graph is called a normal curve.

Skewness

Skewness is the measure of the asymmetry of the distribution of data.

The data is not symmetrical (i.e) it is skewed towards one side.

Skewness is classified into two types.

1. Positive Skew

2. Negative Skew

let us see that,

1.Positively skewed

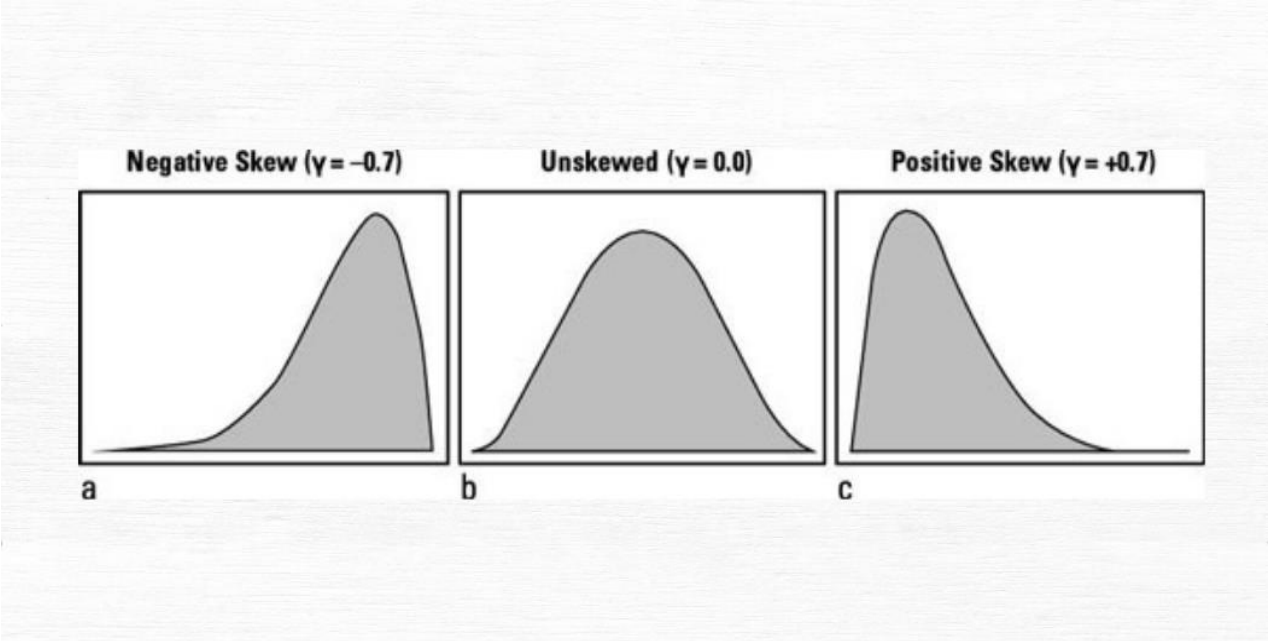
In a Positively skewed distribution, the data values are clustered around the left side of the distribution and the right side is longer.

The mean and median will be greater than the mode in the positive skew.

2.Negatively skewed

In a Negatively skewed distribution, the data values are clustered around the right side of the distribution and the left side is longer.

The mean and median will be less than the mode.



Positive.Negative skewed and unskewed

Kurtosis

Kurtosis is the measure of describing the distribution of data.

