

Week 3 Peer Graded Assignment

November 18, 2019

0.1 Peer-graded Assignment: Segmenting and Clustering Neighborhoods in Toronto

0.1.1 Part 1

```
[1]: import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # library to handle JSON files

!conda install -c conda-forge geopy --yes # uncomment this line if you haven't
↳ completed the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude and
↳ longitude values

import requests # library to handle requests
from pandas.io.json import json_normalize # transform JSON file into a pandas
↳ dataframe

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

# import k-means from clustering stage
from sklearn.cluster import KMeans

!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you
↳ haven't completed the Foursquare API lab
import folium # map rendering library

print('Libraries imported.')
```

Solving environment: done

```
==> WARNING: A newer version of conda exists. <==
current version: 4.5.11
latest version: 4.7.12
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

```
# All requested packages already installed.
```

Solving environment: done

```
==> WARNING: A newer version of conda exists. <==
current version: 4.5.11
latest version: 4.7.12
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

```
# All requested packages already installed.
```

Libraries imported.

```
[1]: pip install lxml
```

```
Requirement already satisfied: lxml in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (4.4.1)
Note: you may need to restart the kernel to use updated packages.
```

```
[5]: #Fetching the data from the web page
url = 'https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
toronto_data = pd.read_html(url, header = 0)
toronto_data = toronto_data[0]
toronto_data.head()
```

```
[5]:
```

	Postcode	Borough	Neighbourhood
0	M1A	Not assigned	Not assigned
1	M2A	Not assigned	Not assigned
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront

```
[7]: #Creating the neighborhoods data with Borough Name ie, eliminating 'Not
      ↳assigned observations'
neighborhoods_data = toronto_data[toronto_data.Borough != 'Not assigned']
neighborhoods_data.reset_index(drop = True, inplace = True)
neighborhoods_data.head()
```

```
[7]:
```

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront
3	M6A	North York	Lawrence Heights
4	M6A	North York	Lawrence Manor

```
[9]: #Grouping the Data by postcode, ensuring that all Neighborhoods under the same
      ↳postcode appear as one observation
neighborhoods_data = neighborhoods_data.
      ↳groupby(['Postcode', 'Borough'])['Neighbourhood'].apply(', '.join)
neighborhoods_data = neighborhoods_data.reset_index(level =
      ↳['Postcode', 'Borough'])
neighborhoods_data.head()
```

```
[9]:
```

	Postcode	Borough	Neighbourhood
0	M1B	Scarborough	Rouge, Malvern
1	M1C	Scarborough	Highland Creek, Rouge Hill, Port Union
2	M1E	Scarborough	Guildwood, Morningside, West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae

```
[17]: #Replacing the 'Neighborhood's with the observation 'Not assigned' their
      ↳Borough Names
print(neighborhoods_data[neighborhoods_data.Neighbourhood == 'Not assigned'])
neighborhoods_data.loc[(neighborhoods_data.Neighbourhood == 'Not assigned'),
      ↳['Neighbourhood']]=neighborhoods_data.Borough
neighborhoods_data.head()
```

Empty DataFrame

Columns: [Postcode, Borough, Neighbourhood]

Index: []

```
[17]:
```

	Postcode	Borough	Neighbourhood
0	M1B	Scarborough	Rouge, Malvern
1	M1C	Scarborough	Highland Creek, Rouge Hill, Port Union
2	M1E	Scarborough	Guildwood, Morningside, West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae

```
[19]: neighborhoods_data[neighborhoods_data.Neighbourhood == 'Not assigned']
```

```
[19]: Empty DataFrame
      Columns: [Postcode, Borough, Neighbourhood]
      Index: []
```

0.1.2 The above code shows that the Neighbourhoods with ‘Not assigned’ Observations have been replaced with their Borough Name

```
[20]: neighborhoods_data
```

```
[20]:
```

	Postcode	Borough \
0	M1B	Scarborough
1	M1C	Scarborough
2	M1E	Scarborough
3	M1G	Scarborough
4	M1H	Scarborough
5	M1J	Scarborough
6	M1K	Scarborough
7	M1L	Scarborough
8	M1M	Scarborough
9	M1N	Scarborough
10	M1P	Scarborough
11	M1R	Scarborough
12	M1S	Scarborough
13	M1T	Scarborough
14	M1V	Scarborough
15	M1W	Scarborough
16	M1X	Scarborough
17	M2H	North York
18	M2J	North York
19	M2K	North York
20	M2L	North York
21	M2M	North York
22	M2N	North York
23	M2P	North York
24	M2R	North York
25	M3A	North York
26	M3B	North York
27	M3C	North York
28	M3H	North York
29	M3J	North York
30	M3K	North York
31	M3L	North York
32	M3M	North York
33	M3N	North York
34	M4A	North York
35	M4B	East York
36	M4C	East York

