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Utilizing Data Mining Techniques to Predict Expected Freeway Travel Time from Experienced Travel Time

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ABSTRACT

1 As the most important real-time traveler information, travel time can be either experienced or
2 expected (i.e. to be experienced). When a vehicle completes a trip, the travel time refers to the
3 experienced travel time. In contrast, when a vehicle starts its journey, the travel time is unknown
4 but can be predicted, which is the expected travel time. Although the experienced travel time is
5 termed as the real-time travel time, a traveler may encounter a somewhat different travel time
6 (from expected travel time) due to the changing traffic conditions. Therefore, expected travel
7 time needs to be predicted. In this study, the expected travel time was predicted from the
8 experienced travel time using the data mining techniques such as k-nearest neighbor (k-NN),
9 least squares regression boosting (LSBoost) and Kalman filter (KF) methods. After comparing
10 the performances of KF to corresponding modeling techniques from both link and corridor
11 perspectives, it is concluded that the KF method offers superior prediction accuracy in a link-
12 based model. Moreover, the effect of different noise assumptions was examined and it is found
13 that the steady noise computed from the full-dataset had the most accurate prediction. A data
14 processing algorithm, which processed more than a hundred million records reliably and
15 efficiently was also introduced.

16 **Keywords:** experienced and expected travel time, arrival and departure time based travel time,
17 travel time prediction, data mining, Kalman filter, modeling Kalman filter noise, K-nearest
18 neighbor method, Boosting, LSBoost.

19 1. Introduction

20 Travel time is an important component of Advanced Traveler Information Systems (ATIS),
21 as it is a key factor for travelers who are faced with non-recurring congestion (Khattak et al.,
22 1996). Aside from measuring transportation system performance, travel time has been used to
23 predict future travel time and traffic state, which help the traffic operations room in versatile
24 ways. Amongst all available techniques, Bluetooth has emerged as one of the fastest growing
25 data collection technologies whose market share is continuing to rise, mainly due to its cost
26 effectiveness (Blogg et al., 2010, Moghaddam and Hellinga, 2013). Bluetooth is a probe-based

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