GREEN PIZZA DELIVERY SERVICES

E-bike Initiative - Pilot

ABSTRACT

Greener way of delivering everyone's favorite food at their door step needs to be introduced as one small step in saving our environment

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1. Introduction

1.1. Background

In today's world where time is valuable, food delivery services have become essential part of everyone's lives. In urban / metropolitan areas , going out for lunch , dinner or coffee takes lot of time & energy.

The first food delivery service was for naengmyeon (cold noodle) in Korea, recorded in 1768. Hyojonggaeng (hangover soup) was also delivered for the yangban in the 1800s. Advertisement for food delivery and catering also appeared in the newspaper in 1906.

In Mumbai, dabbawalas deliver hundreds of thousands of lunches to paying subscribers every workday through a system of rail and bicycle links. The lunches are sent in tiffin carriers, and are prepared in the late morning by either a restaurant or family member (typically a wife for a working husband, since many families still follow traditional asymmetrical gender roles). The tiffins are then returned either in the afternoon or the next day by the same system.

In past few years , we started observing large scale commercialization in food delivery business by introduction of companies like uberEats, Grubhub , Door dash which used technology to scale up the business and revolutionize customer experience.These companies are under constant evolution of how to serve their customers in best way , stay ahead of the competion and avoid the impact to environment.

1.2. Interest

As part of one such startup company in this business, founders came up with plan for introducing **'Green Food Delivery Services'** which will use **e-bikes** in urban areas of the city which are densly populated and make it commercially viable without impacting customer experience.

These services need to be introduced to one city as pilot model to gain markets & customers confidence in acquiring captial for expansion of the model. **Downtown Toronto** as pilot city is chosen along with food specialization as '**Pizza**' based on city's food habits and order preparation times.

Same services will be planned to extend to other food categories in **second phase** of Pilot.

In this exercise , we will focus on below aspects of project to plan this pilot implementation:-

i) Find Pizza places in Downtown Toronto neighborhood for Food partners
ii) Expanding to next food categories like Coffee shops, other restaurants etc.
iii) Find a best mobile Parking slot for ebikes (For charging and parking ebikeswhen not in transit & reachable to all food pickup locations)
iv) Find set of nearby venues for marketing (Onsite, offline – mails / flyers etc)

2. Data Collection

Below are data features collected and processed for the topic.

2.1. Data Sources

2.1.1. Raw Features

- **Postal Codes** of Neighborhoods for Toronto City based on web scraping
- **Geolocation file** available for Toronto based on Lab data https://cocl.us/Geospatial_data
  Merged with Toronto neighborhood data set to get geo locations of Postal codes.

2.1.2. Derived Features

- **Geolocation** of Downtown Toronto using Geopy
- **Pizza locations** around Downtown Toronto using Four square APIs
- **Exploring other location**s around Downtown Toronto using Four square APIs for extension to other food categories and marketing areas.

2.2. Data Cleaning & Processing Steps

Identifying Geolocations for Downtown Toronto

- **Web Scraping** was performed from https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M to get all neighborhoods data.
- Performed data cleaning to filter assigned neighborhoods for **Downtown Toronto.**
- Merged with Geolocation file to add geo locations(latitudes / longitudes) to Postal codes within Downtown Toronto
  Below is dataset:-

Postal code	Borough	Neighborhood	Latitude	Longitude
M5A	Downtown Toronto	Regent Park / Harbourfront	43.65426	-79.360636
M7A	Downtown Toronto	Queen's Park / Ontario Provincial Government	43.662301	-79.389494
M5B	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937
M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306
M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383
M6G	Downtown Toronto	Christie	43.669542	-79.422564
M5H	Downtown Toronto	Richmond / Adelaide / King	43.650571	-79.384568
M5J	Downtown Toronto	Harbourfront East / Union Station / Toronto Is...	43.640816	-79.381752
M5K	Downtown Toronto	Toronto Dominion Centre / Design Exchange	43.647177	-79.381576

M5L	Downtown Toronto	Commerce Court / Victoria Hotel	43.648198	-79.379817
M5S	Downtown Toronto	University of Toronto / Harbord	43.662696	-79.400049
M5T	Downtown Toronto	Kensington Market / Chinatown / Grange Park	43.653206	-79.400049
M5V	Downtown Toronto	CN Tower / King and Spadina / Railway Lands / ...	43.628947	-79.39442
M4W	Downtown Toronto	Rosedale	43.679563	-79.377529
M5W	Downtown Toronto	Stn A PO Boxes	43.646435	-79.374846
M4X	Downtown Toronto	St. James Town / Cabbagetown	43.667967	-79.367675
M5X	Downtown Toronto	First Canadian Place / Underground city	43.648429	-79.38228
M4Y	Downtown Toronto	Church and Wellesley	43.66586	-79.38316

