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Transfer Learning with Graph Neural Networks for Short-Term Highway Traffic Forecasting

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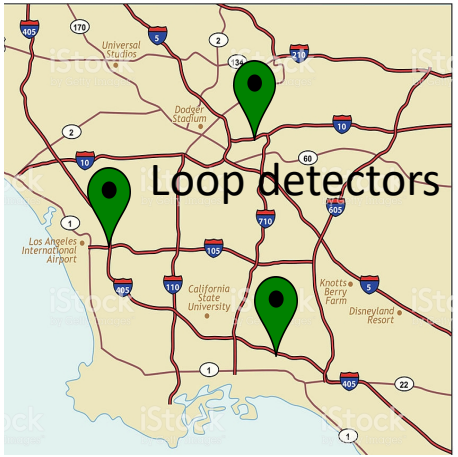
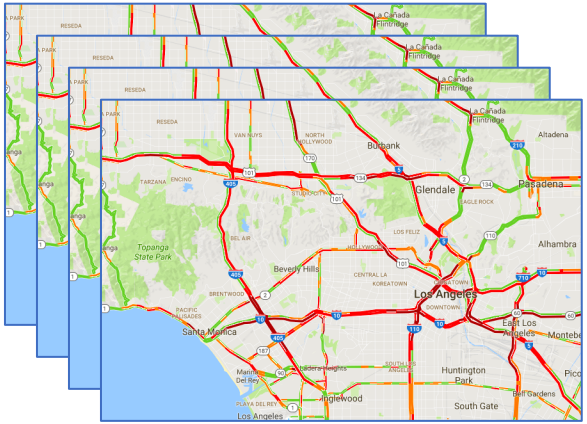
Traffic forecasting

