Exploring Traffic in Brest Harbor by Trajectory Aggregation

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Abstract. For exploring traffic in Brest harbor, we aggregate trajectories of vessels by data-driven Voronoi tessellation and by areas of interest. Traffic dynamics can be studied at a desired temporal resolution.

1 Introduction

In this abstract, we address three questions of the data challenge:

1. Extracting the main traffic flows
2. Computing O/D matrices
3. Assessing the temporal distribution of the traffic

An initial qualitative overview of the traffic flows can be obtained by semi-transparent drawing of the trajectories on a map. An inspection of this visualization suggests that there exist several pre-defined traffic lanes used with different intensity. To get a quantified overview of the traffic flows, we apply a method for trajectory generalization and summarization [1]. This method extracts characteristics points of trajectories (starting and ending points, points of intermediate stops of a given duration, and points of turns), groups them into spatial clusters with a desired spatial extent (radius), and uses the cluster centers as generating seeds for Voronoi tessellation. Based on the tessellation, the trajectories are aggregated into flows. Figure 1 shows the flows that are based on a tessellation obtained for point clusters with 1km radius. The widths of the flow symbols are proportional to the total counts of moves between the cells of the tessellation. We can observe the spatial configuration of the traffic lanes and the intensity (frequency) of their use. In particular, we can see that some flows are asymmetric.

Our interactive aggregation tool can dynamically re-aggregate the data for any type of query, for example, by vessel types, by vessel attributes, such as median speed, or by time (hour of day, day of week, month etc.).

Figure 1 shows that there are several major ports in the harbor and two entry points used by vessels sailing to/from the westward and southward directions. To assess the flows between these control regions, we've outlined them by polygons and used these polygons for trajectory aggregation. Figure 2 shows the overall flows between the selected polygons and the temporal dynamics of the trips counted by the hours of the day. We can see that the most intensive traffic is between the area of Port Militaire and Port de Commerce in the northern part of the harbor and Ile Longue in the southern part. There are numerous connections between the northern area, Ecole Navale

adfa, p. 1, 2011.

and Ile longue, more in the clockwise direction. Many trips start and end in the northern area, their number is represented by a circular symbol. The daily dynamics diagrams show peaks of the visit counts in the morning and early evening hours.

