

VooDoo Doughnut Expansion

1. Introduction

1.1. Background



Who is Voodoo Doughnut?

Research revealed that downtown Portland lacked a single doughnut shop, so in 2003 they rented a hole-in-the-wall storefront scrunched between two Old Town nightclubs, joked to friends and family about being bent on “world doughnut domination,” and opened Voodoo Doughnut. Their initial pastry offerings were a mix of the classic and the unconventional.

Within a month of opening, Voodoo Doughnut received its first mention in the national press.

To date, Voodoo Doughnut has been featured on The Travel Channel, The Cooking Channel, MTV, Good Morning America, The Today Show, The Tonight Show, Wheel of Fortune, Portlandia, Grimm, Leverage, The Amazing Race and Access Hollywood, and in print publications such as People, Conde Nast, Spin, GQ, Jane, Maxim, Food & Wine, and more.

Voodoo Doughnut opened its second location in 2008 and as of 2019, has eight locations in five states, most recently opening a second location in Denver, Colorado. More often than not, the stores – open 24 hours a day, 7 days a week – have a line not just out the door, but around the block.

The information above was obtained from the Voodoo Doughnut website
www.voodoodoughnut.com

1.2. Problem

Shall VooDoo Dougnut Open New Locations in Manhattan, NY and Downtown Toronto, ON?

1.3. Stakeholders

Voodoo Doughnut senior management and the board of directors are the stakeholders.

Senior management and the board of directors will ultimately make the decision whether or not to expand to Manhattan and Toronto.

1.4. Why Might Voodoo Doughnut Be Interested In Expansion?

Two years ago, Voodoo Doughnut hired a new CEO. His background includes growing Mod Pizza from 1 location to more than 350 locations.

Hiring of this CEO clearly indicates Voodoo Doughnut wants to expand, since this CEO has extensive experience in growing/expanding a food service business.

Two of VooDoo Doughnut's most recent locations are high profile: Universal theme park Orlando and Universal them park Hollywood.

Voodoo Doughnut has been expanding and is poised for future expansion.

Expanding to two of the largest cities in North America could provide increased name recognition and opportunities for further expansion

2. Data

2.1. Data Sets to be used

Foursquare location data shall be used for each location: Portland, Manhattan, Downtown Toronto.

The Foursquare location data will provide venue information for each neighbourhood in the cities being examined (E.g. coffee shops, bakeries, parks, ...). It will show the most common venue, up through the 10th most common venue for that neighborhood.

Manhattan neighbourhood data shall be obtained from New York University:

https://geo.nyu.edu/catalog/nyu_2451_34572

Toronto neighbourhood data shall be obtained from Wikipedia:

https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M

Portland only requires the address of the VooDoo Doughnut location in Portland which is obtained from the VooDoo Doughnut website.

The geographic coordinates of each neighbourhood will be obtained using the Python geopy library. This will provide the latitude and longitude values.

2.2. Other Data to be used

Demographic information is obtained from the USA Census Bureau and Toronto Central Census Profile 2016 data from the Canadian government. The demographic data is used to compare the similarities of the cities. Demographic information includes but is not limited to: population size, density, age, education, income.

The number of donut shops in Manhattan is obtained from the New York City Health and Mental Hygiene department. The number of donut shops in downtown Toronto is obtained from https://www.menupix.com/toronto/nc/1565/26/Downtown-Toronto-Donut-Shops/page_0

2.3. How the Data will be used

The target cities (Manhattan and Downtown Toronto) will be compared to Portland (existing location of VooDoo Doughnut)

Foursquare location data can be used to determine type of businesses currently in the target cities as well as to compare them to the current location in Portland to look for opportunities for new locations

Demographic data can be compared between Portland and the target cities using census data to identify similarities

3. Methodology

3.1. Toronto

- Get the geographic information for VooDoo Doughnut in downtown Portland, OR.
- Get the Toronto neighborhoods from Wikipedia. Screen scrape using BeautifulSoup. Put the data into a dataframe. Do cleanup on the data such that all rows are of the same format.
- Group the Neighborhoods with the same postcode.
- Add geographic coordinates (latitude/longitude) to each location. We will only work with Boroughs containing "Toronto" in the name. In general, this will provide data more closely resembling downtown and will more closely mirror the Canada census data.
- Append the VooDoo Doughnut location information to the Toronto data frame.
- Using the Foursquare data, get the top 100 venues are that within 500 meters of each Toronto neighborhood, plus the VooDoo Doughnut location in Portland, OR.
- Group rows by neighborhood and by taking the mean of the frequency of occurrence of each category.