Road network

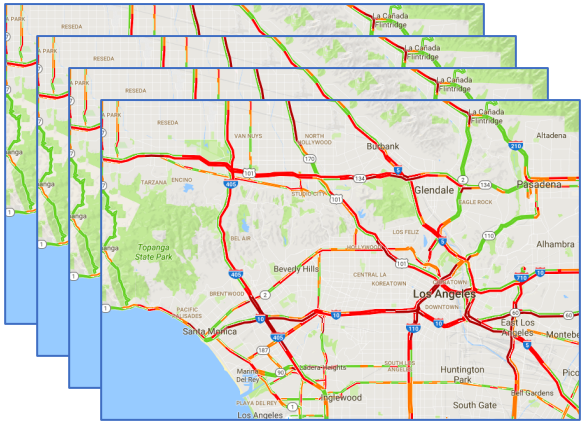


Historic traffic metrics



8.00 AM … 9.00AM

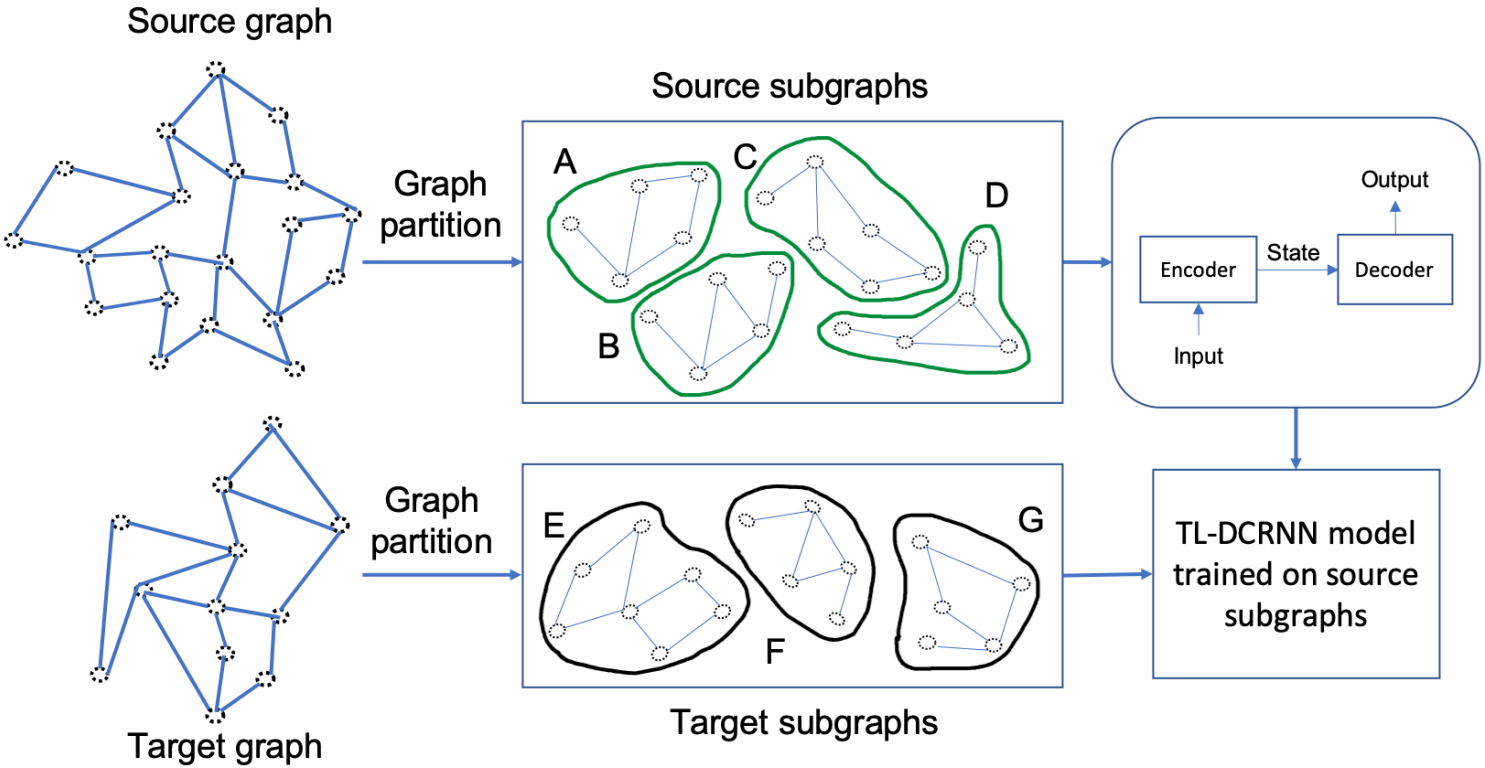
