Report

Shopping Mall development in Charlotte, North Carolina, U.S.A.

by

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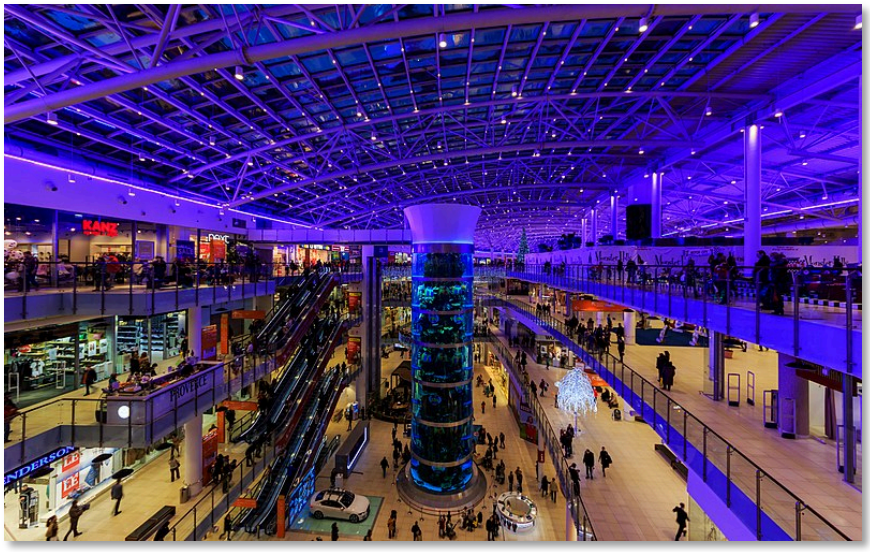

1. Introduction

Shopping malls have received their greatest popularity in the 1970s and 1980s in the U.S. and since investment has stagnated. Numbers exploded, most likely beyond the sustainable numbers in many cities. Additionally, today's brick-and-mortar businesses face the online competition. Despite that many brands meanwhile have successful online stores; the companies wish to remain physically present in their customer's memory daily life.

While shopping malls are the American meeting place and one-stop shop including entertainment, shopping, and dining, many had a fate of neglected and could not attract renewed investment (Sanburn, 2017). The same holds true for the North Carolina metropolis Charlotte, which is representative for the entire country's shopping mall landscape. Charlotte is the largest city in North Carolina and the 23rd largest metropolitan area of the U.S. with ca. 2.5 million residents and growing (Wikipedia, 2019). While a lot of time has passed in the last decades and some shopping malls in Charlotte had a declining business and dwindling number of stores, targets have partially shifted from supplying the market equally well in all city districts to replacement of neglected structures and rejuvenating interest. In parts, the Charlotte is currently suffering from an aging stock of shopping malls. Nevertheless, especially new developments in higher price segments and diligent are a worldwide trend likely to succeed and promise rental of the majority of mall stores (Squareup, 2019).

Business Problem

The objective of this report is to analyze and select the best locations in Charlotte to open a new shopping mall. We will use the data science methodology and machine learning techniques like clustering, this project aims to provide solutions to answer the business question: In the city of Charlotte, NC, a property developer is looking to open a new shopping mall. where are the most promising neighborhoods with least competition and most likely business success?

Target Audience of this report

Developers nowadays ask sensible questions such as: "What kind of foot traffic is there?", "Who are your neighbors? "Will that in-person exposure boost sales enough (both online and in person) to justify the costs?". This project is particularly useful to property developers and investors looking to open or invest in new shopping malls in the south eastern U.S. This report seeks to clarify if there are sufficient capacities for such investments in Charlotte, NC.

2. Methodology

Data types in the report

- City government data on shopping malls (size and location).
- Information on the city' neighborhoods (location)
- Spatial data of North Carolina's commercial and non-commercial venues.

