NE579 Project

J.R. Powers-Luhn

16 October 2018

Background

In the 53 years since the beginning of the first city bike share program in Amsterdam the idea has spread to cities around the world. The largest bike share programs now boast fleets in the tens of thousands. Beijing alone has an estimated 2.35 million bicycles available for rent (Mengjie, 2017).

Poorly regulated bike share systems have resulted in significant oversupply. In 2018, a significant oversupply of bike-share bicycles in Chinese cities resulted in the users treating the bikes as disposable. This led to additional cost to the city as abandoned bikes had to be collected as waste. Bike share companies were forced to declare bankruptcy in spite of the popularity of bike sharing overall (Taylor, 2018).

Studies of bike sharing systems implemented in large cities shows that the programs fall into two categories. Large programs begin to show unique usage patterns, while smaller programs act essentially the same (Sarkar, Lathia, & Mascolo, 2015). Sarkar, et al, found that many lessons learned from bike share program models applied across the ten cities they examined. A model generated for one city should therefore be useful (if not directly applicable) for other cities.

A dataset consisting of time series data for the Washington, D.C. bike sharing system was obtained (Fanaee-T & Gama, 2014)[1]. The dataset tracks weather, holiday/weekday/workday status, and bicycle rental numbers on an hourly and daily basis from 2011 to 2012.

Objectives

This project seeks to generate a predictive model for bicycle rentals based on the time and weather.

Methodologies

Because the weather and season predictors tend to be correlated, I will examine variance reduction techniques to improve the performance of the model. Anomaly detection techniques will be used to discover and discard outliers corresponding to holidays or other days when events took place that could result in atypical usage patterns.

[1] http://archive.ics.uci.edu/ml/datasets/Bike+Sharing+Dataset

Expected Results/Contributions

This predictive model will identify peak use periods for bicycle rentals, providing improved windows for maintenance. The information could also be used by cities establishing new bike share programs to anticipate usage patterns. Predictive models should be useful to avoid the oversupply problems such as those seen by Chinese cities, resulting in smoother deployment in new locations.

References

Fanaee-T, H., & Gama, J. (2014). Event labeling combining ensemble detectors and background knowledge. *Progress in Artificial Intelligence*, *2*(2–3), 113–127. https://doi.org/10.1007/s13748-013-0040-3

Mengjie. (2017). Beijing issues guideline on bike sharing. *Xinhua*. Retrieved from http://www.xinhuanet.com//english/2017-09/15/c_136612435.htm

Sarkar, A., Lathia, N., & Mascolo, C. (2015). Comparing cities' cycling patterns using online shared bicycle maps. *Transportation*, *42*(4), 541–559. https://doi.org/10.1007/s11116-015-9599-9

Taylor, A. (2018). The Bike-Share Oversupply in China: Huge Piles of Abandoned and Broken Bicycles. Retrieved October 16, 2018, from https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/