Future traffic metrics



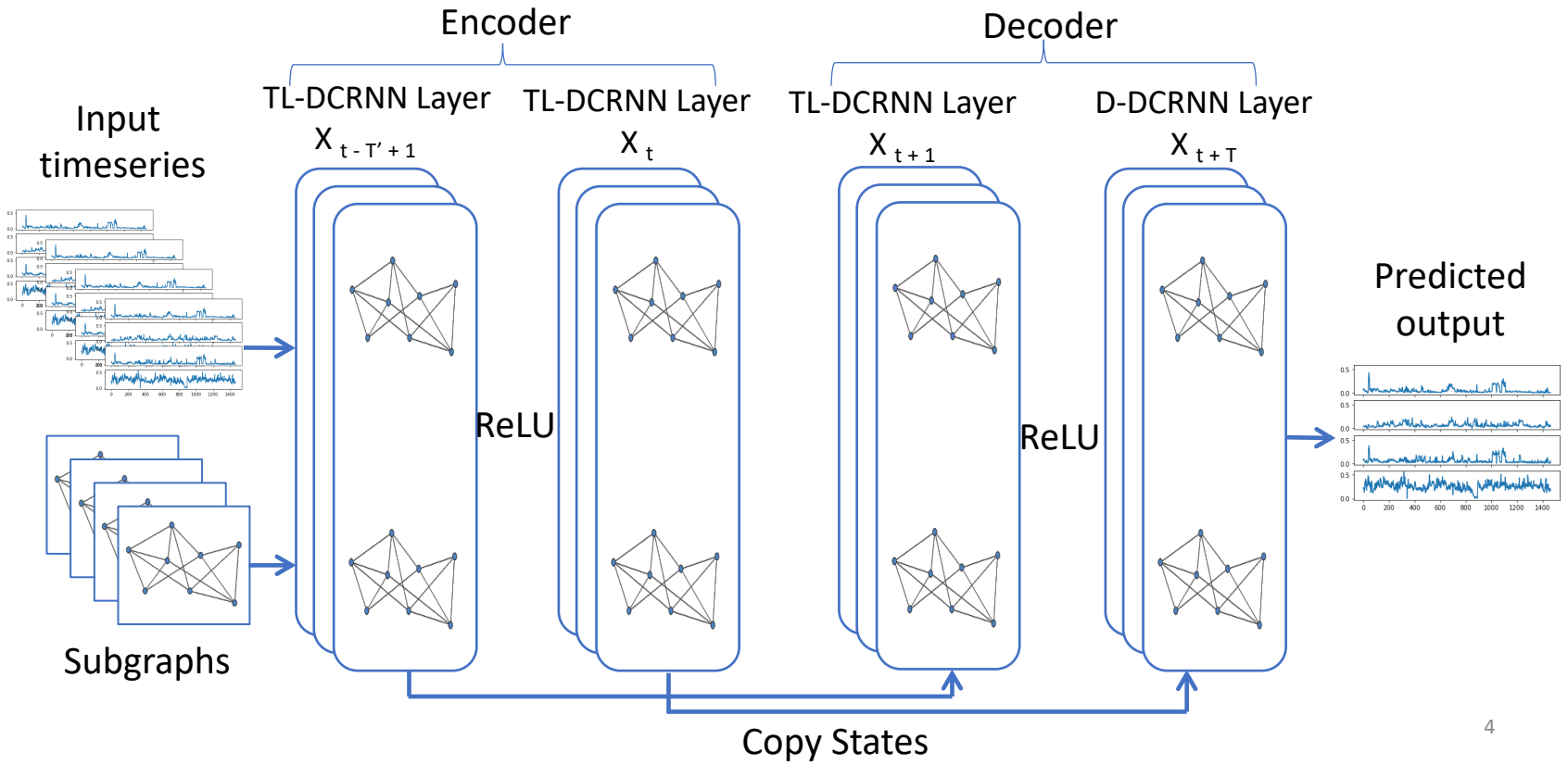
9.00 AM … 10.00AM

Problem: Forecast traffic in absence of location specific network and