

Comprehensive Exam

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Spatio-temporal Data Analysis

Documentation

- Portland Freeway data <https://new.portal.its.pdx.edu/static/files/fhwa/FreewayData.zip> (page)
- Chen, X., Zhang, C., Chen, X., Saunier, N., & Sun, L. (2023). Discovering dynamic patterns from spatiotemporal data with time-varying low-rank autoregression. IEEE Transactions on Knowledge and Data Engineering <https://doi.org/10.1109/TKDE.2023.3294440>
- Cui, Z., Henrickson, K., Ke, R., & Wang, Y. (2019). Traffic Graph Convolutional Recurrent Neural Network: A Deep Learning Framework for Network-Scale Traffic Learning and Forecasting. IEEE Transactions on Intelligent Transportation Systems <https://arxiv.org/abs/1802.07007>
- Toru Seo, Alexandre M. Bayen, Takahiko Kusakabe, Yasuo Asakura, Traffic state estimation on highway: A comprehensive survey, Annual Reviews in Control, Volume 43, 2017, Pages 128-151 <https://doi.org/10.1016/j.arcontrol.2017.03.005>

Questions

The questions rely on [the available traffic data](#) from the City of Portland. The traffic data comprises three types of measurements, namely average speed, volume and occupancy. It is recommended to use the [5-min aggregated data](#).

For the following questions, it is recommended to look for sites with interesting traffic conditions including congestion (characterized by low average speeds).

1. Describe the spatial and temporal variability of traffic data (using two variables: volume and either speed or occupancy) across different sites by taking examples (for various sensor locations) in the provided sample.
2. Analyze the correlation between the data at the various sensor locations and how one can take advantage of these correlations and of the road network structure for tasks such as missing data imputation or traffic forecasting.
3. Present examples or categories of models that are may be used for forecasting (short or medium term) or to understand the relations (even causality) between the variables (including the

provided traffic variables and explanatory variables such as weather conditions or events).

Apply one of the models to one or more traffic variables (not necessarily using extra explanatory variables) and discuss the results.