Venue_Analysis_of_Houston

November 15, 2018

1 Potential venue based On zip codes in Houston

1.1 Introduction

Opening a business/venue in a diverse metropolitan area such as Houston has always needed an indepth study of the neighborhoods of Houston. Houston has approximately 180 zip codes. In this study, we cluster the zip codes and consider each cluster as a super neighborhood. Next, based on the center of each cluster, we look for 100 venues in a 10 mile radius and rank them based on their frequency for each cluster. This study would be useful for any person interested in opening up a venue in Houston. By analyzing the final result yielded in this study, a business person can decide what venue is lacking in each cluster or what venue is prevalent in each cluster. After the decision is made on which cluster to choose, then a zip code within the cluster can also be chosen and the same analysis can be done based on a specific zip code.

1.2 Data

For this project we need the following data:

```
Zip Codes in Houston 
Latitudes and Longitudes of Zip Codes
```

We will use the data available at http://www.geonames.org/postalcode-search.html?q=Houston&country=US&adminCode1=TX The GeoNames geographical database covers all countries and contains over eleven million placenames that are available for download free of charge.

Using Beautifulsoup4 package we will extract the table in the website.

Table would consist of 3 columns

```
Zip Code Latitude Longitude
```

Zip Code column is of type integer and Latitude and Longitude are of type float. A rows example of the table is as follows:

```
In [136]: Houston_data[['Zip Code', 'Latitude', 'Longitude']].head()
```

```
Out [136]:
           Zip Code Latitude Longitude
              77002
                      29.759
                              -95.359
         0
              77092
         1
                      29.832
                              -95.472
         2
              77005 29.718 -95.426
         3
              77006 29.741 -95.392
         4
              77007
                      29.774 -95.403
```

Let's import required packages

```
In [137]: import numpy as np
    import pandas as pd
    from bs4 import BeautifulSoup
    import requests

# 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
    import folium # map rendering library
    from pandas.io.json import json_normalize # tranform JSON file into a pandas datafra.

import matplotlib.cm as cm
    import matplotlib.colors as colors
```

Let's read in the page including the table


```
In [138]: source = requests.get('http://www.geonames.org/postalcode-search.html?q=Houston&coun
         soup = BeautifulSoup(source,'lxml')
         print(soup.prettify())
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" "http://www.w3.org/TR/html4/loop</pre>
<html>
<head>
 <title>
  Postal Codes Texas, United States
 <link href="http://www.geonames.org/opensearch-description.xml" rel="search" title="geonames</pre>
 <link href="/geonames.ico" rel="shortcut icon"/>
 <link href="/geonames.css" rel="StyleSheet" type="text/css"/>
</head>
 <a href="/" title="GeoName Home">
     GeoNames Home
```

```
<a href="/postal-codes/" title="Postal Codes">
   Postal Codes
  </a>
   <a href="/export/" title="Database Dump and Webservice API">
   Download / Webservice
  </a>
  <a href="/about.html" title="About GeoNames">
   About
  </a>
 <form action="/servlet/geonames" class="topsearch" method="get" name="searchForm">
   search
   <input class="topmenu" name="q" size="20" type="text" value=""/>
   <input name="srv" type="hidden" value="1"/>
  </form>
  <span id="topmenulogin">
   <a href="http://www.geonames.org/login" title="login or create new user account">
    login
   </a>
  </span>
 <h3>
Texas - postal codes
</h3>
<br/>
<br/>
<form action="/postalcode-search.html?" method="GET" name="searchForm">
<input name="q" size="40" type="text" value="Houston"/>
<select name="country">
 <option value="">
  all countries
 </option>
 <option value="DZ">
  Algeria
 </option>
 <option value="AS">
  American Samoa
 </option>
 <option value="AD">
  Andorra
 </option>
 <option value="AR">
```

