

# An Overview of Data Visualization techniques, features and their critical analysis

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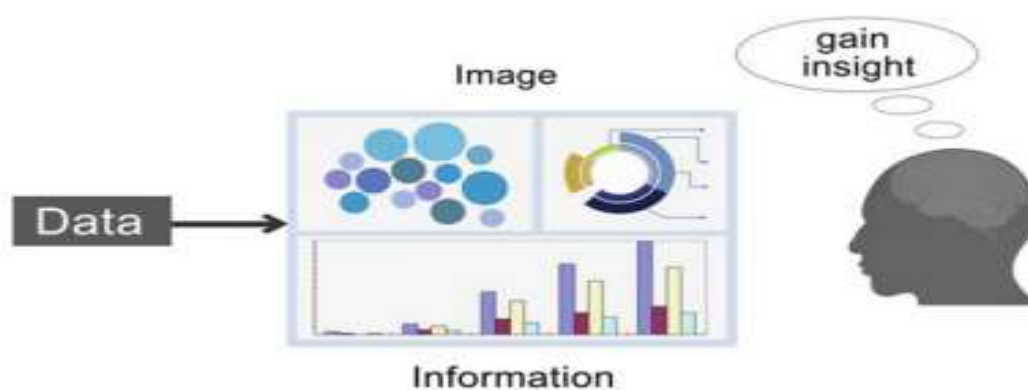
## Abstract:

*A powerful tool for presenting huge datasets in a graphical style, data visualisation also fosters fresh innovation and discovery. It is referred to as an active and energising tool that opens up new research avenues and streamlines the scientific method. A significant amount of data is generated every day as a result of the widespread use of the internet and the web. Thus, there is a requirement to comprehend complex and substantial amounts of data. When there is a lot of data, different data processing methodologies must be used, and different sorts of methods and techniques must be used to show the data. Data visualisation is essential to the success of any business because it makes it possible to effectively manage data and use it to create knowledge. Visualization, in general, is the process of giving statistics and data a visual representation. The visualisation methods make use of a variety of computer graphic effects. Although it might be difficult to visualise data, it is much simpler to grasp data when it is presented in a visual manner as opposed to text, numbers, or big tables with several rows and columns. In this context, the article proposes a thorough explanation of data visualisation fundamental ideas, along with a comparison of their various features and methodologies.*

**Keywords:** Data Visualization, Traditional Data Visualization techniques, features & challenges

## 1.Introduction:

Data visualisation is viewed from the perspective of information services as a technique that, regardless of the underlying structure of the data visualisation, delivers the essential elements of an interface [1]. What is required is a straightforward, uncomplicated, quick, and effective method of presenting data content and comprehending data meanings for users or information providers [3]. The ultimate goal of any data visualisation technology tool, regardless of the type, should be to satisfy the needs of a specific user; however, for those who provide data visualisation technology tools, the ultimate goal is to offer data visualisation services and create suitable visualisation tools or platform [5].



**Figure.1. Process of Data Visualization**

Data visualisation provides numerous advantages, including greater data comprehension, information sharing, aids in better decision-making, increased ROI, and time savings [2]. The presentation of visualisation can also take the shape of a dashboard, where quick links to key analyses are available and key data can be seen at a glance.

Other names for data visualisation include information visualisation and scientific visualisation. Humans have long utilised visualisation techniques to ensure that messages or information last over time. Things that cannot be touched, smelled, or tasted can be represented visually [6].

This paper consists of five sections: Data Visualization, Challenges & Opportunities, Traditional Visualization techniques, Uses & Features and Conclusion

## **2.Challenges:**

Visualization of large dataset is a difficult and challenging task. The traditional ways of presenting data reached a few limitations along with data getting constantly very large. Visualization techniques and tools should have the capability to help the users to identify duplicate, flawed or missing values [9]. The limitation factors such as real-time scalability, perceptual scalability and interactive scalability are very challenging to solve. In this section, we will be discussing the mentioned challenges one by one.

