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Unit V	BIG DATA VISUALIZATION	(06 Hrs)
Introduction to Data visualization, Challenges to Big data visualization, Conventional datavisualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open – source data visualization tools, **Case Study:** Analysis of a business problem of Zomato using visualization, Analytical techniques used in Big data visualization, Data Visualization using Tableau Introduction to: Candela, D3.js, Google Chart API		

- Introduction to Data visualization
- Challenges to Big data visualization
- Conventional data visualization tools

a) What is Data Visualization? What are the major challenges in big data visualization and how to overcome these challenges? **[6]**

i) How data visualization help Big data Analytics. **[4]**
ii) List the conventional Data visualization tools. Explain any Two. **[6]**

How Data Visualization is important in Big Data? Explain challenges to big data visualization? **[6]**

b) Explain data visualization with the help of example? What are the advantages of data visualization? **[8]**

Explain the following data visualization techniques.

i) Candela

ii) D3.js

Introduction to Data visualization

What is Data Visualization?

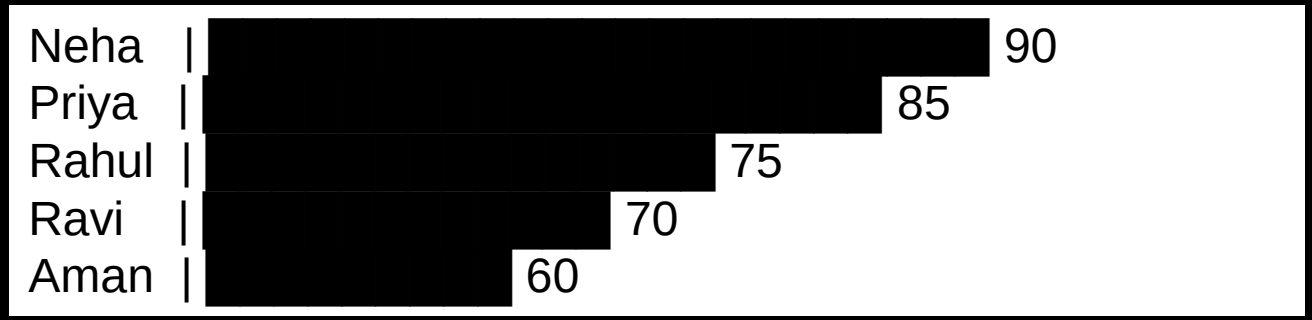
Data Visualization ek process hai jisme **data ko visually represent** kiya jata hai — jaise **graphs, charts, maps, and dashboards** ke through — taaki us data ko **asani se samjha ja sake**.

🔍 **Simple Definition (HiEnglish):**
Data Visualization ka matlab hai data ko images ya visuals ke form mein dikhana, jaise bar chart, pie chart, line graph, etc., taaki data ko jaldi aur clearly samjha ja sake.

Example: School ke students ke marks ka data visualization
Maan lo aapke paas 5 students ke marks hain:

Student	Marks (out of 100)
Rahul	75
Priya	85
Aman	60
Neha	90
Ravi	70

Bar Chart dikhega kuch is tarah:



Isse fayda kya hai?

•Aapko jaldi pata chal jayega kaunse students ne zyada marks liye.

•Visual form mein samajhna easy hota hai compared to sirf numbers padhne se.

•Comparison karna simple ho jata hai

Advantages	Example	Disadvantages	Example
1. Easy to Understand	Bar chart se sales data ko jaldi samajh paate hain.	**1. Misleading Visuals**	Agar graph scale galat ho, toh data ka galat impression ban sakta hai.
2. Quick Insights	Line graph se trend dekhkar future sales predict kar sakte hain.	**2. Over-Simplification**	Kabhi kabhi visuals itne simple hote hain ki important details miss ho jati hain.
3. Better Decision Making	Pie chart se market share ka comparison asani se hota hai.	**3. Data Privacy Risk**	Visuals share karne se sensitive data accidentally leak ho sakta hai.
4. Identify Patterns & Trends	Heatmaps se website user behavior easily samajh aata hai.	**4. Requires Skill**	Achhi visualization banane ke liye tools aur skills ki zarurat hoti hai.
5. Engages Audience	Presentation mein colorful charts se audience zyada interested rehti hai.	**5. Can Be Time Consuming**	Complex visuals banane mein bahut waqt lag sakta hai, especially large data sets ke liye.

