Analyzing the NYC Subway Dataset

Section 0. References

https://bespokeblog.wordpress.com/2011/07/11/basic-data-plotting-with-matplotlib-part-3-histograms/

http://flowingdata.com/2014/02/27/how-to-read-histograms-and-use-them-in-r/

https://plot.ly/histogram/

http://www.itl.nist.gov/div898/handbook/pri/section2/pri24.htm

http://en.wikipedia.org/wiki/Ordinary_least_squares

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

http://dss.princeton.edu/online_help/analysis/interpreting_regression.htm

http://people.duke.edu/~rnau/regintro.htm

Section 1. Statistical Test

1.1 Which statistical test did you use to analyze the NYC subway data? Did you use a one-tail or a two-tail P value? What is the null hypothesis? What is your p-critical value?

Statistical test: Mann–Whitney *U* test, using two-tail P value

Null hypothesis: there is no difference between the average ridership with rain and without rain

P-critical value: 0.05

1.2 Why is this statistical test applicable to the dataset? In particular, consider the assumptions that the test is making about the distribution of ridership in the two samples.

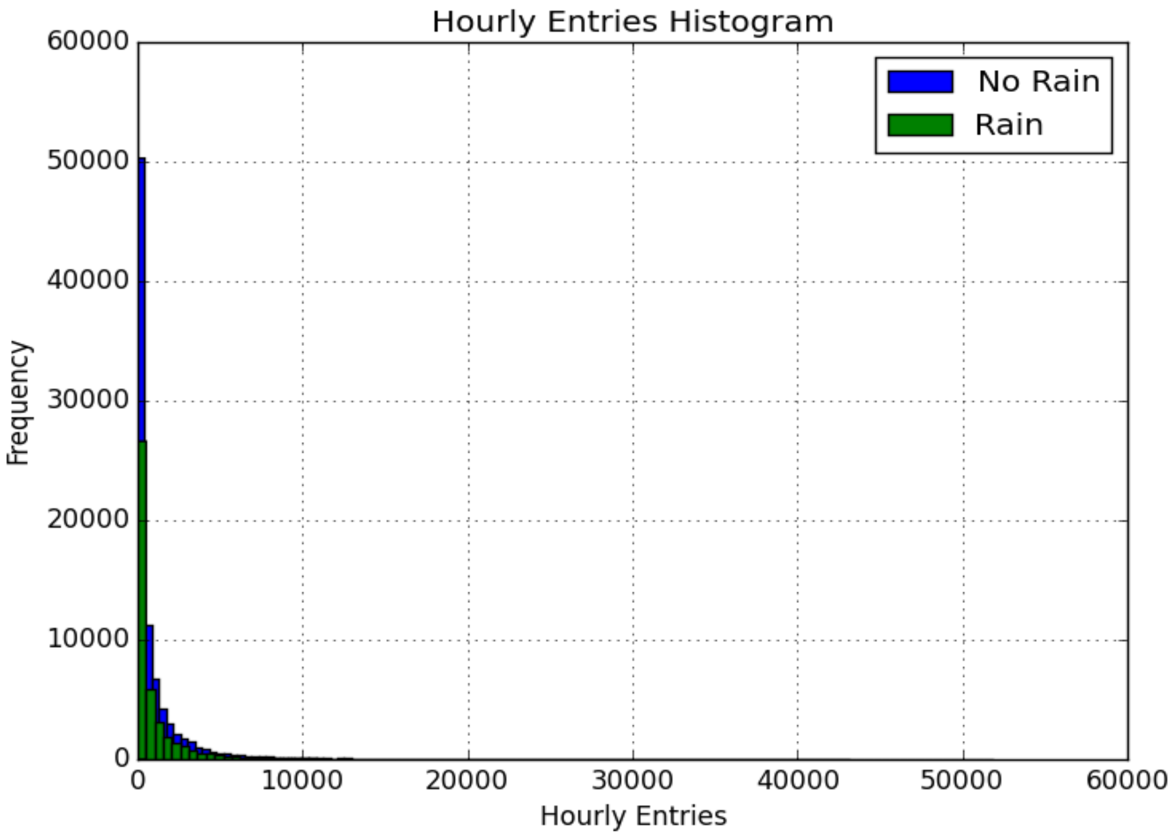


Figure 1

As we see in figure 1 the ridership distribution of the two independent samples (rain, no rain) is skewed right (NOT Normal), which is a good case to use Mann–Whitney U test.
Also this dataset meet other assumptions Mann–Whitney U test as follows:

1- the dependent variable here (enries_hourly) is continuous.

