

Filtering and Smoothing Techniques for Compensating Public Transport GPS Tracks

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Abstract

Purpose: This thesis aims to provide a filtering and smoothing technique for GPS tracks that were recorded during travelling with public transport vehicles. The reason for the necessity to apply a filtering technique to the GPS data is that under certain system settings of the mobile devices, and in certain environmental conditions, the GPS data is inaccurate or not continues. For this purpose, specific information of the vehicle was collected and used not only to improve the detection of erroneous GPS locations but also to correct or remove those locations.

Approach: In a first phase, collected dataset is visualized and analysed to find the most common error patterns that are caused by inaccurate locations. The second phase involves collecting specific information for the vehicle as the ways that can be used by this vehicle. Given that information more procedures can be applied to identify the patterns caused by a wrong GPS location and improve the locations with precise information of possible states that the vehicle can possess. The final phase is to apply a Kalman filter to filter out more minor GPS locations errors and smoothen the track using the revised GPS locations.

Conclusion: Due to the limited datasets and the discrepancy between the performances of the datasets, it is not possible to validate the performance of this filtering and smoothing technique. An analysis of the Hybrid filtered tracks with an worsened performance shows that an adjustment to the maximum possible distance calculation may improve the performance, but perhaps degrades the performance due to side effects *e.g.* not removing all impossible states of the vehicle as indicated by the maximum allowed velocity.

Research limitations: Various types of public transport modes lead to different movement and speed patterns. This thesis focused on railway vehicles. Furthermore, vehicle specific information used for filtering and smoothing technique is limited to Switzerland. Therefore, these findings may need to be adapted to other countries.