37	M4E	East Toronto
38	M4G	East York
39	M4H	East York
40	M4J	East York
41	M4K	East Toronto
42	M4L	East Toronto
43	M4M	East Toronto
44	M4N	Central Toronto
45	M4P	Central Toronto
46	M4R	Central Toronto
47	M4S	Central Toronto
48	M4T	Central Toronto
49	M4V	Central Toronto
50	M4W	Downtown Toronto
51	M4X	Downtown Toronto
52	M4Y	Downtown Toronto
53	M5A	Downtown Toronto
54	M5B	Downtown Toronto
55	M5C	Downtown Toronto
56	M5E	Downtown Toronto
57	M5G	Downtown Toronto
58	M5H	Downtown Toronto
59	M5J	Downtown Toronto
60	M5K	Downtown Toronto
61	M5L	Downtown Toronto
62	M5M	North York
63	M5N	Central Toronto
64	M5P	Central Toronto
65	M5R	Central Toronto
66	M5S	Downtown Toronto
67	M5T	Downtown Toronto
68	M5V	Downtown Toronto
69	M5W	Downtown Toronto
70	M5X	Downtown Toronto
71	M6A	North York
72	M6B	North York
73	M6C	York
74	M6E	York
75	M6G	Downtown Toronto
76	M6H	West Toronto
77	M6J	West Toronto
78	M6K	West Toronto
79	M6L	North York
80	M6M	York
81	M6N	York
82	M6P	West Toronto
83	M6R	West Toronto

84	M6S	West Toronto
85	M7A	Queen's Park
86	M7R	Mississauga
87	M7Y	East Toronto
88	M8V	Etobicoke
89	M8W	Etobicoke
90	M8X	Etobicoke
91	M8Y	Etobicoke
92	M8Z	Etobicoke
93	M9A	Queen's Park
94	M9B	Etobicoke
95	M9C	Etobicoke
96	M9L	North York
97	M9M	North York
98	M9N	York
99	M9P	Etobicoke
100	M9R	Etobicoke
101	M9V	Etobicoke
102	M9W	Etobicoke

	Neighbourhood
0	Rouge, Malvern
1	Highland Creek, Rouge Hill, Port Union
2	Guildwood, Morningside, West Hill
3	Woburn
4	Cedarbrae
5	Scarborough Village
6	East Birchmount Park, Ionview, Kennedy Park
7	Clairlea, Golden Mile, Oakridge
8	Cliffcrest, Cliffside, Scarborough Village West
9	Birch Cliff, Cliffside West
10	Dorset Park, Scarborough Town Centre, Wexford He...
11	Maryvale, Wexford
12	Agincourt
13	Clarks Corners, Sullivan, Tam O'Shanter
14	Agincourt North, L'Amoreaux East, Milliken, Steel...
15	L'Amoreaux West
16	Upper Rouge
17	Hillcrest Village
18	Fairview, Henry Farm, Oriole
19	Bayview Village
20	Silver Hills, York Mills
21	Newtonbrook, Willowdale
22	Willowdale South
23	York Mills West
24	Willowdale West
25	Parkwoods