Identifying Geolocation of Downtown Toronto(using Nominatim)

The geographical coordinate of Downtown Toronto are **43.6563221, -79.3809161.**

Identifying Pizza places

Foursquare Places APIs (Search and explore endpoints for above neighborhoods)

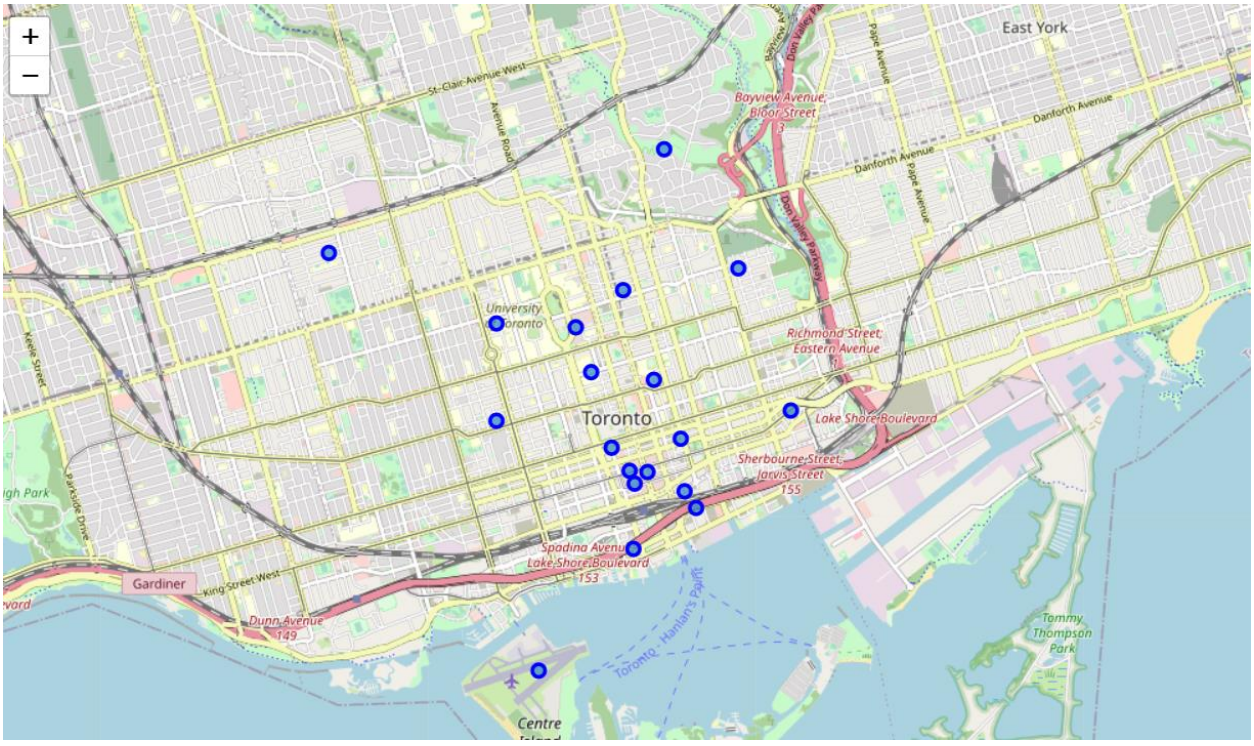
Cleaned and processed JSON responses to stored information in Dataframes.

name	categories	address	lat	lng	distance
Pure Pizza & Burger	Restaurant	314 Parliament St	43.659454	-79.366029	723
Pizzaiolo	Pizza Place	550 Yonge St.	43.664434	-79.384379	475
Slice of New York	Pizza Place	64 Edward St	43.656429	-79.383598	384
True True Diner	Diner	169 King St E	43.65059	-79.371467	333
Uncle Tony's Pizza and Pasta	Italian Restaurant	38 Wellington Street East	43.648287	-79.375005	414
Slice of New York	Pizza Place	64 Edward St	43.656429	-79.383598	348
Pizzaface	Pizza Place	221 Richmond St W	43.649254	-79.38931	409
Pizzaiolo	Pizza Place	3 Rees St.	43.639113	-79.387266	482
Panago	Pizza Place	133 Bremner Blvd.	43.642518	-79.383591	543