### **2.1. Perceptual Scalability:**

#### **Human perception:**

Human eyes struggle to gather useful information from extraordinarily huge amounts of data [11]. There haven't been more visualisation technologies created to gauge and display insightful and useful data for human perception.

#### **Limited Screen:**

Data becomes huge and larger in size which appears very challenging when visualization displays too many features or data items on limited screen. Too many data when present on the limited screen will lead the visualization to be too dense for the users to use[13][15]. The disadvantage of screen resolution forces us to discover new ways to and visualize and display information using several abstraction techniques. It is still more challenging task to present vast data on mobile device due to smaller screens and resolutions.

### **2.2. Real time scalability:**

It is crucial to give users real-time information and decisions based on available data, based on the data that is now available. However, processing vast amounts of data in real time might be burdensome [12][14]. Because many data sets are too huge to fit in memory and querying enormous data could result in excessive latency, the majority of visualisation systems are only built to handle data that is under a specific size. It is difficult to get around problems like slow data connectivity, insufficient storage, and poor data processing.

### **2.3. Interactive Scalability:**

The advantages of data visualisation are growing as a result of interactive scaling. Thanks to interactive data visualisation, data insights can be understood more quickly and effectively [17]. Processing and analysing massive amounts of data before visualisation requires time. While the interactive response time is enabled, scaling complicated query processing methods to terabytes seems to be a significant unresolved research topic.

### 3.Opportunities:

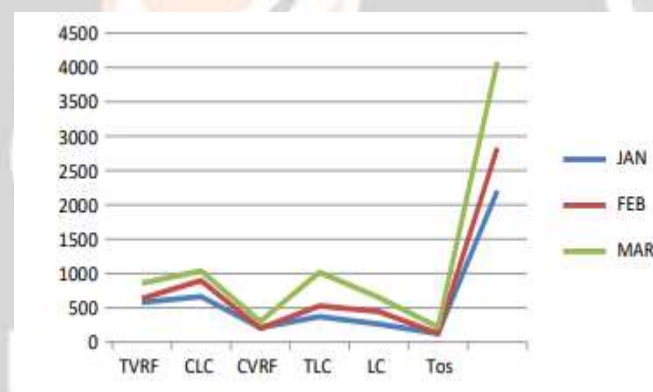
The opportunities are always presented by difficulties. The opportunities and methods presented in this part help to address the big data visualisation issues outlined above. Prior to visualisation, large amounts of data can be reduced using data reduction techniques such as aggregation, filtering, and sampling [19]. These might even deal with problems like big data and fitting all the necessary information on a small screen.

### 4.Traditional Data Visualization Techniques:

Data that cannot be immediately converted by a human being into a visual format is converted using a variety of procedures and technologies. Some of the most widely used multifunctional products with database connectivity include Microsoft Excel, Microsoft Spreadsheet, PowerPoint, and Microsoft Word. They are also effective for data visualisation. Organizations that don't need highly specialised data visualisation use these software's effectively [20]. Traditional data visualisation methods that are still used to show data include line charts, pie charts, heat maps, area charts, graphs, bar charts, maps, etc.

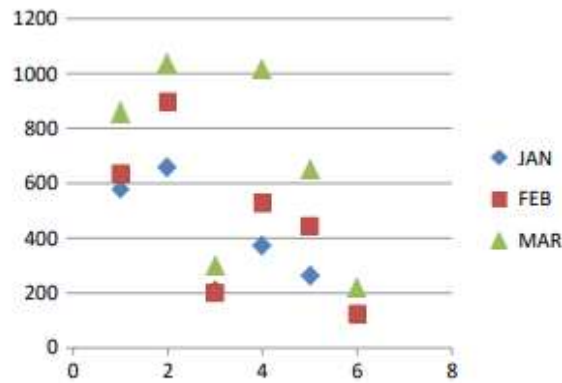
#### Line chart:

It is a key and efficient method for enhancing the visual appeal and imaginative quality of the data. This graph will demonstrate the connection between these two patterns [7]. This graph works very well for comparing many values at the same time.