Challenges to Big data visualization

Challenge (Chunauti)	Explanation (Samjhauta)	Example (Udaharan)	How to Overcome (Kaise Paayen)
Volume (Data ka size)	Bahut zyada data ko store aur process karna mushkil	Facebook ya YouTube ke crore users ka data	Distributed Storage (HDFS), Data Compression, Cloud Storage
Velocity (Data ki speed)	Data bahut fast generate ho raha hai	Sensor data, Social media live updates	Real-time processing tools (Apache Kafka, Spark Streaming)
Variety (Data ki variety)	Data alag-alag types me hota hai (structured, unstructured)	Text, Images, Videos, Logs	Data Integration tools, NoSQL databases, Data Lakes
Veracity (Data ki sahi-ta)	Data me galtiyan ya uncertainty ho sakti hai	Sensor errors, Fake social media posts	Data cleaning, Validation techniques, Machine Learning
Value (Data ka moolya)	Data ka sahi matlab nikalna mushkil	Raw data se useful insights nikalna	Advanced analytics, Data mining, AI/ML models
Scalability (System badhana)	Data aur system ko scale karna mushkil	User base badhne par system slow ho jana	Scalable architectures, Cloud computing, Load balancing
Data Security & Privacy	Data ki suraksha aur privacy maintain karna	Customer data ka chori hona	Encryption, Access controls, Compliance standards
Data Quality (Data ki quality)	Data sahi aur complete nahi hota	Missing values, Duplicate records	Data cleaning, ETL processes

Conventional data visualization tools

Tool Name	Explanation	Example Use Case
Microsoft Excel	Sabse common spreadsheet tool jisme charts, graphs easily banate hain. Small to medium data ke liye best.	Sales data ka monthly bar chart banana
Tableau	Powerful visualization tool, drag & drop interface, interactive dashboards banata hai. Large datasets handle kar sakta hai.	Company ke sales trends ko interactive dashboard me dikhana
Power BI	Microsoft ka business analytics tool, easy integration with other MS products, real-time data visualization.	Marketing campaign ka performance track karna
QlikView	Data discovery tool jo data ko associative model me analyze karta hai, user-friendly dashboards banata hai.	Customer segmentation analysis
Google Data Studio	Free tool from Google for creating reports and dashboards, easy integration with Google products like Analytics, Sheets.	Website traffic ka report banana
D3.js	JavaScript library for custom and flexible data visualizations on the web. Developer-friendly but coding knowledge required.	Interactive maps or custom animated charts
SAP Lumira	Enterprise data visualization tool for creating and sharing BI content with interactive visualizations.	Manufacturing data ka analysis and visualization

Techniques for Visual Data Representation

Technique	Explanation	Example Use Case
Bar Chart	Rectangular bars se data dikhata hai, categories compare karne ke liye best.	Alag-alag products ki monthly sales
Line Chart	Points ko lines se connect karta hai, time ke sath trends dikhata hai.	Stock price ka ek saal me change
Pie Chart	Circular chart jisme slices data ke parts dikhate hain.	Market share of different companies
Histogram	Bar chart jaisa, par data ko ranges (bins) me group karta hai.	Students ke grades ka distribution
Scatter Plot	Points ko XY axes par plot karta hai, relationship dikhata hai.	Height aur weight ke beech relation
Area Chart	Line chart jaisa, lekin line ke neeche area fill hota hai, volume dikhata hai.	Website traffic ka time ke sath increase/decrease
Heatmap	Colors use karta hai data ki intensity dikhane ke liye grid/me.	Variables ke beech correlation matrix
Box Plot (Box-and-Whisker)	Data distribution ko quartiles aur outliers ke sath dikhata hai.	Different classes ke exam score ka spread
Tree Map	Nested rectangles me hierarchical data ko proportionally dikhata hai.	Computer ke folders me disk space usage
Bubble Chart	Scatter plot jaisa, bubble size third variable ko dikhata hai.	Sales vs profit, bubble size se market size dikhana
Gantt Chart	Project schedule ko timeline pe dikhata hai, tasks ke sath.	Software development project plan
Radar Chart (Spider Chart)	Multiple variables ko center se axes pe plot karta hai.	Employee ke skills across different areas dikhana

Draw histogram with a suitable example and explain its usage

◆ **What is a Histogram?**

A **histogram** is a type of bar graph used to represent the **frequency distribution** of continuous numerical data. It shows how data is grouped into **intervals (called bins)** and how many data points fall into each interval.

