Test of Hoteling’s Law at Manhattan

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Test about the Hoteling’s Law to see If it works in real business environment

Hoteling’s Law is that: ”*Suppose there are two competing shops located along the length of a street running north and south, with customers spread equally along the street. Both shop owners want their shops to be where they will get most market share of customers. If both shops sell the same range of goods at the same prices then the locations of the shops are themselves the 'products'. Each customer will always choose the nearer shop as it is disadvantageous to travel to the farther.” - Wikipedia*

Hotteling’s Law

This theory argues that if the shops offer the similar products, the shop with most dominant area will win. Here is some figure that explain. Let's say there are two stores A and B. If they decided to open their shop in a linear city that has 12 dashes of land.

|------|------|

First, they build the shop as they can share same amount of customer.

They both win ------ (6 dashes) of the area/customers that are coming from.

|---A---|---B---|

But if B moves 2 dashes closer to shop A.

|---A--**-**|**-B-----**|

Shop B wins some of A's customers since they sell similar products and customer choose to go to the closer shop. A loses some of its customers.

So A decided to move towards shop B, so A can win some customers too.

|------A|B------|

Here, both shops end up with locating at the center.

Likewise, this theory argues that if the shop was located away from the center, they will loose the competition.

|--A---**--**|**-B-----**|

In this project, I will test if this theory is correct at the city in Manhattan.
The reason why I chose Manhattan for this project is that Manhattan is a island like shape and is isolated from other land. So I thought that it is easy to calculate the center of the Manhattan.

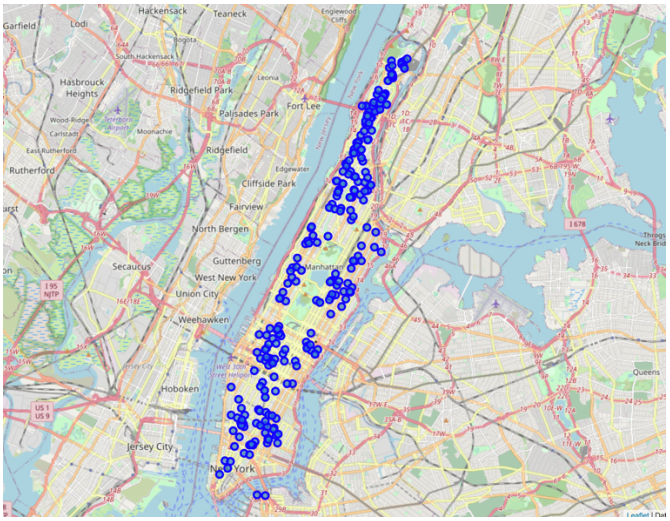
Why?

This theory is very is very interesting because people say that there are a lot of economical and geographical noise in the real world. If the theory is somehow true, open shop as close as possible to the center of the city. I could use this conclusion to advice my friend to do so.

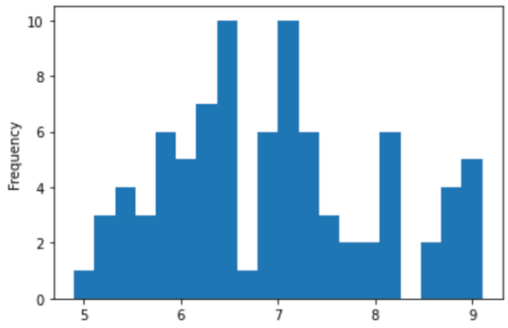
Data acquisition and cleaning

I will use Foursquare data in Manhattan. For **pizza restaurants** in Manhattan with **similar rate** (6-8 range out of 10), I will see if the **pizza restaurants** in the near the center of Manhattan has more likes (to estimate # of customers). The reason for choosing pizza restaurant is that assumption that pizza cannot be extrema expensive, and restaurant would stay in the similar budget rage. I would get the Location Data and Shop Ratings from Foursquare API. The location data is easy to get from the Foursquare, but it was challenging to get the shop ratings and number of likes because the call was limited on the free account. I was able to call 50 shops per day for detailed information. So some of the shops are missing on my project.