Pizzeria Libretto	Pizza Place	155 University Ave	43.648334	-79.385111	426
Cora Pizza	Pizza Place	658 Spadina Ave.	43.663406	-79.402319	199
Amato Pizza	Pizza Place	380 College St	43.65707	-79.405103	592
Pizzaiolo	Pizza Place	104 Yonge St	43.649831	-79.378403	474
Domino's Pizza	Pizza Place	462 Sherbourne St	43.666469	-79.374537	577
Pizzaiolo	Pizza Place	1 Toronto St.	43.650206	-79.376184	529
Pizzaiolo	Pizza Place	707 Yonge St.	43.669415	-79.386372	472

3. Data Analysis

Data analysis was performed using data visualization , by plotting Downtown Toronto map areas

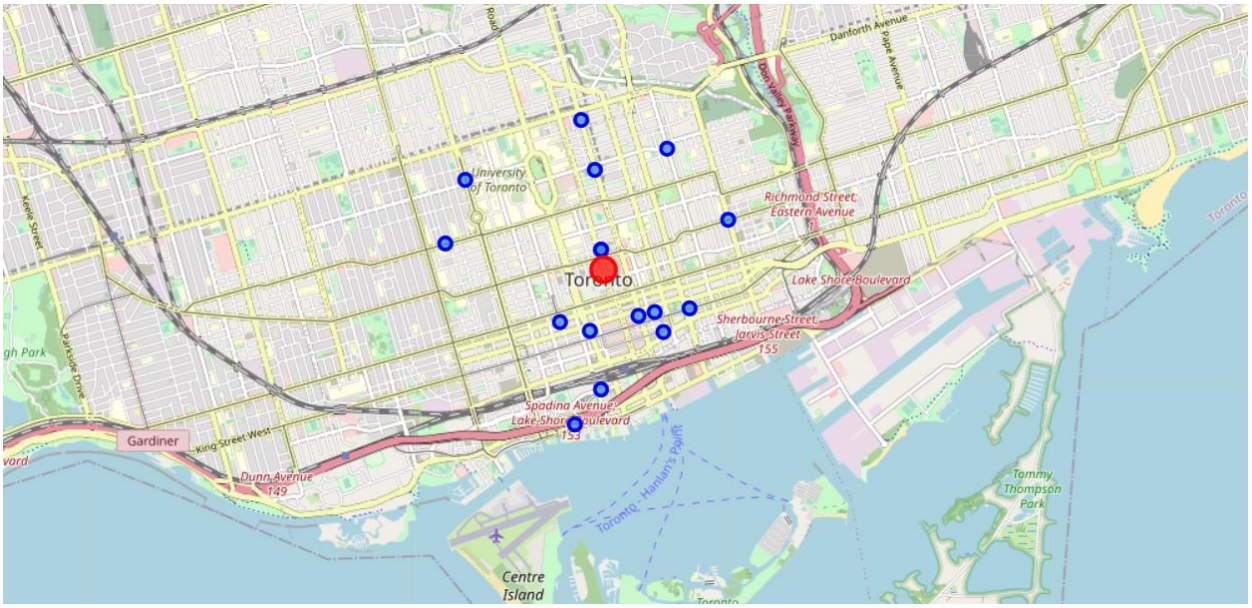


Plotting Identified Pizza Places in Downtown Toronto

Green Pizza Delivery Services

Finding central optimized area to open parking spot for e-bikes reachable to all pizza places by Euclidian distance means from all Geo locations.(Ensure customer delivery times by reaching to all pizza places in near same time when Pick up order is placed)

{'latitude': 43.65445281848269, 'longitude': -79.38326674957031}



Using this Center location, find other categories of Food options which require less food prep time and are often consumed by customers. Below categories can be used for second and third phase of Pilot implementation

Categories	Count
Coffee Shop	10
Park	6
Restaurant	5
Hotel	4
Café	4
Bakery	3
Farmers Market	3
Vegetarian / Vegan Restaurant	3
Dance Studio	2
Sandwich Place	2
Japanese Restaurant	2
Diner	2
Liquor Store	2
Plaza	2
Neighborhood	2
Theater	2
Supermarket	2
Historic Site	2
Beer Bar	2
Shopping Mall	1
Mediterranean Restaurant	1
Gym	1
Dessert Shop	1
Caribbean Restaurant	1
Pool	1
Monument / Landmark	1
Event Space	1
Baseball Stadium	1
Spa	1
Tapas Restaurant	1
Hostel	1
Skating Rink	1
French Restaurant	1
Chocolate Shop	1
Art Gallery	1
Yoga Studio	1
Sporting Goods Shop	1
Food Truck	1
Brewery	1

