Visual exploration of massive amounts of Trajectories with Small Multiples

Supervision

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Project type

Internship or Master project with extension

Requirements

The candidate should have a passport from a NATO country, preferably West-European.

Context

The results of this project will be part of the Poseidon Project (www.esi.nl/poseidon and www.win.tue.nl/~cwillems), where Dutch universities are challenged by the industrial partners Thales Nederland (www.thales.nl) and Noldus IT (www.noldus.nl). The visualization group conducts research in the area of visualization of spatio-temporal data. In practice this means that we try to visually analyze moving objects (Thales → ships, Noldus → animals) to find behavioral patterns. Data of moving objects is per object a list of tuples (trajectory) containing: time, position, and other attributes such as speed or direction. Since the data is obtained by sensors with a high frequency the data size is often large.

Description

We have made a blue-print (figure 1) for a tool that helps the user to visually explore a data set of moving objects. The big picture is as follows. On the right-hand side a matrix of pictures is given, where on the axis two attributes are displayed, in this case “ship type” and “Quality of Service (QoS)”. An attribute axis is divided in editable bins. Some bins have a meaning, such as a class of “large ships” containing “tankers and container carriers” for the “type”-attribute or “Morning” for time. From this matrix we can go up and down in the analysis. By going up, the user wants to know which attributes are interesting to explore using the matrix on the left. By drilling down in the analysis, the user wants to compare two pictures of the right matrix, like “tankers in the morning” and “tugs in the evening”.

The challenge of this project is to write a prototype that can handle large amounts of data in an interactive way. It should be able to use position in Euclidian (X,Y) and Geographic coordinates (latitude, longitude) to explore both ship and mouse data. We encourage to use Java with the JOGL OpenGL bindings. If needed it is possible to use CUDA for GPGPU programming, using C++ and JNI/JNA or the new Java CUDA bindings Jacuzzi (apps.sourceforge.net/wordpress/jacuzzi/).

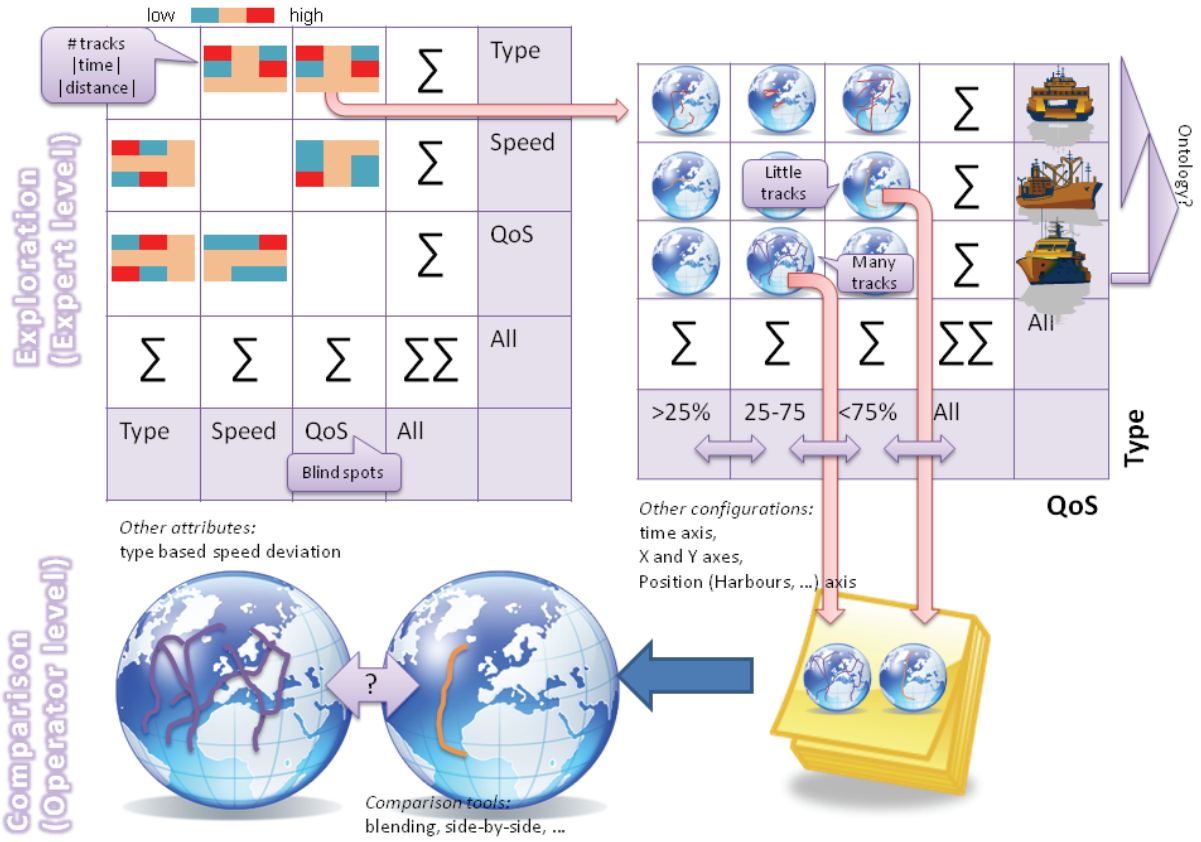

Figure 1: Visual exploration of high dimensional trajectories

Extension to master project

This project can be extended to a master project by exploring the following:

- Correlation measures for attribute selection
- Visualization techniques for showing trajectories in the right matrix
- Techniques to compare trajectory data sets at data level or image level