- Put the neighborhood data, along with the venue information from Foursquare into a dataframe.
- Cluster the neighborhoods using k-means clustering machine learning. K-means clustering is used, since it is able to discover inherent groupings (clusters) of neighborhoods to determine which neighborhoods are most appropriate for a new VooDoo Doughnut location.
- Try to determine the optimal number of clusters using the Elbow Method and the Silhouette Method.
- Examine the clusters and determine which cluster the VooDoo Doughnut location resides.

3.2. Manhattan

- For Manhattan, read in the New York City data from the json file at New York University into a data frame.
- Add the latitude and longitude data to each data frame row.
- Get a subset of the data, just including the Borough of Manhattan.
- Append the VooDoo Doughnut location to the Manhattan data frame.
- Using the Foursquare data, get the top 100 venues are that within 500 meters of each Manhattan neighborhood, plus the VooDoo Doughnut location in Portland, OR.
- Group rows by neighborhood and by taking the mean of the frequency of occurrence of each category.
- Put the neighborhood data, along with the venue information from Foursquare into a dataframe.
- Cluster the neighborhoods using k-means clustering machine learning. K-means clustering is used, since it is able to discover inherent groupings (clusters) of neighborhoods to determine which neighborhoods are most appropriate for a new VooDoo Doughnut location.
- Try to determine the optimal number of clusters using the Elbow Method and the Silhouette Method.
- Examine the clusters and determine which cluster the VooDoo Doughnut location resides.

4. Results

4.1. Demographics

There are currently 143 donut shops in Manhattan, with 129 of these being Dunkin' Donuts. Downtown Toronto has 72 donut shops, with 65 being Tim Horton's.

Portland

Population: 653,115

Median Age: 36.8 <http://worldpopulationreview.com/us-cities/portland-population/>

Households: 260,949

Median Household Income: \$61,532

Population per square mile: 4,375.2

Bachelor's or higher: 48.2%

Manhattan

Population: 1,628,701

Median Age: 35.7 <http://www.city-data.com/city/Manhattan-New-York.html>

Households: 758,345

Median Household Income: \$69,529

Population per square mile: 69,467.5

Bachelor's or higher: 60.7%

Toronto

Population: 1,232,258

Median Age: 37.9

Households: 568,160

Median household income: CA\$68,148 ~ US\$55,181

Population per Square Mile: 6,412.6 per square kilometre = 2,476 per square mile

Bachelor's or higher: (1,043,920 total 15 or older – 355,425 no diploma or degree) / 1,232,258 = 56%

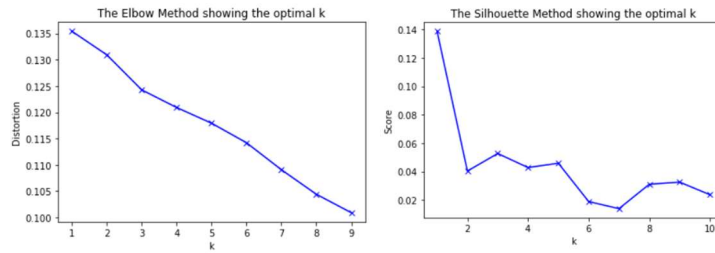
Despite spanning two countries and being geographically dispersed, the three cities are more similar than one might suspect. The median age is similar. Each city has a high education level, with Manhattan having the highest. Manhattan also has the highest median household income. The one major difference is the population per square mile. Manhattan is much more densely populated than Portland or Toronto.

