Visual Analysis of Floating Taxi Data based on selection areas

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Extended Abstract

Tracked movement from numerous observed objects includes often large data size and is difficult to handle, especially in terms of visualization. In the following we describe the possibility of getting more insight into massive movement data. Our inspected data set consists of more than 7000 observed taxis in Shanghai and is referred to as Floating Car Data (FCD). With this term numerous approaches appeared in the last decades facing the problem of how to connect digitized road network with tracked positions of moving objects. The aim is often to improve the modelling of traffic in road networks. Since FCD sets of taxis have often large size not only problems of reasonable processing are appearing but as well advanced ideas of geovisualization. Established interactive traffic maps show one possible solution for the visual inspection. Other approaches use advanced techniques for the detection of interesting patterns, which may be connected with appearing events (e.g. congestion).

Visual analysis tools for large FCD sets utilizing linked views were investigated by for example Tominski et al. (2012) and Ferreira et al. (2013). They make use of area selections for recorded tracks of moving objects with the aim of representing more detailed information at certain locations. Following up on this approach, we introduce a method for detailed spatiotemporal inspection of FCD partitions: selection areas for linking traffic flow information with diagrams and other visual representations. Besides information based on FCD, it is possible to link other data sources, like air quality measures, data on the public transport and traffic accidents or data coming from social networks. These interactive area selections may have the aim of detecting spatiotemporal correlations between vehicle traffic and pollution in the area around a certain building or crossroads. We analyze the relation between global and local view of derived (averaged) traffic flow

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parameters and the comparison with additional interpolated data on particulate matter (PM2.5). The components of a possible linked visualization display for the described example are pictured in Figure 1.

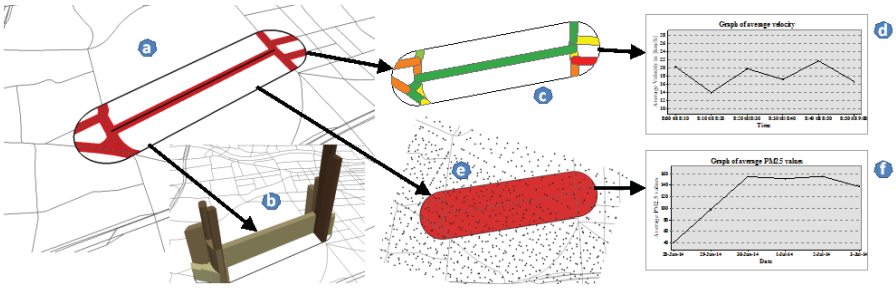

Figure 1. Possible display of a global and local view on FCD with (**a**) road selector on road network; (**b**) extrusion of road segments based on taxi density; (**c**) coloration based on average velocity ranges; (**d**) graph of average velocity; (**e**) proportion of interpolated PM2.5 values and (**f**) associated graph.

This method of inspection helps to discover different aspects of traffic and its correlation with air pollution. Resulting from this knowledge, it may be possible to facilitate further processing and visualization steps for FCD. The association of different data sets is only based on a selected area in space (selection areas) and the time component. Graphical data representations include 3D surface extrusions and other visualization techniques based on density estimation, interpolation and weighting of taxi FCD records and trajectory partitions within selected areas.

Our idea consists of providing traffic information ("microscopic" traffic patterns) for a possible end user and of giving additional information on "the raw" FCD and on other information, like air quality. With this method, we aim to extend the concept of a static traffic map for providing more interactivity in the visual analysis process. This may help to detect long term trends of the inspected quantities of selected areas. The proposed method can be tested based on its practical ease of use for a potential user. The results of this evaluation may be the initial point for the conception of a possible graphical user interface (GUI) for the visual analysis of FCD.

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