Argentina

</option>

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Australia

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Austria

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<option value="BD">

Bangladesh

</option>

<option value="BY">

Belarus

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Belgium

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Bermuda

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Brazil

</option>

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Bulgaria

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Canada

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Chile

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 ${\tt Colombia}$

</option>

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Costa Rica

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Croatia

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Czechia

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Denmark

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Dominican Republic

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<option value="F0">

Faroe Islands

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Finland

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France

</option>

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French Guiana

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Germany

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 ${\tt Greenland}$

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Guadeloupe

</option>

<option value="GU">

 ${\tt Guam}$

</option>

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Guatemala

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Guernsey

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Hungary

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Isle of Man

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Jersey

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Latvia

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Liechtenstein

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Lithuania

</option>

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Luxembourg

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Macedonia

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Malaysia

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Marshall Islands

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Martinique

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Mayotte

</option>

<option value="MX">

Mexico

</option>

<option value="FM">

Micronesia

</option>

<option value="MD">

Moldova

</option>

<option value="MC">

Monaco

</option>

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Netherlands

</option>

<option value="NC">

New Caledonia

</option>

<option value="NZ">

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Northern Mariana Islands

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Palau

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Philippines

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Poland

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Portugal

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Puerto Rico

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<option value="R0">

Romania

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Russia

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Réunion

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Saint Pierre and Miquelon

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```
San Marino
```

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Slovakia

</option>

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Slovenia

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South Africa

</option>

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Spain

</option>

<option value="LK">

Sri Lanka

</option>

<option value="SJ">

Svalbard and Jan Mayen

</option>

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Sweden

</option>

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Switzerland

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Thailand

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Turkey

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U.S. Virgin Islands

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Ukraine

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United Kingdom

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Uruguay

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 Wallis and Futuna
</option>
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 Åland
</option>
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 Alaska
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 Alabama
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 Arkansas
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 Arizona
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 California
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 Connecticut
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 District of Columbia
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 Hawaii
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Idaho

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Illinois

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Missouri

</option>

<option value="MS">

Mississippi

</option>

<option value="MT">

Montana

</option>

<option value="NC">

North Carolina

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North Dakota
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Nebraska
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Pennsylvania
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<option value="RI">
Rhode Island
</option>
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South Carolina
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South Dakota
</option>
<option value="TN">
Tennessee
```

</option>

Texas </option>

<option selected="" value="TX">

```
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               Utah
            </option>
            <option value="VA">
               Virginia
            </option>
            <option value="VT">
               Vermont
            </option>
            <option value="WA">
               Washington
            </option>
            <option value="WI">
               Wisconsin
            </option>
            <option value="WV">
               West Virginia
            </option>
            <option value="WY">
               Wyoming
            </option>
          </select>
          <input type="submit" value="search"/>
      </form>
      <small>
         Either enter a postal code (eg. "9011", "AB1", "9980-999") or a city (eg. "London")
      <script type="text/javascript">
google_ad_client = "pub-8752809630410472";
/* postalcodes160x600 */
google_ad_slot = "7311338040";
google_ad_width = 160;
google_ad_height = 600;
//-->
               </script>
               <script src="http://pagead2.googlesyndication.com/pagead/show_ads.js" type="text/javascript" type="text/javas
               </script>
```

```
Place
Code
Country
Admin1
{\tt Admin2}
Admin3
<small>
</small>
Houston
77002
United States
Texas
Harris
```

```
<a href="/maps/browse_29.759_-95.359.html" rel="nofollow">
 <small>
  29.759/-95.359
 </small>
 </a>
<small>
 2
 </small>
Houston
77092
United States
Texas
Harris
<a href="/maps/browse_29.832_-95.472.html" rel="nofollow">
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 </small>
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<small>
 3
 </small>
```

```
Houston
77005
United States
Texas
Harris
<a href="/maps/browse_29.718_-95.426.html" rel="nofollow">
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77006
United States
Texas
```

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Texas
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Houston
```

