# Proposals for Student Projects and Theses

SpiraClock for Google Android Devices

The SpiraClock combines the representation of scheduled events with the display of the current time. The goal of this project is to implement the SpiraClock on a mobile device running Google Android. The implementation has to provide an interface to access one's personal agenda scheduled in Google Calendar.
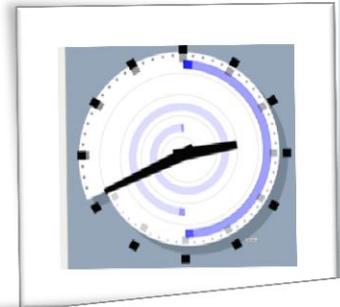
Parser for the DOT language and file format

DOT is a formally defined language and file format for graph data, including node and edge definitions as well as descriptions of their visual representation. In this project, a parser for the DOT format has to be implemented and be integrated into the graph visualization system CGV. Additionally, an exported has to be implemented to export CGV's internal graph data into DOT files.
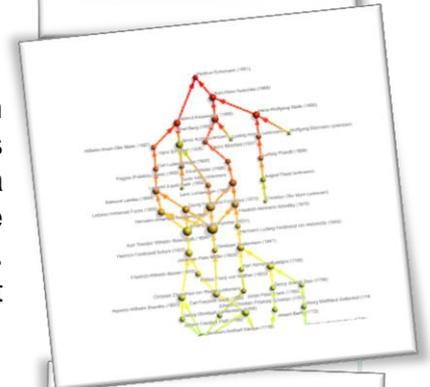
Enhanced Matrix Visualization

An existing implementation of a matrix visualization has to be extended and enhanced so as to allow users to re-order the rows and columns of the matrix interactively as well as automatically based on basic similarity criteria. Animations have to be used to make the re—ordering process comprehensible for the user.
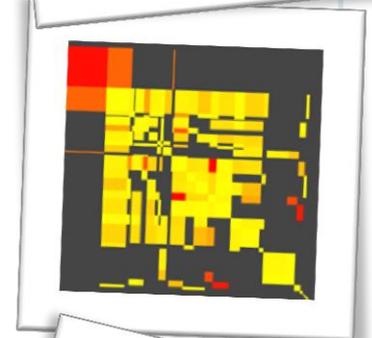
Many-to-Many Relational Parallel Coordinates

Parallel coordinates show data tuples as poly lines that intersect parallel dimension axes according to the individual data values in a tuple. This allows for recognizing correlations between two data dimensions (i.e., the axes). Novel arrangements of axes aim at showing correlations between more than 2 dimensions. Such interactively adjustable axes arrangements are to be implemented in this project.
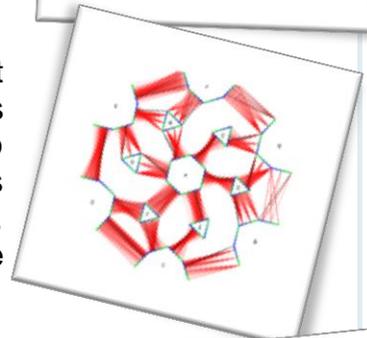
Fisheye Navigation for Clustered Graphs

Hierarchically clustered graphs enable users to explore and navigate large structured information spaces. Schaffer et al. (1996) provide experimental evidence that fisheye techniques can be beneficial for navigation and exploration. The goal of this project is to develop navigation techniques for graphs whose layouts span several magnitudes of precision (i.e., very large coordinates, but also very small differences).
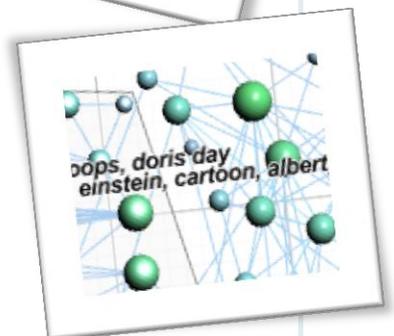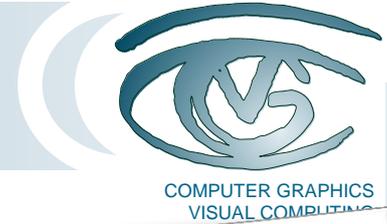
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Parallelized MCL for the GPU

MCL is a well-accepted method for clustering graphs. The runtime of the clustering is proportional to the $O(n^3)$ complexity of the required matrix multiplication steps of the MCL approach. The goal of this project is develop a parallelized version of MCL utilizing the capabilities of modern GPUs for reducing the runtime of the clustering.
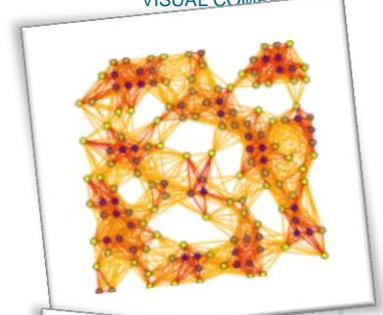
Smooth and Efficient Zooming and Panning

Animations are useful to support users during zoom and pan operations carried out while exploring unknown data. In this project, the approach of „Smooth and Efficient Zooming and Panning" has to be designed and implemented so as to make it flexibly applicable in multiple visualization tools. A demonstrator has to illustrate the approach in a comprehensible way.
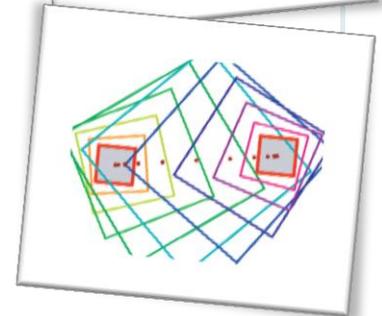
A Zoomable Worlds-Within-Worlds Interface
(for Touch-Enabled Devices)