2- the independent variable here (rain status) consists of two categories (rain, no rain)

1.3 What results did you get from this statistical test? These should include the following numerical values: p-values, as well as the means for each of the two samples under test.

U= 1924409167.0
P-value: 0.024*2=0.048
Mean of ridership with rain: 1105.44
Mean of ridership without rain: 1090.278

1.4 What is the significance and interpretation of these results?

We can reject null hypothesis, as p-value is less than p-critical value, and assure that there is a significant difference between the average ridership with rain and without rain.

Section 2. Linear Regression

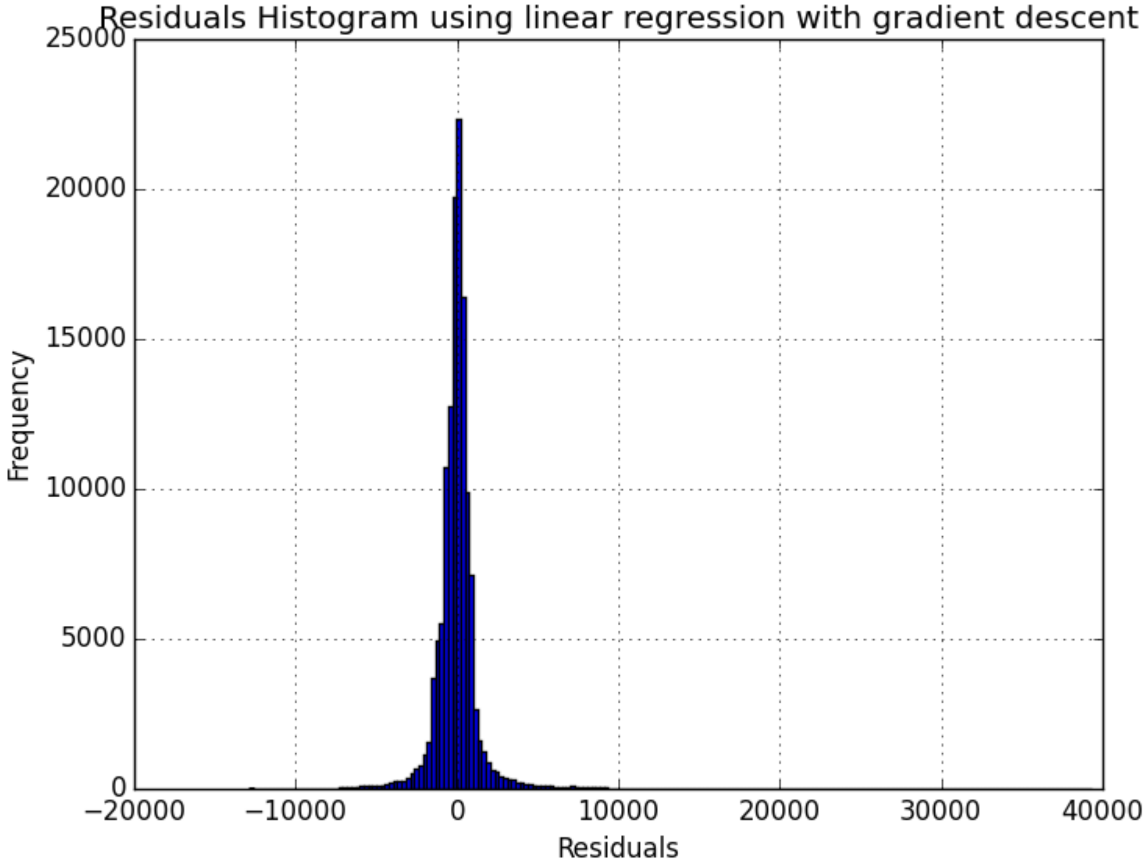


Figure 2

2.1 What approach did you use to compute the coefficients theta and produce prediction for ENTRIESn_hourly in your regression model?

