# Exploring Trajectory Attributes in Brest Harbor

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Abstract. We describe a procedure for analyzing trajectory attributes that includes spatial clustering of the trajectories and visual analysis of the distribution of attribute values in the temporal and spatial dimensions.

1 Introduction

We extract trips from the tracks of the vessels by removing stationary points and then dividing the tracks by temporal gaps of more than 30 minutes and spatial gaps of more than 2km. Knowing the positions of the major ports, we use them for further splitting. In the result, we obtain 7,702 trajectories. To detect clusters of repeated trips, we use the density-based clustering method Optics with a similarity function that assesses the similarity of two trajectories based on the geographic distances between their starting and ending points [1]. Our visual analytics toolkit supports a rich library of similarity measures [1,2] and can be applied to data in main memory or in a database [2] for scalable processing. More sophisticated similarity measures supported by moving object databases are also available [3].
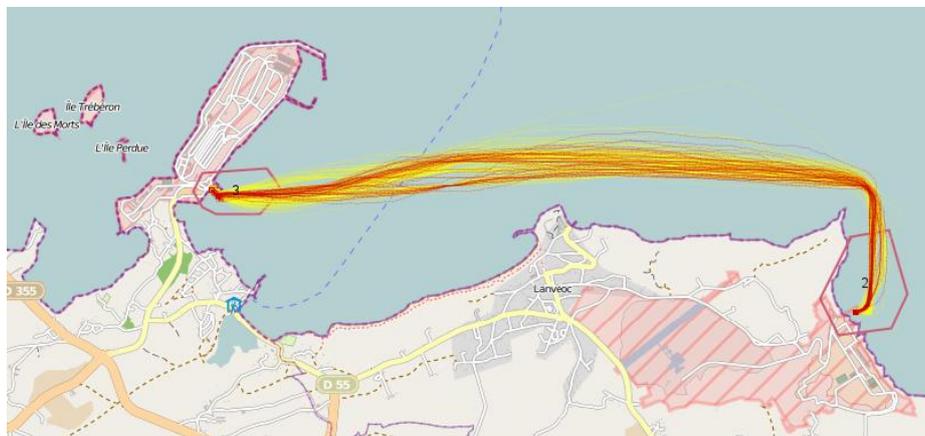

Fig. 1. Two clusters of trajectories sailing from Ecole Navale to Ile Longue (220 trajectories, yellow) and back (56 trajectories, red)

