UNIT-2: VISUAL REPRESENTATIONS

Dipesh Koirala

OUTLINE
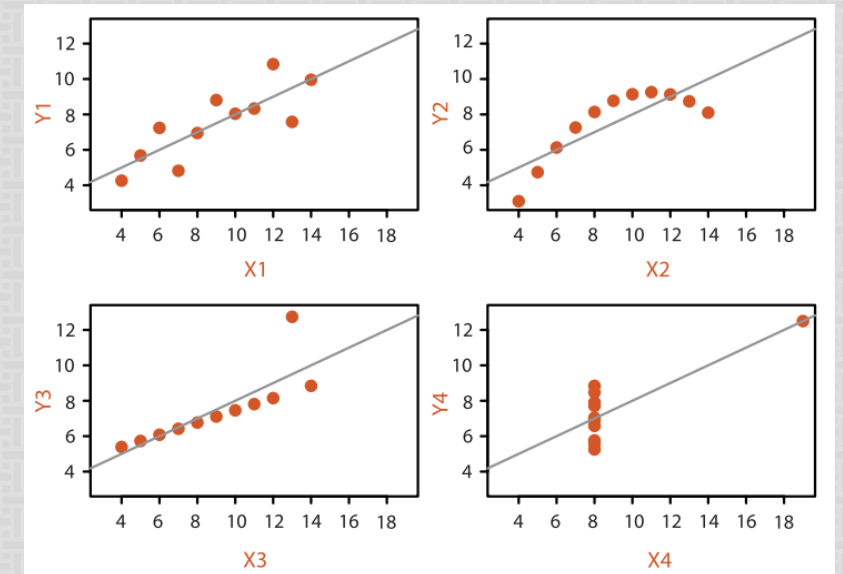
❖ Visualization Reference Model

❖ Visual Mapping

❖ Visual Analytics

❖ Design of Visualization Applications

VISUALIZATION REFERENCE MODEL

❖ Visualization is the process of starting with data and generating visuals from the data.

Anscombe's Quartet: Raw Data

|		1		2		3		4	
		X	Y	X	Y	X	Y	X	Y
		10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
		8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
		13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
		9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
		11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
		14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
		6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
		4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
		12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
		7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
		5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89
Mean		9.0	7.5	9.0	7.5	9.0	7.5	9.0	7.5
Variance		10.0	3.75	10.0	3.75	10.0	3.75	10.0	3.75
Correlation		0.816		0.816		0.816		0.816	

Difficult to understand, **then visualize..**

❖ This process of starting with data and generating a visualization or image is described as a pipeline, known as **Visualization Reference Model.**

❖ It provides *structured approach and various stages* for transforming raw data into insightful visualizations.

