The Battle of Neighborhood:

Customers satisfaction evaluation for Starbucks shops in Manhattan by scores in Foursquare

Applied Data Science Capstone Project

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Abstract

In this report, we used Starbucks in Manhattan as an example, and demonstrated how to use Foursquare location data to evaluate the customers satisfaction level of each shop. We extracted, visualized, and compared rating and popularity scores for Starbucks coffee shops with their nearby coffee shop competitors and identified Starbucks shops with significantly worse or better rating, or higher or lower popularity. Our methods and results can provide supports for business decisions and can be applied in other similar shops and situations.

Introduction

Evaluating the customers satisfaction of each shop is an essential problem for business owners and operators. It is a very important factor to make business decision such as opening a new shop or market strategy. We are going to propose a data analysis-based method to evaluate customers satisfaction of each shop and identify shops with better or worse customers satisfaction level. Anyone in the business management team of Starbucks or other coffee shops (such as owner, manger), or need making a business decision (such as determining if and how to marketing for a shop) will be interested in this report.

There are many methods to evaluate customers satisfaction (such as a survey for customers) but all methods have different kinds of limitations. On the other hand, we usually compared the interested shop with other shop to get "relative" satisfaction level. But each shop is different than others and their customers satisfaction, such as number of reviews are usually influenced by many factors (for example, shops may have different customer populations). Simply comparison between different shops can be biased or misleading.

With the development of the big-data, more user generated review data (such as Foursquare or Yelp) were collected for each shop. Those data provided a direct way to compare different kinds of scores (such as user rating) between shops in the same category. When integrating with location information (nearby shops), many bias factors can be adjusted (for example, shops in the same location have the same customer population), and the score between shops will be comparable and a direct reflection of customers satisfaction of the shop. This can be an important criterion for shop evaluation.

Here we used Starbucks in Manhattan as an example, demonstrated how to use Foursquare location data to evaluate the performance of each shop. We extracted, visualized, and compared rating and popularity scores for Starbucks coffee shops with their nearby coffee shop competitors and identified Starbucks shops with significantly worse or better rating, or higher or lower popularity. Our methods and results can provide supports for business decisions and can be applied in other similar situations.

Data

The same New York neighborhood information as in the course will be used to extract neighborhood information. Foursquare location data for shops in each neighborhood will be queried. Then all coffee shops in the shop list will be selected and Foursquare API will be used to extract all information/scores related to each shop, including Rating, count of Rating, Count of Likes, and Count of Tips.

Methods

Data will be summarized in mean, median, and IQR for each group. Data will be visualized by different methods including boxplot, histogram, and heatmap. Log transformation will be performed in count data to make them distribute more normally. The scores for each Starbucks shop will be compared to other coffee shops to identify Starbucks shops with significantly worse or better rating, or higher or lower popularity (count of Rating, Count of Likes, and Count of Tips). To adjust other factors such as location, we defined two types of "other coffee shops" to compare with each Starbucks shop: (1) Other coffee shops within the same Neighborhood; (2) Five other nearest coffee shops; t test will be used to identify if the Starbucks shop has a significantly lower or higher score (for example, rating) than "other coffee shops". If test P value was less than 0.05 in comparing with any of the two types of "other coffee shops", the score will be considered as significantly different. Then all Starbucks shops will be classified based on their score difference in rating and popularity.

Results

Overview of coffee shops in NYC

First, we extracted all the coffee shop IDs for each Neighborhood in Manhattan in NYC from Foursquare data. As a result, there are 143 coffee shops in total. 18 of them are Starbucks and 125 of them are not Starbucks (Table 1). "Starbucks" is the most popular coffee shop (N=15), and Blue Bottle Coffee is the second popular (N=9) (Table 2).

Brand	Count
Starbucks	15
Blue Bottle Coffee	9
La Colombe Torrefaction	5
Oslo Coffee Roasters	4
787 Coffee	3
Oslo Coffee Roasters	3

Brand	Count
Not Starbucks	125
Starbucks	18

Table 1: Number of Starbucks.   Table 2: Number of different coffee shops.