We demonstrate the possibilities for analysis by an example of two clusters of trajectories connecting Ecole Navale and Ile Longue in the southern part of the harbor (Figure 1). Figure 2 shows the temporal distribution of these trajectories. We can
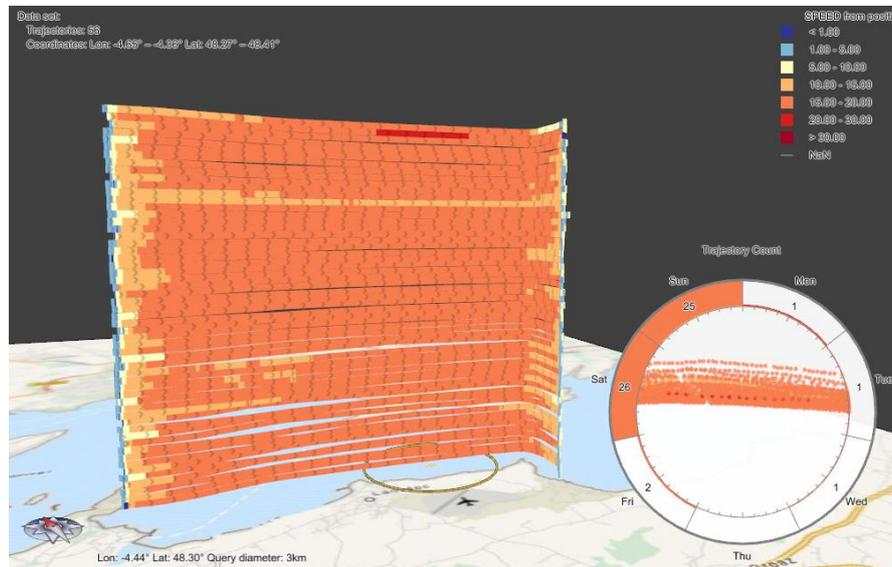
observe that these trips mostly occur in morning and evening hours of Saturday and Sunday (days 6 and 7) and in the middle of day during the working days.
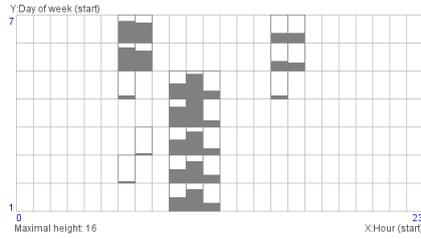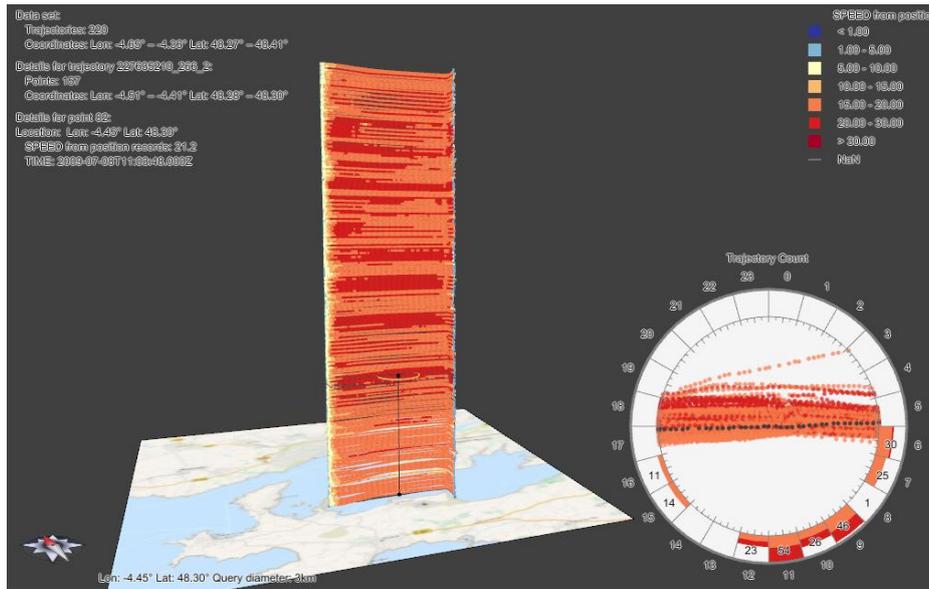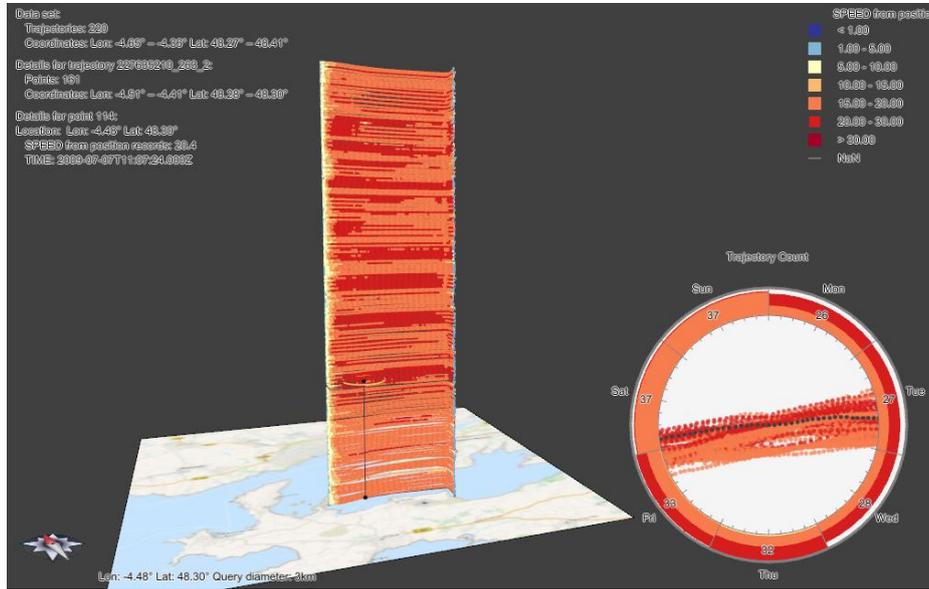

Fig. 2. Distribution of the trips for the days of week and hours of day
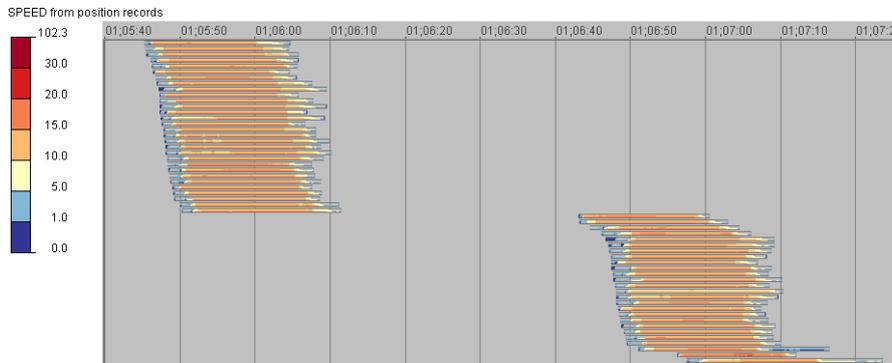
Fig. 3. Temporal variation of the speed values in the trips from Ile Longue to Ecole Navale.