Sources of data

We use Wikipedia as a reliable source of information curated by the city and backed up by references (List of Charlotte neighborhoods, 2019). Wikipedia can be web scraped with the Python package beautifulsoup (beautifulsoup 4, 2019), which parses html code and will grant access to the neighborhood data for further calculations. For spatially locating these neighborhoods, the Python library GeoPy 1.20 will be employed (GeoPy, 2019). Existing shopping malls and statistical data about Charlotte is freely available from the Charlotte Open Data Portal (Existing Shopping Centers, 2019). The Charlotte Open Data Portal's shopping mall set differentiates sizes of shopping malls: "Convenience", "Neighborhood", "Community", "Regional", and "Super-Regional". The focus of our project will be the "Super-Regional" category. Furthermore, additional store and shopping-mall data will be sourced from the (partially) free location API foursquare (Foursquare, 2019). We will focus on the venue category "Shopping Mall". The Charlotte Open Data Portal's data and the Foursquare data will be analyzed separately and compared.

In fact, a lot of demographic data for analysis is available by many cities and based on census data. Census block data is popular with many analysts, since it is more granular than zip codes, i.e. it offers a better resolution of a value. A single zip code may contain multiple census blocks, but a problem arises when census blocks and zip code areas overlap. The problem can be solved by GIS analysts, but is not straight forward. Hence, we are not going to use demographic data such as income, population density etc., even if they would help us a lot in making a decision.

Data analysis

We will make exploratory requests from the Foursquare database of commercial venues surrounding the neighborhood coordinates in a radius of 2000 m and a maximum of 100 venues. Based on this we will calculate venue density per neighborhood and restrict the data to the shopping-mall type venues.

The Python library scikit-learn (scikit-learn, 2019) offers a wide range of modeling and classifying unlabeled data. The analysis will make use of the unsupervised analysis k-means clustering, which offers the option of entering a user-defined number of clusters. Summarizing the store and mall abundance for each neighborhood will determine the successfulness of a new project in or near a given city neighborhood. For the spatial representation of the spatial distribution of the clusters we will use the folium library (folium, 2019).

3. Results

The Charlotte Open Data Portal's "Existing Shopping Malls" data set shows the distribution of five different size categories of shopping malls (Figure 1).

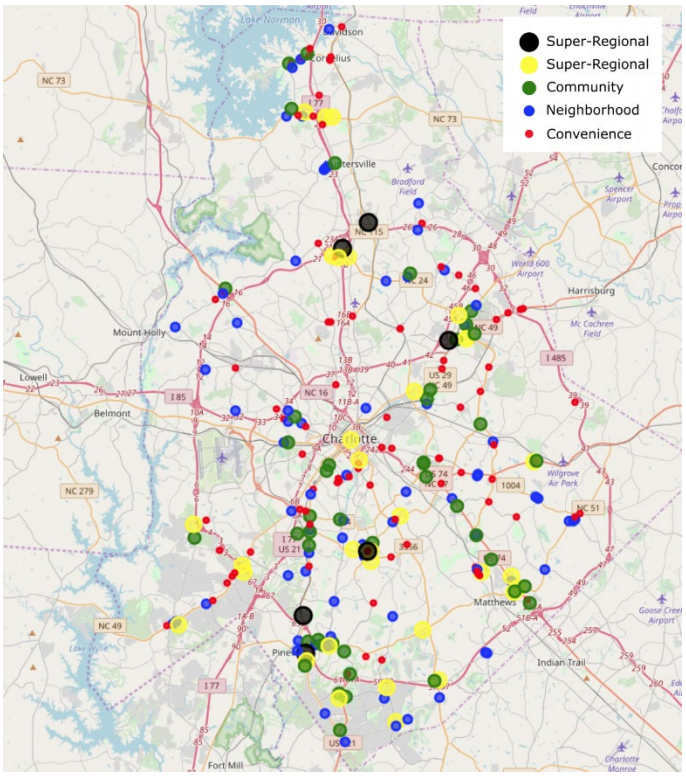

Figure 1: Charlotte Open Data Portal "Existing Shopping Malls" data set.

For our analysis only the size category "Super-Regional" is relevant (Figure 2). This shows the Super Regional type is only common in the northern and southern suburban developments along larger and smaller highways.

The web scraping resulted in five boroughs with 86 neighborhoods: South Charlotte (n=28), West Charlotte (n=22), North Charlotte (n=15), East Charlotte (n=19), and Center City (n=3) (Figure 3).