26 Don Mills North
 27 Flemington Park, Don Mills South
 28 Bathurst Manor, Downsview North, Wilson Heights
 29 Northwood Park, York University
 30 CFB Toronto, Downsview East
 31 Downsview West
 32 Downsview Central
 33 Downsview Northwest
 34 Victoria Village
 35 Woodbine Gardens, Parkview Hill
 36 Woodbine Heights
 37 The Beaches
 38 Leaside
 39 Thorncliffe Park
 40 East Toronto
 41 The Danforth West, Riverdale
 42 The Beaches West, India Bazaar
 43 Studio District
 44 Lawrence Park
 45 Davisville North
 46 North Toronto West
 47 Davisville
 48 Moore Park, Summerhill East
 49 Deer Park, Forest Hill SE, Rathnelly, South Hill, ...
 50 Rosedale
 51 Cabbagetown, St. James Town
 52 Church and Wellesley
 53 Harbourfront
 54 Ryerson, Garden District
 55 St. James Town
 56 Berczy Park
 57 Central Bay Street
 58 Adelaide, King, Richmond
 59 Harbourfront East, Toronto Islands, Union Station
 60 Design Exchange, Toronto Dominion Centre
 61 Commerce Court, Victoria Hotel
 62 Bedford Park, Lawrence Manor East
 63 Roselawn
 64 Forest Hill North, Forest Hill West
 65 The Annex, North Midtown, Yorkville
 66 Harbord, University of Toronto
 67 Chinatown, Grange Park, Kensington Market
 68 CN Tower, Bathurst Quay, Island airport, Harbourf...
 69 Stn A PO Boxes 25 The Esplanade
 70 First Canadian Place, Underground city
 71 Lawrence Heights, Lawrence Manor
 72 Glencairn

```

73 Humewood-Cedarvale
74 Caledonia-Fairbanks
75 Christie
76 Dovercourt Village,Dufferin
77 Little Portugal,Trinity
78 Brockton,Exhibition Place,Parkdale Village
79 Downsview,North Park,Upwood Park
80 Del Ray,Keelesdale,Mount Dennis,Silverthorn
81 The Junction North,Runnymede
82 High Park,The Junction South
83 Parkdale,Roncesvalles
84 Runnymede,Swansea
85 Queen's Park
86 Canada Post Gateway Processing Centre
87 Business Reply Mail Processing Centre 969 Eastern
88 Humber Bay Shores,Mimico South,New Toronto
89 Alderwood,Long Branch
90 The Kingsway,Montgomery Road,Old Mill North
91 Humber Bay,King's Mill Park,Kingsway Park Sout...
92 Kingsway Park South West,Mimico NW,The Queensw...
93 Queen's Park
94 Cloverdale,Islington,Martin Grove,Princess Gar...
95 Bloordale Gardens,Eringate,Markland Wood,Old B...
96 Humber Summit
97 Emery,Humberlea
98 Weston
99 Westmount
100 Kingsview Village,Martin Grove Gardens,Richvie...
101 Albion Gardens,Beaumont Heights,Humbergate,Jam...
102 Northwest

```

0.1.3 Part 2

Downloading the Geospatial_Data

```

[23]: url = 'https://cocl.us/Geospatial_data'
      Geospatial_data = pd.read_csv(url)
      Geospatial_data.head()

```

```

[23]:   Postal Code  Latitude  Longitude
0      M1B  43.806686  -79.194353
1      M1C  43.784535  -79.160497
2      M1E  43.763573  -79.188711
3      M1G  43.770992  -79.216917
4      M1H  43.773136  -79.239476

```

Renaming the Postal Code to Postcode and Merging the Geospatial_data and the neighborhoods_data by a common variable Postcode


```
[28]: Geospatial_data = Geospatial_data.rename(columns = {"Postal Code":"Postcode"})
      Geospatial_data.head()
```

```
[28]:   Postcode   Latitude  Longitude
0      M1B  43.806686 -79.194353
1      M1C  43.784535 -79.160497
2      M1E  43.763573 -79.188711
3      M1G  43.770992 -79.216917
4      M1H  43.773136 -79.239476
```

```
[32]: combined_data = pd.merge(neighborhoods_data,Geospatial_data)
      combined_data
```

```
[32]:   Postcode   Borough \
0      M1B  Scarborough
1      M1C  Scarborough
2      M1E  Scarborough
3      M1G  Scarborough
4      M1H  Scarborough
5      M1J  Scarborough
6      M1K  Scarborough
7      M1L  Scarborough
8      M1M  Scarborough
9      M1N  Scarborough
10     M1P  Scarborough
11     M1R  Scarborough
12     M1S  Scarborough
13     M1T  Scarborough
14     M1V  Scarborough
15     M1W  Scarborough
16     M1X  Scarborough
17     M2H   North York
18     M2J   North York
19     M2K   North York
20     M2L   North York
21     M2M   North York
22     M2N   North York
23     M2P   North York
24     M2R   North York
25     M3A   North York
26     M3B   North York
27     M3C   North York
28     M3H   North York
29     M3J   North York
30     M3K   North York
31     M3L   North York
32     M3M   North York
```

