Project ECE20875: Python for Data Science

Spring 2022

1. **Project team information**

   Mini-Project Spring 2022
   ECE20875
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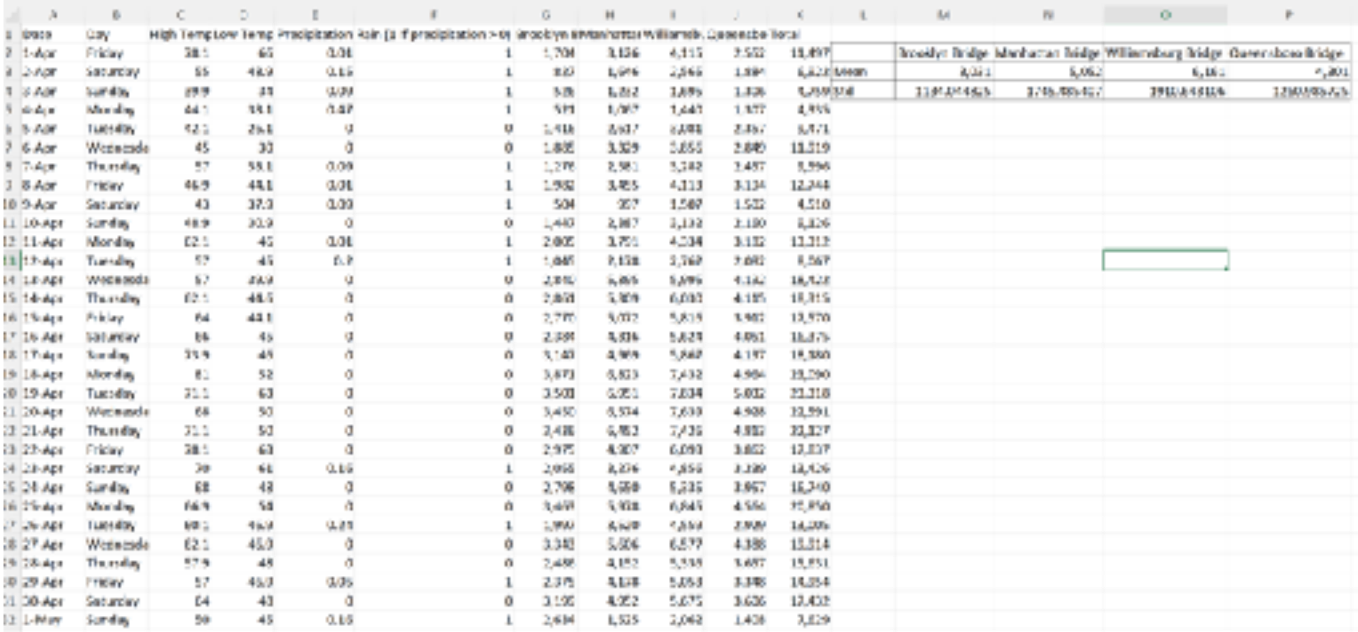
   Path (data set) chosen: 1

2. **Descriptive Statistics**

By observing the NYC_Bicycle_Counts_2016_Corrected.csv dataset, there are 8 different variables we can use to tackle the problems. 'High Temp', which is the highest temperature of the day; 'Low Temp', which is the lowest temperature of the day; 'Precipitation', which is the amount of rain or snow of the day; the number of bikes on the 4 individual bridge and the total amount of bikes on the 4 bridges.

