World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:14, No:04, 2020

# Modeling Average Paths Traveled by Ferry Vessels Using AIS Data

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**Abstract :** At the USDOT's Bureau of Transportation Statistics, a biannual census of ferry operators in the U.S. is conducted, with results such as route mileage used to determine federal funding levels for operators. AIS data allows for the possibility of using GIS software and geographical methods to confirm operator-reported mileage for individual ferry routes. As part of the USDOT's work on the ferry census, an algorithm was developed that uses AIS data for ferry vessels in conjunction with known ferry terminal locations to model the average route travelled for use as both a cartographic product and confirmation of operator-reported mileage. AIS data from each vessel is first analyzed to determine individual journeys based on the vessel's velocity, and changes in velocity over time. These trips are then converted to geographic linestring objects. Using the terminal locations, the algorithm then determines whether the trip represented a known ferry route. Given a large enough dataset, routes will be represented by multiple trip linestrings, which are then filtered by DBSCAN spatial clustering to remove outliers. Finally, these remaining trips are ready to be averaged into one route. The algorithm interpolates the point on each trip linestring that represents the start point. From these start points, a centroid is calculated, and the first point of the average route is determined. Each trip is interpolated again to find the point that represents one percent of the journey's completion, and the centroid of those points is used as the next point in the average route, and so on until 100 points have been calculated. Routes created using this algorithm have shown demonstrable improvement over previous methods, which included the implementation of a LOESS model. Additionally, the algorithm greatly reduces the amount of manual digitizing needed to visualize ferry activity.

**Keywords :** ferry vessels, transportation, modeling, AIS data

**Conference Title :** ICSSM 2020 : International Conference on Spatial Sciences and Management

**Conference Location :** Boston, United States

**Conference Dates :** April 23-24, 2020