✓ **Usage of a Histogram:**

- To **visualize the distribution** of large sets of continuous data
- To see **patterns**, like **normal distribution**, **skewness**, or **gaps** in data
- To identify **outliers** or unusual patterns
- Commonly used in **statistics**, **data analysis**, **quality control**, etc.

❖ **Example:**
Suppose a teacher records the **marks** of 30 students in a Math test (out of 100):

Marks:
45, 55, 67, 70, 85, 60, 62, 48, 90, 77, 82, 51, 69, 73, 65,
59, 61, 80, 75, 50, 66, 71, 68, 74, 58, 63, 81, 76, 79, 72

We can divide these into **bins** of 10 marks each:
- 40–49
- 50–59
- 60–69
- 70–79
- 80–89
- 90–99

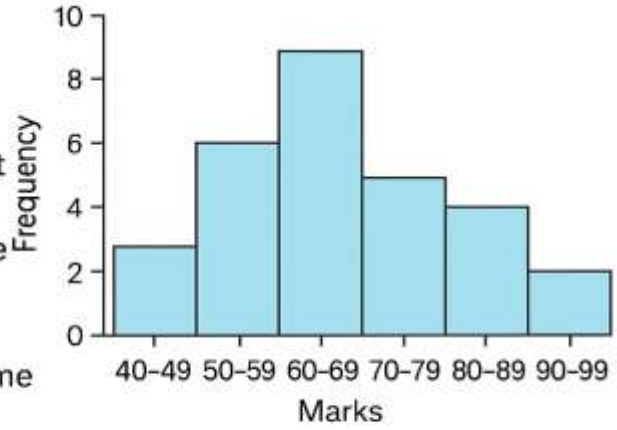
Marks Range	Frequency
40–49	2
50–59	5
60–69	9
70–79	8
80–89	4
90–99	1

Histogram

Histogram ek aisa chart hota hai jisme continuous data ko intervals (ya bins) me divide karke unka frequency dikhaya jata hai.

Example

Jaise upar ke example me humne student ke marks ko alag-alag range me divide kiya aur dekha ki kaunse range me kitne students aaye.



◆ 1. Scatter Plot

Definition:

Scatter plot ek graph hota hai jisme **do variables ke beech ke relationship** ko dikhaya jata hai using dots (points).

Usage:

- Jab hume dekhna hota hai ki **X aur Y variables ke beech koi pattern ya relation hai ya nahi**
- Correlation samajhne ke liye (positive, negative, or none)

X = Study Hours
Y = Marks

Data:
(1, 40), (2, 50), (3, 55), (4, 65), (5, 70), (6, 80)

Explanation:
Jaise-jaise study hours badh rahe hain, marks bhi badh rahe hain → Positive correlation.

3. Heat Map

Definition:
Heat map ek visual chart hota hai jisme data values ko **colors** ke through represent kiya jata hai. Zyada value = dark color, kam value = light color.
Usage:
•Data trends aur intensities ko visual form me dekhna
•Correlation matrix ya large data matrix ko easily samajhne ke liye
Example:
Students ka performance in 3 subjects:

Student	Math	Science	English
A	95	80	75
B	70	65	85
C	60	55	90

Draw boxplot with a suitable example and explain its usage

🎁 **Boxplot Kya Hota Hai?**
Boxplot (ya **box-and-whisker plot**) ek aisa graph hai jo kisi data set ka **summary** dikhata hai:
Ye 5 important values dikhata hai:
1.Minimum (sabse chhoti value)
2.Q1 (First Quartile) – 25% data iske niche hota hai
3.Median (Q2) – beech ki value (50%)
4.Q3 (Third Quartile) – 75% data iske niche hota hai
5.Maximum (sabse badi value)
Iske alawa agar koi **outliers** (bahut chhoti ya badi value) hain, to woh bhi show hote hain.

