DATA VISUALIZATION ASSIGNMENT..

10/10

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Explain how human Perceptual processing models and Getsalt principles influence the effectivness of data visualisation. Discuss with suitable examples how visualisation designers can minimize information overload and maximize information clarity using concepts such as Gibsons Affordance theory, data abstraction and appropriate Dataset representation.

(1) Human visual perception processes information much faster than textual or numerical forms. Cognitive models show:-

→ we notice patterns, color differences and shapes within 200-250 ms

→ Our working memory can only hold about +-2 Chunks, so overloaded dashboards or charts overwhelm users

Example:-

-A heatmap showing customer churn highlights high churn regions instantly via color contrast → fasto comprehension than a table with numbers.

(2) Gestalt principles in visualisation explains how People percieve visual elements as Organised patterns rather than isdated points.

⇒ proximity

⇒ similarity

⇒ continuity

⇒ closure

⇒ figure - ground

Example:-

In a line graph of stock prices, users see "trend" rather than individual points.

⇒ using consistent colors for categories across multiple charts reduces confusion (similarity)

③ Gibson's Affordance theory in visualisation.

Affordance: how a design "suggests" its usage. In visualisation, affordance guide interaction and interpretation:

⇒ Sliders, filters, zoom options

⇒ clickable legends

⇒ Icons/markers

Example:- In a COVID-19 dashboard, an Interactive timeline slider affords exploring cases by month, helping users find trends themselves rather than Processing static, dense data.

④ Data abstraction and Dataset Representation.

Large, raw datasets must be abstracted to prevent Overload. Techniques include:-

→ Aggregation

→ Filtering

→ Hierarchial abstraction

→ Dimensionality reduction

Example :-

Instead of plotting 1 million customer transactions, a designer uses a histogram of spending ranges or a treemap by region → clarity without losing insight.

(5) Minimising overload and maximising clarity

→ use Gestalt grouping
→ leverage affordances
→ Abstract effictively
→ choose appropriate representation
  ⇒ Trends – line chart
  ⇒ Proportions - pie chart
  ⇒ Distribution – histogram

Example :-

→ A Heatmap of soil moisture
→ A timeline slider
→ Data is abstracted into averages

Results :-

Farmers get actionable insights without being overloaded.

(2) with the help of suitable datasets, compare and contrast different visualisation techniques used in univariate, Bivariate and Multivariate analysis. explain how the choice of visualisation depends on type of data and the number of variables being analysed. Provide one example for each.

(1) Univariate Analysis (single variable)

Suitable visualisations

For categorical Data →

Bar chart, pie chart, pareto chart

For continious Data →

Histogram, Boxplot, violin plot, Density plot

Example Dataset :-

Dataset :- student Marks Dataset

Variable :- "Maths scores" (Continious)

⇒ Histogram

⇒ Boxplot

⇒ violin plot

Example :- A histogram of math scores helps a teacher quickly see whether most students scored in the 60-80 range.

2. Bivariate Analysis (Two variables)

Relationship between two variables

Suitable visualizations

→ Categorical vs categorical ⇒ clustered bar chart

* Categorical vs continious ⇒ Boxplot, violin plot

* continious vs continious ⇒ Scatterplot, Hexbin plot

Example Dataset:

Sales Dataset.

* variables :- 'Advertising Budget', 'Sales Revenue'

Visualisation and Insight:

⇒ Scatterplot with fit line

⇒ Boxplot (Sale vs Region)

Example:- A marketing manager plots Advertising Budget vs Sales using a scatterplot → finds that higher budget.

③ Multivariate Analysis :-

⇒ Interaction among multiple variables simultaneously.

Suitable visualisations:-

→ Categorical + continious

→ continous + continious + categorical

→ All continious.

Example:- A doctor use a heatmap of patient health metrics to identify which variable strongly correlate with heart disease risk.