Gradient descent (as implemented in exercise 3.5)
OLS using Statsmodels
Or something different?

In exercise 3.5 I have used Gradient descent with some modifications on the feature list and the dummy variable, the result r squared was 0.50.

After plotting the residual between the resulted predictions and the observed ones as shown on ***figure 2***, I found that it has a normal distribution which is a good indicator of using the regression model, but I was interested to explore another approach of the linear regression. So I have used ***OLS using Statsmodels*** with the same feature list.

2.2 What features (input variables) did you use in your model? Did you use any dummy variables as part of your features?

Features: rain, fog, meantempi, and precipi
There is also a dummy variables including Hour and UNIT

2.3 Why did you select these features in your model? We are looking for specific reasons that lead you to believe that the selected features will contribute to the predictive power of your model.

Your reasons might be based on intuition. For example, response for fog might be: "I decided to use fog because I thought that when it is very foggy outside people might decide to use the subway more often."
Your reasons might also be based on data exploration and experimentation, for example: "I used feature X because as soon as I included it in my model, it drastically improved my R^2 value."

1. rain: is used because I thought that when it is raining people might prefer using the subway

2. fog: is used based on intuition that people might prefer using the subway when it is foggy

3. meantempi: I thought that the temperature may affect the decision of using the subway

4. precipi: I think that precipitation may have an effect of whether people using the subway or not

5. unit [dummy variable]: is used because I think that there may be stations have more people using the subway than other stations, it has a very powerful effect on the r-squared value.

6. hour [dummy variable]: is used because I think that the hour of the day affects the ridership of the subway it may be high during rush hours and very low on the night hours

2.4 What are the coefficients (or weights) of the non-dummy features in your linear regression model?

rain	-38.9144
fog	115.0606
meantempi	-9.1100
precipi	-1.7722

2.5 What is your model's R^2 (coefficients of determination) value?

0.50

2.6 What does this R^2 value mean for the goodness of fit for your regression model? Do you think this linear model to predict ridership is appropriate for this dataset, given this R^2 value?

The resulted r squared value means that we can predict the ridership using our feature list(rain, fog, meantempi, percipi, unit, and hour) with 50% accuracy, which is not excellent, but a moderate percentage

Section 3. Visualization

Please include two visualizations that show the relationships between two or more variables in the NYC subway data.

Remember to add appropriate titles and axes labels to your plots. Also, please add a short description below each figure commenting on the key insights depicted in the figure.