historical time series data

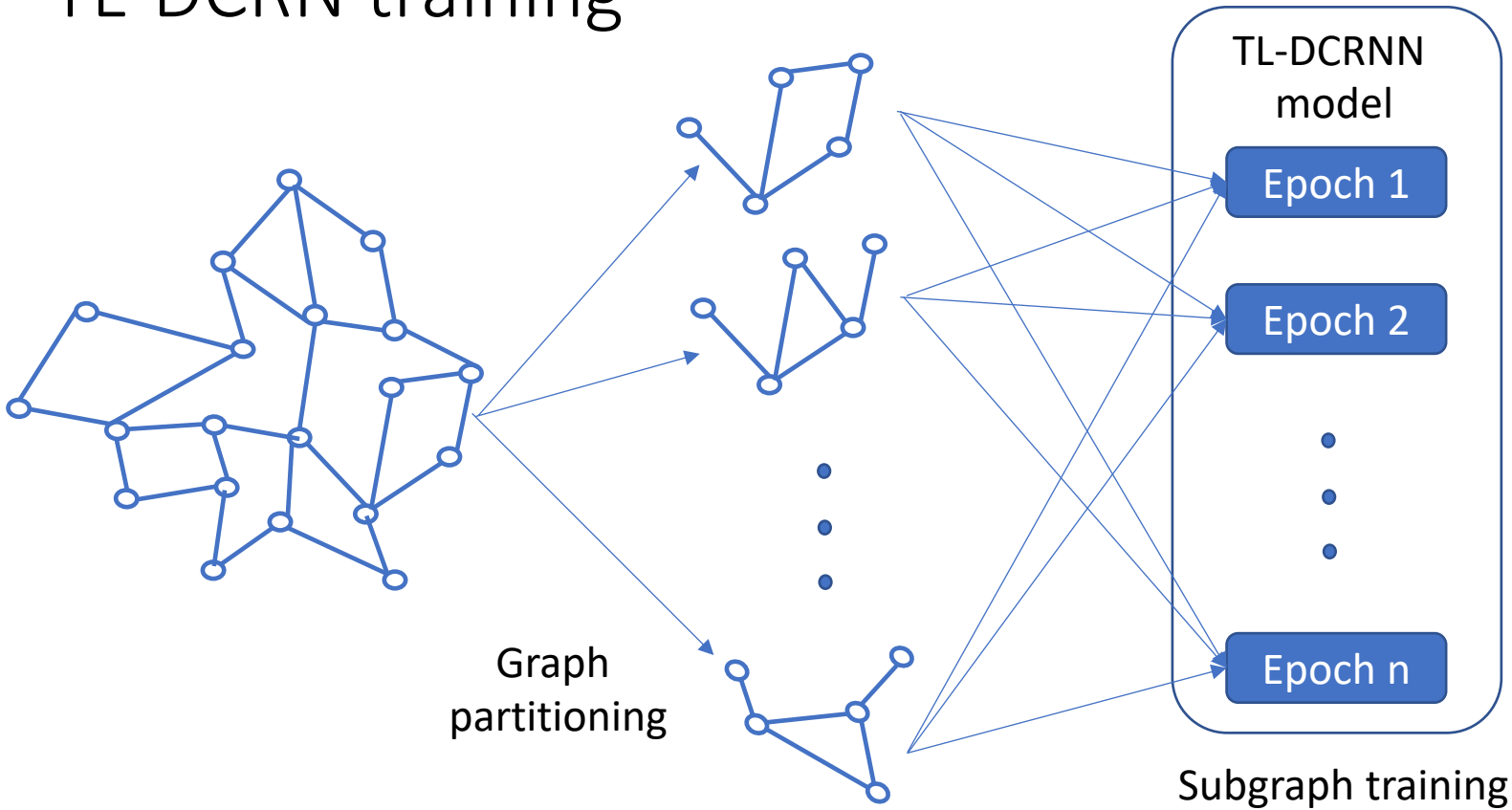
Transfer learning Diffusion convolutional recurrent neural network (TL-DCRNN)