4.2. Number of Clusters for Manhattan and Toronto

4.2.1. Manhattan

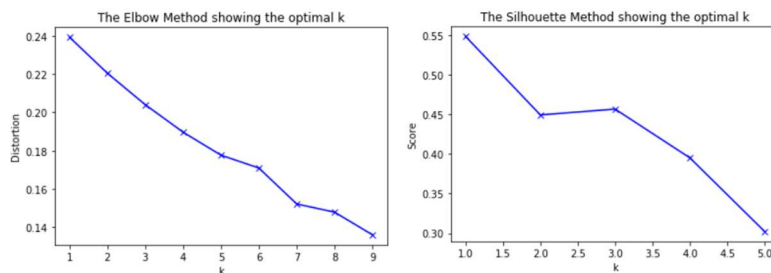
Two methods were tried to determine the optimal number of clusters for k-means clustering: Elbow Method and Silhouette Method. Neither method proved very useful. Several different numbers of clusters were tried. The Elbow Method essentially produced a straight line, indicating no optimal number of clusters. The Silhouette

Method only indicated more than one cluster is needed, but was inconclusive beyond that. Therefore, the average number of clusters, five, were chosen.



4.2.2. Toronto

Toronto has similar results to Manhattan, with the Elbow Method being virtually a straight line. The Silhouette Method gave a hint at two clusters, but it was not definitive. Therefore, five clusters were used.



4.3. Manhattan Cluster

For Manhattan, the neighborhoods in Cluster Label 2 most closely match the neighborhood for the existing VooDoo Doughnut location in Portland. This is the most appropriate cluster to locate a new VooDoo Doughnut location. However, Cluster Label 1, with its large number of coffee shops can also be considered as an expansion location.

CLUSTER LABEL 2

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Chinatown	2	Chinese Restaurant	American Restaurant	Cocktail Bar	Vietnamese Restaurant	Optical Shop	Bakery	Spa	Salon / Barbershop	Asian Restaurant	Sandwich Place
6	Central Harlem	2	African Restaurant	Seafood Restaurant	Bar	American Restaurant	Cosmetics Shop	Fried Chicken Joint	French Restaurant	Chinese Restaurant	Café	Library
8	Upper East Side	2	Italian Restaurant	Exhibit	Bakery	Art Gallery	Coffee Shop	Hotel	Cocktail Bar	Gym / Fitness Center	French Restaurant	Mexican Restaurant
13	Lincoln Square	2	Theater	Plaza	Café	Italian Restaurant	Performing Arts Venue	Gym / Fitness Center	Concert Hall	Park	Indie Movie Theater	French Restaurant
14	Clinton	2	Theater	Coffee Shop	Gym / Fitness Center	American Restaurant	Italian Restaurant	Wine Shop	Gym	Hotel	Spa	French Restaurant
15	Midtown	2	Hotel	Theater	Sporting Goods Shop	Coffee Shop	Clothing Store	Spa	Bakery	Bookstore	Steakhouse	Food Truck
16	Murray Hill	2	Coffee Shop	Hotel	Sandwich Place	Japanese Restaurant	American Restaurant	Italian Restaurant	Gym / Fitness Center	Gym	Mediterranean Restaurant	Bakery
17	Chelsea	2	Coffee Shop	Italian Restaurant	Bakery	Nightclub	Ice Cream Shop	Hotel	Theater	American Restaurant	Seafood Restaurant	Market
18	Greenwich Village	2	Italian Restaurant	Clothing Store	Sushi Restaurant	Café	French Restaurant	Seafood Restaurant	Cosmetics Shop	Boutique	Indian Restaurant	Ice Cream Shop
21	Tribeca	2	American Restaurant	Park	Italian Restaurant	Wine Shop	Spa	Café	Coffee Shop	Wine Bar	Greek Restaurant	Hotel
22	Little Italy	2	Bakery	Café	Bubble Tea Shop	Mediterranean Restaurant	Spa	Clothing Store	Chinese Restaurant	Italian Restaurant	Sandwich Place	Salon / Barbershop
23	Soho	2	Clothing Store	Boutique	Art Gallery	Shoe Store	Women's Store	Spa	Mediterranean Restaurant	Sporting Goods Shop	Furniture / Home Store	Bakery
24	West Village	2	Italian Restaurant	New American Restaurant	Park	American Restaurant	Jazz Club	Cocktail Bar	Cosmetics Shop	Wine Bar	Bakery	Coffee Shop
28	Battery Park City	2	Park	Coffee Shop	Hotel	Gym	Wine Shop	Boat or Ferry	Memorial Site	BBQ Joint	Gourmet Shop	Italian Restaurant
31	Noho	2	Italian Restaurant	French Restaurant	Art Gallery	Cocktail Bar	Mexican Restaurant	Boutique	Rock Club	Coffee Shop	Pizza Place	Gift Shop
32	Civic Center	2	Italian Restaurant	Gym / Fitness Center	Coffee Shop	Hotel	French Restaurant	Yoga Studio	Spa	Sandwich Place	American Restaurant	Cocktail Bar
33	Midtown South	2	Korean Restaurant	Hotel	Japanese Restaurant	Cosmetics Shop	Hotel Bar	Cocktail Bar	Coffee Shop	Boutique	American Restaurant	Dessert Shop
34	Sutton Place	2	Gym / Fitness Center	Indian Restaurant	Italian Restaurant	Furniture / Home Store	Coffee Shop	Gym	Dessert Shop	Health & Beauty Service	Grocery Store	Sushi Restaurant
35	Turtle Bay	2	Italian Restaurant	Steakhouse	Sushi Restaurant	Wine Bar	Coffee Shop	Ramen Restaurant	French Restaurant	Park	Japanese Restaurant	Indian Restaurant
38	Flatiron	2	Yoga Studio	American Restaurant	Japanese Restaurant	Gym	Clothing Store	Gym / Fitness Center	Café	Cosmetics Shop	Cycle Studio	Dessert Shop
39	Hudson Yards	2	American Restaurant	Hotel	Italian Restaurant	Gym / Fitness Center	Coffee Shop	Café	Dog Run	Ice Cream Shop	Thai Restaurant	Gym
40	VooDoo	2	Hotel	Food Truck	Coffee Shop	Burger Joint	American Restaurant	Park	Steakhouse	Mexican Restaurant	Sandwich Place	Restaurant