VISUALIZATION REFERENCE MODEL

Structured approach:
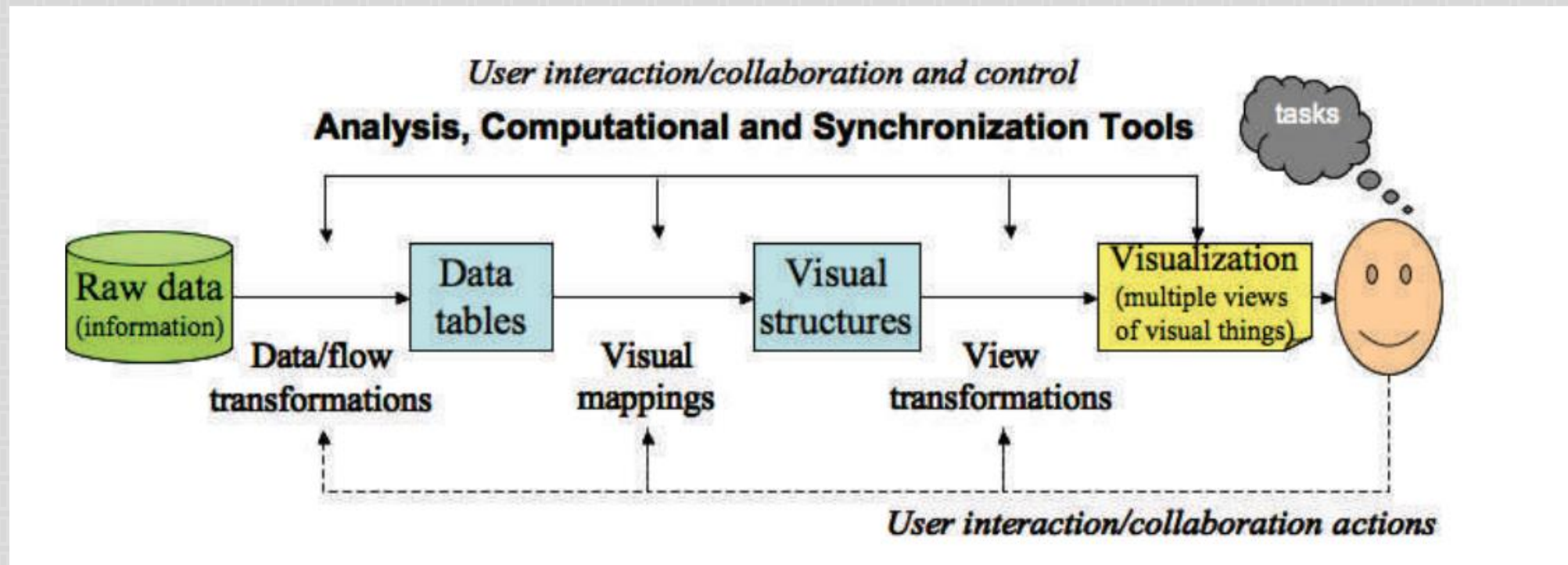
VISUAL REFERENCE MODEL

It consists of four main stages:

1. Data Selection

❖Involves *collecting or identifying the data* that will be potentially visualized.

❖**E.g.,** A marketing company wants to create a visualization that shows the sales performance of a new product. The data acquisition stage would involve collecting sales data from various sources.

2. Data to visual mappings

❖Involves mapping of data values to *graphical entities or their attributes*. This mapping often involves processing the data prior to mapping, such as scaling, filtering, interpolating, or subsampling.

❖**E.g.,** Use of marks like points, lines or areas to represent data and channel to control the appearance.

VISUAL REFERENCE MODEL

3. Scene parameter setting (view transformations)

❖ Involves specifying *several attributes of the visualization* that are relatively independent of the data. These include color map selection (for different domains, certain colors have clearly defined meaning).

❖ **E.g.,** creating of different types of plots with different parameter.

4. Rendering or generation of the visualization

❖ Involves *rendering of visuals* for visualization. This involves using the appropriate visualization tools or software.

❖ **E.g.,** Visualization rendering involves using software tools such as Tableau or PowerBI to create interactive dashboards or reports that can be used to analyze the sales data.

VISUAL MAPPING

❖ Visual mapping is the *process of mapping data to visual elements such as color, shape, and size.* It is an essential step in creating effective visualizations that can be easily understood by users.

❖ The choice of visual mapping can influence how the data is interpreted by the viewer.

❖ E.g,: A chart that shows the growth of a company can use a *color-coded line to represent the different product lines.* This visual mapping can help the viewer quickly identify which product lines are growing and which ones are declining.
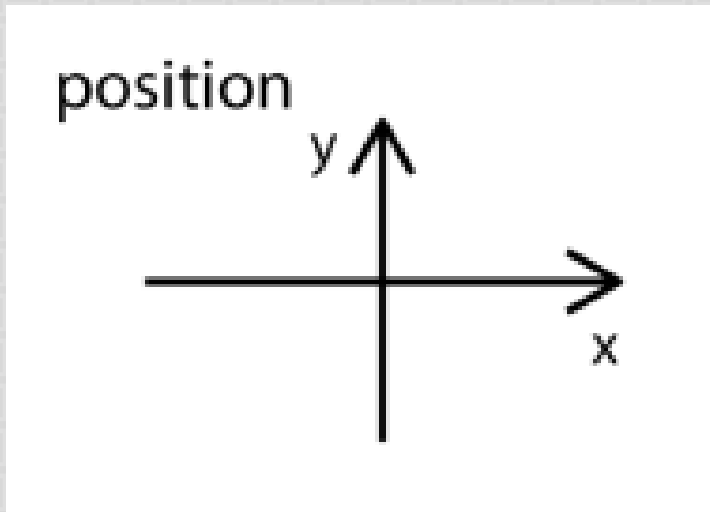
Techniques:

❖ Position Mapping

❖ Color Mapping

❖ Shape Mapping

❖ Size Mapping

❖ Texture Mapping

VISUAL MAPPING

There are several techniques of visual mapping, including the following:

❖ **Position mapping:** In this technique, data points are mapped to specific positions in coordinate system. For e.g., scatter plot.
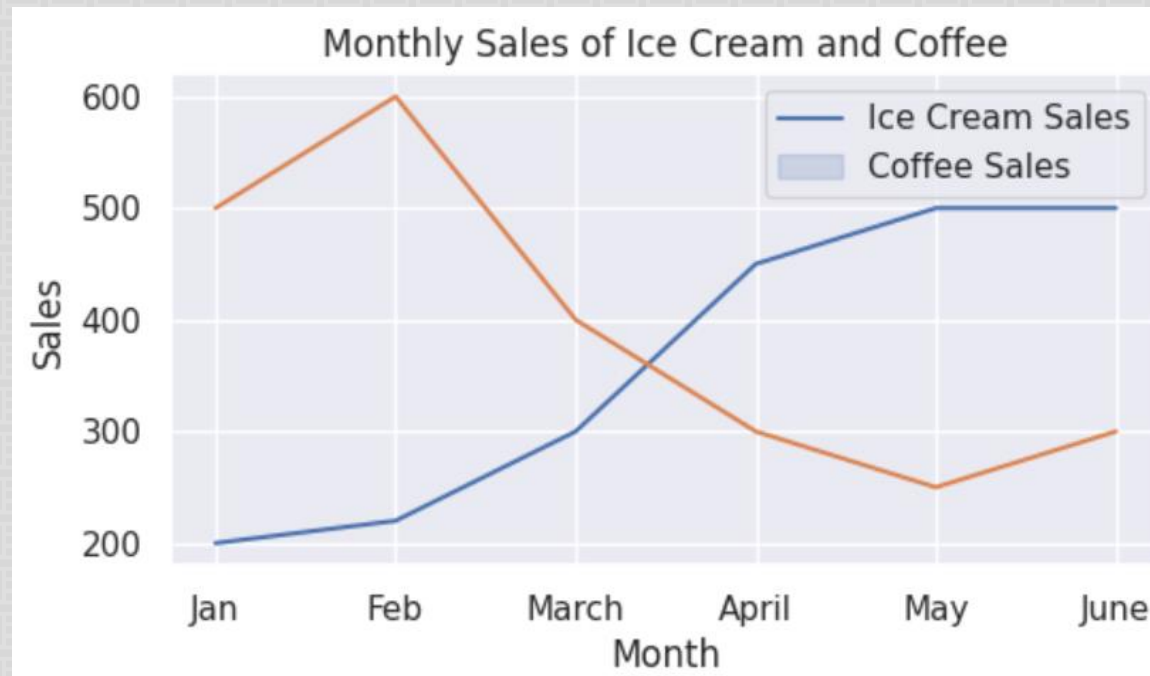
VISUAL MAPPING

There are several techniques of visual mapping, including the following:

❖ **Color mapping:** In this technique, *different colors are assigned to different data categories* or values. For e.g., a line chart representing sales data by product might use different colors to represent each region.

Monthly Sales of Ice Cream and Coffee

VISUAL MAPPING

❖ **Shape mapping:** In this technique, *different shapes are assigned to different data categories* or values. For e.g., a scatter plot representing the relationship between two variables might use different shapes to represent third category.

