

### **Description of Potential Topic Areas**

We have chosen the “Bike Rentals (per day)” dataset {Fanaee-T, 2013 #8} for analysis. This dataset captures the bike-sharing rental process, providing insights into the environmental and seasonal factors influencing bike rentals. Our outcome variable is the number of bikes rented (continuous). Other variables include whether the day is a holiday (yes/no), the day of the week (numbered 1 to 7), and weather (categorical, 1-4 with a higher number indicating worse weather), windspeed (continuous), temperature (Celsius, continuous), feeling temperature (Celsius, continuous), and humidity (continuous). This information is derived from the two-year historical log of the Capital Bikeshare system in Washington D.C., USA, encompassing the years 2011 and 2012.

### **Questions of Interest:**

1. How do holidays affect the number of bike rentals?
2. Which day of the week has the most bike rentals?
3. Can we accurately forecast the number of bikes that will be rented by incorporating all relevant weather variables into a predictive model?

### **Anticipated Discoveries:**

There is mixed literature on whether holidays reduce {Kim, 2018 #4} or increase {Hu, 2022 #3} bike rentals. We hope to add to this literature to provide clarity on the relationship between holidays and bike rentals. We expect that on weekdays, more bikes may be rented for work, while weekends might see fewer rentals due to having the opportunity to do other casual activities. This prediction is supported by the discoveries published by Dr. Kubařák et al. {Kubařák, 2021 #7}. Warmer temperatures (20-30 degrees Celsius) are expected to increase rentals, but higher wind speed and rain could reduce them. {Sears, 2012 #5} Additionally, we acknowledge that differences among cultures, countries, or locations with varied weather climates could influence these findings, as indicated by our literature research. Therefore, our findings will only be generalizable to Washington D.C., where we are obtaining these data, or other similarly structured American cities.

### **Motivation:**

We want to analyze how holidays, weekdays, and weather affect bike rentals, helping bike-sharing companies and governments make better informed decisions. We aim to improve predicting demand, optimize when to release bikes, and use weather info for better planning. By understanding holiday impacts, predicting busy weekdays, and considering weather effects, our goal is to give businesses useful marketing insights.

Local governments will also use this helpful information. If good weather, holidays, or weekdays is known to significantly increase the number of bike rentals, local governments may want to have more traffic police around populated areas to guide the bike vs vehicle flow of traffic. Further, they may want to increase traffic police to ensure the safety of the bikers. These results can help local governments manage traffic and safety, making bike-sharing systems work better.

### **Impact:**

By learning how holidays and weekdays affect rentals, companies can plan marketing and governments can manage traffic better. Predicting peak days helps companies release bikes wisely, making more money with the correct resource allocation. Considering weather in planning means better decisions for everyone. We want to help businesses with smart marketing and support governments in keeping bike-sharing safe and efficient for a greener and healthier future.

Author contributions:

In preparing this report, each member made contributions to various aspects of the research:

Lauren: project coordination, literature review

Cesar: literature review

Viktoria: writing (original draft, review and editing)

Elsa(Zhengqi): formal analysis (coding), data processing

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