

Data Visualization Assignment - 1

Name :- Nutan Karthik

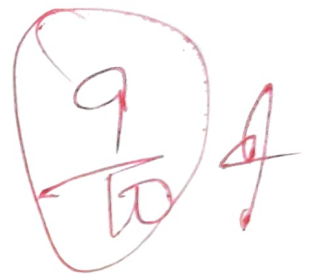
Vid NO :- 26970

Subject :- Data Visualization

Course Code :- 10212 CS214

Faculty :- Dr. Sathish. N

Slot :- Su L6



Human Perceptual Processing, Gestalt Principles, and Data Visualization

1. Human Perceptual Processing Models:

- * Humans perceive patterns and relationships faster than raw numbers.
- * Visualization leverages pre-attentive attributes (Color, size, shape, orientation) that the human brain detects quickly without conscious effort

Example is:

A red dot among blue dots immediately stands out and quickly anomaly detection in charts.

2. Gestalt Principles in Visualization:

Gestalt Psychology explains how humans group visual elements

* Proximity:

Items close together are seen as a group

Ex: clustered bar charts.

* Similarity:

Similar colors / shapes imply relation

Ex: Same color for one category across charts).

* Continuity:

Lines are perceived as continuous trends:

Ex: line charts for time series.

* Closure:-

Viewers "fill in gaps"

Ex:- Incomplete pie slices spin from a circle.

3. Reducing information overload:-

* Gibson's Affordance Theory:-

Visual design should suggest its use

Ex:- A slider in a dashboard "affords" interaction \rightarrow users know they can filter data.

* Data Abstraction:-

Summarize and filter unnecessary details.

Example:-

Summarize and filter unnecessary details.

Instead of row in sales rewards, show aggregated monthly sales trend.

* Appropriate Representation:- Match chart type with data

Categorical \rightarrow bar chart / pie chart

Continuous data trend \rightarrow line chart

High dimensional \rightarrow heatmap / (A plots).

Example:- in a financial dashboard too many row stock prices = overload. Instead,

* line chart for trends (Clarity)

* Heatmap for correlations

* Drop down for filtering stocks (affordance).

Visualization for univariate, Bivariate and multivariate Analysis:-

1. univariate Analysis (one Variable):-

* Focus: Distribution, Frequency, Summary of one Variable

Common techniques:

- Bar chart \rightarrow for Categorical data (eg: gender counts)
- Histogram \rightarrow for Continuous data (eg: Exam score distribution).
- Violin / Box plot \rightarrow for spread & outliers.

Example:-

Dataset: student Exam scores

- Histogram \rightarrow shows most students scored between 60-80.

2. Bi-variate Analysis (Two Variables):-

• Focus: Relationship between two Variables

• Techniques:

- Scatter plot \rightarrow two continuous Variables
- Bar chart \rightarrow categorical vs Continuous
- Line chart with fit line \rightarrow trend / relationship

Example:-

Dataset: Hours studied vs Exam score

- Scatterplot with regression line \rightarrow shows positive correlation

3. Multivariate Analysis (More Than two Variables):-

Focus: Interaction among 3+ Variables.

Techniques:-

- Heat map \rightarrow correlation Matrix of multiple Continuous Variables.

Bubble Chart \rightarrow X, Y, and bubble size = 3rd variable

Pair plot \rightarrow Multiple Scatterplot for combinations.

Parallel coordinates \rightarrow high dimensional Continuous data.

Example:-

- Dataset: Car features (Price, Mileage, Horsepower, Engine size)
- Heat Map:- Shows Mileage negatively Correlated with horsepower
- Bubble chart:- X = Engine size, Y = Price, Bubble size = Mileage

Comparison Table:-

Analysis type	Variables	Categorical Data	Continuous data	Example Visualization
Univariate	1	Bar chart	Histogram Box Plot	Student Score distribution
Bivariate	2	Grouped bar chart	Scatterplot, line chart	Hours Studied vs Score
Multivariate	3+	Mosaic plot	Heatmap Bubble Chart, Parallel Coords	Car features, Comparison

Choice of Visualization depends on:

* Data type (Categorical \rightarrow bar, Continuous \rightarrow histogram/line)

* number of variables (uni \rightarrow 1 plots, bi \rightarrow Scatter/line, multi \rightarrow

Heat Maps, bubble, parallel words.