Travel time is considered as one of the most important traffic variable both for systems' users, as well as operators, as can be identified by the industrial applications that have been regarded for the past years. The current era of big data availability, new opportunities and threats are emerging in modeling and predicting travel time. The scope of this paper aims to the introduction of reliability metrics in travel time predictions, additionally to the requirements for prediction robustness and accuracy. For achieving this, a novel dynamic and adaptive mechanism for predicting future travel time is proposed, based on stochastic treatment of observed travel times that are conditioned by multiple traffic variables and collected from multiple sources (loop detectors and Bluetooth sensors), on a dynamic and adaptive control scheme. The methodological foundations of the proposed prediction mechanism rely on semi-parametric hazard-based modeling, suitably introduced in an adaptive calibration mode, able to project travel time distributions. Application results are presented in detail, using extensive database from the Cyprus Traffic Control Centre, exposing the notable benefits that can be obtained from the use of Big Data stochastic analysis in travel time predictions, especially in realistic circumstances.

Keywords: Travel Time Reliability; Dynamic Stochastic Modeling; Big Data.

Abstract

The proposed control framework for predicting travel time in real time is based on the historical and long-term travel time data from different origins, destinations (O - D) locations, by taking into account available disaggregate traffic data.

The proposed control framework for predicting travel time in real time, constitutes the most significant component of this information system that incorporates:

1. Input Estimation
2. Data Collection
3. Data Filtering
4. Stochastic treatment of observed travel times that are conditioned by multiple traffic variables and collected from multiple sources (loop detectors and Bluetooth sensors), on a dynamic and adaptive control scheme.

The reliability of travel time predictions depends on the choice of reliability threshold. The choice of the suitable percentage for reliable travel time prediction depends on the reliability on the selected OD pairs for the predicted travel time.

The authors acknowledge the Department of Public Works of the Ministry of Transport, Communications and Works in Cyprus for providing the data used in this study.

Methodological Framework

The proposed control framework for predicting travel time in real time is based on the historical and long-term travel time data from different origins, destinations (O - D) locations, by taking into account available disaggregate traffic data.

The proposed control framework for predicting travel time in real time, constitutes the most significant component of this information system that incorporates:

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Background Research

Travel time is considered as one of the most important traffic variable both for systems' users, as well as operators, as can be identified by the industrial applications that have been regarded for the past years. The current era of big data availability, new opportunities and threats are emerging in modeling and predicting travel time. The scope of this paper aims to the introduction of reliability metrics in travel time predictions, additionally to the requirements for prediction robustness and accuracy. For achieving this, a novel dynamic and adaptive mechanism for predicting future travel time is proposed, based on stochastic treatment of observed travel times that are conditioned by multiple traffic variables and collected from multiple sources (loop detectors and Bluetooth sensors), on a dynamic and adaptive control scheme. The methodological foundations of the proposed prediction mechanism rely on semi-parametric hazard-based modeling, suitably introduced in an adaptive calibration mode, able to project travel time distributions. Application results are presented in detail, using extensive database from the Cyprus Traffic Control Centre, exposing the notable benefits that can be obtained from the use of Big Data stochastic analysis in travel time predictions, especially in realistic circumstances.

Keywords: Travel Time Reliability; Dynamic Stochastic Modeling; Big Data.

Purpose

1. Introduction of reliability metrics in travel time.
2. Time travel modeling and prediction based on semi-parametric hazard-based modeling.
3. The dynamic probabilistic estimation of travel time between a predefined set of Origin-Destinations (O-D) locations, by taking into account available disaggregate traffic data.

Methodological Framework

The proposed control framework for predicting travel time in real time is based on the historical and long-term travel time data from different origins, destinations (O - D) locations, by taking into account available disaggregate traffic data.

The proposed control framework for predicting travel time in real time, constitutes the most significant component of this information system that incorporates:

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Application To Travel Time Prediction and Results

Test bed Area

1. Northern Europe: FHWA, United Kingdom, Cyprus.
2. Population: 300,000 inhabitants.
3. 24 Inductive Loops.
4. 24 Bluetooth Sensors.
5. Population: 300,000.
6. 27 Bluetooth sensors.
7. 27 selected OD pairs.

The green line on the map depicts the administrative regions of the study area, separating the city into northern and southern sections.

Conclusions

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Conclusion

The reliability of travel time predictions depends on the choice of reliability threshold. The choice of the suitable percentage for reliable travel time prediction depends on the reliability on the selected OD pairs for the predicted travel time.

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