Micro-Macro Views for Visual Trajectory Cluster Analysis

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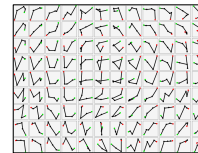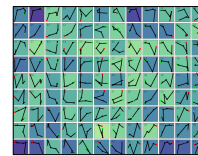
Motivation

- **Visual cluster analysis** aims to support analysis of large data sets
- Grouping of individual data items into **clusters** is of interest
- Inspired by Tufte's notion of **micro-macro displays** [T90], we present an approach combining the visualization of both **the cluster (macro)** and the **data sample (micro)** level in one single view

In earlier work [SBvLK09] we considered visual cluster analysis of trajectory data using the **Self-Organizing Map** (SOM) [K01] algorithm.

- The **macro view** shows **cluster prototypes** overlaid on the SOM grid
- **Background color-coding** optionally shows certain cluster properties (e.g., density, prototype distances, topological properties, etc.)

Trajectory SOM-Clustering
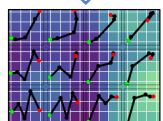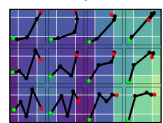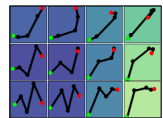

Density Heatmap

Approach

We currently work on extending our base macro display by a **micro view** showing also the **distribution of data items** with respect to the location of the cluster prototypes.
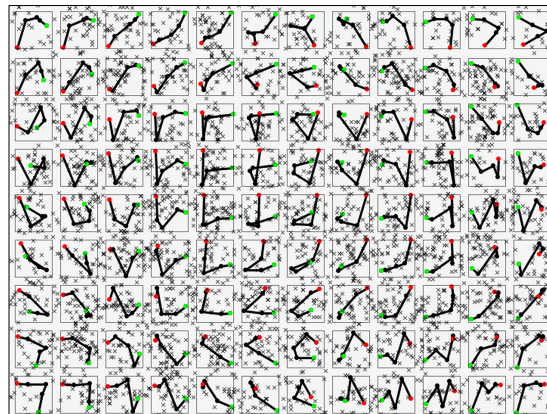
- Implementation: interactive adaptive **refinement** of given SOM-grid
- Spline **interpolation** of SOM prototypes for each high-resolution grid cell and for each vector component of the (potentially, high-dimensional) SOM prototype vectors
- The data items are then mapped to the **high-resolution grid** by finding the best matching unit on the refined grid
- Parameters of the approach can be **interactively** controlled (e.g., refinement resolution, color mapping normalization options, etc.)

We define a set of micro views based on the high-resolution grid which allow fine-granular analysis of **quality metrics** and **sample distribution** properties in terms of the SOM cluster structure.
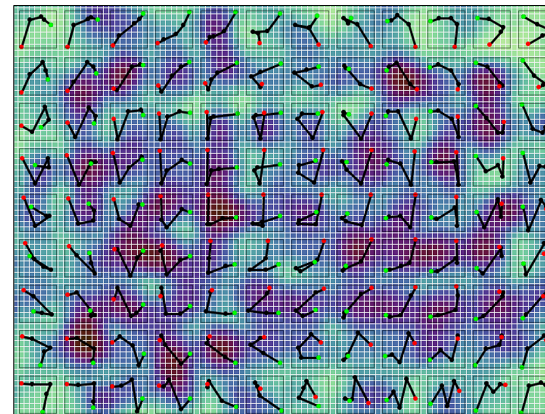
Scatter View

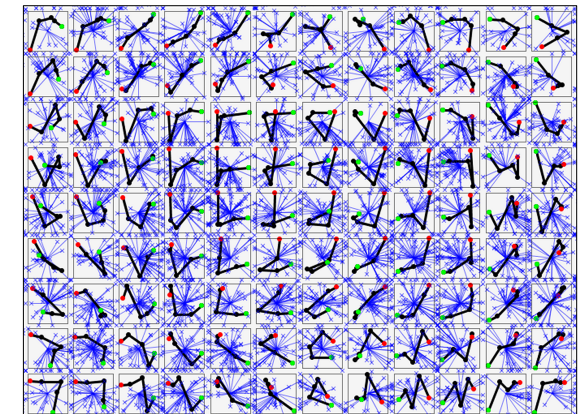**Refining the SOM-grid resolution**

The scatter view shows the distribution of items on the high-resolution grid in relation to the trajectory clusters using a dot representation.

Density View

The density view visualizes the sample distribution density in a color coded heatmap representation. Alternative heatmaps show the quantization error, the U-Matrix, etc.

Star View

The star view is a connector-based view which indicates for each data sample its nearest cluster prototype on the original (coarse) SOM grid.

Future Work

- Implementation of additional visualization techniques based on scatter plots, density heat maps, and nearest neighbor connectors
- Implementation of comparative views for contrasting the SOM clustering with the output of other unsupervised clustering algorithms, e.g., K-means, DB-Scan, etc.

References

- [K01] T. Kohonen: Self-Organizing Maps, 3rd ed. Springer, Berlin.
- [SBvLK09] T. Schreck, J. Bernard, T. von Landesberger, J. Kohlhammer: Visual Cluster Analysis of Trajectory Data With Interactive Kohonen Maps. Information Visualization Journal. In press.
- [T90] E. Tufte: Envisioning Information. Graphics Press. 1990.

Acknowledgments

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