Simple D3.Js Visualization for airplane delay dataset

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1 Introduction

Over the last years, the amount of flights and U.S population have increased reciprocally. These raises had a direct impact on supply-demand pricing, enhancing the airlines offers. As matter of facts, there are more people who have the willingness to take a plane for a short distance, than to travel in another means of transport like buses or personals vehicles. This fact came up with an increment in the number of flight routes, population concentration areas and overcrowding airport runway.

Strictly speaking, these issues can be translated in new challenges in terms of traffic control regulation, security guarantees and delays prevention systems. Related works have proposed different prevention measures and services to anticipate any indecent or hindrance during the passenger trip.

This work was conceived as an alternative of the related proposals, particularly we think that enhancing the visual understanding by new visualization methods. As an example, an inexperienced person can understand the situation in order to make efficients decisions as the data comes up.

We have assumed that the information will be treated and processed in real time over its final implementation. In order to validate our data visualization approach a dataset from the U.S. Department of Transportation's (DOT) was studied and explored. The DOT dataset tracks the on-time performance of domestic flights operated by large air carriers. Summary information on the number of on-time, delayed, canceled and diverted flights appears in DOT's monthly Air Travel Consumer Report published about 30 days after the month's end. DOT have began collecting details on the causes of flight delays since June 2003. This version of the dataset was compiled from the Statistical Computing Statistical Graphics 2009 Data Expo.

This work is structured as follows. In this Section the objectives are listed. The section state of the art introduce the related work. Finally our application methodology is described below.

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2 Conception path

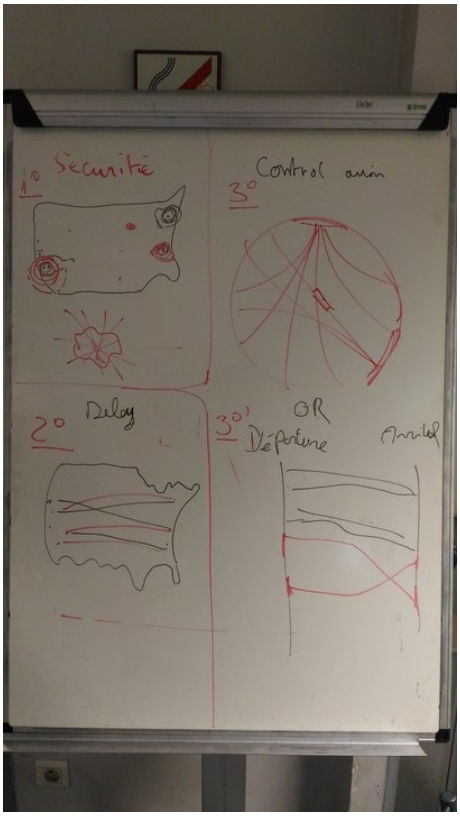

Figure 1: 3 diagrams to visualize problems of security, delay and air traffic control

We predict to build 3 diagrams, one for each problematic we want to handle.

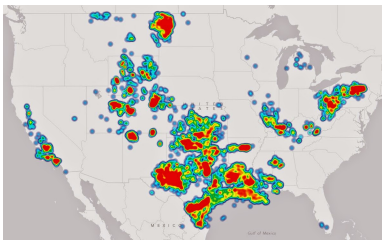

Figure 2: Example of heat-Map

The Figure 2 is used to see how is spread the air traffic in the different airports of the United States. This diagram would be a heat-map who shows in which airports the traffic is more dense. In terms of security, this kind of visualization could be useful to improve the safeguard of airports.

FIGURE 3: Example of path of flights in the USA

Figure 3 is a map of the United States who shows the delay of airplanes depending on their departure and arrival. We aim to see where the delay is imortant to be able to improve the regulation of air traffic.

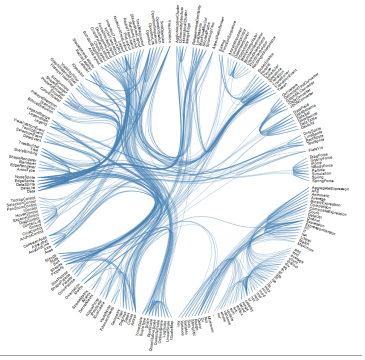

FIGURE 4: Example of hierarchical Edge Bundling

Finally, Figure 4 is a view which allow to see where comes from and where goes airplanes without any concept of delay. The only goal here is to show the main paths used by airplanes and try to see if some of them are more practiced than others. Whereas the previous drawing (Airports linked on a map of the USA) seems to show the same data, we think this one could bring a better and easier toolkit to understand spatial data.

We have 2 methods to make this. The first one is a circular diagram where airports are placed around the circle. Thus, each lines establish a relation between two airports, one is the departure, the second one, the arrival. This method contains the same spatial information, however it enhances the knowledge capacity of this graph, as it describes a temporal dimension. We may choose at least one of the both drawing to visualize airplane's paths.

3 RELATED WORK

Data visualization methods have been applied to traffic datasets for many years. One of the earliest chart is the Marey's time-line graph [2]. Despite the rudimentary of his being, this chart was a first step forward to understand the opportunities of what data-visualization can offer in this domain. However, this solution is difficult to apprehend as the cardinality of data grows up. This chart, firstly made to study train delay, have been used in many alternative ways. One of the most common one is to alter every line thickness to fit the density also known as load in train traffic study.

Density visualizations such as heat-maps improved the understanding of spatial-temporal characteristics of traffic related data. [4] This method, has become a widely applied technique for visualizing complex spatial patterns [1]. The discrete distribution of travel is processed into a continuous color distribution, where the travel demand intensity and trip hot spots are intuitively revealed. As such, heat maps can provide an interpretable visual representation of complex spatial distribution patterns, which brings a fresh perspective to estimate an activity.

In order to trustfully appreciate the air fights activity, some ideas were to plot the plane movements as a straight line from the take off airport to the landing one. Such method is often used to extract pattern from large dataset. [3] As we have a large dataset as described in the introduction. This ability to highlights some key points out of chart is non-trivial issue. Furthermore, displaying temporal patterns is considerably harder than showing static patterns.

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