Querying the Foursquare API with these 87 neighborhoods yielded 5160 venues within a radius of 2000 m of the coordinates. In 19 neighborhoods the query limit of 100 venues was reached. These commercial venues belong into 291 unique venue categories among which there was the category "Shopping Mall". For each neighborhood the mean abundance of shopping malls was calculated and processed for k-means clustering.

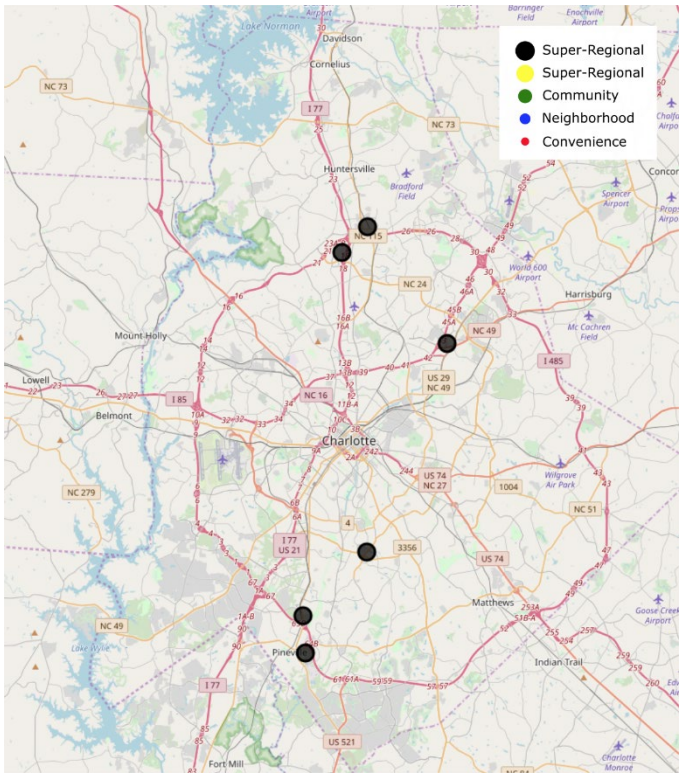

Figure 2: Charlotte Open Data Portal "Existing Shopping Malls" data set. Super-Regional shopping malls only.

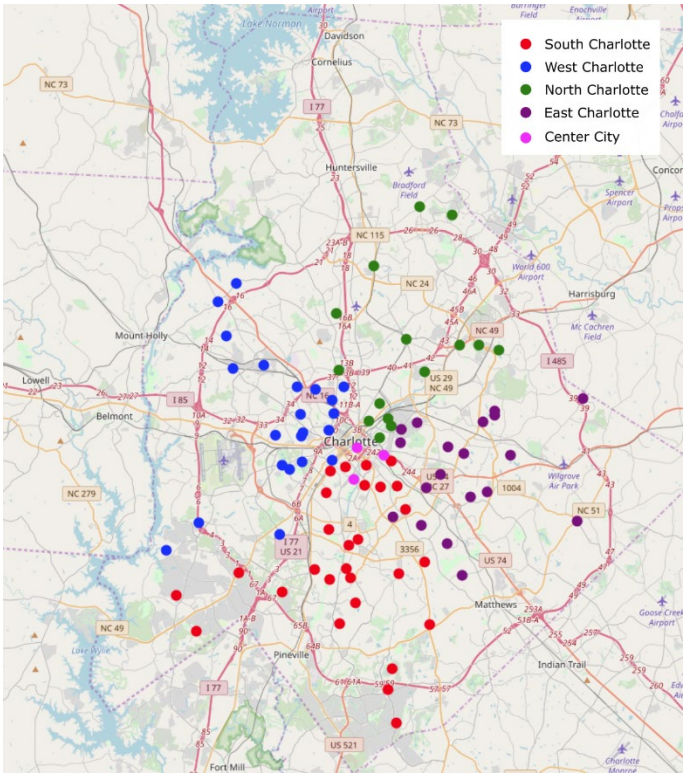

Figure 3: Charlotte's 87 neighborhoods web scraped from Wikipedia.