**Figure.2 Line Chart representation**

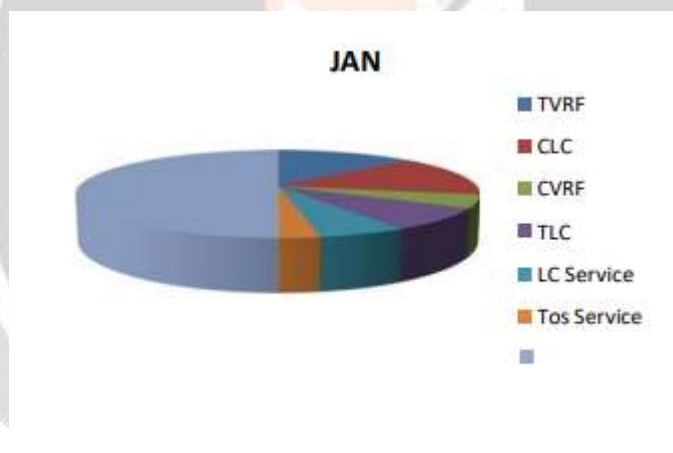
**Scatter plot:** The scatter plot, a two-dimensional tool for comparing any two items, is also known as a scatter diagram, scatter chart, and scatter graph [18]. By illustrating how the data points are dispersed across a graph region or are just randomly distributed, it also supports and aids in understanding how closely one set of data is related to another.



**Figure.3 Line Chart representation**

**Pie chart:**

The pie chart, often known as a circle graph, is used to compare the components of a whole. Pie slices are used to represent the data in the pie chart. The huge slice represents a large amount of data, whereas the small slice represents a smaller amount. This graph essentially displays the percentage of the entire that each component makes up. Exploding pie charts and donut charts are two often used variations of pie charts [4].



**Figure.4.Pie Chart representation**

**Bar chart:**

This graph, which uses both vertical and horizontal bars, is also known as a column chart. When there is a lot of data present, this graphic is not particularly useful [8]. The bar chart is essential and is mostly used by industries to compare their costs, sales, and other metrics.

**Bubble Chart:**

Similar to dispersed plots, the bubble chart substitutes bubbles for the makers. This graph at least requires three measurements: the first two are used to draw the axes, and the third is used to size the bubbles that will display the relationship [10]. With a huge amount of data, this chart seems to be a nice preference.

**5.Features and Uses of Data Visualization:**

We can easily distinguish the red area from the blue because our eyes are able to capture patterns and colours, as well as the square from the circular. Data visualisation is an alternate form of visual art that captures our attention and retains us on the content that has been visually recorded. Every time we examine a chart, we quickly spot any outliers or trends that may be present in the dataset.

**The basic uses of the Data Visualization technique are as follows:**

- Finding the data with outcomes that can be interpreted and presented requires a commanding technique.
- Data visualisation plays a key role in the pre-processing stage of the data mining process.
- By pointing out the incorrect data and corrupted or missing information, it aids in the data cleansing process.
- Choosing and creating variables

**The data visualization features are listed below:**

- Identifying the areas that need improvement or attention.
- Clarifies which factors influence customer behaviour.
- Integration Capability.
- Predict sales volumes.
- Decision-making ability.

**Conclusion**

Data visualisation plays a significant part in giving visual images that make it simpler to understand the information included in the dataset, as indicated in the aforementioned material. It has developed into a powerful and widely used tool for analysing and understanding enormous amounts of complex data. Presenting ideas in a typical manner is now quick and easy. It must effectively, precisely, and clearly communicate difficult concepts. Because of these benefits, data visualisation is valuable and well-liked in many fields.

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