TimeNotes: A Study on Effective Chart Visualization and Interaction Techniques for Time-Series Data

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Outline

❖ Time-series Data
  ❖ Chronolens, Stack Zoom
❖ Domain Situation
❖ Data
❖ Visual encoding (TimeNotes)
  ❖ Layout, node manipulation, overlay, annotation
❖ User Study
❖ Advantages & Disadvantage

Time-series data

❖ One challenge is that screen resolution is small in comparison to data storage capacity.
❖ Over-plotting problem

Navigating and communicating through a large data space is an important task...

ChronoLens

Chronolenses support more elaborate data analysis tasks, without the need to derive new time-series visualizations.

Domain Situation

Movement ecologists need to explore time-series graphs of several attributes (acceleration, magnetic field intensity, pressure...) to gain an understanding of the mapping from signal to behaviour.

How to efficiently extract the signal of interest and annotate them when considering data recorded at a high-frequency over long periods of time?

Data

15 minute (approximately) sub-section of remote animal monitoring data obtained from a deployment of a behavioral data collection tag on a Condor consisting of 34,746 data items.

Encode - layout

TimeNotes utilizes a space-filling node-link diagram to represent the hierarchical zoom structure.

What: Data

Multidimensional table: multiple qualitative value attribute (signal data), one ordered key attribute (time)

What: Derived

Overview of entire dataset, find patterns/behaviours, compare signals, keep history of actions, construct a presentation view

Why: Tasks

Hierarchical zooming, reorder, reolve, animated transitions

Flow: Encode

Space-filling node-link layout, line charts

Flow: Manipulate

Select patterns across the data-sets, navigate with pan, hierarchical zooming, reorder, manipulate, animated transitions

Flow: Facet

Superimpose, distinguished with colour

Scale

Ordered key attribute: Ten thousands. qualitative value attribute: one or many

User study

❖ Provide detailed and flexible view for a specific variable dataset
❖ Hierarchical zooming helps solve the conflict of big data size and limited screens, compare and explore behaviour at different scales
❖ Bookmark, annotation and export operations help future reference

Hierarchical Navigation (Leaf Counting)

B. Comparison (Amplitude)

C. Comparison (Frequency)

D. Hierarchical Navigation (Zoom/Pan and Labelling)

E. Hierarchical Navigation (Label Analysis)

Advantage & Disadvantage

❖ Snapping nodes together overlays the nodes together for better comparison of signals.
❖ Connections are mapped into the overlay plot with unique colour.

Annotations be placed anywhere on the display space.

Annotations move with the node and are hidden when a node is minimized.
Thanks!