Analyzing the NYC Subway Dataset

Section 0. References

https://github.com/alfredessa/pandascookbook

http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.hist

http://pandas.pydata.org/pandas-docs/stable/visualization.html#visualization-hist

http://docs.ggplot2.org/0.9.3.1/geom_bar.html

https://pypi.python.org/pypi/pandasql

http://blog.yhathq.com/posts/pandasql-sql-for-pandas-dataframes.html

Udacity discussion forums

Section 1. Statistical Test

1.1 The Mann-Whitney U test was used to analyze the NYC subway data. A two-tail P value was used.

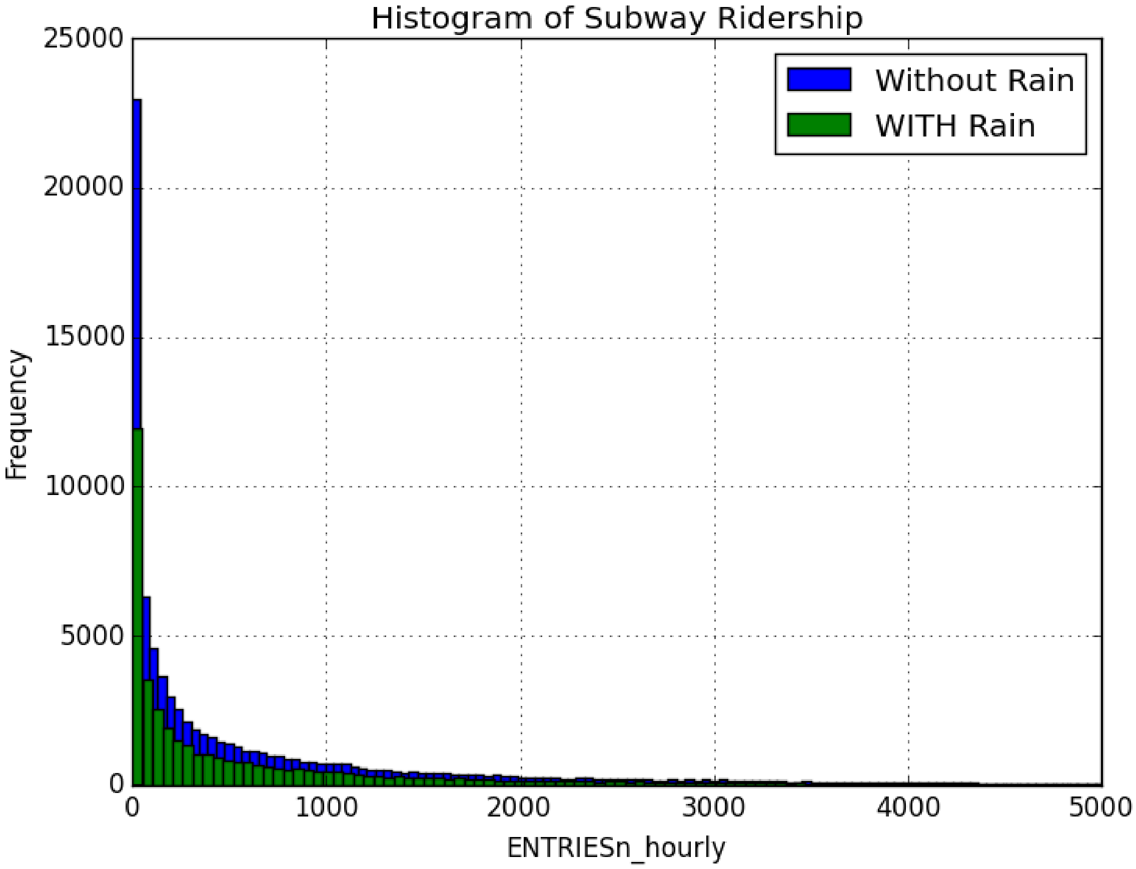
The Null hypothesis H_o : The mean of the subway ridership with Rain = The mean of the subway ridership *without* Rain

The Alternative hypothesis H_a : The mean of subway ridership with Rain is NOT equal to The mean of subway ridership *without* Rain

The P- critical value of 0.05 is used for the U test.

1.2 The Mann-Whitney U test is applicable since it is a non-parametric test. The U test doesn't assume that the data is drawn from any particular probability distribution. A T-test was also considered for the analysis of the data but the T-test requires that the underlying data be normally distributed. Creating histograms for the subway ridership showed that the data was positively skewed and non-normal (see figure 1). Thus the Mann-Whitney U test is more suitable for the comparison of subway ridership data on rainy Vs non-rainy days.