❖ **Size mapping:** In this technique, different sizes are assigned to different data categories or values. For e.g., a bubble chart representing sales data by product might use different bubble sizes to represent different product categories.
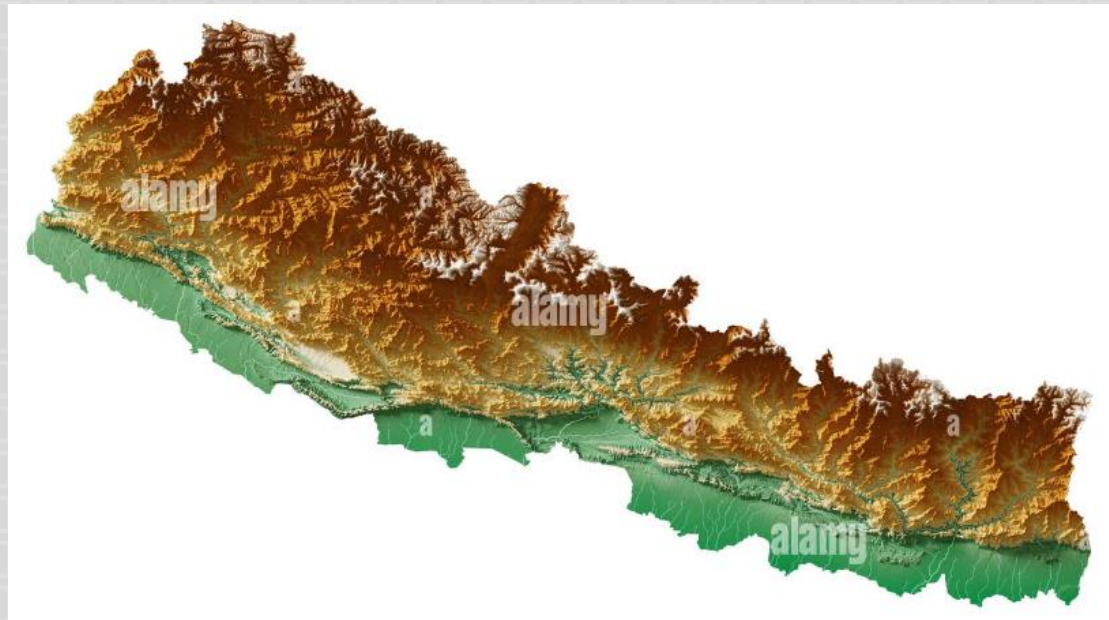
shape

size

VISUAL MAPPING

There are several techniques of visual mapping, including the following:

❖ **Texture mapping:** In this technique, different textures are assigned to different data categories or values. For e.g., a map representing different natural resources might use different textures to represent different resources.

VISUAL ANALYTICS

❖ Visual analytics is the process of using visual representations to analyze and understand data.

❖ In involves *combining visualization techniques with analytical methods* to gain insights and make decisions based on data.

❖ **The goal of visual analytics is to empower users to uncover patterns, trends, and relationships.**

