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Real-time road traffic state prediction based on ARIMA and Kalman filter

Key words: Autoregressive integrated moving average (ARIMA) model; Kalman filter; Road traffic state; Real-time

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Motivation

- Most of the existing prediction methods are excessively intensive in different locations and conditions.
- Although the ARIMA model conducts short-term traffic prediction effectively, high prediction accuracy in a low-order ARIMA model and parameter estimation in a high-order ARIMA model are difficult to achieve.
- A new road traffic prediction method that can solve the difficulties found in single modeling methods and to improve prediction accuracy is needed.

Main idea

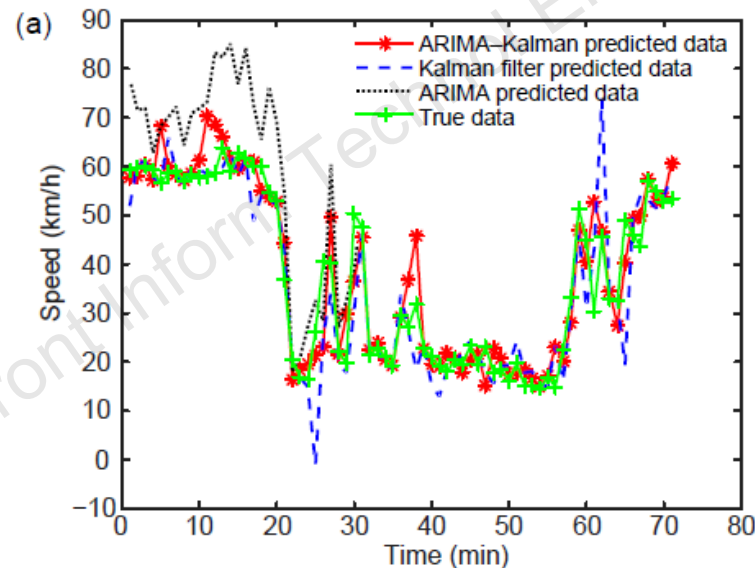
- High prediction accuracy in a low-order ARIMA model and parameter estimation in a high-order ARIMA model are difficult to achieve.
- Kalman filter can achieve a feasible prediction accuracy, but the states matrices are different to achieve.
- The ARIMA model was introduced into the Kalman filter to construct the state, measurement and updating equations to gain the hybrid model.

Method

1. The ARIMA model was constructed based on historical road traffic data.
2. The ARIMA model was introduced into the Kalman filter to construct the state, measurement and updating equations to complete the training.
3. The optimal model parameters corresponding to the smallest absolute percentage error of the historical prediction results were determined.
4. Real-time road traffic data were introduced into the proposed algorithm to complete the real-time road traffic data prediction.

Major results

- ARIMA-Kalman prediction method can reach high prediction accuracy than signal mode.



Speed prediction results of HI2075a on June 22

Conclusions

- The real-time road traffic state prediction based on ARIMA and Kalman filter has a higher accuracy.
- The traffic state prediction based on ARIMA and the Kalman filter model performs admirably in tracking trends in the variation of the traffic state.
- The proposed algorithm is more stable than the pure ARIMA model and Kalman filter.
- The proposed algorithm is easy to implement on a computer and is suitable for the online prediction of the road traffic state.