✅ **Boxplot Ka Use Kahan Hota Hai?**

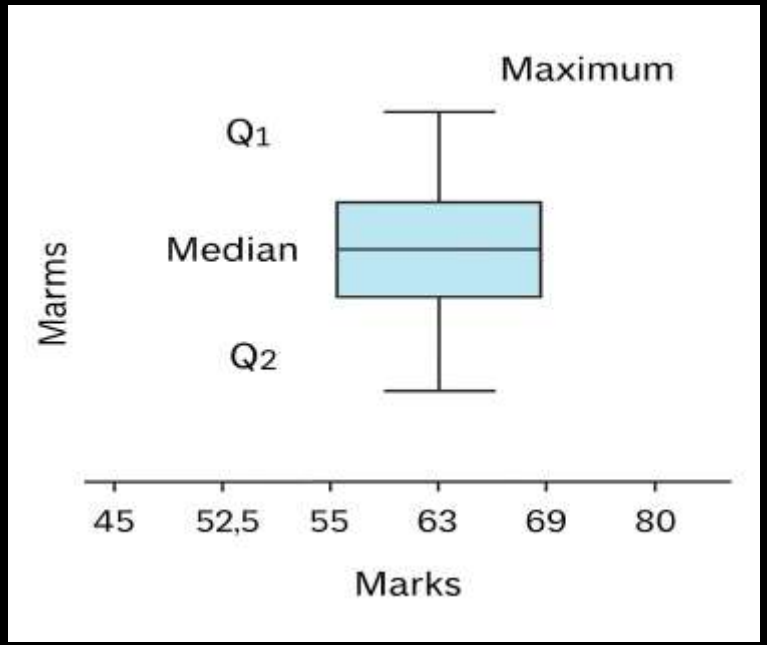
- Data ka **summary** dekhne ke liye
- **Outliers** detect karne ke liye
- Data **skewed** hai ya nahi, yeh check karne ke liye
- **Multiple data sets** compare karne ke liye (e.g. boys vs girls ke marks)

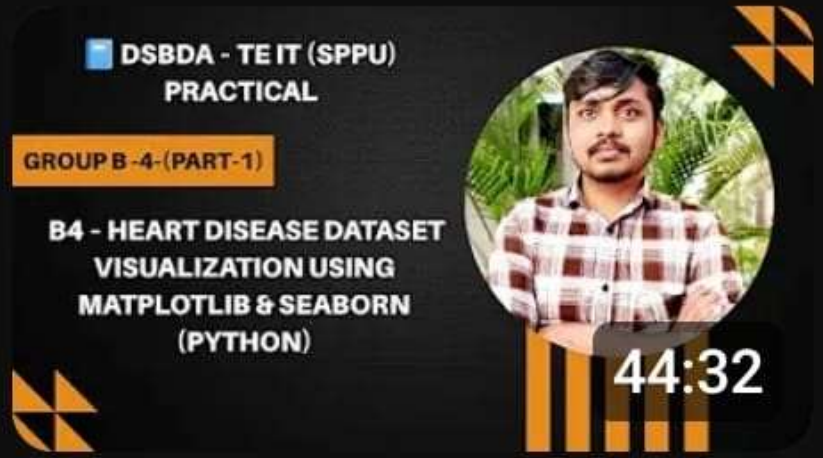
❖ **Example:**
Ek class me 10 students ke Math ke marks (out of 100):

Marks: 45, 50, 55, 60, 62, 65, 68, 70, 75, 90

Step-by-step summary:
•**Minimum** = 45
•**Maximum** = 90
•**Median (Q2)** = (62 + 65)/2 = 63.5
•**Q1** (First 25%) = (50 + 55)/2 = 52.5
•**Q3** (Top 75%) = (68 + 70)/2 = 69

Boxplot ek visual tool hai jo aapko ek nazar me data ka **center**, **spread**, aur **outliers** batata hai.
Agar median box ke beech me hai, to data **symmetric** hai. Agar median Q1 ya Q3 ke paas hai, to data **skewed** ho sakta hai.





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Types of Visualization

Type	Explanation	Example Use Case
Categorical Visualization	Data ko categories me divide karke dikhata hai, jaise bar charts, pie charts.	Different product sales ka comparison
Time Series Visualization	Time ke sath data ke changes dikhata hai, jaise line charts, area charts.	Stock market trends over months
Relational Visualization	Do ya zyada variables ke beech relationship dikhata hai, jaise scatter plots, bubble charts.	Height vs weight ka relation
Geospatial Visualization	Map par data ko plot karta hai, jaise heatmaps, choropleth maps.	Population density by region
Hierarchical Visualization	Data ke hierarchical structure ko show karta hai, jaise tree maps, dendrograms.	Company ke department-wise employee distribution
Statistical Visualization	Data distribution aur summary statistics ko dikhata hai, jaise box plots, histograms.	Exam scores ka distribution
Multidimensional Visualization	Multiple variables ko ek saath dikhata hai, jaise radar charts, parallel coordinates.	Employee skills across multiple areas
Network Visualization	Nodes aur links ke through network relationships show karta hai.	Social media friends network
Interactive Visualization	User input ke hisaab se dynamic charts banta hai, jaise dashboards, drill-down charts.	Business dashboards showing live sales data

Visualizing Big Data

Aspect	Explanation
What is it?	Big Data ko samajhna aur analyze karna mushkil hota hai kyunki data volume bahut zyada hota hai. Visualization se complex data ko easily samajh sakte hain.
Challenges	- Data volume bohot bada hota hai- Data variety (structured, unstructured)- Data velocity (fast changes)- Performance issues in rendering- Real-time visualization ki zarurat
Techniques	- Sampling: Data ka chhota subset leke visualize karna- Aggregation: Data ko groups me summarize karna- Filtering: Relevant data hi dikhana- Real-time streaming visualization- Using scalable tools and parallel processing
Example	Netflix ke user data ka visualization jisme user activity, preferences, aur trends ko samjha jata hai using interactive dashboards.

Data Visualization ke Big Data mein advantages

Point	Explanation	Example
1. Complex Data ko Simple Banata Hai	Big Data bohot bada aur complex hota hai. Visualization use charts, graphs, dashboards mein convert karta hai, jisse samajhna easy ho jata hai.	1 crore customer transactions ka data heatmap mein dikhana jahan zyada sales wali cities highlighted ho.
2. Fast Insights Milti Hai	Bada data manually analyze karna mushkil hai, visuals se trends, patterns, aur anomalies jaldi mil jati hain.	Sales data ka line graph dekhkar pata chal jata hai ki kis month mein sales gir rahi hain.
3. Decision Making Easy Hoti Hai	Visual analytics se businesses jaldi aur sahi decision le sakte hain jaise customer behavior ya fraud detection.	Fraud transactions ke bar chart se suspicious activity ko jaldi identify karna.
4. Data Exploration Aur Interaction	Interactive dashboards se users data ko filter, zoom, aur explore kar sakte hain, jo analysis mein madad karta hai.	Dashboard mein sales ko region-wise filter karke best performing area identify karna.
5. Communication and Reporting	Visuals se complex findings stakeholders ko easily samjhaye ja sakte hain, jo understanding improve karta hai.	Monthly sales report ko colorful charts ke saath present karna jisse management ko achhi clarity mile.

Tools Used in Data Visualization

Tool	Description	Best For	Language/Platform
Tableau	Drag-and-drop interface, powerful dashboards, real-time connection	Business intelligence dashboards	Desktop/Web
Power BI	Microsoft ka tool, easy MS product integration, rich visuals	Business analytics, reporting	Desktop/Web
D3.js	JavaScript library for custom, interactive web charts	Web-based, high customization	JavaScript (Web)
Matplotlib	Python library for static and interactive plots	Scientific computing, research	Python
Candela	Python toolkit for interactive viz in Jupyter notebooks	Data science, scientific visualization	Python
QlikView	Self-service BI tool for dashboards	Enterprise analytics	Desktop/Web
Google Data Studio	Free dashboard and report creation tool	Marketing, reporting	Web
Plotly	Interactive graphing for Python, R, and JS	Web-based interactive dashboards	Python/JS/R
Apache Superset	Open source BI tool with SQL support and rich visuals	Scalable big data dashboards	Web

Tableau

Feature / Aspect	Explanation
Overview	Ek popular data visualization tool hai jo complex data ko easily samajhne ke liye use hota hai.
User Interface	Drag-and-drop interface with intuitive dashboard creation.
Integration	Bahut saare data sources se connect kar sakta hai — SQL, Excel, Cloud services, etc.
Data Handling	Large datasets ko efficiently handle karta hai with high-performance data engine.
Visualization Options	Wide range of charts, maps, graphs, aur advanced visualizations available hain.
Pricing	Paid software hai; free trial available hai; enterprise ke liye thoda mehenga pad sakta hai.
Learning Curve	Thoda difficult ho sakta hai beginners ke liye, lekin advanced features ke liye powerful hai.
Sharing & Collaboration	Dashboards ko web, mobile apps, ya Tableau Server ke through easily share kar sakte hain.
Customizability	Bahut zyada customization options hain with Tableau Calculations aur advanced expressions.
Real-time Data Support	Real-time data connections aur live dashboards ko support karta hai.
Community & Support	Strong community, bohot saare tutorials, forums, and official training available hai.
Best For	Complex data analytics, enterprise-level BI, aur detailed visual storytelling ke liye best hai.
Example Use Case	Large retail company ke sales data ka analysis aur trends visualize karna.

Power BI

Feature / Aspect	Explanation
Overview	Microsoft ka popular BI tool hai jo data visualization aur reporting ke liye widely use hota hai.
User Interface	User-friendly drag-and-drop interface with MS Office jaisa look and feel.
Integration	Microsoft ecosystem ke saath bahut achha integration — Excel, Azure, SQL Server, etc.
Data Handling	Medium to large data handle karta hai, lekin bahut bade datasets me performance thodi kam ho sakti hai.
Visualization Options	Achhi variety of visuals available hain, plus extra custom visuals Power BI marketplace se milte hain.
Pricing	Free version available hai limited features ke saath; paid Pro version affordable hai.
Learning Curve	Easy to learn, especially jo log MS Office use karte hain unke liye.
Sharing & Collaboration	Dashboards ko Power BI Service me publish karke easily share kar sakte hain; MS Teams ke saath integration.
Customizability	DAX language use karta hai custom calculations ke liye, lekin Tableau jitna flexible nahi hai.
Real-time Data Support	Real-time data dashboards bana sakte hain, par refresh rate data source pe depend karta hai.
Community & Support	Large Microsoft community support aur detailed documentation available hai.
Best For	Business users, quick reporting, MS ecosystem users, mid-sized organizations ke liye best hai.
Example Use Case	Company ke monthly financial reports banana aur teams ke saath share karna.

Open-Source Data Visualization Tools

✅ 1. Matplotlib Functions

◆ a) plt.plot()

Purpose: Line graph for showing trends over time or sequence.
Example:

```
import matplotlib.pyplot as plt

x = [1, 2, 3, 4, 5]
y = [10, 20, 15, 25, 30]

plt.plot(x, y)
plt.title("Line Graph")
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
plt.show()
```

◆ **b) plt.bar()**
Purpose: Bar chart for comparing categories.
Example:

```
import matplotlib.pyplot as plt

subjects = ['Math', 'Science', 'English']
scores = [80, 70, 90]

plt.bar(subjects, scores, color='skyblue')
plt.title("Student Scores")
plt.ylabel("Marks")
plt.show()
```

✅ 2. Seaborn Functions

◆ a) sns.histplot()

Purpose: Histogram for distribution of a variable.
Example:

```
import seaborn as sns
import matplotlib.pyplot as plt

data = [55, 60, 65, 60, 70, 75, 80, 60, 62, 66]
sns.histplot(data, bins=5, kde=True)
plt.title("Histogram of Marks")
plt.show()
```

◆ **b) sns.boxplot()**
Purpose: Boxplot for showing distribution, median, and outliers.
Example:

```
import seaborn as sns
import matplotlib.pyplot as plt

scores = [55, 60, 65, 70, 80, 85, 90, 100, 105]
sns.boxplot(data=scores)
plt.title("Boxplot of Scores")
plt.show()
```

📊 Case Study: Enhancing Zomato's Delivery Efficiency and Customer Satisfaction

🔍 **Objective:**
Zomato ko apne delivery operations aur customer satisfaction improve karne ke liye key issues identify karne hain, taaki customer retention badhe aur revenue optimize ho.

Metric	Insight	Visualization
Average Delivery Time	Kuch cities jaise Delhi aur Hyderabad mein delivery time zyada hai, jo customer dissatisfaction ka reason ban sakta hai.	Bar Chart: Average delivery time per city.
Order Cancellation Rate	Cash on Delivery (COD) orders mein payment failures ki wajah se cancellations zyada ho rahe hain.	Pie Chart: Reasons for order cancellations.
Customer Ratings	High-rated restaurants mein repeat orders zyada hote hain, jabki low-rated restaurants mein cancellations aur complaints badh jaate hain.	Heat Map: Restaurant ratings vs. repeat orders.
Payment Method Usage	UPI aur Debit Card sabse preferred payment methods hain, lekin COD abhi bhi significant percentage hold karta hai.	Donut Chart: Distribution of payment methods.
Revenue by City	Kuch cities jaise Mumbai aur Bangalore high revenue generate karte hain, jabki kuch cities mein potential hone ke bawajood revenue low hai.	Geo Map: Revenue distribution across cities.