❖ **E.g.,** A stock market *trader uses visual analytics to analyze stock prices over time*. The trader may use a candlestick chart to visualize the price movements and identify trends. They can then use analytical methods to identify patterns and make informed decisions on buying or selling stocks.
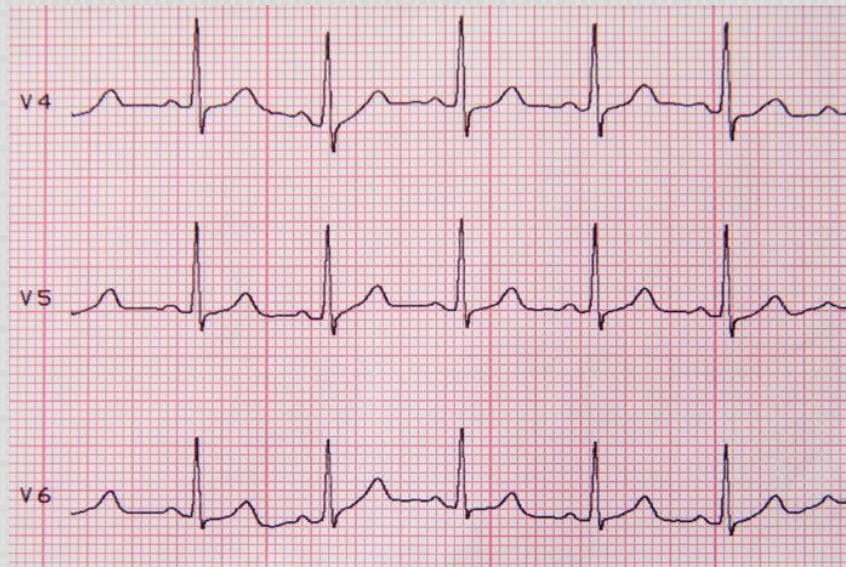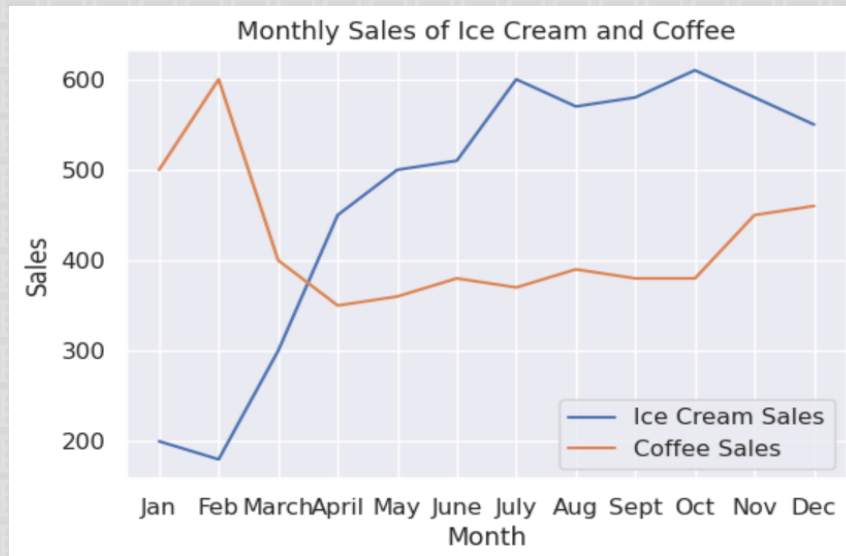
VISUAL ANALYTICS

Involves several steps, they are:

❖ Data preparation: In this step, *data is collected, cleaned and transformed* into a format that can be used for analysis. This may involve tasks such as data cleaning, data normalization, and data integration.

❖ Data exploration: Data is visualized using interactive visualizations such as scatter plots, bar charts, line charts. User can explore the data by interacting with the visualizations and *identifying patterns and trends.*

❖ Data Analysis: User applies analytical techniques such as *statistical analysis, machine learning and data mining* to the data to uncover deeper insights.

❖ Decision-making: User makes decision based on the insights gained from the data analysis. User can use the *insights to identify opportunities , mitigate risks or optimize processes.*

VISUAL ANALYTICS

VISUAL ANALYTICS

Here are some examples of visual analytics in action:

1. **Business intelligence:** Visual analytics tools can be used to analyze sales data, customer data, and other business metrics to gain insights into business performance and identify opportunities for growth.

2. **Healthcare:** Visual analytics tools can be used to analyze patient data, clinical data, and medical imaging data to identify patterns and trends in patient health and optimize treatment plans.

3. **Finance:** Visual analytics tools can be used to analyze financial data, such as stock prices, market trends, and trading volumes, to identify investment opportunities and make informed investment decisions.

4. **Social media analysis:** Visual analytics tools can be used to analyze social media data, such as user behavior, sentiment analysis, and engagement metrics, to gain insights into user preferences and optimize social media marketing campaigns.

DESIGN OF VISUAL APPLICATION

❖ The design of visualization applications involves *creating user interfaces that enable users to interact* with and explore data through visualizations.