Summary Statistics Table:

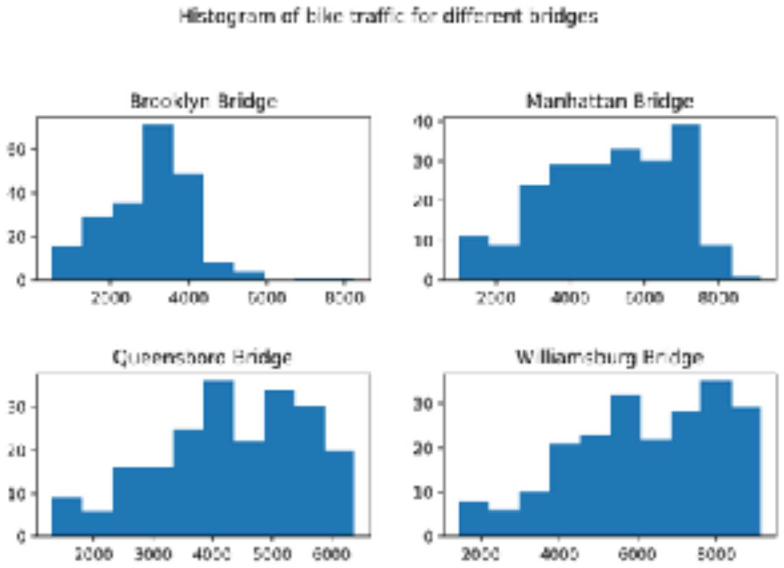


	A	B	C	D	E	F	G	H	I	J	K
1	Date	Day	High Temp	Low Temp	Precipitation	Rain (1 if precipitation > 0)	Brooklyn B	Manhattan	Williamsb	Queensbo	Total
2	1-Apr	Friday	78.1	66	0.01	1	1,704	3,126	4,115	2,552	11,497
3	2-Apr	Saturday	55	48.9	0.15	1	827	1,646	2,565	1,884	6,922
4	3-Apr	Sunday	39.9	34	0.09	1	526	1,232	1,695	1,306	4,759
5	4-Apr	Monday	44.1	33.1	0.47	1	521	1,067	1,440	1,307	4,335
6	5-Apr	Tuesday	42.1	26.1	0	0	1,416	2,617	3,081	2,357	9,471
7	6-Apr	Wednesday	45	30	0	0	1,885	3,329	3,856	2,849	11,919
8	7-Apr	Thursday	57	53.1	0.09	1	1,276	2,581	3,148	2,457	9,462
9	8-Apr	Friday	46.9	44.1	0.01	1	1,982	3,455	4,113	3,194	12,744
10	9-Apr	Saturday	43	37.9	0.09	1	504	997	1,507	1,502	4,510
11	10-Apr	Sunday	48.9	30.9	0	0	1,447	2,387	3,132	2,160	9,126
12	11-Apr	Monday	62.1	45	0.01	1	2,005	3,791	4,334	3,182	13,312
13	12-Apr	Tuesday	57	45	0.2	1	1,045	2,159	2,762	2,601	8,567
14	13-Apr	Wednesday	57	39.9	0	0	2,840	6,095	5,695	4,162	18,792
15	14-Apr	Thursday	62.1	48.5	0	0	2,861	5,309	6,033	4,185	18,315
16	15-Apr	Friday	64	48.1	0	0	2,770	5,072	5,815	3,902	13,970
17	16-Apr	Saturday	66	45	0	0	2,384	3,836	5,624	4,061	15,875
18	17-Apr	Sunday	73.9	45	0	0	3,140	4,999	5,867	4,197	18,380
19	18-Apr	Monday	81	52	0	0	3,673	6,823	7,432	4,964	22,290
20	19-Apr	Tuesday	73.1	63	0	0	3,500	6,251	7,834	5,032	22,218
21	20-Apr	Wednesday	66	50	0	0	3,450	6,534	7,639	4,968	22,591
22	21-Apr	Thursday	73.1	50	0	0	3,438	6,453	7,436	4,952	22,327
23	22-Apr	Friday	78.1	63	0	0	2,975	4,207	6,090	3,852	17,137
24	23-Apr	Saturday	70	61	0.16	1	2,058	3,276	4,856	3,239	13,426
25	24-Apr	Sunday	68	48	0	0	2,796	4,558	5,535	3,967	16,340
26	25-Apr	Monday	66.9	58	0	0	3,469	5,918	6,845	4,556	20,850
27	26-Apr	Tuesday	69.1	46.9	0.23	1	1,990	4,620	4,856	2,909	14,376
28	27-Apr	Wednesday	62.1	46.0	0	0	3,343	5,506	6,577	4,388	19,814
29	28-Apr	Thursday	57.9	48	0	0	2,488	4,152	5,335	3,657	15,631
30	29-Apr	Friday	57	46.0	0.05	1	2,375	4,178	5,053	3,348	14,954
31	30-Apr	Saturday	64	43	0	0	3,195	4,252	5,675	3,636	17,432
32	1-May	Sunday	59	45	0.18	1	2,614	1,525	2,062	1,408	7,829

L	M	N	O	P
	Brooklyn Bridge	Manhattan Bridge	Williamsburg Bridge	Queensboro Bridge
Mean	3,031	5,052	6,161	4,301
Std	1139.254465	1745.485467	1910.144116	1260.950624

In problem 3, we converted the Precipitation variable into a binary Rain variable which is 1 if the value of precipitation if greater than 0. And we used the mean and standard deviation of the number of bikes for problem 1.

These are the histagram of bike traffic for different bridges which we will be using it for problem 1.



3. **Approach**

For prpoblem 1, we first subplot the distribution of data, which are the number of bike traffic in each city. We then plot the histogram of the data, number of bike traffic in each city. Finally, we calculated the percentage of data within one standard deviation range of the mean in each city.

For problem 2, we first visulize the relationships between Low temp and Total, High Temp and Total, Precipitation and Total, the temperature difference and Total. We found that except for the temperature difference, the other 3 parameters seem to have significant effect on the number of bikes on that day. So we decided to consider ‘High Temp’, ‘Low Temp’, and ‘Precipitation’ as features and apply linear regression to predict the total number of bikes. We split the data by 80% for training and 20% for testing. Then after the linear regression model is fitted, we apply test it with the testing data and check the error to see if linear regression is a feasible approach to this problem.

For problem 3, we first plot the scatter of total number of bike traffic and the precipitation, and it seems that there was no obvious polynomial model or linear model that cab be used to fit the data. During the process of plotting, we faced a problem that the comma in total number of traffic would cause problem, so we had to get rid of commas in the total number data. We used logistic regression for this problem, we set the data to 1 if the precipitation is greater than 0, else set to 0. Finally, we built our model.

4. **Analysis**

In problem 1, we assume that we should place our censors at Manhattan, Queensboro, Williamsburg after we see the plot of the data distribution. Then, the histogram of number of bike traffic in each city solidify our assumption. However, we still need a quantitative proof to back our assumption. According to the percentage of data within one standard deviation range of each city, we can see that Brooklyn has 72% of the data within one standard deviation, Manhattan has 58% of the data within one standard deviation range, Queensboro has 62% of the data within one standard deviation range, and Williamsburg has 62% of the data within one standard deviation range. Thus, we suggest placing censors at Manhattan, Queensboro, and Williamsburg.

In problem 2, after fitting the linear regression model with the proposed features, we got the model with interception = -404.55833226787945 and the list of coefficient is [401.5002207 -170.78716459 -7171.71486332]. With the values we got, we can predict the total number of bikes with the equation:

$$\widehat{\mathrm{total}} = -404.55833226787945 + 401.5002207*\mathrm{High} - 170.78716459*\mathrm{Low} - 7171.71486332*\mathrm{Precipitation}$$

After obtaining the equation, we yield an accuracy of 0.7496750269174777 within Total_hat and Total (predicted value and ground truth). Therefore, we can conclude that it is feasible to predict the total number of bicyclists that day by observing the weather forecast (low/high temperature and precipitation).

In problem 3, after the result that we use logistic regression to predict the data, we yield an accuracy of 0.7441860465116279 within y_predicted and y_test so we can conclude that we can use the total number of bike traffic to predict whether it is raining or not.