CONTENTS

PREDICTING PARKING SPACE OCCUPANCY

Student information
Author: Robert Boer
Institution: Erasmus University Rotterdam
Graduation year: 2017

Know before you go: predicting parking space occupancy by exploiting publicly accessible data

Global urban population is growing at rapid pace and as a result, the demand for mobility in urban areas is exploding. Nowadays, road networks become increasingly congested and as a consequence massive amounts of time, fuel and money are wasted. In certain urban areas, a significantly large amount of 30 to 45% of overall traffic is caused by cars in search of a parking space.

In an attempt to guide motorists towards vacant parking spaces, currently existing solutions provide real-time parking space availability information. These solutions are far from optimal, as the information disseminated might have already become obsolete by the time of arrival.

It would therefore be of great benefit to motorists when parking space availability upon arrival can be predicted in an accurate manner well ahead of time.

Although previous research has attempted to predict parking space by including external variables in predictive models, it falls short in attributing significant attention to the identification of external variables that are capable of improving accuracy obtained from prediction algorithms.

Furthermore, prior literature has failed to investigate the impact of extending the time horizon of predictions on the prediction error of the models.

In order to close these gaps in literature,

1. we identify to what extent the inclusion of external, publicly accessible data in the parking space prediction model influences its predictive performance and
2. we assess the effect of extending the forecasting horizon up to 24 hours on the predictive performance of parking space prediction models.

Inclusion of external variables

For this purpose, we leverage data on three distinct parking facilities in the city of Amsterdam, the Netherlands. Our research shows that the inclusion of external variables in prediction models for parking space occupancy can significantly improve its performance. Compared to baseline models that only leverage historical occupancy, we are able to reduce error rates with up to 49.15% by including external variables.

However, the choice for which external data sources to include in these models is heavily dependent on the parking facility studied and the predictive modelling technique used. Nevertheless, we find evidence that including Fourier terms as external variables leads to improved forecast accuracy in nearly all situations.

Inclusion of event information

Furthermore, we find that the inclusion of event information as external variables in Artificial Neural Networks leads to significant forecast improvements, particularly for parking facilities situated in areas where (large-scale) events happen on a regular basis.

Moreover, we find that including all external variables into the predictive model, does not necessarily lead to the best predictive model in terms of accuracy.

Furthermore, our results show that, although forecast errors increase rapidly for small step ahead predictions, error rates typically converge to a stable and acceptable maximum error rate after predicting six hours ahead of time. This paves the way for informing motorists by disseminating parking space predictions in real

time via web-based - or smartphone applications or other media.