In Neighborhood level, there are 39 neighborhoods with coffee shops (Table 3, Figure 1). Financial District has most coffee shop (N=10) and Chelsea has the second most (N=9).

Neighborhood	Count
Financial District	10
Chelsea	9
Carnegie Hill	8
Upper East Side 6	6
Midtown	6
Soho	6
Yorkville	6

Table 3: Number of coffee shops in each neighborhood (Top 7 only).
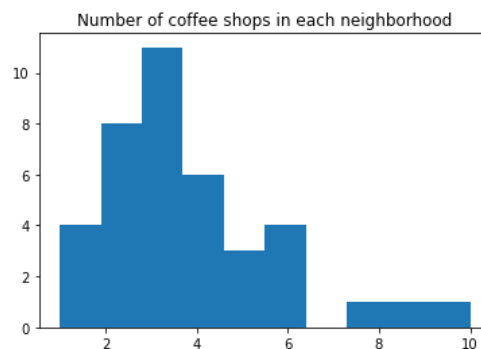

Figure 1: Distribution of coffee shops in each neighborhood.

Scores of coffee shops in NYC

We extracted the score information of all coffee shops from Foursquare data, including Rating (user review scores); Tier (Cheap; Moderate; Expensive); Rating Signal (Number of ratings), Like Count (Number of Likes), and Tip Count (Number of Tips) for each coffee store. Their distribution listed in Table 4 and Figure 2. We can find that the scores are very different between shops. For example, the rating ranges from 5.4-9.3, and the number of ratings ranges from 0-3123.

Name	Description	Mean	SD	25%-75%	Min-Max
Rating	User Rating Score	8.26	0.64	7.8-8.4	5.4-9.3
Tier	Cheap/Expensive	Cheap 117 Moderate 15 Expensive 1			
ratingSignals	Number of "Rating"	294	418	49-360	0-3123
LikeCount	Number of "Like"	219	321	34-270	0-2439
TipCount	Number of "Tip" (Review)	61	93	9-78	0-687

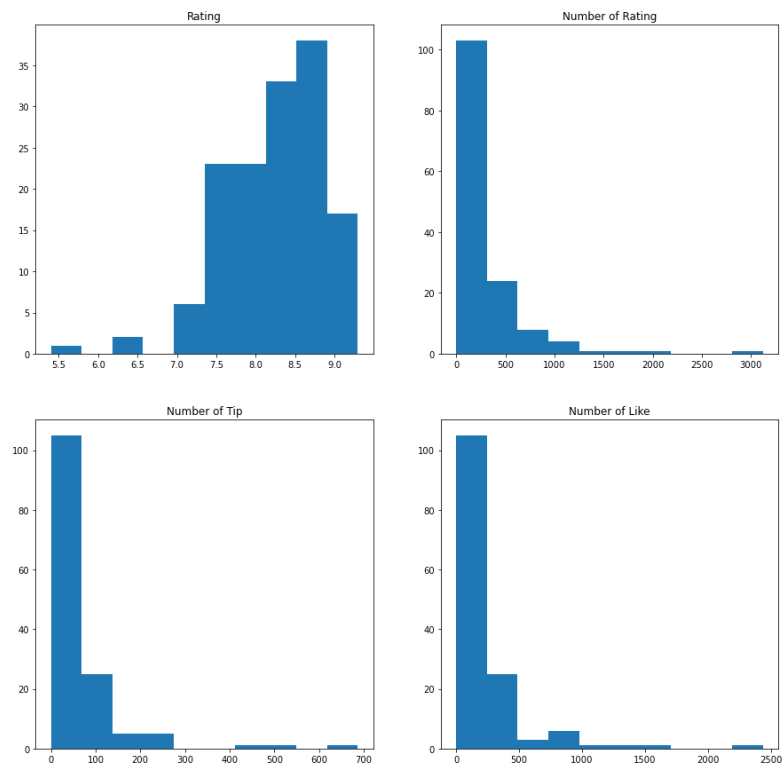Table 4: Meaning and summarization of scores used in this analysis.

Figure 2: Distribution of scores used in this analysis.

In neighborhood level, we used mean score to represent the score of each neighborhood. The results (Table 5, Figure 3) are very similar to shop level but has a smaller variation and range.

Name	Mean	SD	25%-75%	Min-Max
Rating	8.18	0.5	7.9-8.6	6.5-9.0
Number of Ratings	272	227	131-346	15-1172
Number of Like	198	180	76-261	1-913
Number of Tip	56	50	25-70	1-263

Table 4: Meaning and summarization of scores used in this analysis in neighborhood level.
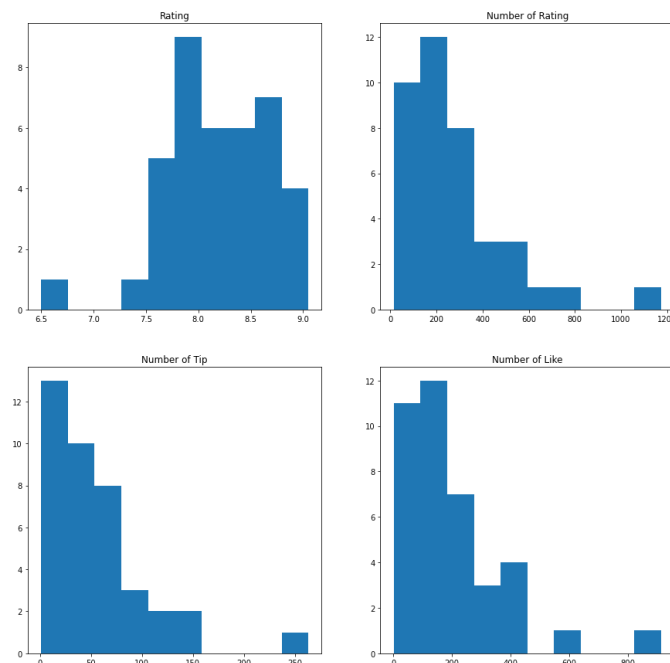

Figure 3: Distribution of scores used in this analysis in neighborhood level.

The we visualized the distribution of scores in each neighborhood (Figure 4, neighborhoods with at least 4 coffee shops only). We can also find that (1) The scores varied a lot within a neighborhood and between neighborhoods; (2) Popularity scores are highly related; (3) Different neighborhoods have different patterns (for example, some with small variations and some with large variations).

The score distribution in shop and neighborhood level indicated that the scores are very different across different shops. So it is better to only compare one shop with other shops in the same neighborhood or very close to it (See methods for definition of "other coffee shops").
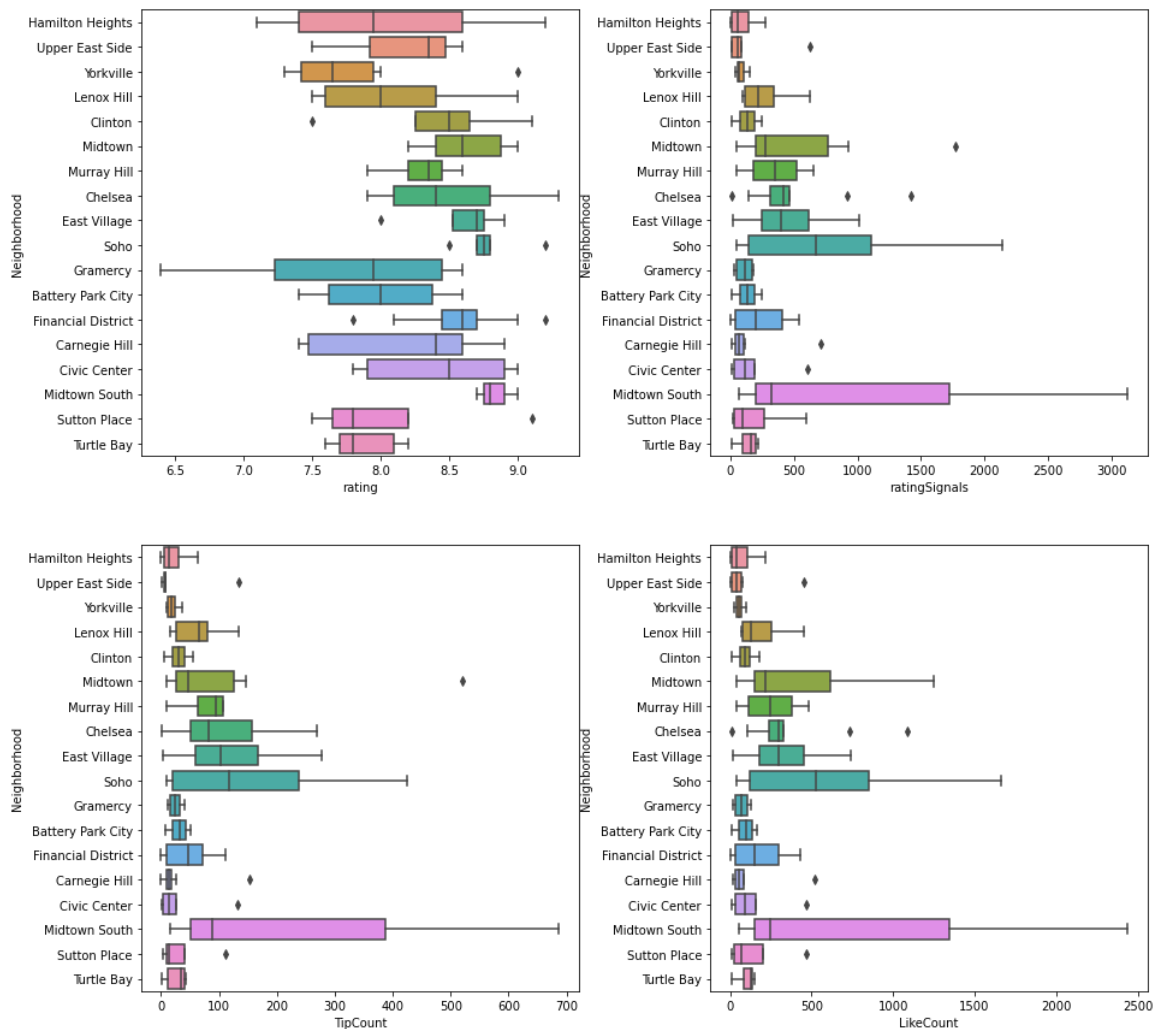
Figure 4: Distribution of scores in each neighborhood (neighborhoods with at least 4 coffee shops only).

We also used heatmap to cluster and visualize the overall score distribution of all coffee shops. In the heatmap, we can easily find that all the "popularity scores" are highly correlated with each other, and count of tips has more variations than other popularity scores. At the shop level, we can find that three type of shops (from top to bottom of the heatmap): (1) Low rating, Low popularity; (2) High rating, High popularity; (3) High rating, Low popularity. Starbucks shops (Red in annotation bar) are among the three types (Figure 5).
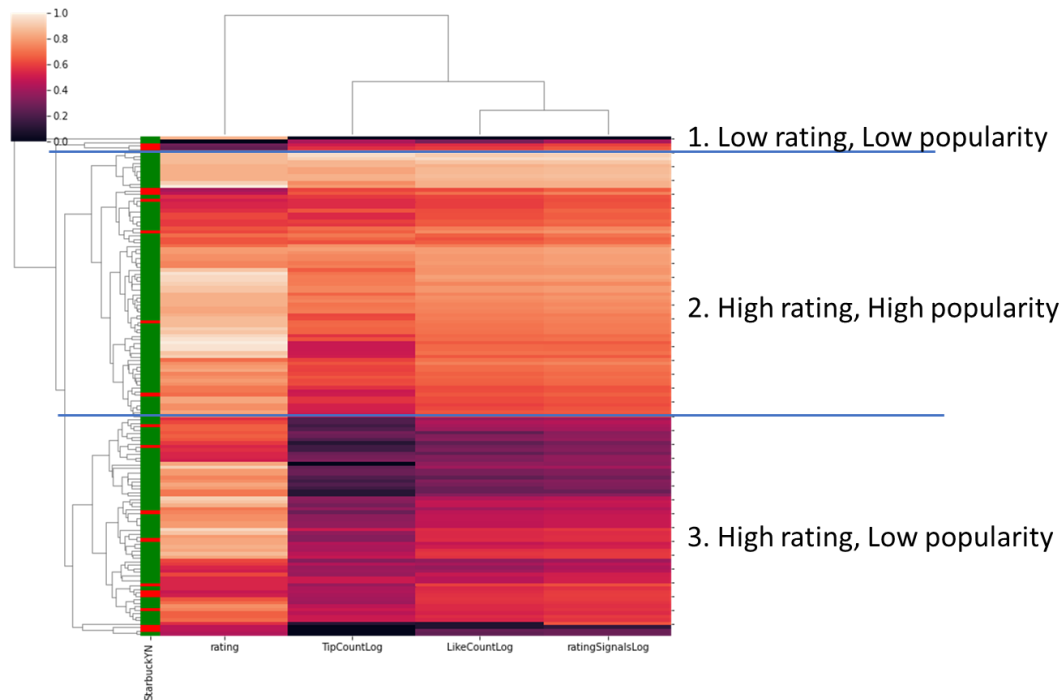
Figure 5: Cluster and heatmap of scores for all coffee shops. The annotation bar on the left side indicated shop type (Red: Starbucks; Green: Not Starbucks)

Scores of Starbucks vs scores of other coffee shops

Then we compared the Scores of Starbucks vs scores of other coffee shops. In overall level, we can find that Starbucks shops have significantly lower ratings than other shops (p<0.001), and lower but not significantly popularity scores (p>0.05) (Table 5, Figure 6).

		Missing	Overall	Not Starbucks	Starbucks	P-Value
n			143	125	18	
rating, mean (SD)		0	8.3 (0.6)	8.4 (0.6)	7.6 (0.7)	<0.001
TipCountLog, mean (SD)		0	3.3 (1.4)	3.3 (1.4)	2.7 (1.4)	0.078
ratingSignalsLog, mean (SD)		0	4.8 (1.4)	4.9 (1.5)	4.5 (1.4)	0.249
LikeCountLog, mean (SD)		0	4.5 (1.5)	4.6 (1.5)	4.1 (1.3)	0.223
message, n (%)	Cheap	0	126 (88.1)	109 (87.2)	17 (94.4)	0.663
	Expensive		1 (0.7)	1 (0.8)		
	Moderate		16 (11.2)	15 (12.0)	1 (5.6)	

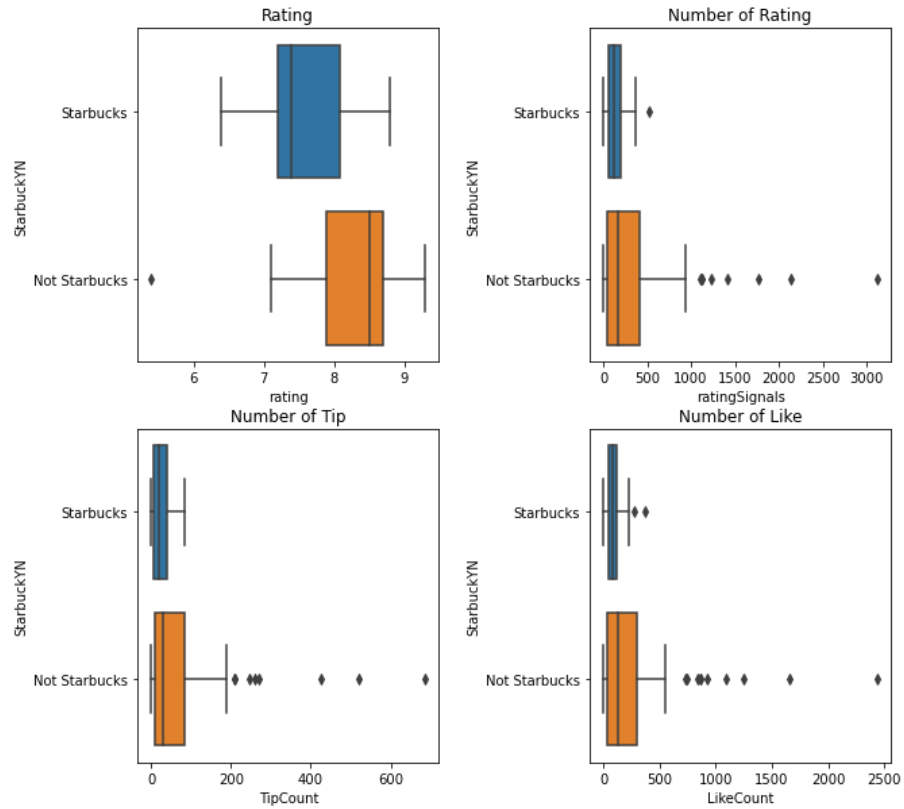Table 5: Scores summarization of Starbucks vs other coffee shops.

Figure 6: Scores distribution of Starbucks vs other coffee shops.

Then we used t test to see if each Starbuck shop is better or worse in score than other shops nearby or in the same neighborhood (Table 6).

	Neighborhood	Venue	Venue ID	RatingCompare	RatingPopularityCompare	LikePopularityCompare	TipPopularityCompare
0	Marble Hill	Starbucks	55f81cd2498ee903149fcc64	No Difference	No Difference	No Difference	No Difference
1	Marble Hill	Starbucks	57655be738faa66160da7527	Significantly Lower	Significantly Lower	Significantly Lower	Significantly Lower
2	Washington Heights	Starbucks	4aafdf93f964a520f66420e3	Significantly Lower	No Difference	No Difference	Significantly Higher
3	Upper East Side	Starbucks	5c01826e60d11b002c912004	Significantly Lower	No Difference	No Difference	No Difference
4	Upper East Side	Starbucks Reserve	57eeb8e3498e1dd086ebf03f	No Difference	No Difference	No Difference	No Difference
5	Yorkville	Starbucks	4a819c70f964a52006f71fe3	No Difference	No Difference	No Difference	No Difference
6	Yorkville	Starbucks	4b69efa9f964a52014bd2be3	Significantly Lower	Significantly Higher	Significantly Higher	Significantly Higher
7	Roosevelt Island	Starbucks	4b0807abf964a520890223e3	Significantly Lower	No Difference	No Difference	No Difference
8	Lincoln Square	Starbucks	4abb899bf964a520f18320e3	Significantly Lower	No Difference	No Difference	No Difference
9	Chelsea	Starbucks Reserve Roastery	5c13bf838afbe0002de55061	No Difference	No Difference	No Difference	No Difference
10	Manhattan Valley	Starbucks	4fdc9a79e4b0735a6deafc25	No Difference	No Difference	No Difference	No Difference
11	Gramercy	Starbucks	4a704000f964a52040d71fe3	Significantly Lower	No Difference	No Difference	No Difference
12	Battery Park City	Starbucks Reserve	4ce41f161594236ac316fb49	No Difference	No Difference	No Difference	No Difference
13	Financial District	Starbucks	4a9ff5d9f964a520ba3d20e3	Significantly Lower	Significantly Higher	Significantly Higher	Significantly Higher
14	Carnegie Hill	Starbucks	57fd457a498e39cd34012586	No Difference	No Difference	No Difference	Significantly Lower
15	Carnegie Hill	Starbucks	5330323b498e2836f173cf9e	Significantly Lower	No Difference	No Difference	No Difference
16	Sutton Place	Starbucks	4ad13d14f964a520a3dd20e3	No Difference	No Difference	No Difference	No Difference
17	Tudor City	Starbucks	5d7bb678290f5e00075785d9	Significantly Lower	Significantly Lower	Significantly Lower	Significantly Lower

Table 6: Test result of each Starbucks shop vs other coffee shops.

If we classify Starbucks shops into different categories by their comparison with other shops, we can find more than half of them have significantly lower rating score. Most of them have similar popularity. Small proportion of them have lower or higher popularity than other coffee shops (Figure 7).
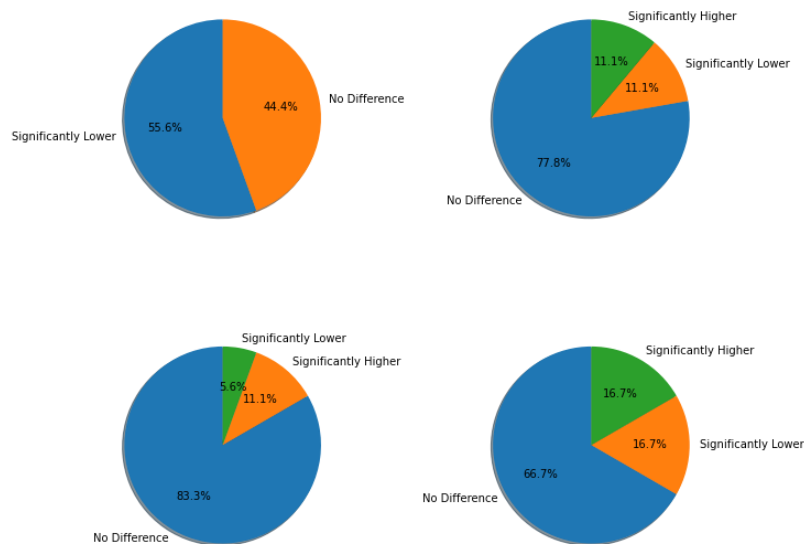

Figure 7: Categories of Starbucks shops vs other coffee shops.

If we take significance in any popularity scores (count of Rating, Count of Likes, and Count of Tips) as significant difference in popularity, we can classify Starbucks shops into the following customers satisfaction evaluation categories (Figure 8). In this result, we found 66% Starbuck shops have the same customers satisfaction level as other coffee shops. 6% have the same rating but lower popularity. 11% have lower rating and lower popularity. 17% have lower rating but higher popularity (Figure 8). Different business can be made based on their customers satisfaction level.
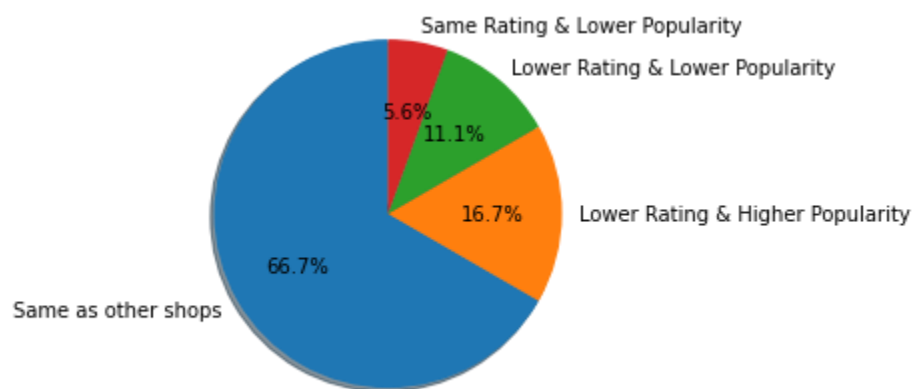

Figure 8: Customers satisfaction evaluation categories of Starbucks shops.

Discussion

In this analysis, we find that (1) The scores in Foursquare system can be used in shop evaluation effectively; (2) We successfully identified Starbucks coffee shops with lower customer rating or popularity; Based on those findings, we will recommend further actions should be taken to improve the customer experiences for shops with lower rating, and further marketing activities should be taken to promote shops with lower popularity scores but normal rating scores.

This is an example about how to use Foursquare location data to evaluate the customers satisfaction level of any shop. It can be used in many other types of shops (such as hotel or restaurant) or evaluation (such as customer tips). Our methods and results can provide supports for business decisions and can be helpful for management team of any shop (Starbucks as example here).

On the other hand, there are many limitations in this analysis, including limited data source and not considering other factors (such as population in the area, length of shop established). But we believe our analysis is in the right direction and can be a simple and quick methods for evaluation and business decision making.

Conclusion

In this report, we used Starbucks in Manhattan as an example, demonstrated how to use Foursquare location data to evaluate the customer satisfaction performance of each shop. We extracted, visualized, and compared rating and popularity scores for Starbucks coffee shops with their nearby coffee shop competitors and identified Starbucks shops with significantly worse or better rating, or higher or lower popularity. Our methods and results can provide supports for business decisions and can be applied in other similar shops evaluations and resolve similar questions in these situations.