**Fig. 4.** Variation of the speed values along the selected trajectories.

Fig. 5. Variation of the speed values along the trajectories from Ecole Navale to Ile Longue.

We select one attribute of these trajectories, speed, for further analysis (paper [5] includes an example of analyzing another attribute, tortuosity). The temporal positions of 56 trips and the temporal variation of the speed values during these trips are shown in a time bar display [4] in Figure 3. We can see that a usual trip lasts for about 20 minutes and that all trips start either in the interval 5:35-5:40AM or bin the interval

6:45-6:50AM. All trips have quite similar dynamics of the speeds. Figure 4 presents a visualization of the same data by means of the trajectory wall technique [5]. The time query panel in the bottom right corner shows that most of these trips happen either on Saturday or on Sunday.

Figure 5 applies the same visualization to 220 trips in the opposite direction. It is noticeable that higher speed values occur more often during the working days than during the weekends and more often in the middle of the day than in the morning or in the evening. Further inspection of these trajectories on the time bar display (Figure 6) reveals that the morning trips have been shifted by one hour back during the period from the 29th of March 2009 till the 24th of October 2009. This period corresponds to the summer time period in France in 2009.
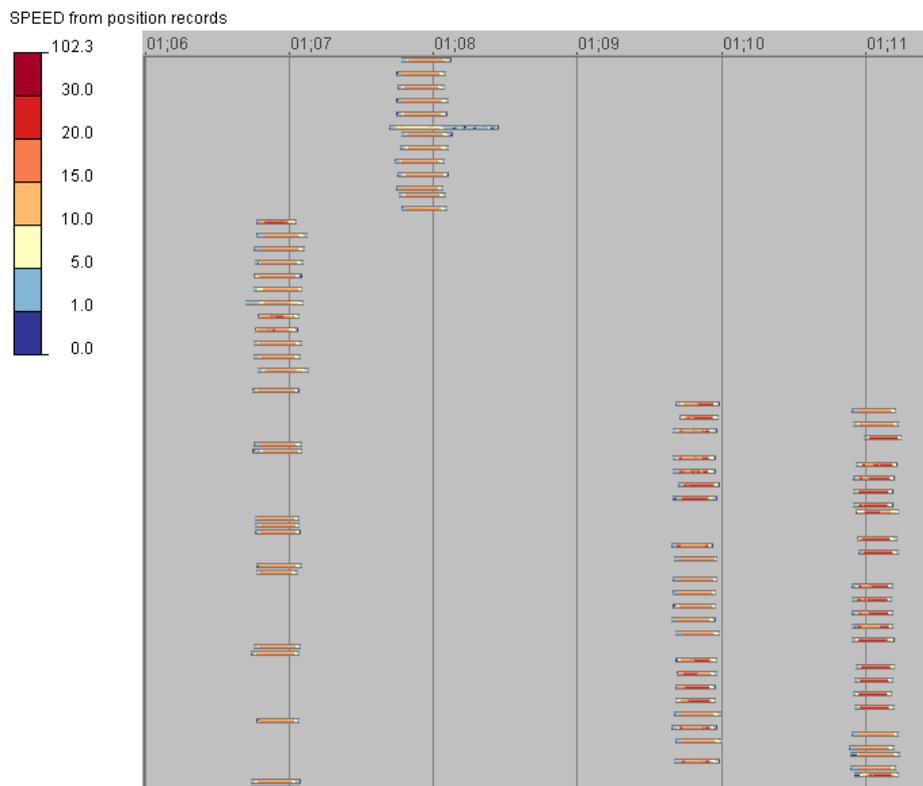
Fig. 6. A fragment of trajectory time bar for trips from Ecole Navale to Ile Longue.

Further analysis of the attributes of vessel traffic can be performed by combining additional visual analytics tools and methods, as suggested by [6,7]. Paper [6] presents an example of a multi-perspective analysis of another vessel traffic data set. Different parts of the analysis focus on trajectories, events, places of interest, and time intervals. These possibilities for extended analysis will be demonstrated and discussed at the workshop.

Acknowledgements

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