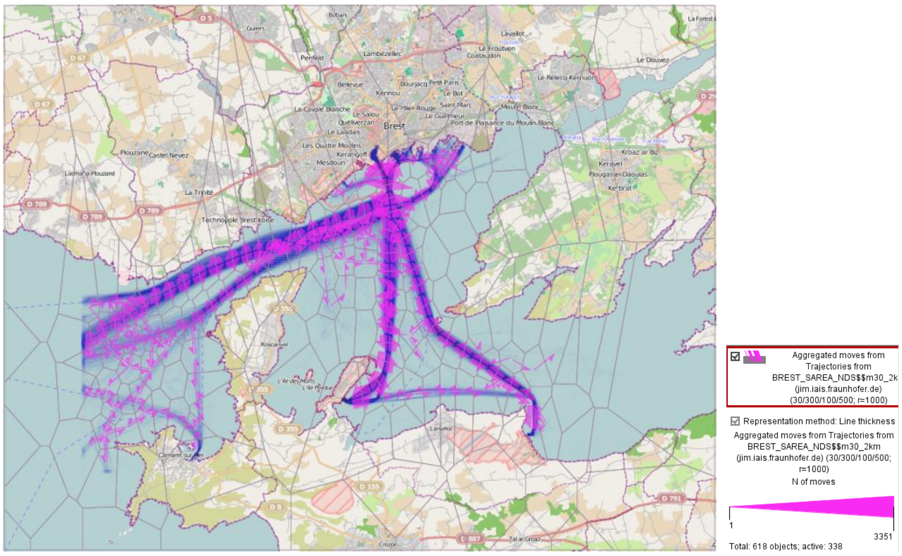

Fig. 1. Flows by Voronoi tessellation

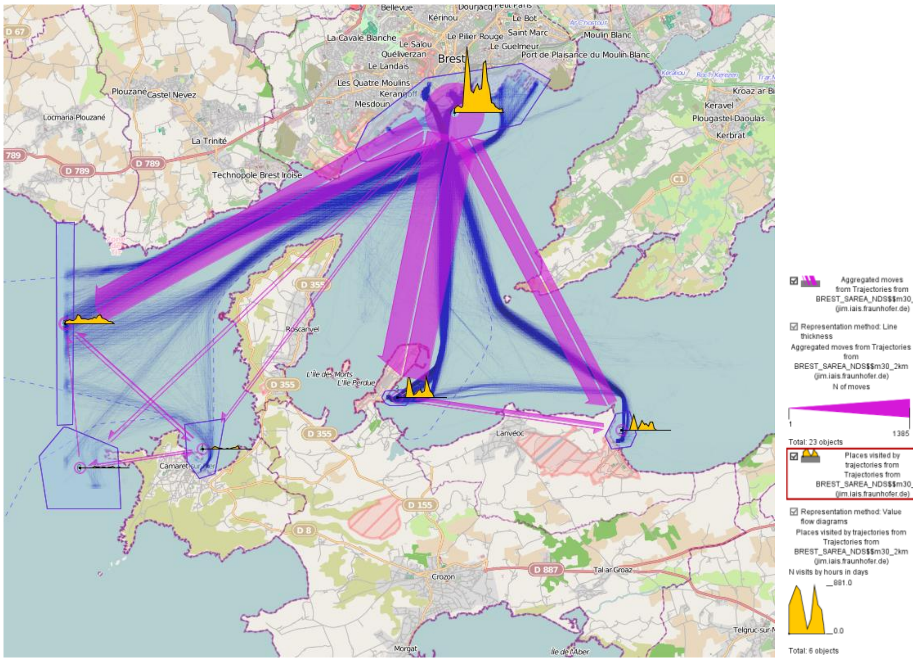

Fig. 2. Flows between the ports and daily dynamics of activities in the ports

The resulting aggregates can also be represented in the form of an O/D matrix with the counts of the trips between the areas of interest. Similarly to other aggregates, this matrix can be re-computed dynamically for selected subsets of the data.

The diagrams in Figure 3 show the daily dynamics of the flows in all directions. We can further observe the quantitative asymmetry and different dynamics of the flows between the Brest city in the northern part and Ile Longue and Ecole Navale in the southern part. The trips starting and ending in the northern part are more frequent during the morning hours.

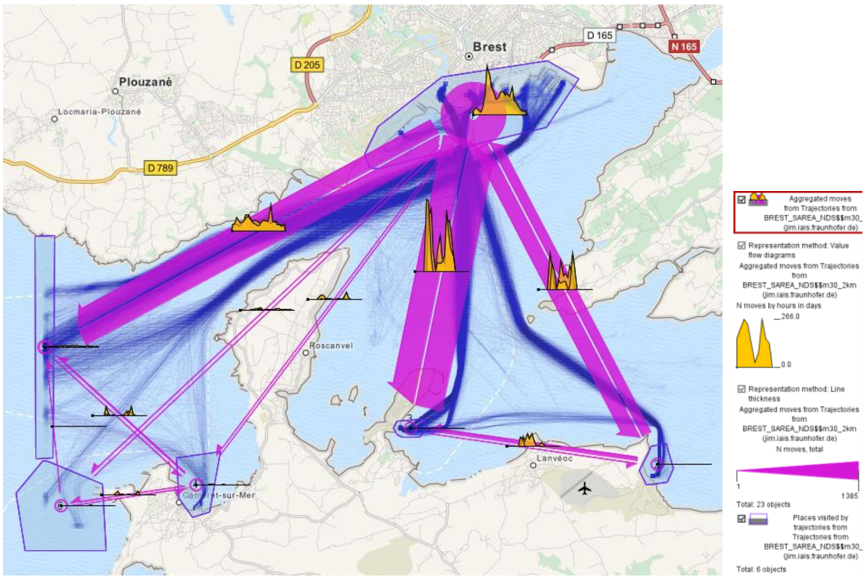

Fig. 3. Dynamics of flows between ports

Further analysis of vessel traffic can be performed by combining additional visual analytics tools and methods, as suggested by [2,3]. These possibilities will be demonstrated at the workshop.

References

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