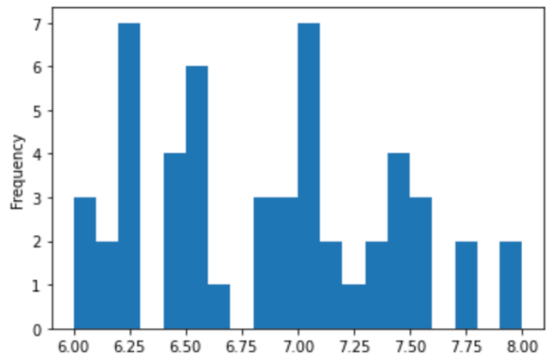
- Pizza Restaurant in Manhattan



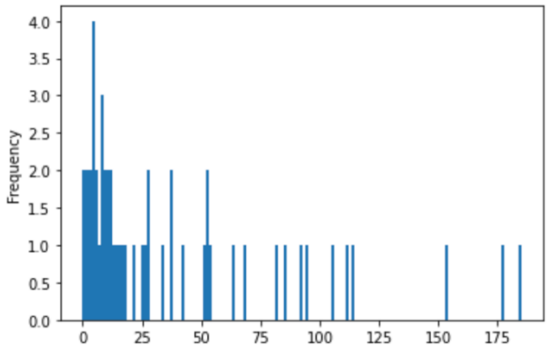
- Pizza Restaurant Rating Distribution (Out of 10)



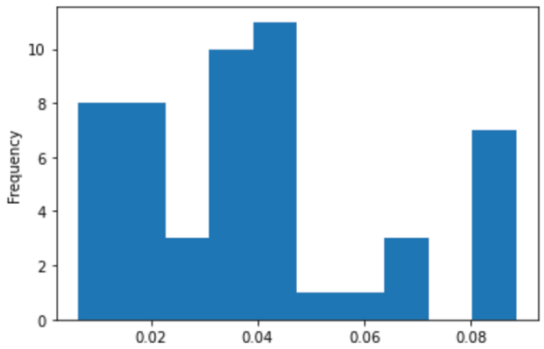
- Pizza Restaurant Rating Distribution (Range 6 to 8)



- Distribution of Number of Likes
-



- Distribution of Euclidean Distane



Methodology

I used ANOVA test which is test of the explanatory variable significantly describes the response variable. In my project, the explanatory variable is the Euclidean Distance from the center of Manhattan, and the response variable is the number of likes that represents # of customer visits in the past.

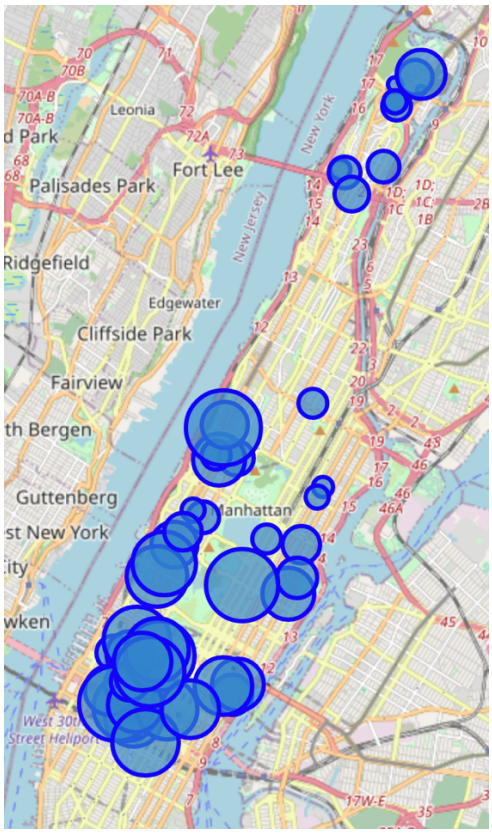
Result

The ANOVA test shows that explanatory variable (distance from the center) statistically significant predictor of the response variable (number of likes). In the other word, within the same price range and similar quality, the shops are recommended to open towards to the center of the city.

	sum_sq	df	F	PR(>F)
C(eucli_dist)	1.086405e+05	50.0	1.104971e+28	7.552544e-15
Residual	1.966396e-25	1.0	NaN	NaN

Discussion

Maps with restaurant with rate (6 to 8). The size of the circle represents number of likes. If I place the center of the city at the central park, I can observe that as the shops get farther from the park, the circles get smaller.



Conclusion

In conclusion, if there are a lot of competitors and their products are similar and almost same quality, the shop/restaurant is recommended to open at the center of the city. The city must be like Manhattan where no geographical barrier and evenly distributed structure.