Organic Grocery	1
Gastropub	1
Train Station	1
Pub	1
Ice Cream Shop	1
Cosmetics Shop	1
Arts & Crafts Store	1
American Restaurant	1
Clothing Store	1
Mexican Restaurant	1
Gourmet Shop	1
Street Art	1
Garden	1
Lake	1
Bubble Tea Shop	1
Concert Hall	1
Cheese Shop	1
Performing Arts Venue	1
Record Shop	1
Bar	1

Based on above categories, Coffee shops are found to be larger in number in this area and can be potentially targeted for second Phase of Pilot. Third Phase can be other restaurants / bakeries (But with different delivery guaranteed times due to order prep times)

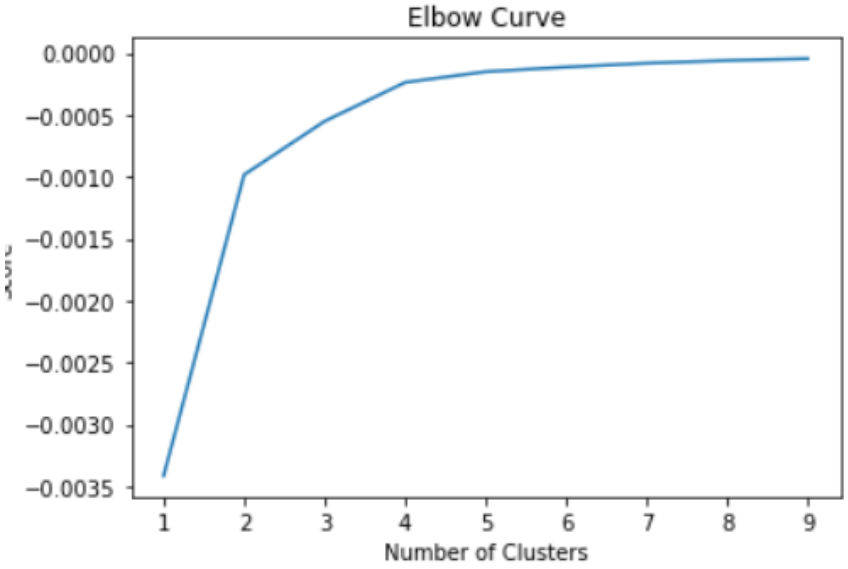
Plotting Map for Pizza, Coffee Shops and remaining restaurants on map.

We can definitely see that second and third phase lead to more no of Food Pick up centers and using single parking spot wont be sufficient. More no of parking spots need to be identified

4. Modeling

Based on data analysis, it was identified using single delivery location to cover all three phases of Pilot implementation might not be right strategy. We will need to identify clusters of geolocation and find min number of parking spots needed to provide best service at optimum operational costs.

Using Kmeans for geo clustering of all geolocations found for Pizza, Coffee shops and other restaurants (Using Elbow Curve to Identify best K value for clustering)



When we graph the plot, we see that the graph levels off slowly after 3 clusters. We can use 3 spots as delivery hubs for Downtown Toronto areas.

