Dynamic Demand Prediction for Sustainable Bike Sharing Systems

By Alexander Busch and Kaifeng Lu as part of the course project of ECE1724H: Bio-inspired Algorithms for Smart Mobility. Dr. Alaa Khamis, University of Toronto, 2024.

Literature Review

Depth and Breadth of Survey

1. A review on bike-sharing: The factors affecting bike-sharing demand [1]:

2. Data Analysis and Optimization for (Citi)Bike Sharing [2]:

3. Modeling bike-sharing demand using a regression model with spatially varying coefficients [3]:

4. Modeling Bike Availability in a Bike-Sharing System Using Machine Learning [4]:

Taxonomic Table and Tabular Comparison

For the development of accurately prediction approaches the most important factors are:

- The data used: Essential is the features incorporated and the size, diversity and quality of the dataset. Because all compared approaches use recorded data from bike-sharing systems, the quality of the data is uniformly high, however, the size varies. We propose to classify features:

- The architecture of the model: In order to achieve intelligent prediction, usually deeper models perform significantly better. Special modules of neural network architecture, such as Memory Components (RNNs, LSTMs, GRUs), Convolutions (CNN, GNN) or attention components strongly influence what the model is able to learn.

Approach	Target Variable	Spatial Features Incorporated	Spatial Architecture	Temporal Features
Temporal Architecture				

References

Bibliography

[1] E. Eren and V. E. Uz, "A review on bike-sharing: The factors affecting bike-sharing demand," *Sustainable Cities and Society*, vol. 54, p. 101882–101883, 2020, doi: https://doi.org/10.1016/j.scs.2019.101882.

[2] E. O'Mahony and D. Shmoys, "Data Analysis and Optimization for (Citi)Bike Sharing," *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 29, no. 1, Feb. 2015, doi: 10.1609/aaai.v29i1.9245.

[3] H. I. Ashqar, M. Elhenawy, M. H. Almannaa, A. Ghanem, H. A. Rakha, and L. House, "Modeling bike availability in a bike-sharing system using machine learning," in *2017 5th IEEE International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS)*, 2017, pp. 374–378. doi: 10.1109/MTITS.2017.8005700.

[4] X. Wang, Z. Cheng, M. Trépanier, and L. Sun, "Modeling bike-sharing demand using a regression model with spatially varying coefficients," *Journal of Transport Geography*, vol. 93, p. 103059–103060, 2021, doi: https://doi.org/10.1016/j.jtrangeo.2021.103059.