

Road Traffic Forecasting with Unknown Multiple Periodicities and Complex Patterns

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Abstract

We aim to forecast road traffic, given traffic data that may contain unknown multiple periodicities and complex patterns. As a data-driven approach, we consider the spatiotemporal relationship, both the long-term and unexpected short-term patterns in the temporal domain, and multiple periodicities in the long-term patterns, as well as other informative features such as flow and occupancy for an all-in-one traffic forecasting. The diverse patterns in the data are jointly considered via a Gaussian process regression-based learning method. Given traffic data with the aforementioned patterns, we first detect any possible hidden periodicities with the long-term inputs; subsequently, the detected multiple periodicities as well as the short-term and other complex patterns are compiled to form the feature set for unified traffic forecasting. The proposed method is close to an end-to-end approach which takes the raw traffic inputs and provides the prediction output after computation. That is, very little domain knowledge is needed from domain experts to find useful features from the traffic inputs for the prediction model training. In the effectiveness study, we evaluate the proposed method on a public RDE dataset. Given the data, the proposed method can reach one to two mph MAE in its peak performance for a challenging traffic forecasting 30 min ahead of the current moment, outperforming other state-of-the-art traffic forecasting methods in almost all cases.

Keywords : Gaussian process regression, Intelligent Transportation Systems, periodicity analysis, traffic forecasting.

Short Bio

Hsing-Kuo Pao (Kenneth) received the bachelor degree in mathematics from National Taiwan University, and M.S. and Ph.D. degrees in computer science from New York University. From 2001 to 2003, he was a post-doctorate research fellow in the University of Delaware, and later he joined in Vita Genomics as a research scientist. In 2003, he joined the department of computer science and information engineering in National Taiwan University of Science and Technology, and now a professor and chairman in the department. His current research interests include machine learning methodology and its applications such as IoT analytics, computer vision and information security.