🔍 Insights aur Recommendations

- **Delivery Operations Optimize Karna:**
  High delivery time wale cities mein logistics aur restaurant preparation time improve karne ki zarurat hai.
- **Digital Payments Promote Karna:**
  COD orders mein payment failures zyada hote hain, isliye UPI aur Debit Card jaise digital payments ko encourage karna chahiye.
- **Restaurant Partnerships Enhance Karna:**
  Low-rated restaurants ke saath collaborate karke unki service quality improve karna customer satisfaction badha sakta hai.
- **Targeted Marketing Campaigns:**
  High revenue generating cities mein marketing efforts focus karna aur low revenue cities mein customer engagement strategies implement karna chahiye.

📌 **Conclusion**

Data visualization tools jaise Google Looker Studio aur Power BI ka use karke Zomato apne operational challenges ko identify kar sakta hai aur data-driven decisions le sakta hai. Isse not only customer satisfaction improve hoga, balki overall business performance bhi enhance hogi.

Analytical techniques used in Big Data visualization

Technique	Explanation (Hinglish)	Use Case
1. Cluster Analysis	Similar data points ko group karna, taaki patterns aur segments identify kiye ja sakein.	Customer segmentation, market research.
2. Regression Analysis	Ek variable ke effect ko doosre variable par samajhna, jaise sales par advertising spend ka impact.	Sales forecasting, risk assessment.
3. Time Series Analysis	Data ke time-based trends aur patterns ko analyze karna, jaise seasonal variations.	Stock market prediction, weather forecasting.
4. Dimensionality Reduction	High-dimensional data ko simplify karna, taaki visualization aur analysis easy ho jaye.	Image processing, genomics data analysis.
5. Predictive Analytics	Historical data ka use karke future outcomes predict karna, jaise customer churn prediction.	Fraud detection, customer retention strategies.
6. Link Analysis	Data points ke beech relationships ko visualize karna, jaise social networks mein connections.	Social network analysis, fraud detection.
7. Spatial Analysis	Geographical data ko analyze karna, jaise location-based trends identify karna.	Urban planning, delivery route optimization.
8. Data Mining	Large datasets se useful patterns aur knowledge extract karna, jaise purchasing behavior.	Market basket analysis, recommendation systems.
9. Neural Networks	Human brain se inspired models jo complex patterns ko recognize karte hain, jaise image recognition.	Natural language processing, image and speech recognition.
10. Treemapping	Hierarchical data ko nested rectangles ke form mein represent karna, taaki proportions aur relationships samajh aaye.	Disk space usage visualization, organizational structures.

1. D3.js (Data-Driven Documents)

Aspect	Explanation
What is it?	D3.js ek JavaScript library hai jo web pages par dynamic aur interactive data visualizations banane ke liye use hoti hai. Yeh HTML, SVG, aur CSS ke sath kaam karti hai.
Key Features	- Data ko DOM (Document Object Model) ke sath bind karti hai.- Complex custom charts aur animations bana sakte hain.- Bahut flexible lekin coding intensive hai.
Use Case Example	Interactive bar charts, line graphs, maps ya custom animations jo user input ke hisaab se change hote hain banana.
Pros	- Bahut zyada customization possible hai.- Open source aur strong community support.- Web par rich interactive graphics create karta hai.
Cons	- Thoda mushkil seekhne me (coding knowledge chahiye).- Zyada boilerplate code likhna padta hai.

2. **Candela**

Aspect	Explanation
What is it?	Candela ek high-level data visualization toolkit hai jo Python ecosystem ke liye banayi gayi hai. Yeh IPython aur Jupyter notebooks ke sath use hoti hai.
Key Features	- Complex visualizations ko simple banata hai, khas kar scientific data ke liye.- Interactive visualization components provide karta hai.- Web-based visualizations generate karta hai.
Use Case Example	Scientific computing ya data science projects me Jupyter notebooks ke andar interactive plots aur graphs banana.
Pros	- Python users ke liye easy hai.- Interactive aur reusable visualization components.- Jupyter notebooks ke sath seamless integration.
Cons	- D3.js jitna flexible nahi.- Mostly scientific/research oriented visualization tak limited hai.