33	M3N	North York
34	M4A	North York
35	M4B	East York
36	M4C	East York
37	M4E	East Toronto
38	M4G	East York
39	M4H	East York
40	M4J	East York
41	M4K	East Toronto
42	M4L	East Toronto
43	M4M	East Toronto
44	M4N	Central Toronto
45	M4P	Central Toronto
46	M4R	Central Toronto
47	M4S	Central Toronto
48	M4T	Central Toronto
49	M4V	Central Toronto
50	M4W	Downtown Toronto
51	M4X	Downtown Toronto
52	M4Y	Downtown Toronto
53	M5A	Downtown Toronto
54	M5B	Downtown Toronto
55	M5C	Downtown Toronto
56	M5E	Downtown Toronto
57	M5G	Downtown Toronto
58	M5H	Downtown Toronto
59	M5J	Downtown Toronto
60	M5K	Downtown Toronto
61	M5L	Downtown Toronto
62	M5M	North York
63	M5N	Central Toronto
64	M5P	Central Toronto
65	M5R	Central Toronto
66	M5S	Downtown Toronto
67	M5T	Downtown Toronto
68	M5V	Downtown Toronto
69	M5W	Downtown Toronto
70	M5X	Downtown Toronto
71	M6A	North York
72	M6B	North York
73	M6C	York
74	M6E	York
75	M6G	Downtown Toronto
76	M6H	West Toronto
77	M6J	West Toronto
78	M6K	West Toronto
79	M6L	North York

80	M6M	York
81	M6N	York
82	M6P	West Toronto
83	M6R	West Toronto
84	M6S	West Toronto
85	M7A	Queen's Park
86	M7R	Mississauga
87	M7Y	East Toronto
88	M8V	Etobicoke
89	M8W	Etobicoke
90	M8X	Etobicoke
91	M8Y	Etobicoke
92	M8Z	Etobicoke
93	M9A	Queen's Park
94	M9B	Etobicoke
95	M9C	Etobicoke
96	M9L	North York
97	M9M	North York
98	M9N	York
99	M9P	Etobicoke
100	M9R	Etobicoke
101	M9V	Etobicoke
102	M9W	Etobicoke

	Neighbourhood	Latitude	Longitude
0	Rouge, Malvern	43.806686	-79.194353
1	Highland Creek, Rouge Hill, Port Union	43.784535	-79.160497
2	Guildwood, Morningside, West Hill	43.763573	-79.188711
3	Woburn	43.770992	-79.216917
4	Cedarbrae	43.773136	-79.239476
5	Scarborough Village	43.744734	-79.239476
6	East Birchmount Park, Ionview, Kennedy Park	43.727929	-79.262029
7	Clairlea, Golden Mile, Oakridge	43.711112	-79.284577
8	Cliffcrest, Cliffside, Scarborough Village West	43.716316	-79.239476
9	Birch Cliff, Cliffside West	43.692657	-79.264848
10	Dorset Park, Scarborough Town Centre, Wexford He...	43.757410	-79.273304
11	Maryvale, Wexford	43.750072	-79.295849
12	Agincourt	43.794200	-79.262029
13	Clarks Corners, Sullivan, Tam O'Shanter	43.781638	-79.304302
14	Agincourt North, L'Amoreaux East, Milliken, Steel...	43.815252	-79.284577
15	L'Amoreaux West	43.799525	-79.318389
16	Upper Rouge	43.836125	-79.205636
17	Hillcrest Village	43.803762	-79.363452
18	Fairview, Henry Farm, Oriole	43.778517	-79.346556
19	Bayview Village	43.786947	-79.385975
20	Silver Hills, York Mills	43.757490	-79.374714
21	Newtonbrook, Willowdale	43.789053	-79.408493