Figure 1Subway Ridership data



1.3 The results of the Mann-Whitney U Test are summarized below:

P-Value = 0.02499 *2 (for two-tailed test) = 0.4998 ~ 0.5

U-statistic = 1924409167.0

Mean when raining = 1105.45

Mean when NOT raining = 1090.28

1.4 The P-value of ~0.5 means that there is a significant difference between the two data sets – Ridership when raining Vs Ridership with No rain. With a P- critical = 0.05, the P-value is in the P-critical region. Which means that we can reject the Null hypothesis. Furthermore, the Mean ridership when raining > the Mean ridership when not raining, bolstering the claim that subway ridership increases when raining.

2 Section 2. Linear Regression

2.1 The Gradient Decent approach was taken to compute the coefficients of theta and produce prediction for ENTRIESn_hourly.

2.2 The input variables are as follows:

rain, Hour, meantempi, fog and precipi

meantempi didn't have any effect on the R2 value and maybe considered a dummy variable.

2.3 I picked 'rain' and 'precipi' since the amount of rain probably had an effect on subway ridership, the higher the rain amount the more likely people are take the subway Vs driving. I added fog as it would probably have a discouraging effect on wanting to drive.

2.4 The weights of the non-dummy features in the linear regression are in the table below:

Table 1 Variables and associated Weights

Variable	Weight
rain	-1.42128836e+01
Hour	4.68337403e+02
fog	6.53282087e+01
precipi	-9.18209020e+00

2.5 R2 (coefficients of determination) value = 0.46

2.6 The R2 value means that 46% of the variation in the subway ridership is related to or explained by the variables in table 1. A better linear regression model may be needed to infer valid conclusions.

Section 3. Visualization

3.1 Histogram of Subway Ridership:

Figure 2 Subway Rider Ship Histogram

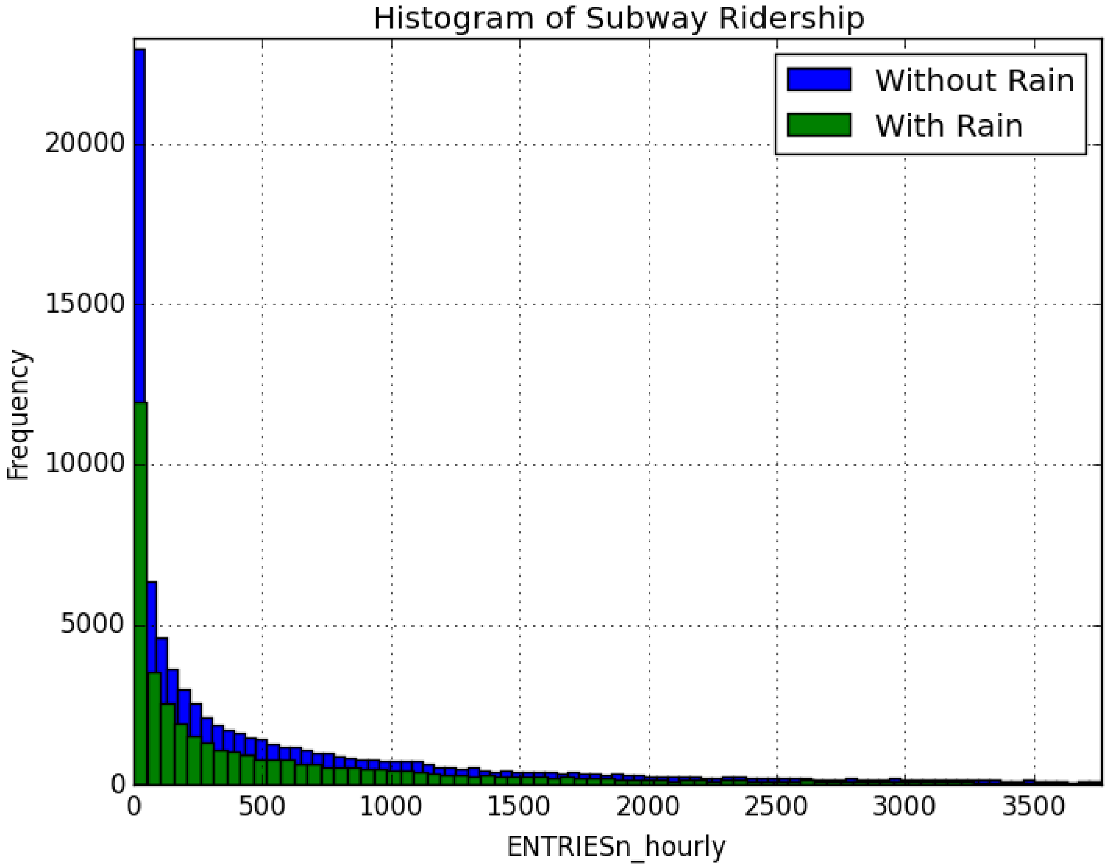


Figure 2 shows two histograms:

- The blue histogram shows subway ridership when there is no rain
- The green histogram shows subway ridership when it is raining

The two histograms illustrate the type of distribution for each data set. Both are positively skewed and non-normal.

3.2 Plot showing the variation in subway ridership by day of the week

Figure 3 Plot of Average Subway Ridership by day of the week

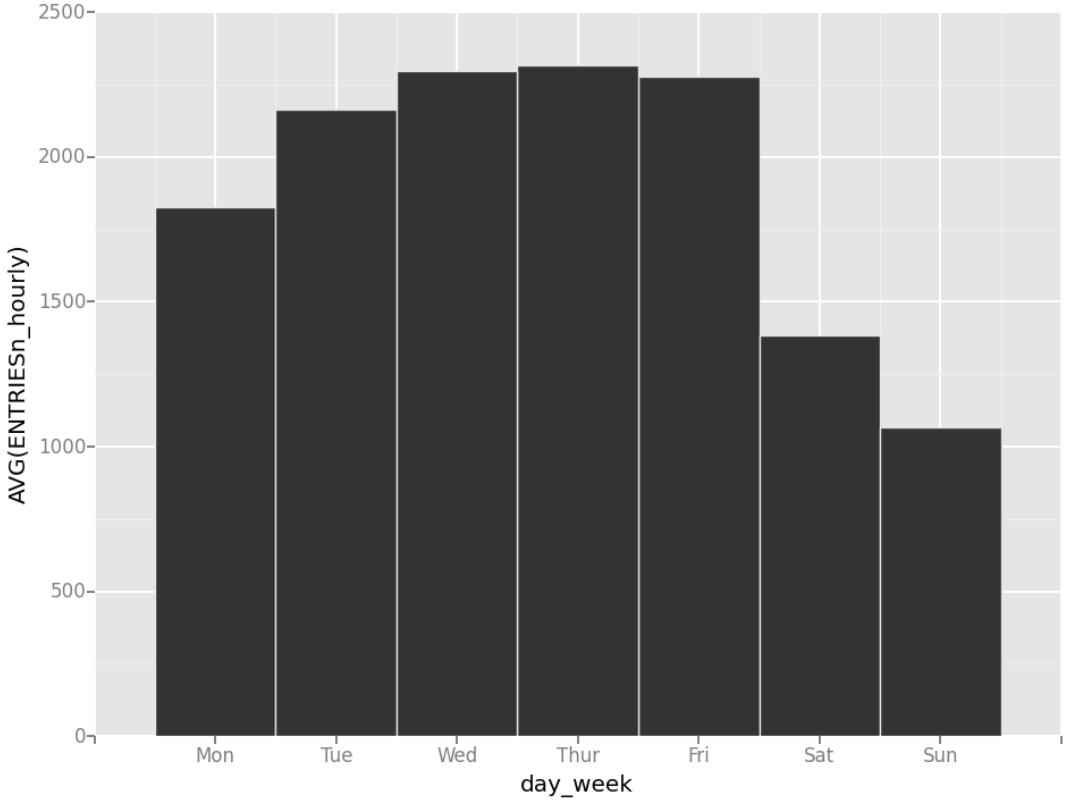


Figure 3 shows the average variation in subway ridership based on the day of the week. The weekends have less traffic which is consistent with fewer travelers commuting to work. The average ridership goes up until Thursday and then starts to drop off. Monday is the best work day to pick subway travel for commuting.

Section 4. Conclusion

4.1 Based on the data analysis weather does have an effect on the subway ridership. In particular the ridership increases when it is raining. The Mann-Whitney U test P- value 0.4998 ~ 0.5 and Mean when raining = 1105.45, which is greater than the Mean when not raining =1090.28, point to an increase in subway ridership when it is raining. Table 2 shows the mean ridership values as a well as the median ridership values. Since the data is skewed (see figure 1) the median is a better measure of assessing ridership. The higher median value for ridership when it is raining points to an increased ridership during rain.

Table 2 Mean and Median comparison when raining Vs not raining

Mean Ridership when Raining	Mean Ridership when NOT raining	Median Ridership when Raining	Median Ridership when NOT raining
1105.44	1090.28	**282**	278

The Linear regression analysis also supports the notion that weather has an effect on subway ridership. Using the variables – ‘rain’, ‘hour’, ‘fog’ and ‘precipi’ yielded R2 value = .46. Which implies that 46% of the variation in the subway ridership is related to or explained by the variables. Unfortunately this R2 value is too low to be a viable measure of predicting ridership trends. Although many variations of the input variables to the linear regression model were tried the best value was only .46.

Section 5. Reflection

5.1 The underlying dataset was non-normal and thus not a suitable candidate for the T-Test. A T-Test along with the Mann-Whitney U test would have helped in the analysis. The dataset was also uneven with greater number of data points when it was not raining Vs when raining. Relying on Mean values alone would skew the results.

Table 3 Difference in Rain Vs No Rain Counts

Count of Values when Raining	Count of Values when Not Raining
44104	87847

A better implemented Linear Regression model would also have helped in establishing which factors in particular have a higher effect on subway ridership.