CLUSTER LABEL 1

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
5	Manhattanville	1	Coffee Shop	Seafood Restaurant	Deli / Bodega	Liquor Store	Park	Sushi Restaurant	Mexican Restaurant	Italian Restaurant	Boutique	Gym / Fitness Center
9	Yorkville	1	Coffee Shop	Bar	Italian Restaurant	Gym	Pizza Place	Deli / Bodega	Sushi Restaurant	Wine Shop	Japanese Restaurant	Ice Cream Shop
10	Lenox Hill	1	Coffee Shop	Italian Restaurant	Pizza Place	Sushi Restaurant	Café	Deli / Bodega	Sporting Goods Shop	Burger Joint	Gym	Cocktail Bar
12	Upper West Side	1	Italian Restaurant	Coffee Shop	Wine Bar	Bar	Café	Cosmetics Shop	Mediterranean Restaurant	Bakery	Vegetarian / Vegan Restaurant	Indian Restaurant
19	East Village	1	Bar	Chinese Restaurant	Wine Bar	Ice Cream Shop	Mexican Restaurant	Cocktail Bar	Pizza Place	Vegetarian / Vegan Restaurant	Ramen Restaurant	Coffee Shop
20	Lower East Side	1	Pizza Place	Café	Art Gallery	Japanese Restaurant	Cocktail Bar	Bakery	Ramen Restaurant	Coffee Shop	Chinese Restaurant	Clothing Store
25	Manhattan Valley	1	Coffee Shop	Pizza Place	Indian Restaurant	Bar	Yoga Studio	Mexican Restaurant	Clothing Store	Playground	Cosmetics Shop	Cocktail Bar
27	Gramercy	1	Italian Restaurant	Bar	Mexican Restaurant	Wine Shop	Bagel Shop	Pizza Place	Cocktail Bar	Ice Cream Shop	Hotel	Grocery Store
29	Financial District	1	Coffee Shop	Pizza Place	American Restaurant	Food Truck	Wine Shop	Hotel	Steakhouse	Gym / Fitness Center	Gym	Cocktail Bar
30	Carnegie Hill	1	Coffee Shop	Pizza Place	Cosmetics Shop	Café	Yoga Studio	Bookstore	Japanese Restaurant	French Restaurant	Bakery	Grocery Store

4.4. Toronto Cluster

For Toronto, the neighborhoods in Cluster Label 0 most closely match the neighborhood for the existing VooDoo Doughnut location in Portland. Therefore, this is the most appropriate cluster to locate a new VooDoo Doughnut location.