22	Willowdale South	43.770120	-79.408493
23	York Mills West	43.752758	-79.400049
24	Willowdale West	43.782736	-79.442259
25	Parkwoods	43.753259	-79.329656
26	Don Mills North	43.745906	-79.352188
27	Flemingdon Park,Don Mills South	43.725900	-79.340923
28	Bathurst Manor,Downsview North,Wilson Heights	43.754328	-79.442259
29	Northwood Park,York University	43.767980	-79.487262
30	CFB Toronto,Downsview East	43.737473	-79.464763
31	Downsview West	43.739015	-79.506944
32	Downsview Central	43.728496	-79.495697
33	Downsview Northwest	43.761631	-79.520999
34	Victoria Village	43.725882	-79.315572
35	Woodbine Gardens,Parkview Hill	43.706397	-79.309937
36	Woodbine Heights	43.695344	-79.318389
37	The Beaches	43.676357	-79.293031
38	Leaside	43.709060	-79.363452
39	Thorncliffe Park	43.705369	-79.349372
40	East Toronto	43.685347	-79.338106
41	The Danforth West,Riverdale	43.679557	-79.352188
42	The Beaches West,India Bazaar	43.668999	-79.315572
43	Studio District	43.659526	-79.340923
44	Lawrence Park	43.728020	-79.388790
45	Davisville North	43.712751	-79.390197
46	North Toronto West	43.715383	-79.405678
47	Davisville	43.704324	-79.388790
48	Moore Park,Summerhill East	43.689574	-79.383160
49	Deer Park,Forest Hill SE,Rathnelly,South Hill,...	43.686412	-79.400049
50	Rosedale	43.679563	-79.377529
51	Cabbagetown,St. James Town	43.667967	-79.367675
52	Church and Wellesley	43.665860	-79.383160
53	Harbourfront	43.654260	-79.360636
54	Ryerson,Garden District	43.657162	-79.378937
55	St. James Town	43.651494	-79.375418
56	Berczy Park	43.644771	-79.373306
57	Central Bay Street	43.657952	-79.387383
58	Adelaide,King,Richmond	43.650571	-79.384568
59	Harbourfront East,Toronto Islands,Union Station	43.640816	-79.381752
60	Design Exchange,Toronto Dominion Centre	43.647177	-79.381576
61	Commerce Court,Victoria Hotel	43.648198	-79.379817
62	Bedford Park,Lawrence Manor East	43.733283	-79.419750
63	Roselawn	43.711695	-79.416936
64	Forest Hill North,Forest Hill West	43.696948	-79.411307
65	The Annex,North Midtown,Yorkville	43.672710	-79.405678
66	Harbord,University of Toronto	43.662696	-79.400049
67	Chinatown,Grange Park,Kensington Market	43.653206	-79.400049
68	CN Tower,Bathurst Quay,Island airport,Harbourf...	43.628947	-79.394420

69	Stn A PO Boxes 25 The Esplanade	43.646435	-79.374846
70	First Canadian Place,Underground city	43.648429	-79.382280
71	Lawrence Heights,Lawrence Manor	43.718518	-79.464763
72	Glencairn	43.709577	-79.445073
73	Humewood-Cedarvale	43.693781	-79.428191
74	Caledonia-Fairbanks	43.689026	-79.453512
75	Christie	43.669542	-79.422564
76	Dovercourt Village,Dufferin	43.669005	-79.442259
77	Little Portugal,Trinity	43.647927	-79.419750
78	Brockton,Exhibition Place,Parkdale Village	43.636847	-79.428191
79	Downsview,North Park,Upwood Park	43.713756	-79.490074
80	Del Ray,Keelesdale,Mount Dennis,Silverthorn	43.691116	-79.476013
81	The Junction North,Runnymede	43.673185	-79.487262
82	High Park,The Junction South	43.661608	-79.464763
83	Parkdale,Roncesvalles	43.648960	-79.456325
84	Runnymede,Swansea	43.651571	-79.484450
85	Queen's Park	43.662301	-79.389494
86	Canada Post Gateway Processing Centre	43.636966	-79.615819
87	Business Reply Mail Processing Centre 969 Eastern	43.662744	-79.321558
88	Humber Bay Shores,Mimico South,New Toronto	43.605647	-79.501321
89	Alderwood,Long Branch	43.602414	-79.543484
90	The Kingsway,Montgomery Road,Old Mill North	43.653654	-79.506944
91	Humber Bay,King's Mill Park,Kingsway Park Sout...	43.636258	-79.498509
92	Kingsway Park South West,Mimico NW,The Queensw...	43.628841	-79.520999
93	Queen's Park	43.667856	-79.532242
94	Cloverdale,Islington,Martin Grove,Princess Gar...	43.650943	-79.554724
95	Bloordale Gardens,Eringate,Markland Wood,Old B...	43.643515	-79.577201
96	Humber Summit	43.756303	-79.565963
97	Emery,Humberlea	43.724766	-79.532242
98	Weston	43.706876	-79.518188
99	Westmount	43.696319	-79.532242
100	Kingsview Village,Martin Grove Gardens,Richvie...	43.688905	-79.554724
101	Albion Gardens,Beaumont Heights,Humbergate,Jam...	43.739416	-79.588437
102	Northwest	43.706748	-79.594054

[]: