# All Lectures Summary

# 1 Introduction to visualisation

**Summary**

- factors for effective visualization

- data

- tasks

- users

- People have been using visualization for centuries
- Human visual perception is extremely powerful

# 2 Users, tasks, data

**Summary**

- Shneiderman's mantra is a good starting point for design
- Humans are diverse like snowflakes
- Task abstractions allow us to compare across domains
- Data has both semantics and type
- Identifying attributes is key to understanding data

# 3 Visualization process

**Summary**

- Visualizations are broken down into marks (elements) and channels (parameters)
- Data is linked to these channels
- A lot of care needed to choose which and how many channels to use
- Visualization pipeline helps organize software/notebooks

# 4 Color

**Summary**

- Balance aesthetics with perceptual issues
- Hue for categories (<8!)
- Saturation for numbers
- Use colorbrewer!

# 5 Infovis: Single views

**Summary**

- Often using tabular data
- Information visualization is mapping abstract dimensions to spatial/visual
- Care needed to choose spatial mappings
- Single views form foundation of more elaborate visualizations

# 6 Infovis: networks and trees

**Summary**

- Node-link diagrams should minimize edge crossings and curved edges
- Adjacency matrix needs interactive reordering to show patterns
- Treemaps are a compact representation of trees

# 7 Infovis: multiple views

**Summary**

- eyes over memory
- Splitting views is very powerful
- Interaction is key

# 8 Volume Visualization,Part 1

**Summary**

- Data is usually given on a grid
- Conceptual volvis framework is a pipeline from data to visualization
- Indirect vs direct visualization
- Transfer function maps data values to color

# 9 Volume visualization
## Iso-Surface Extraction and Marching Cubes

**Summary**

- 256 Cases
- Reduce to 15 cases by symmetry
- Ambiguity in certain cases
- Causes holes if arbitrary
- choices are made
- Up to 5 triangles per cube

# 10 Volume Visualization
## Part 2 Direct Volume Visualization

# 11 Transfer functions/classification

**Summary**

- Histograms give intuition about interesting values
- Gradient in data value to find transitions
- Transfer functions require exploration
- Segmentation is powerful but more investigation needed

# 12 Volume Visualization: Splatting

# 13 Introduction to flow visualization

**Summary**

- Data is a set of vectors in 3D + time
- Visualization to see key aspects of flow
- Steady vs unsteady flow
- Direct vs geometric flow visualization

# 14 Glyphs and arrows

**Summary**

- Direct flow visualization : encode the flow information at each voxel
- Arrows in 2D: simple and effective
- Arrows in 3D: need to handle occulsion
- Glyphs:

# 15 Geometric flow visualization

**Summary**

- Geometric flow visualization visualizes the integrated flow field
- Different viewpoints of flow:

– Eulerian
– Lagrangian

- Standard techniques:

– streamlines
– pathlines
– Streaklines

- Need to be careful w.r.t. placement and number of lines

# 16 Integration

Summary

- analytic determination of streamlines usually not possible
- Euler: simple, imprecise, esp. with small dt
- RK: more accurate in higher orders
- Other lines are integrations over time/space

# 17 Additional techniques

**Summary**

- LIC – overview, easy to understand
- Feature-based – when you know what you’re looking for
- Topology – hybrid method, good for feature tracking