Ch 13: Reduce Items and Attributes
Ch 14: Embed: Focus+Context

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CPSC 547, Information Visualization
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http://www.cs.ubc.ca/~tmm/courses/547-17
News

• topic/date assignments out soon  
  – got last straggler just minutes ago
• marks for pitches and L12/L13/L14 out soon

• next time  
  – I’ll discuss presentation expectations  
    • and give example presentation  
    – new room! in Forestry (2424 Main Mall), Room 2300 A

• reminder: meetings due by Fri 5pm  
• reminder: proposals due by Mon 5pm
### Idiom design choices: Part 2

<table>
<thead>
<tr>
<th>Mani pulate</th>
<th>Facet</th>
<th>Reduce</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄 Change</td>
<td>🔄 Juxtapose</td>
<td>🔄 Filter</td>
</tr>
<tr>
<td>🔄 Select</td>
<td>🔄 Partition</td>
<td>🔄 Aggregate</td>
</tr>
<tr>
<td>🔄 Navigate</td>
<td>🔄 Superimpose</td>
<td>🔄 Embed</td>
</tr>
</tbody>
</table>

- **Manipulate**
  - Change
  - Select
  - Navigate

- **Facet**
  - Juxtapose
  - Partition
  - Superimpose

- **Reduce**
  - Filter
  - Aggregate
  - Embed
Reduce items and attributes

- reduce/increase: inverses
- filter
  - pro: straightforward and intuitive
    - to understand and compute
  - con: out of sight, out of mind
- aggregation
  - pro: inform about whole set
  - con: difficult to avoid losing signal
- not mutually exclusive
  - combine filter, aggregate
  - combine reduce, change, facet
Idiom: **dynamic filtering**

- item filtering
- browse through tightly coupled interaction
  — alternative to queries that might return far too many or too few

System: **FilmFinder**

Idiom: **DOSFA**

- attribute filtering
- encoding: star glyphs

Idiom: **histogram**

- static item aggregation
- task: find distribution
- data: table
- derived data
  - new table: keys are bins, values are counts
- bin size crucial
  - pattern can change dramatically depending on discretization
  - opportunity for interaction: control bin size on the fly
Continuous scatterplot

- static item aggregation
- data: table
- derived data: table
  - key attrs x,y for pixels
  - quant attr: overplot
density
- dense space-filling 2D matrix
- color: sequential
categorical hue +
ordered luminance colormap

Idiom: **scented widgets**

- augment widgets for filtering to show *information scent*
  - cues to show whether value in drilling down further vs looking elsewhere
- concise, in part of screen normally considered control panel

Idiom: **boxplot**

- static item aggregation
- task: find distribution
- data: table
- derived data
  - 5 quant attrs
    - median: central line
    - lower and upper quartile: boxes
    - lower upper fences: whiskers
      - values beyond which items are outliers
  - outliers beyond fence cutoffs explicitly shown

[40 years of boxplots. Wickham and Stryjewski. 2012. had.co.nz]
Idiom: **Hierarchical parallel coordinates**

- dynamic item aggregation
- derived data: *hierarchical clustering*
- encoding:
  - cluster band with variable transparency, line at mean, width by min/max values
  - color by proximity in hierarchy

Spatial aggregation

• MAUP: Modifiable Areal Unit Problem
  – gerrymandering (manipulating voting district boundaries) is one example!

[http://www.e-education.psu.edu/geog486/l4_p7.html, Fig 4.cg.6]
Dimensionality reduction

• attribute aggregation
  – derive low-dimensional target space from high-dimensional measured space
  – use when you can’t directly measure what you care about
    • true dimensionality of dataset conjectured to be smaller than dimensionality of measurements
    • latent factors, hidden variables

Tumor Measurement Data

data: 9D measured space

→ DR

derived data: 2D target space

Malignant
Benign
Dimensionality reduction for documents

**Task 1**
- **In:** High-dimensional data
- **Out:** 2D data

**What?**
- In High-dimensional data
- Out 2D data

**Why?**
- Produce
- Derive

**Task 2**
- **In:** 2D data
- **Out:** Scatterplot Clusters & points

**What?**
- In 2D data
- Out Scatterplot
- Out Clusters & points

**Why?**
- Discover
- Explore
- Identify

**How?**
- Encode
- Navigate
- Select

**Task 3**
- **In:** Scatterplot Clusters & points
- **Out:** Labels for clusters

**What?**
- In Scatterplot
- In Clusters & points
- Out Labels for clusters

**Why?**
- Produce
- Annotate
Dimensionality vs attribute reduction

• vocab use in field not consistent
  – dimension/attribute

• attribute reduction: reduce set with filtering
  – includes orthographic projection

• dimensionality reduction: create smaller set of new dims/attrs
  – typically implies dimensional aggregation, not just filtering
  – vocab: projection/mapping
Further reading

  —Chap 13: Reduce Items and Attributes


Embed: Focus+Context

• combine information within single view
• elide
  – selectively filter and aggregate
• superimpose layer
  – local lens
• distortion design choices
  – region shape: radial, rectilinear, complex
  – how many regions: one, many
  – region extent: local, global
  – interaction metaphor
Idiom: **DOITrees Revisited**

- **elide**
  - some items dynamically filtered out
  - some items dynamically aggregated together
  - some items shown in detail

Idiom: **Fisheye Lens**

- distort geometry
  - shape: radial
  - focus: single extent
  - extent: local
  - metaphor: draggable lens

http://tulip.labri.fr/TulipDrupal/?q=node/351
http://tulip.labri.fr/TulipDrupal/?q=node/371
Idiom: **Stretch and Squish Navigation**

- distort geometry
  - shape: rectilinear
  - foci: multiple
  - impact: global
  - metaphor: stretch and squish, borders fixed

System: **TreeJuxtaposer**

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Distortion costs and benefits

• benefits
  – combine focus and context information in single view

• costs
  – length comparisons impaired
    • network/tree topology comparisons unaffected: connection, containment
  – effects of distortion unclear if original structure unfamiliar
  – object constancy/tracking maybe impaired

Further reading

  – Chap 14: Embed: Focus+Context


Next Time

• Thu Mar 2, to read
  – VAD Ch. 15: Case Studies
    • several examples of analysis with full framework

• reminders:
  – meetings due by Fri Mar 3, 5pm
  – proposals due by Mon Mar 6, 5pm