

EXPT NO:4	Visual encoding of data
DATE: 20.01.2026	

PRE-LAB QUESTIONS

- 1. How does the human visual system process visual variables?**
The human visual system quickly perceives color, size, shape, position, and motion, enabling rapid pattern recognition and comparison in visual data.
- 2. Why is improper encoding misleading in analytics?**
Improper encoding can distort data meaning, hide patterns, exaggerate differences, and lead to incorrect conclusions or decisions.
- 3. What are perceptual limitations in visualization?**
Perceptual limitations include difficulty distinguishing similar colors, limited attention span, visual clutter, and inability to accurately judge area or volume.
- 4. How does color choice affect interpretation?**
Color influences emphasis, grouping, emotional response, and readability; poor color choices can cause confusion or misinterpretation of data.
- 5. Why should AI dashboards be perceptually optimized?**
Perceptually optimized dashboards improve clarity, speed of understanding, reduce cognitive load, and support accurate human-AI decision making.

OBJECTIVE: To apply effective visual encoding principles for meaningful data communication.

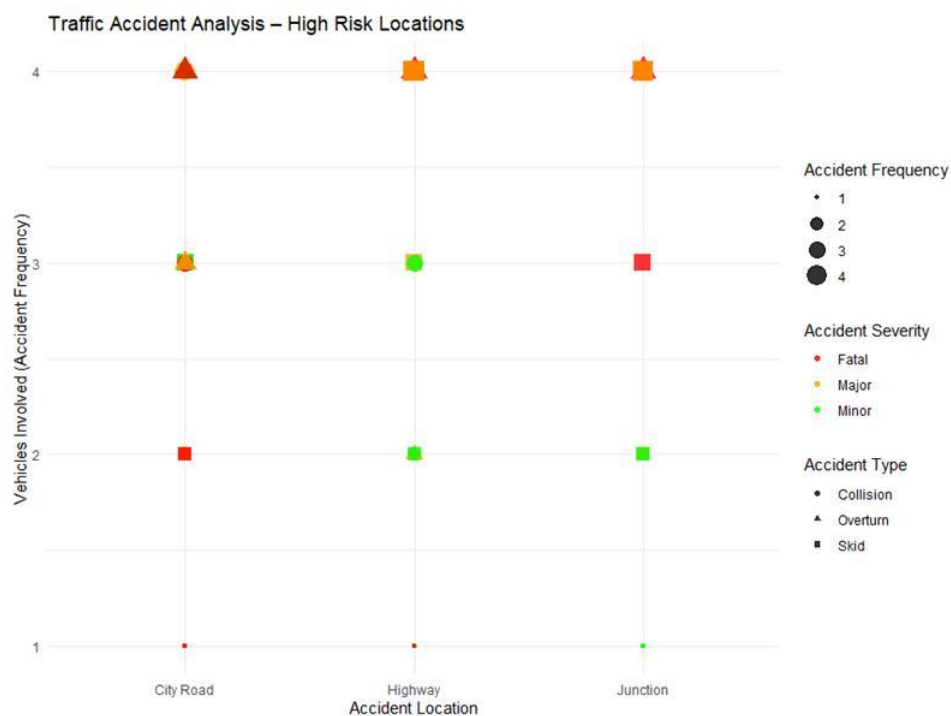
SCENARIO: A city traffic department analyzes accident data to identify high-risk zones and accident severity patterns.

IN-LAB TASKS (Using R Language) • Encode severity using color gradients • Represent accident frequency using size • Use shape to indicate accident type

CODE:

```
# =====  
# Roll No: 23BAD076  
# =====  
library(ggplot2)  
accident_data <- read.csv("4.traffic_accidents.csv")  
head(accident_data)  
  
ggplot(accident_data, aes(  
  x = Location,  
  y = Vehicles_Involved  
) +  
  geom_point(  
    aes(  
      color = Severity,  
      size = Vehicles_Involved,  
      shape = Accident_Type  
    ),  
    alpha = 0.8  
  ) +  
  scale_color_manual(  
    values = c(  
      "Minor" = "green",  
      "Major" = "orange",  
      "Fatal" = "red"  
    )  
  ) +  
  labs(  
    title = "Traffic Accident Analysis - High Risk Locations",  
    x = "Accident Location",  
    y = "Vehicles Involved (Accident Frequency)",  
    color = "Accident Severity",  
    size = "Accident Frequency",  
    shape = "Accident Type"  
  ) +  
  theme_minimal()
```

OUTPUT:



POST-LAB QUESTIONS

- 1. Which visual variable best conveys severity and why?**
Color best conveys severity because it is quickly perceived by the human eye and effectively highlights differences in risk levels (e.g., green for minor, red for fatal).
- 2. How can poor encoding mislead policy decisions?**
Poor encoding can hide critical trends, exaggerate impacts, or misrepresent data, leading policymakers to take incorrect or ineffective actions.
- 3. What precautions should be taken for color-blind users?**
Use color-blind-safe palettes, combine color with shapes or labels, avoid red–green contrasts, and ensure sufficient contrast.
- 4. How does visual encoding affect AI explainability?**
Clear visual encoding makes AI outputs transparent and interpretable, helping users understand model behavior, while poor encoding reduces trust and clarity.
- 5. Suggest improvements for large-scale public dashboards.**
Use simple layouts, interactive filters, scalable visuals, clear legends, and accessibility-friendly design to ensure effective communication for diverse users.

LEARNING OUTCOME: Students learn perceptually effective visual communication for AI systems.

ASSESSMENT

Description	Max Marks	Marks Awarded
Pre Lab Exercise	5	
In Lab Exercise	10	
Post Lab Exercise	5	
Viva	10	
Total	30	
Faculty Signature		