CLUSTER LABEL 0

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	East Toronto	0	Health Food Store	Trail	Pub	Department Store	Event Space	Ethiopian Restaurant	Electronics Store	Eastern European Restaurant	Dumpling Restaurant	Donut Shop
1	East Toronto	0	Greek Restaurant	Coffee Shop	Ice Cream Shop	Italian Restaurant	Furniture / Home Store	Bookstore	Restaurant	Brewery	Bubble Tea Shop	Pub
2	East Toronto	0	Park	Sushi Restaurant	Ice Cream Shop	Board Shop	Sandwich Place	Brewery	Burger Joint	Fast Food Restaurant	Burrito Place	Fish & Chips Shop
3	East Toronto	0	Café	Coffee Shop	Bakery	Italian Restaurant	American Restaurant	Comfort Food Restaurant	Bookstore	Seafood Restaurant	Sandwich Place	Brewery
5	Central Toronto	0	Gym	Hotel	Pizza Place	Clothing Store	Convenience Store	Sandwich Place	Breakfast Spot	Food & Drink Shop	Park	General Entertainment
6	Central Toronto	0	Sporting Goods Shop	Coffee Shop	Clothing Store	Yoga Studio	Rental Car Location	Diner	Spa	Dessert Shop	Salon / Barbershop	Burger Joint
7	Central Toronto	0	Pizza Place	Dessert Shop	Sandwich Place	Coffee Shop	Gym	Italian Restaurant	Café	Sushi Restaurant	Park	Seafood Restaurant
9	Central Toronto	0	Pub	Coffee Shop	American Restaurant	Liquor Store	Sports Bar	Restaurant	Bagel Shop	Supermarket	Sushi Restaurant	Fried Chicken Joint
11	Downtown Toronto	0	Coffee Shop	Restaurant	Chinese Restaurant	Pizza Place	Park	Pub	Market	Café	Italian Restaurant	Bakery
12	Downtown Toronto	0	Coffee Shop	Sushi Restaurant	Japanese Restaurant	Gay Bar	Restaurant	Hotel	Gastropub	Men's Store	Café	Mediterranean Restaurant