We chose for the k-means clustering k=4 clusters. The clusters reflect the mean abundance of shopping malls near each neighborhood (see Appendix). The characteristics of the four clusters are the following:

- Cluster 0: Neighborhoods with no shopping-mall abundance
- Cluster 1: Neighborhoods with medium shopping-mall abundance
- Cluster 2: Neighborhoods with high shopping-mall abundance
- Cluster 3: Neighborhoods with low shopping-mall abundance

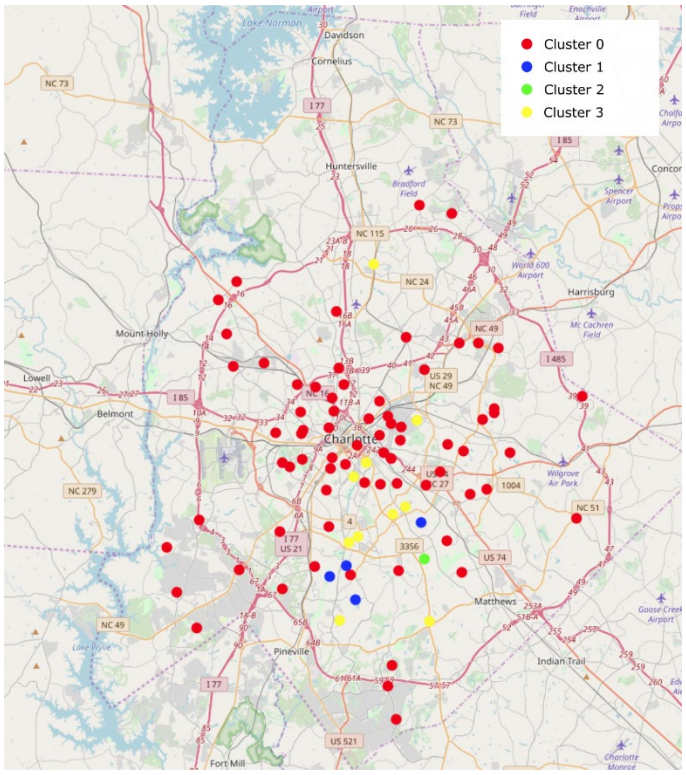

Figure 4: The k-means cluster assignments to neighborhoods (k=4).

4. Discussion

The k-means clustering suggests the following:

- Most of the shopping malls in Charlotte are concentrated in the south east, with the highest number in cluster 2 and medium number in cluster 1 (Figure 4).

- The low-abundance neighborhoods (cluster 3) are mainly in the outer and inner south eastern sector (Figure 4).

- Cluster 0 neighborhoods have no shopping mall abundance within 2000 m and are located mainly in north, east and west (Figure 4).

Comparing the Charlotte Open Data Portal data and the Foursquare data largely match (Figure 5). However, the data delivered by the city government suggests larger concentrations of big shopping malls in the north and south suburban area of Charlotte. Contrary, Foursquare data suggest that only the south is a concentration. This may be caused by a lack of neighborhood data in the northern section of town due to the slightly lower number of neighborhoods on the Wikipedia website (n=15) for North Charlotte compared to the other boroughs (n=19-28). If Wikipedia is incomplete, or there are fewer named neighborhoods needs to be investigated.