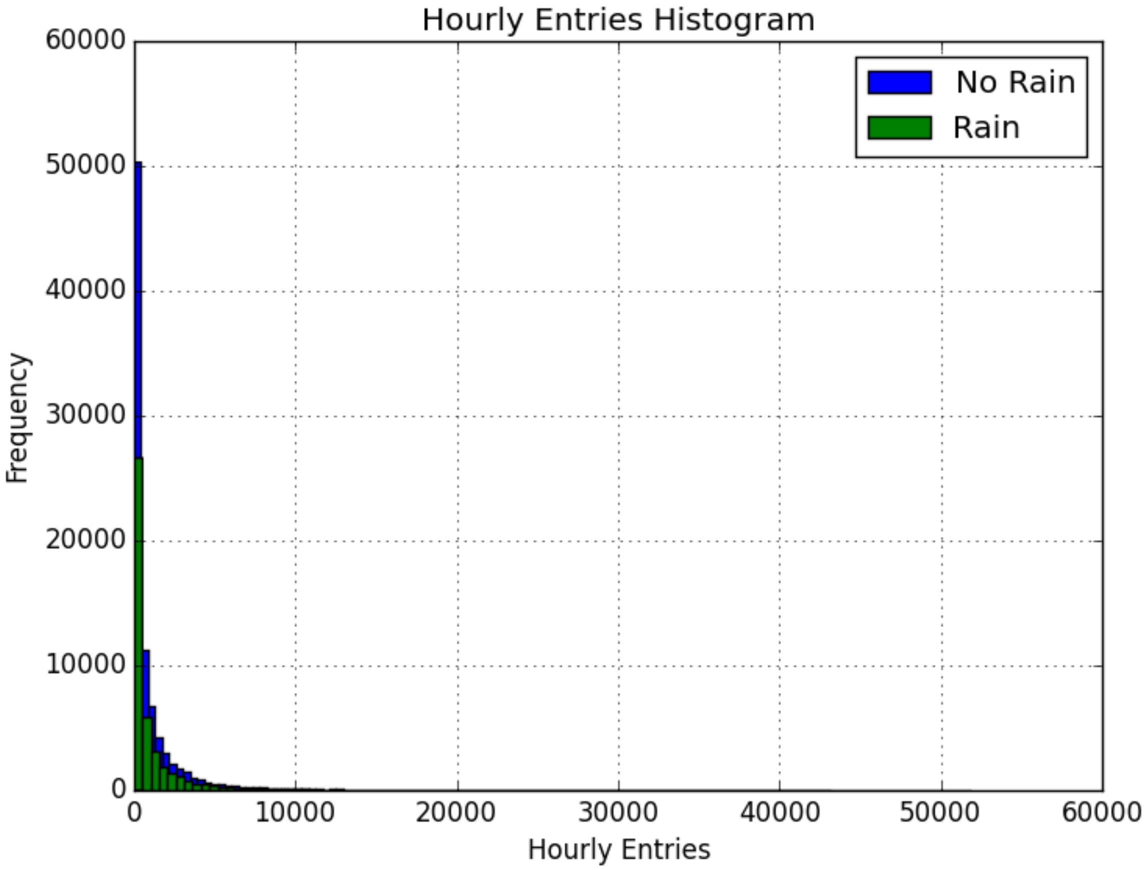
3.1 One visualization should contain two histograms: one of ENTRIESn_hourly for rainy days and one of ENTRIESn_hourly for non-rainy days.

1. You can combine the two histograms in a single plot or you can use two separate plots.

2. If you decide to use to two separate plots for the two histograms, please ensure that the x-axis limits for both of the plots are identical. It is much easier to compare the two in that case.

3. For the histograms, you should have intervals representing the volume of ridership (value of ENTRIESn_hourly) on the x-axis and the frequency of occurrence on the y-axis. For example, each interval (along the x-axis), the height of the bar for this interval will represent the number of records (rows in our data) that have ENTRIESn_hourly that falls in this interval.

4. Remember to increase the number of bins in the histogram (by having larger number of bars). The default bin width is not sufficient to capture the variability in the two samples.