❖ The goal of designing visualization applications is *to make the process of exploring and analyzing data as easy and intuitive as possible.*

❖ A well-designed visualization application should provide users with clear and informative visualizations, as well as tools to explore and manipulate the data.
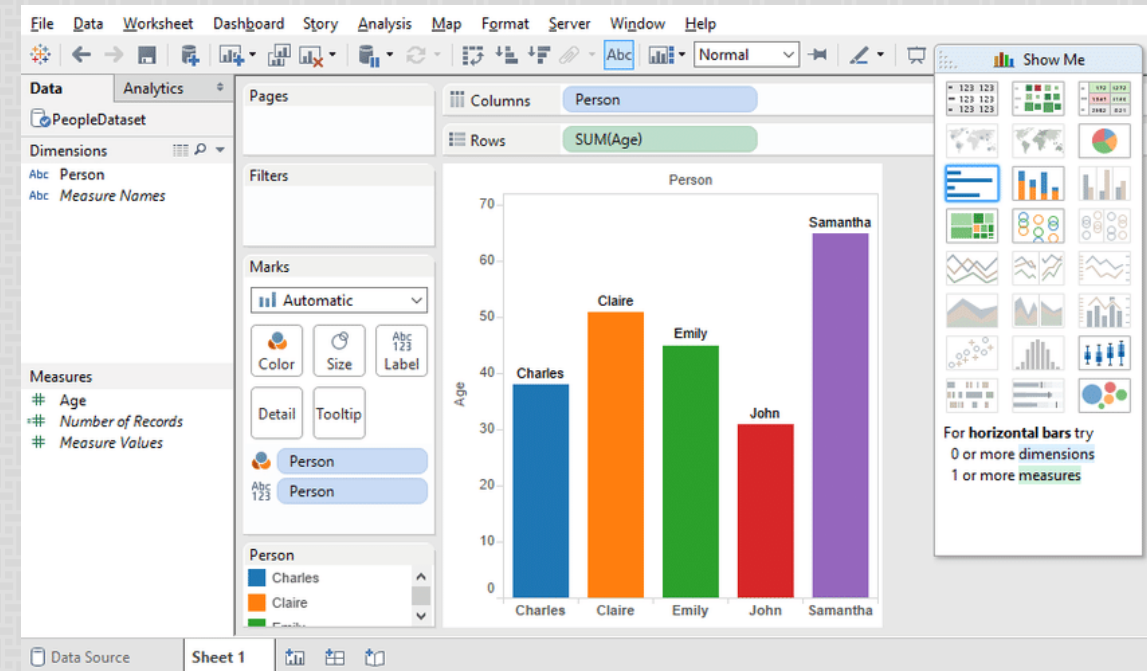
DESIGN OF VISUAL APPLICATIONS

Here are some key considerations in the design of visualization applications:

1.**Data preparation and loading:** The application should make it easy to load and prepare data for visualization. This might include features such as data cleaning, normalization, and filtering.

2.**Visualization options:** The application should provide a range of visualization options, including charts, graphs, maps, and other visualizations. Each visualization should be designed to effectively communicate the data being presented.

3.**Interactivity:** The application should provide interactive tools that enable users to explore and manipulate the data. This might include features such as *zooming, panning, filtering, and sorting.*

4.**Customization:** The application should allow users to customize the visualizations and data displays to suit their needs. This might include options for *changing colors, fonts, and other visual elements.*

5.**Collaboration:** The application should enable users to collaborate and share their visualizations with others. This might include features such as *shared dashboards, commenting, and sharing options.*

DESIGN OF VISUAL APPLICATIONS

Here are some examples of visualization applications:

1.Tableau: Tableau is a popular visualization application that provides a range of interactive visualization options. Users can *drag and drop data onto the interface to create custom visualizations* and dashboards. Tableau also includes a range of data analysis tools.

2.Power BI: Power BI is a business analytics service that provides a range of visualization options and tools for exploring and analyzing data. Users can create custom dashboards and reports, and share them with others.

3.D3.js: D3.js is a JavaScript library for creating custom visualizations and interactive data displays. D3.js provides a range of visualization options, and enables users to customize the visualizations using code.

THANK YOU

DIPESH KOIRALA