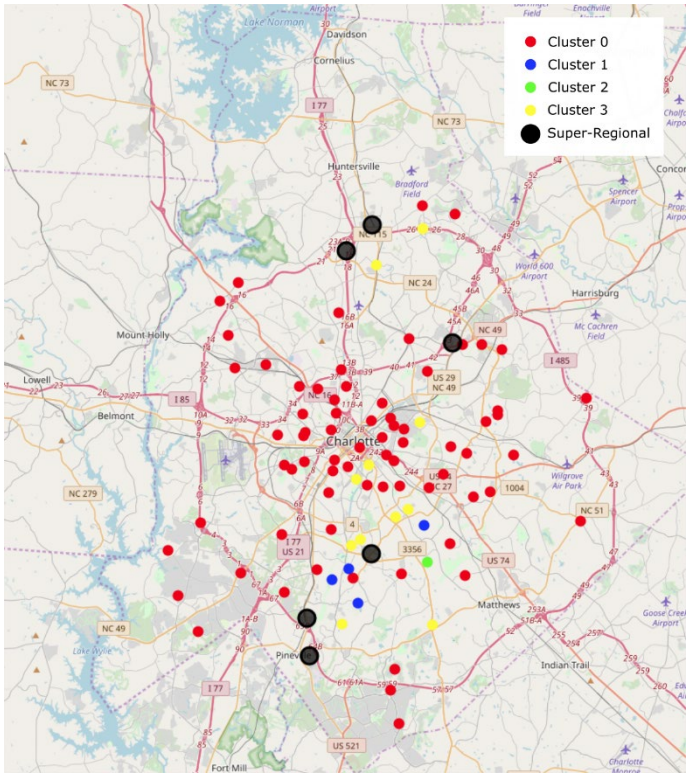

Figure 5: Foursquare data compared to the city government's shopping mall information (Charlotte Open Data Portal).

5. Conclusion

The current distribution of shopping malls in Charlotte represents a great opportunity. High potential areas are in the in the eastern and western boroughs as there is very little to no competition from existing malls.

Meanwhile, shopping malls in South Charlotte (clusters 2 and 3) are likely suffering from intense competition due to oversupply and high concentration of retail space.

As main takeaway, new developments are recommended to stay clear of the well-developed southern sector and should focus on areas with lower mall density. Additional demographic factors such as income should be considered when creating new shopping opportunities.

6. References

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7. Appendix

Table 1: Cluster 0

	Neighborhood	Shopping Mall	Cluster	Borough	Latitude	Longitude
0	Ashley Park	0	0	West Charlotte	35.23054	-80.8842
1	Ayrsley	0	0	South Charlotte	35.13856	-80.9354
2	Belmont	0	0	North Charlotte	35.2291	-80.8197
3	Beverly Woods	0	0	South Charlotte	35.13531	-80.8438
4	Biddleville	0	0	West Charlotte	35.2455	-80.857
5	Blakeney	0	0	South Charlotte	35.03703	-80.8056
6	Camp Greene	0	0	West Charlotte	35.23256	-80.883
7	Carmel Village	0	0	South Charlotte	35.13802	-80.8037
8	Chantilly	0	0	South Charlotte	35.21339	-80.8101
9	Clanton Park	0	0	West Charlotte	35.20798	-80.8936
10	College Downs	0	0	North Charlotte	35.2918	-80.738
11	Coulwood	0	0	West Charlotte	35.29753	-80.9461
12	Derita	0	0	North Charlotte	35.29525	-80.7978
13	Dilworth	0	0	South Charlotte	35.20959	-80.8476
14	Dixie/Berryhill	0	0	West Charlotte	35.15374	-80.9954
15	Eastfield/Prosperity	0	0	North Charlotte	35.3843	-80.7868
16	Easthaven	0	0	East Charlotte	35.19277	-80.7312
17	Eastland	0	0	East Charlotte	35.21885	-80.7503
18	Eastover	0	0	South Charlotte	35.19633	-80.8189
19	Elizabeth	0	0	Center City	35.21778	-80.8161
20	Enderly Park	0	0	West Charlotte	35.24498	-80.8845

21	Grier Heights	0	0	South Charlotte	35.19683	-80.8051
22	Grove Park	0	0	East Charlotte	35.23976	-80.7347
23	Hickory Grove	0	0	East Charlotte	35.24476	-80.7251
24	Hickory Ridge	0	0	East Charlotte	35.21731	-80.7115
25	Hidden Valley	0	0	North Charlotte	35.27345	-80.7822
26	Highland Creek	0	0	North Charlotte	35.37911	-80.76
27	Idlewild	0	0	East Charlotte	35.18969	-80.7445
28	Lincoln Heights	0	0	West Charlotte	35.26342	-80.8487
29	Lockwood	0	0	North Charlotte	35.24045	-80.8284
30	Madison Park	0	0	South Charlotte	35.16747	-80.8617
31	Mint Hill	0	0	East Charlotte	35.17346	-80.6571
32	Mountain Island	0	0	West Charlotte	35.33311	-80.9376
33	Myers Park	0	0	South Charlotte	35.19737	-80.8322
34	Nations Ford	0	0	South Charlotte	35.12555	-80.8998
35	Newell	0	0	North Charlotte	35.28831	-80.7217
36	NoDa	0	0	North Charlotte	35.24252	-80.8124
37	Northlake	0	0	North Charlotte	35.31269	-80.8553
38	Oakhurst	0	0	East Charlotte	35.19559	-80.7811
39	Oakview Terrace	0	0	West Charlotte	35.26176	-80.8725
40	Paw Creek	0	0	West Charlotte	35.27589	-80.9402
41	Piper Glen	0	0	South Charlotte	35.07411	-80.809
42	Plaza Hills	0	0	East Charlotte	35.23503	-80.8017
43	Plaza-Midwood	0	0	East Charlotte	35.22617	-80.8027