Google Charts API

Kya hai?

Google Charts ek free JavaScript-based charting library hai jo aapko interactive charts aur dashboards banane mein madad karta hai.

Features:

•Line, bar, pie, scatter, aur geo charts jaise multiple chart types support karta hai.

•Charts ko customize karne ke liye options available hain.

•Google Sheets aur other data sources se easily integrate hota hai.

Use Case:

Website par real-time data dashboards banana, jaise website traffic ya sales data visualization.

Q5) a) What is Data Visualization? What are the major challenges in big data visualization and how to overcome these challenges? **[6]**

b) Explain various techniques for visual data representation. **[6]**

c) Explain the following data visualization techniques. **[5]**

i) Candela

ii) D3.js

OR

Q6) a) Explain data visualization with respect to l-D, 2-D, 3-D data. **[6]**

b) Explain various analytical techniques used in big data visualization. **[6]**

c) Draw histogram with a suitable example and explain its usage. **[5]**

Q5) a) i) How data visualization help Big data Analytics. **[4]**

ii) List the conventional Data visualization tools. Explain any Two. **[6]**

b) Explain data visualization with the help of example? What are the advantages of data visualization? **[8]**

OR

Q6) a) Explain any 4 Types of data visualization with example. **[8]**

b) i) Explain different data visualization tools. **[6]**

ii) Explain Data Visualization with Tableau. **[4]**

Q5) a) How Data Visualization is important in Big Data? Explain challenges to big data visualization? **[6]**

b) Explain various techniques for visual data representation. **[6]**

c) Explain the following data visualization techniques. **[6]**

i) Google Chart API

ii) D3.js

OR

Q6) a) Explain data visualization with respect to l-D, 2-D, 3-D data? **[6]**

b) Explain various analytical techniques and tools used in data visualization. **[6]**

c) Draw boxplot with a suitable example and explain its usage. **[6]**

Q5) a) Explain any 4 Types of data visualization with example. **[9]**

b) Explain different data visualization tools. **[9]**

OR

P.T.O.

Q6) a) Explain data visualization with the help of example? What are the advantages of data visualization? **[9]**

b) Explain Data Visulization with Tableau. **[9]**

Q5) a) Explain different techniques of Big Data visualization. **[7]**

b) Explain challenges in Big data visualization. **[7]**

c) Write two data visualization functions from matplotlib. **[3]**

OR

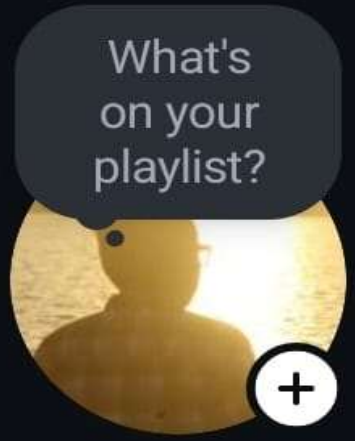
P.T.O.

Q6) a) Explain different tools for data visualization. **[7]**

b) Explain scatter plot, histogram and heat map with example. **[7]**

c) Write two data visualization functions from seaborn. **[3]**

jayesh_kande_



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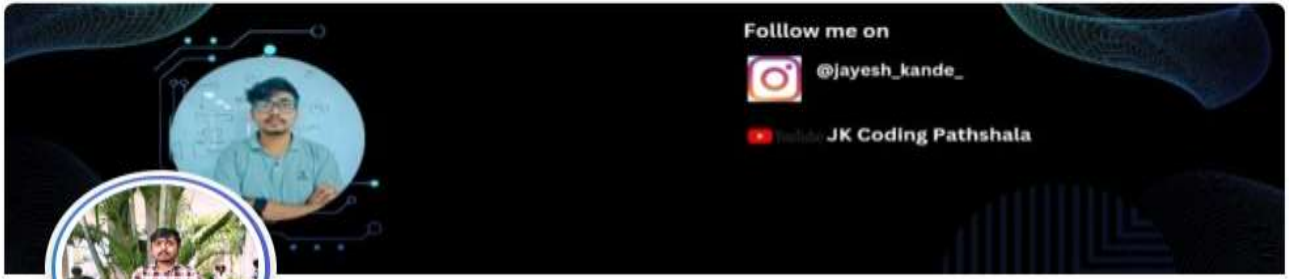

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