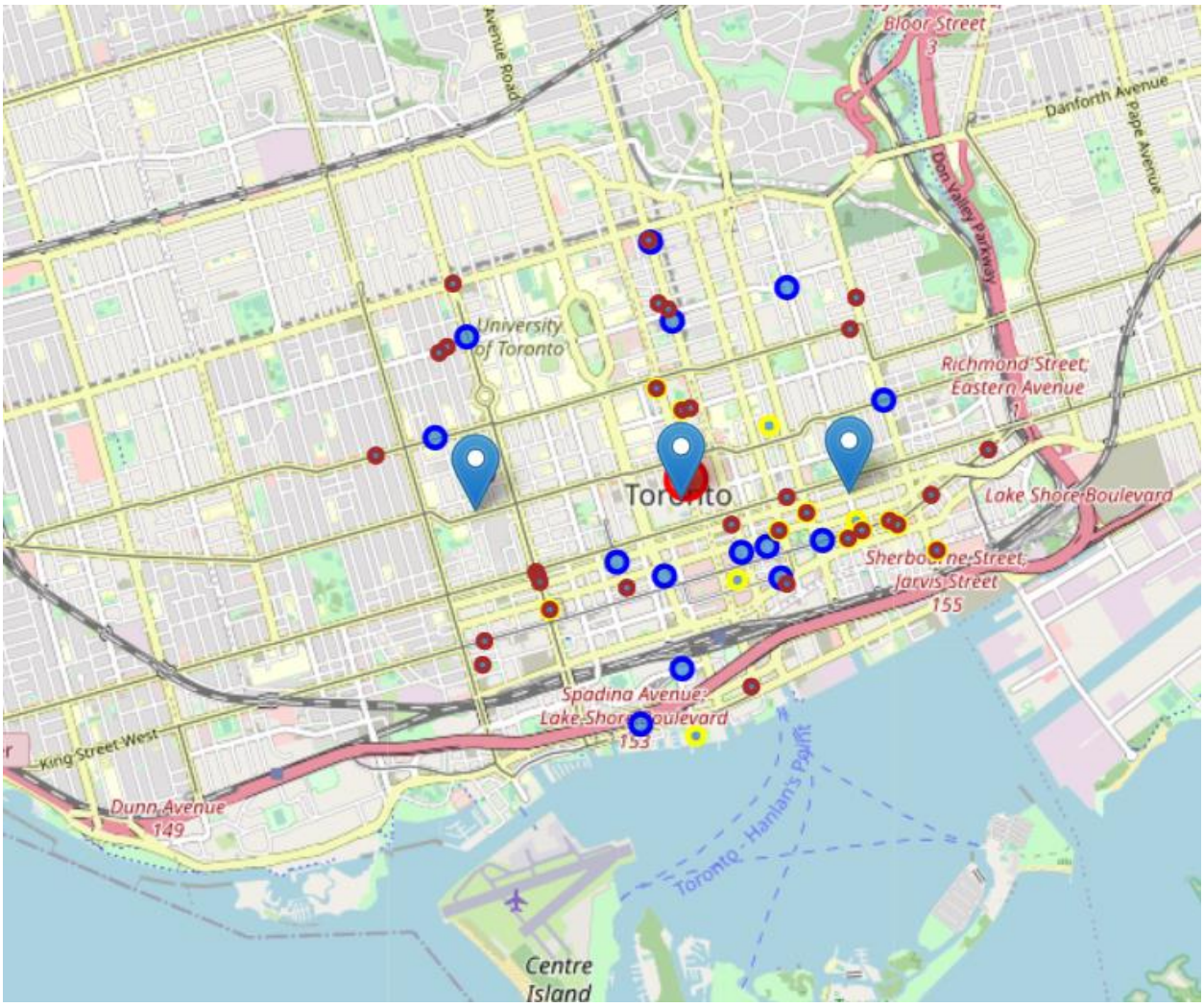
Results

Next will be to identify 3 Delivery Spots (Centers of 3 Clusters by applying k-means)

Three Centers identified are :-

[[43.65152214 -79.37102911]
 [43.65178696 -79.39782399]
 [43.6623284 -79.38396404]]

Below Map represents all food locations categorized by different colors and 3 Potential areas of Ebike Parking Spot.



5. Conclusion

We identified how to implement Green Pizza delivery services pilot in DownTown Toronto area

- Pizza Places were identified as food partner in the area for First Phase .
- Considering long term vision of expanding these services to food categories beyond Pizza, it was identified that second phase can be inclusion of Coffee shops
- After Coffee shops, other restaurants can be considered
- Based on all three phases, it was identified by K means clustering model that if we have to setup multiple Parking spots for ebikes , then what is right number and potential locations of those spots.
- Other venues identified like Parks, Gyms , etc can be targeted for localized marketing of Green pizza delivery services

Provided we have availability of data, this study can be further be expanded to entire city , other factors can also be included in coming up with Potential Food partners and Parking spots like Restaurant reviews , traffic conditions or orders placed per restaurants.

One can argue that K-clustering might not be optimized , but it was evaluated that when you have to restrict clustering in relatively closed areas, Kmeans clustering is effective also on geo locations.

6. References

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

https://en.wikipedia.org/wiki/Food_delivery

https://datascience.stackexchange.com/questions/761/clustering-geo-location-coordinates-lat-long-pairs