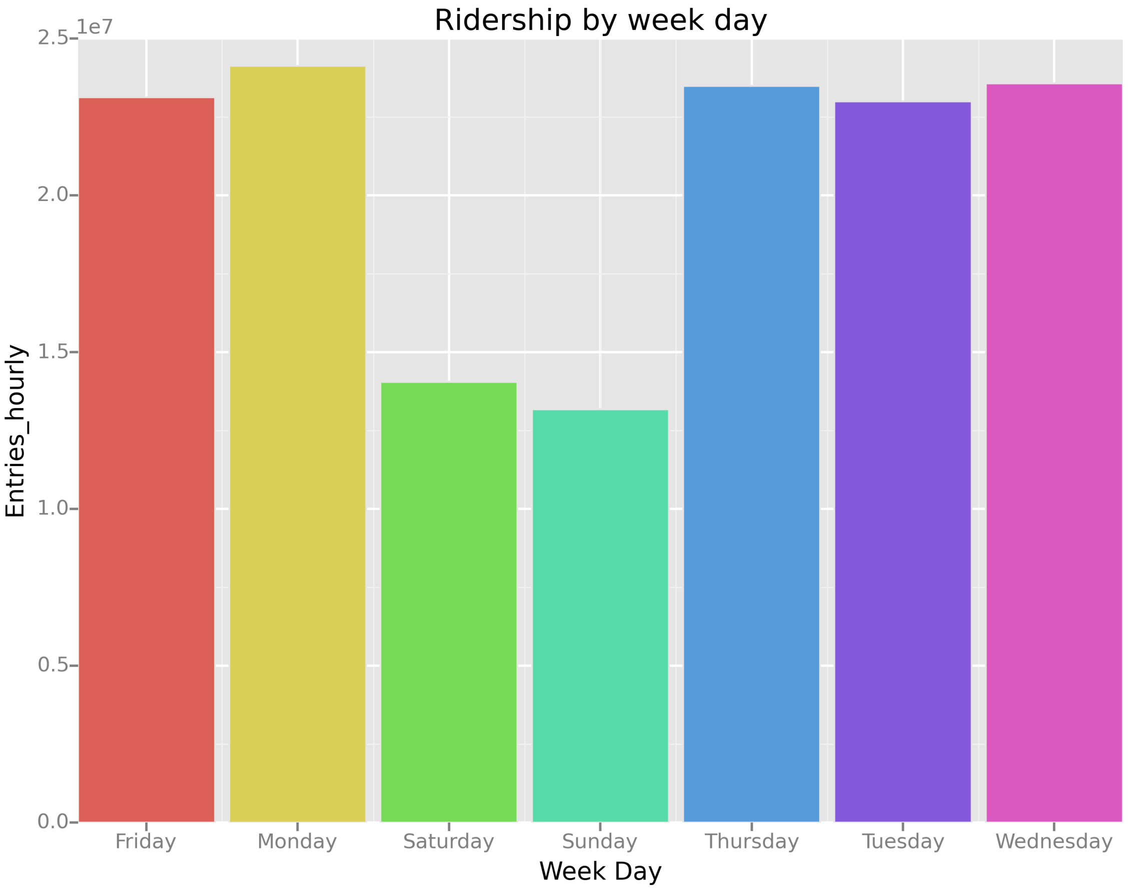


This figure shows that the frequency of the ridership on no rain is always greater than the ridership on rain.

There also another thing on the hourly entries, we can see that the frequency is very high on the most left (the smallest number of entries per hour) and skewed to right.

3.2 One visualization can be more freeform. You should feel free to implement something that we discussed in class (e.g., scatter plots, line plots) or attempt to implement something more advanced if you'd like. Some suggestions are:

. Ridership by time-of-day
. Ridership by day-of-week



This figure shows that the highest ridership volume happens on Monday and the lowest happens on Sunday.

There is also another thing to notice, the ridership on weekend (Saturday & Sunday) are close to each other and are much lower than the other days, which is very logical.

Section 4. Conclusion

Please address the following questions in detail. Your answers should be 1-2 paragraphs long.

4.1 From your analysis and interpretation of the data, do more people ride the NYC subway when it is raining or when it is not raining?

4.2 What analyses lead you to this conclusion? You should use results from both your statistical tests and your linear regression to support your analysis.

Using Mann–Whitney *U* test, with two-tail P value indicated that there is a significant difference between the average ridership on rainy and non-rainy hours, because the p-value (0.048) is less that 0.05.

The results shows that there is a difference of 15 entries increase in the mean ridership in rainy hours than non-rainy hours.

Using my regression model OLS, we expect that the ridership is decreased by 38.9144 when it is raining if the other features are fixed with accuracy of 50 %

Section 5. Reflection

Please address the following questions in detail. Your answers should be 1-2 paragraphs long.

5.1 Please discuss potential shortcomings of the methods of your analysis, including:

1.Dataset,
2. Analysis, such as the linear regression model or statistical test.

5.2 (Optional) Do you have any other insight about the dataset that you would like to share with us?

From my point of view the biggest shortcoming here is [DATEn], the dataset all about may 2011, which may have its own characteristics like weather conditions, which might not be common on the whole year.

It might be incorrect to apply our test results and linear regression model expectations to a public population of different month

I think we need to have a bigger samples includes various months to provide other variables a chance of correlation to the ridership