TL-DCRNN model

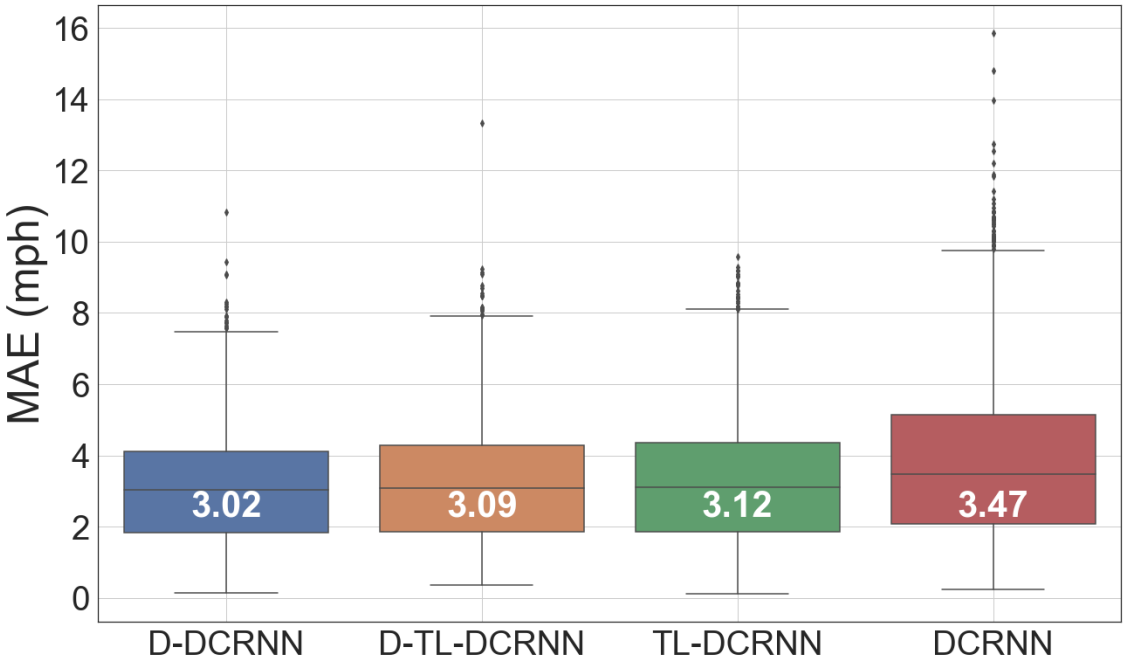


TL-DCRN training



Results – LA on SF0

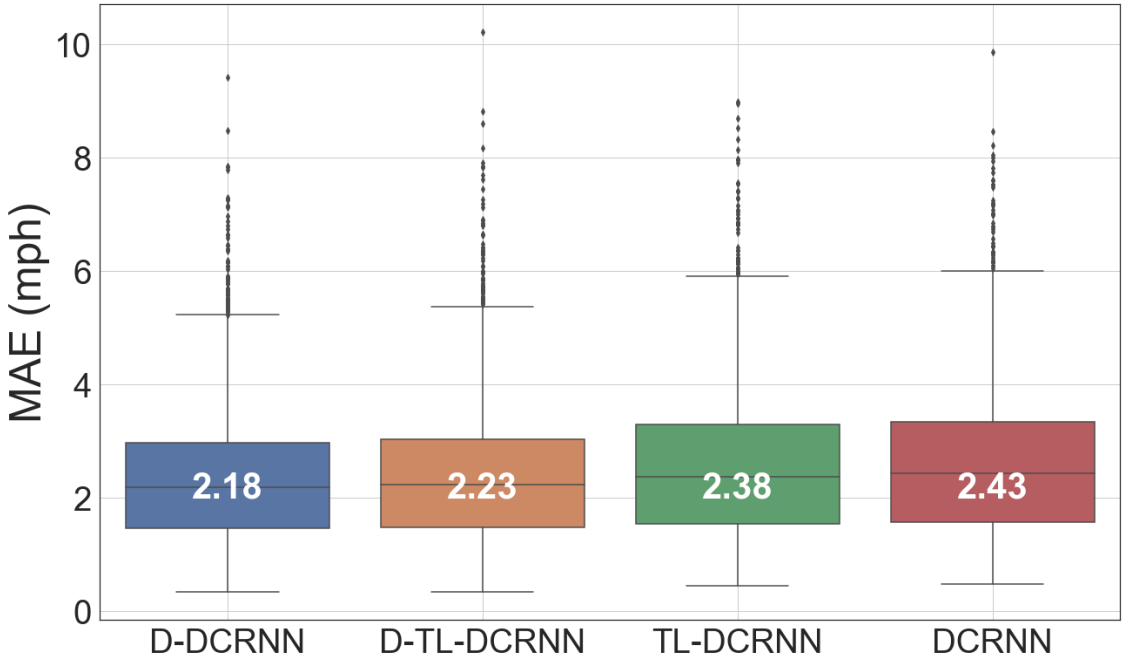
- D-DCRNN and D-TL-DCRNN trained on LA dataset and tested on the LA
- TL-DCRNN and DCRNN – trained on SFO dataset and tested on the LA



TL-DCRNN outperformed DCRNN on LA

Results – SF0 on LA

- D-DCRNN and D-TL-DCRNN trained on SFO dataset and tested on the SFO
- TL-DCRNN and DCRNN - trained LA dataset and tested on the SFO



TL-DCRNN outperformed DCRNN on SFO

Comparison with other model

- All models are trained on LA dataset and tested on the PEMS-BAY

Models	MAE	RMSE	MAPE
STGCN [16]	6.53 ± 2.69	10.07 ± 3.47	13.31 ± 6.38 %
FC-LSTM [4]	4.69 ± 1.79	8.48 ± 3.17	12.32 ± 8.78 %
GMAN [17]	4.05 ± 1.56	7.57 ± 2.51	8.5 ± 4.58 %
DCRNN [6]	3.3 ± 1.24	6.91 ± 2.19	8.21 ± 5.57 %
TL-DCRNN	2.13 ± 1.09	5.23 ± 2.29	5.55 ± 4.34 %

TL-DCRNN outperformed all state-of-the-art traffic forecasting methods in a transfer learning setting

Conclusion and Future Work

- TL-DCRNN outperformed all state-of-the-art traffic forecasting methods
- Allow practitioners to apply data-driven methods trained on datasets collected elsewhere
- Enabling a wide range of transportation system operations operate efficiently in reduced infrastructure and data acquisition cost

- Deployment strategies for traffic management systems across the country
- Extend this approach beyond highway implementations