COMPARATIVE ANALYSIS OF VARIOUS TRAVEL TIME ESTIMATION ALGORITHMS TO GROUND TRUTH DATA USING ARCHIVED DATA

Kristin A. Tufte, Christopher M. Monsere, Robert L. Bertini, Sirisha Kothuri, Aaron Breakstone
Portland State University
Department of Civil & Environmental Engineering
Intelligent Transportation Systems Laboratory
tufte@cecs.pdx.edu

Advanced Traveler Information Systems (ATIS) are a critical component of regional intelligent transportation systems (ITS). One critical component of ATIS is the ability to accurately provide the public with estimates of current travel conditions between strategic points along critical freeway segments and arterials. While many technologies are available for real-time estimates of traffic conditions, the most common data source is inductive loop detector data from instrumented freeway systems. Estimates of travel times provided to the traveling public may involve numerous delivery systems, including a desktop PC, an in-vehicle display, a handheld device, highway advisory radio and dynamic message signs (DMS). Past work has shown that there is a certain degree of error inherent to the process of automatically generating travel time estimates from loop detector data, especially under congested or incident conditions. Difficulties can arise when communications are disrupted or when individual detectors or stations periodically malfunction, report inaccurate data, or are placed in a way that masks actual traffic conditions on key links or provides limited coverage of the freeway system. Various algorithms, both practical and theoretical, have been proposed or used to estimate travel times using inductive loops but have not been compared in a systematic fashion.

Previous research by Portland State University has developed a rich set of ground truth data that consists of probe vehicle data collected on Portland freeways in April and May 2005 and bus dispatch data obtained from TriMet—the Portland metropolitan area's transit service. Further, PORTAL - the Portland region's Archived Data User Service (ADUS) - contains data from almost 500 inductive loop detectors on Portland area freeways from July 2004 to the present, at a 20-second level of aggregation. All of the loop detector stations are dual loop configuration placed in the mainline lanes located downstream of on-ramps in the freeway network and produce data on speed, volume, and occupancy. Several travel time estimation algorithms used in practice, in addition to algorithms based on traffic flow theory, were implemented in the PORTAL architecture. These algorithms vary in complexity, in the number of data values they require to produce an estimate, and in the level of detail contained in the trajectories they produce. A statistical comparison of the algorithms' travel time estimates with ground truth data for a portion of the I-5 corridor in Portland was conducted. Morning and evening peak periods and uncongested conditions are included in order to demonstrate the performance of the various algorithms under different traffic conditions. A summary of results from this analysis is presented as well as recommendations of which algorithms are the most effective and accurate in which conditions. This evaluation can be used by transportation professionals to assess their travel time calculation methodology.

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