This data is distributed in different ways. They are,

1. Platykurtic

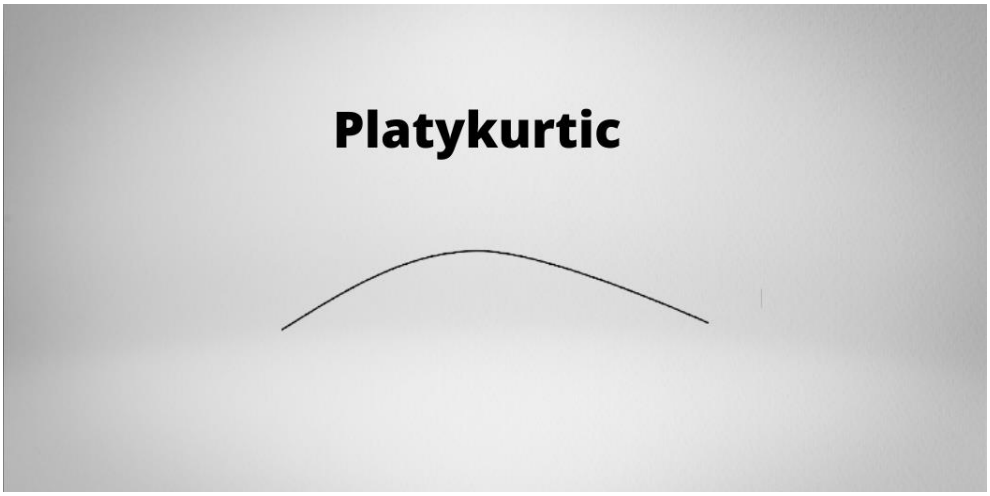
2. Mesokurtic

3. Leptokurtic

Let us discuss in detail,

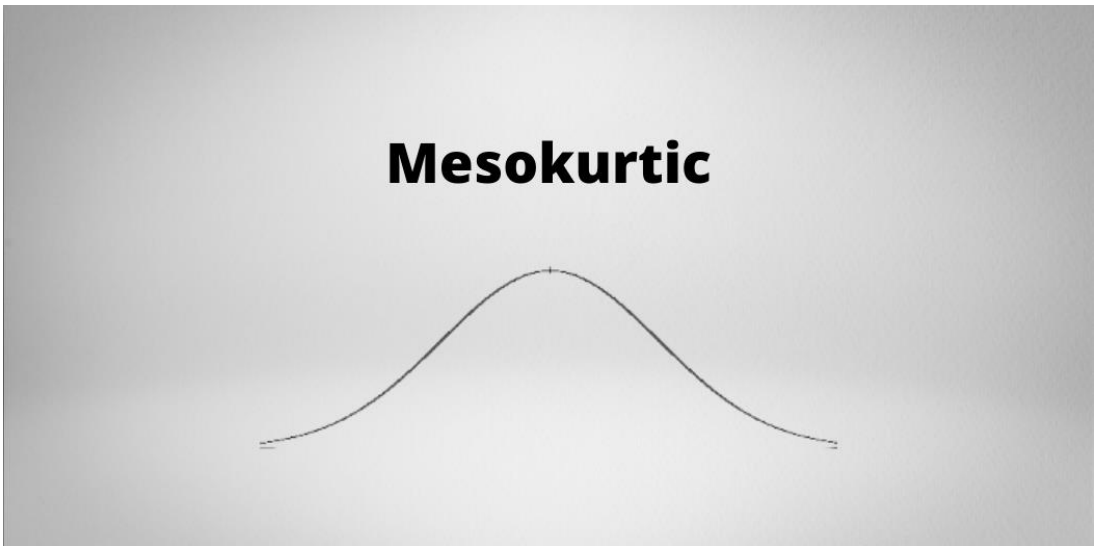
1. Platykurtic

The platykurtic shows a distribution with flat tails. Here the data is distributed faltly . The flat tails indicated the small outliers in the distribution.



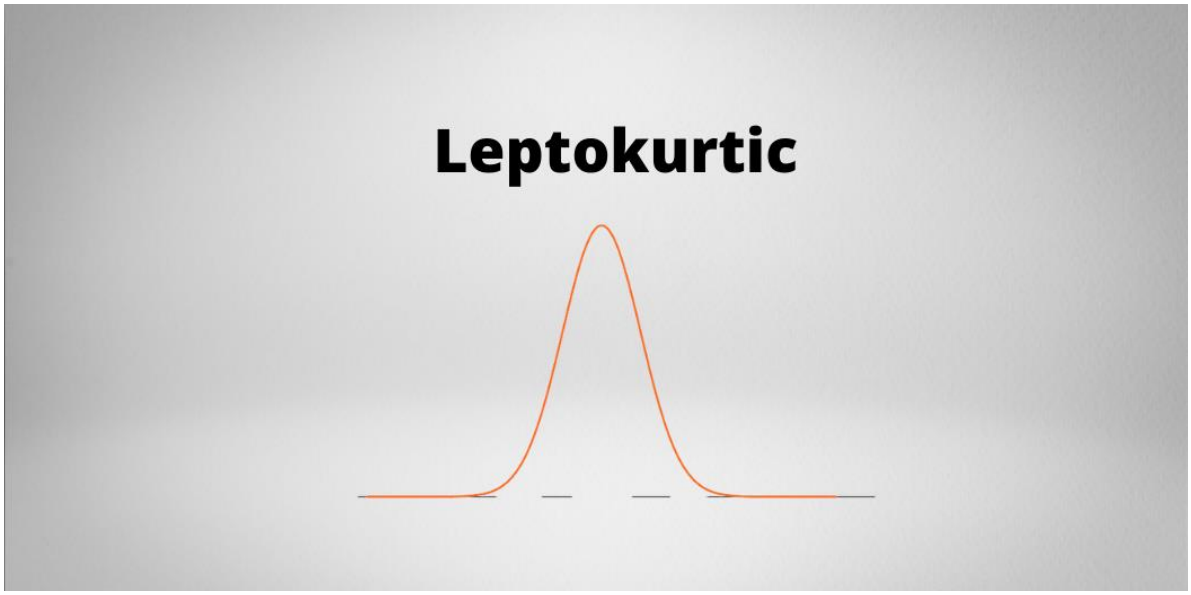
2. Mesokurtic

In Mesokurtic, the data is widely distributed. It is normally distributed and it also matches normal distribution.



3. Leptokurtic

In leptokurtic, the data is very closely distributed. The height of the peak is greater than width of the peak.



Differences