Zoomable interfaces and the concept of worlds-within-worlds are commonly applied to falcilitate the exploration of large information spaces. The objective for this project is to design and implement a generic solution for zoomable worlds within zoomable worlds. An important aspect will be fluid interaction to facilitate easy navigation in the information space. An existing zoomable interface can be used as a starting point.
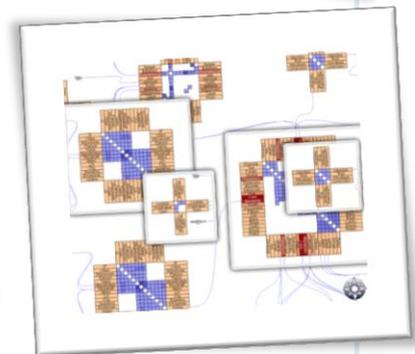
Shader techniques for information visualization

Modern GPUs offer flexible and efficient rendering via shader programs. The goal of this project is to investigate how the classic visualization pipeline can be realized via modern shader technology. To this end, the visualization operators of Chi's data state reference model need to be implemented as shader programs.
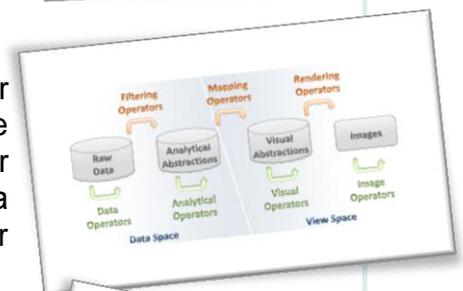
3D projections of climate networks

Climate researchers investigate climate networks that span the globe. For their research, different types of geographic projections are needed to fully understand the data. Sphere and cylinder representations of the world are to be combined with node-link representations of the network. The project can be conducted in close collaboration with climate researchers.
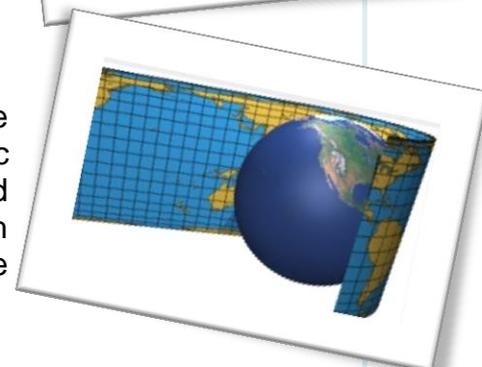
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Interactive Queries for Trajectory Data

Exploring trajectories especially larger numbers of them requires interactive querie mechanisms to focus the exploration on data relevant to the task at hand. In this project, interactive query mechanisms are to be designed and implemented. The techniques have to be integrated into an existing trajectory visualization tool.
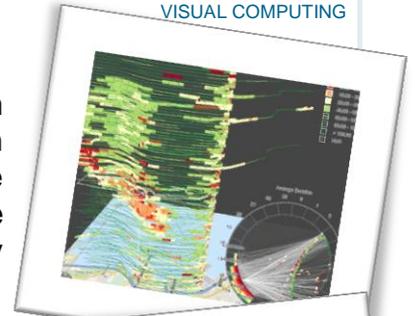
Trajectory Clustering

Trajectory analysis of larger numbers of trajectories requires a clustering step that creates groups of trajectories with similar properties. In this project, similarity is related to the geometry or shape of the trajectories, that is trajectories that take similar paths through space. The goal is to implement an efficient solution that utilizes mulit-processor architectures.
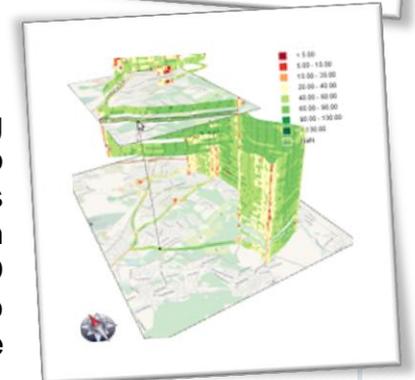
Scattered Data Interpolation

Scattered data interpolation can be used to create a dense visual representation of data that is given only for a sparse set of points. The advantage of the dense visualization is that every pixel of the display shows a color depending on the underlying data. In this project, an API and demonstrator for visualizations based on scattered data interpolation are to be implemented. An existing solution can be used for inspiration.
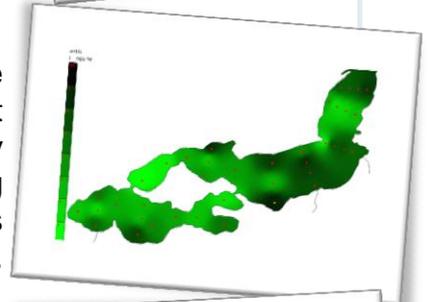
Interaction techniques for the space-time cube

The space-time cube is a classic approach for visualizing spatio-temporal data. The approach is widely used, but also much-debated because it is a 3D technique. The goal of this project is to review the space-time cube from an interaction perspective. Based on appropriate user studies, existing 3D navigation techniques shall be assessed and improved to increase the usability and acceptance to the 3D space-time cube.