44	Raeburn	0	0	South Charlotte	35.05999	-80.8127
45	Ravenwood	0	0	East Charlotte	35.24704	-80.7251
46	Reedy Creek	0	0	East Charlotte	35.25558	-80.6518
47	Reid Park	0	0	West Charlotte	35.21061	-80.8999
48	Revolution Park	0	0	West Charlotte	35.21321	-80.8835
49	Sardis Woods	0	0	East Charlotte	35.13687	-80.7513
50	Sedgefield	0	0	South Charlotte	35.19259	-80.8636
51	Sheffield Park	0	0	East Charlotte	35.20448	-80.7693
52	Shopton	0	0	West Charlotte	35.17199	-80.9685
53	Shuffletown	0	0	West Charlotte	35.32061	-80.9527
54	South End	0	0	South Charlotte	35.20689	-80.8601
55	Starmount	0	0	South Charlotte	35.14067	-80.8728
56	Steele Creek	0	0	South Charlotte	35.12322	-80.9869
57	Stonehaven	0	0	East Charlotte	35.15827	-80.7639
58	Thomasboro/Hoskins	0	0	West Charlotte	35.26332	-80.8878
59	Todd Park	0	0	West Charlotte	35.27838	-80.9149
60	Tryon Hills	0	0	North Charlotte	35.25208	-80.8198
61	University City	0	0	North Charlotte	35.29157	-80.7534
62	Uptown	0	0	Center City	35.22286	-80.838
63	Villa Heights	0	0	North Charlotte	35.23694	-80.8099
64	Washington Heights	0	0	West Charlotte	35.25483	-80.8589
65	Wesley Heights	0	0	West Charlotte	35.23447	-80.8613
66	Westerly Hills	0	0	West Charlotte	35.23106	-80.9055
67	Wilmore	0	0	West Charlotte	35.21402	-80.8586

68	Wilson Heights	0	0	North Charlotte	35.27477	-80.8534
69	Windsor Park	0	0	East Charlotte	35.22319	-80.7632
70	Yorkmount Park	0	0	West Charlotte	35.16444	-80.9019
71	Yorkshire	0	0	South Charlotte	35.09912	-80.9707

Table 2: Cluster 1

	Neighborhood	Shopping Mall	Cluster	Borough	Latitude	Longitude
0	Ballantyne	0.02439	1	South Charlotte	35.11811	-80.8398
1	Quail Hollow	0.022727	1	South Charlotte	35.13388	-80.8605
2	Sherwood Forest	0.033333	1	East Charlotte	35.17068	-80.7854
3	SouthPark	0.02	1	South Charlotte	35.14121	-80.8467

Table 3: Cluster 2

	Neighborhood	Shopping Mall	Cluster	Borough	Latitude	Longitude
0	Landsdowne	0.052632	2	South Charlotte	35.14559	-80.7826

Table 4: Cluster 3

	Neighborhood	Shopping Mall	Cluster	Borough	Latitude	Longitude
0	Arboretum	0.016949	3	South Charlotte	35.10344	-80.7785
1	Barclay Downs	0.01	3	South Charlotte	35.16086	-80.8374
2	Cameron Wood	0.010753	3	South Charlotte	35.10432	-80.8523
3	Cherry	0.01	3	South Charlotte	35.21063	-80.8308
4	Cotswold	0.014493	3	South Charlotte	35.18119	-80.7983
5	Coventry Woods	0.017241	3	East Charlotte	35.17632	-80.8085
6	Croft	0.018182	3	North Charlotte	35.34462	-80.8241

7	Midtown	0.01	3	Center City	35.20104	-80.8407
8	Parkdale	0.01	3	South Charlotte	35.1571	-80.8449
9	Shamrock	0.016667	3	East Charlotte	35.23968	-80.7884