13	Downtown Toronto	0	Coffee Shop	Pub	Park	Bakery	Restaurant	Theater	Café	Breakfast Spot	Mexican Restaurant	Farmers Market
14	Downtown Toronto	0	Coffee Shop	Clothing Store	Café	Fast Food Restaurant	Cosmetics Shop	Bakery	Middle Eastern Restaurant	Tea Room	Pizza Place	Italian Restaurant
15	Downtown Toronto	0	Café	Coffee Shop	Restaurant	Clothing Store	Italian Restaurant	Hotel	Beer Bar	Bakery	Cosmetics Shop	Diner
16	Downtown Toronto	0	Coffee Shop	Bakery	Seafood Restaurant	Steakhouse	Café	Cheese Shop	Farmers Market	Cocktail Bar	Beer Bar	Shopping Mall
17	Downtown Toronto	0	Coffee Shop	Sandwich Place	Italian Restaurant	Ice Cream Shop	Burger Joint	Café	Chinese Restaurant	Spa	Japanese Restaurant	Gym / Fitness Center
18	Downtown Toronto	0	Coffee Shop	Café	Steakhouse	Thai Restaurant	Bar	Burger Joint	American Restaurant	Asian Restaurant	Bakery	Cosmetics Shop
19	Downtown Toronto	0	Coffee Shop	Aquarium	Hotel	Café	Fried Chicken Joint	Italian Restaurant	Restaurant	Brewery	Scenic Lookout	Bar
20	Downtown Toronto	0	Coffee Shop	Café	Hotel	Bar	American Restaurant	Restaurant	Seafood Restaurant	Gastropub	Deli / Bodega	Steakhouse
21	Downtown Toronto	0	Coffee Shop	Café	Hotel	Restaurant	American Restaurant	Gym	Italian Restaurant	Seafood Restaurant	Deli / Bodega	Bakery
24	Central Toronto	0	Sandwich Place	Café	Coffee Shop	History Museum	Liquor Store	Indian Restaurant	Cosmetics Shop	Pharmacy	American Restaurant	Pizza Place
25	Downtown Toronto	0	Café	Italian Restaurant	Bar	Bakery	Sandwich Place	Bookstore	Restaurant	Japanese Restaurant	Nightclub	Chinese Restaurant
26	Downtown Toronto	0	Café	Bar	Mexican Restaurant	Coffee Shop	Chinese Restaurant	Dumpling Restaurant	Vietnamese Restaurant	Bakery	Park	Record Shop
27	Downtown Toronto	0	Airport Service	Airport Terminal	Coffee Shop	Harbor / Marina	Boat or Ferry	Sculpture Garden	Rental Car Location	Bar	Plane	Boutique
28	Downtown Toronto	0	Coffee Shop	Restaurant	Café	Beer Bar	Seafood Restaurant	Hotel	Bakery	Japanese Restaurant	Italian Restaurant	Farmers Market
29	Downtown Toronto	0	Coffee Shop	Café	Hotel	Restaurant	Steakhouse	Asian Restaurant	Japanese Restaurant	American Restaurant	Deli / Bodega	Gym
30	Downtown Toronto	0	Grocery Store	Café	Park	Athletics & Sports	Nightclub	Restaurant	Candy Store	Diner	Italian Restaurant	Baby Store
31	West Toronto	0	Bakery	Pharmacy	Supermarket	Middle Eastern Restaurant	Brewery	Café	Bank	Bar	Music Venue	Gym / Fitness Center
32	West Toronto	0	Bar	Coffee Shop	Restaurant	Men's Store	Asian Restaurant	Vietnamese Restaurant	Café	New American Restaurant	Bakery	Pizza Place
33	West Toronto	0	Coffee Shop	Breakfast Spot	Café	Climbing Gym	Stadium	Sandwich Place	Burrito Place	Restaurant	Pet Store	Bakery
34	West Toronto	0	Grocery Store	Café	Mexican Restaurant	Thai Restaurant	Bar	Fried Chicken Joint	Park	Music Venue	Cajun / Creole Restaurant	Diner
35	West Toronto	0	Gift Shop	Restaurant	Eastern European Restaurant	Dog Run	Dessert Shop	Bank	Bar	Movie Theater	Cuban Restaurant	Breakfast Spot
36	West Toronto	0	Coffee Shop	Pizza Place	Café	Sushi Restaurant	Italian Restaurant	Health Food Store	Bookstore	Bar	Fish & Chips Shop	Smoothie Shop
37	East Toronto	0	Gym / Fitness Center	Auto Workshop	Park	Comic Shop	Pizza Place	Restaurant	Burrito Place	Brewery	Skate Park	Smoke Shop
38	VooDoo	0	Hotel	Food Truck	Coffee Shop	Burger Joint	American Restaurant	Asian Restaurant	Park	Restaurant	Steakhouse	Sandwich Place

5. Discussion

VooDoo Doughnut should pursue opening new locations in Manhattan and Toronto. While barriers to entry are high, due to the both Manhattan and Toronto being dominated by a single donut shop chain, there still is opportunity for Voodoo Doughnut. The closest analog to VooDoo Doughnut is Krispy Kreme, which has opened donut shops in both Manhattan and Toronto,

despite the competition from the large, entrenched donut chains. Krispy Kreme started major expansion from a much smaller number of locations in the 1990s, to a nationwide (USA) and international presence today. Krispy Kreme can be seen as a model of successful donut shop expansion and a model VooDoo Doughnut may seek to emulate.

6. Conclusion

In conclusion, both Manhattan and Toronto are appropriate locations for VooDoo Doughnut expansion. Donuts are already a strong part of the culture in Manhattan and Toronto. The neighborhoods in Manhattan and Toronto most closely resembling the existing Portland VooDoo Doughnut location have been determined. While both Manhattan and Toronto are each dominated by a single large donut chain, Krispy Kreme has been able to open donut shops in both cities, clearly indicating expansion to Manhattan and Toronto is possible.