An Environment for Telecollaborative Data Exploration

Gudrun Klinker

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1. Different Approaches to Visualization

- Customizability vs. Domain-Specificity
- Performance / Control flow
- Data Representations (dynamic/static)
- Data Presentations
- Explorative Capabilities
- [Collaboration]
2. Data Presentation vs. Data Representation

Observation: There are many ways (dimensions) for visualizing a data set.

- Intensity- and color- images
- Graphs and surface plots
- Icons
- Printed numbers
- Movie loops
- Sounds
- Various styles, overlaid or interleaved.

All dimensions are created equal.
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Data mapping:

- **Dimensions of data set**
  - cropped
  - permuted
  - lin. comb.
  - projected
  - sliced
  - merged
  \{a,b,c,\ldots,n\}

- **Presentation parameters**
  - i,r,g,b
  - x,y,z
  - t
  - shape p1,\ldots,pi
  - sound s1,\ldots,sj
  - stereo pos
  \{A,B,C,\ldots,M\}

**Mapping**
- rescale
- crop
- interpolate
- subsample
- wrap
- substitute

**E.g.: Intensity image**
- As terrainmap: \(\{x,y,i\} \rightarrow \{x,y,z\}\)
- As movieloop (x-vector): \(\{x,y,i\} \rightarrow \{x,t,i\}\)
- As movieloop (graph): \(\{x,y,i\} \rightarrow \{x,t,z\}\)
3. Data Exploration

Observation: Users don’t just look at their data. They want to
- Explore (probe) the data.
- Analyze some parts of it (ROI).
- Relate it to other measurements.

The feedback channel:
- Makes the current mouse position available to a visual program.
- Provides tools to maintain the transformations between the mouse in the window and the corresponding array index.
Feedback channel:

- Read Image
  - \{x, y\}
  - Crop Image
    - \{x- xs, y- ys\}
    - Zoom Image
      - \{(x- xs)*z, (y- ys)*z\}
  - Display Image
    - \[x', y'\]
  - Print Value
    - \[x'/z+xs, y'/z+ys\]
  - Print Value
    - \[x'/z, y'/z\]
  - Print Value
    - \[x', y'\]
Feedback channel:

- Read Image
  - \( \{x,y\} \)
  - Crop Image
    - \( \{x- xs, y- ys\} \)
  - Print Value
    - \( [x/z+xs, y/z+ys] \)
- Print Value
  - \( [x/z, y/z] \)
- Print Value
  - \( [x', y'] \)
- Zoom Image
  - \( ((x- xs)\times z, (y- ys)\times z) \)
  - Display Image
    - \( [x', y'] \)
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Feedback channel:

- Read Image
  - \{x, y\}
- Crop Image
  - \{x- xs, y- ys\}
- Zoom Image
  - \{(x- xs)*z, (y- ys)*z\}
- Display Image
- Print Value
  - \[x'/z+xs, y'/z+ys\]
  - \[x''+xs, y''+ys\]
- Print Value
  - \[x'/z, y'/z\]
  - \[x'', y''\]
- Print Value
  - \[x', y'\]
  - \[x''*z, y''*z\]
  - \[(x''-xs)*z, (y''-ys)*z\]

- \(x'', y''\)
- \(x'', y''\)
- \(x''-xs, y''-ys\)
4. Telecollaboration

Observations:

- Every once in a while, users want to discuss the current state of their data analysis with a colleague (who may not be at the same place).
- The collaboration partners on both ends need to be able to
  - Fully participate in the analysis session.
  - Individually customize their views when desired.
  - Communicate with each other on a meaningful level of abstraction.

- Several individualizable data mapping and presentation paths.
- Linked cursors.
- Window migration.
Example

Tele-collaborative analysis of multispectral data.
Tele-collaborative multi-spectral data analysis in TDE (AVS)