```
77024
United States
Texas
Harris
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77025
United States
Texas
Harris
```

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77027
United States
Texas
Harris
<a href="/maps/browse_29.74_-95.446.html" rel="nofollow">
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```

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77030
United States
Texas
Harris
<a href="/maps/browse_29.704_-95.401.html" rel="nofollow">
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 11
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Houston
77032
United States
```

```
Texas
Harris
<a href="/maps/browse_29.937_-95.33.html" rel="nofollow">
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 29.937/-95.33
 </small>
</a>
<small>
 12
</small>
Houston
77040
United States
Texas
Harris
```

```
<a href="/maps/browse_29.874_-95.528.html" rel="nofollow">
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 13
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Houston
77042
United States
Texas
Harris
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 </a>
<small>
 14
 </small>
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```
Houston
77054
United States
Texas
Harris
<a href="/maps/browse_29.685_-95.402.html" rel="nofollow">
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 15
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Houston
77056
United States
Texas
```

```
Harris
<a href="/maps/browse_29.745_-95.468.html" rel="nofollow">
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<small>
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Houston
77057
United States
Texas
Harris
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```

```
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 17
</small>
Houston
77058
United States
Texas
Harris
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 </small>
 </a>
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 18
 </small>
Houston
```

```
77060
United States
Texas
Harris
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 19
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Houston
77061
United States
Texas
Harris
```

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Houston
77070
United States
Texas
Harris
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Houston
77074
United States
Texas
Harris
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 </small>
Houston
77077
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United States
Texas
Harris
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 23
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Houston
77079
United States
Texas
Harris
```

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 24
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Houston
77090
United States
Texas
Harris
<a href="/maps/browse_30.017_-95.447.html" rel="nofollow">
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  30.017/-95.447
 </small>
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<small>
 25
```

```
</small>
Houston
77098
United States
Texas
Harris
<a href="/maps/browse_29.735_-95.412.html" rel="nofollow">
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</a>
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 26
 </small>
Houston
77003
United States
Texas
```

```
Harris
<a href="/maps/browse_29.749_-95.339.html" rel="nofollow">
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Houston
77004
United States
Texas
Harris
<a href="/maps/browse_29.725_-95.363.html" rel="nofollow">
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29.725/-95.363
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 28
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Houston
77008
United States
Texas
Harris
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 29
 </small>
Houston
```

```
77010
United States
Texas
Harris
<a href="/maps/browse_29.754_-95.361.html" rel="nofollow">
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Houston
77017
United States
Texas
Harris
```

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<a href="/maps/browse_29.686_-95.255.html" rel="nofollow">
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 31
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Houston
77041
United States
Texas
Harris
<a href="/maps/browse_29.86_-95.582.html" rel="nofollow">
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 </small>
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```

```
<small>
 32
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Houston
77046
United States
Texas
Harris
<a href="/maps/browse_29.733_-95.431.html" rel="nofollow">
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  29.733/-95.431
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</a>
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 33
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Houston
77063
```

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United States
Texas
Harris
<a href="/maps/browse_29.735_-95.522.html" rel="nofollow">
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 29.735/-95.522
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 34
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Houston
77065
United States
Texas
Harris
```

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<a href="/maps/browse_29.932_-95.611.html" rel="nofollow">
 <small>
  29.932/-95.611
 </small>
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<small>
 35
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Houston
77068
United States
Texas
Harris
<a href="/maps/browse_30.007_-95.49.html" rel="nofollow">
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  30.007/-95.49
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```

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36
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Houston
77069
United States
Texas
Harris
<a href="/maps/browse_29.986_-95.521.html" rel="nofollow">
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  29.986/-95.521
 </small>
 </a>
<small>
 37
 </small>
Houston
77081
United States
```

```
Texas
Harris
<a href="/maps/browse_29.712_-95.485.html" rel="nofollow">
 <small>
  29.712/-95.485
 </small>
 </a>
<small>
 38
 </small>
Houston
77084
United States
Texas
Harris
<a href="/maps/browse_29.844_-95.662.html" rel="nofollow">
```

```
<small>
  29.844/-95.662
 </small>
 </a>
<small>
 39
 </small>
Houston
77086
United States
Texas
Harris
<a href="/maps/browse_29.923_-95.494.html" rel="nofollow">
 <small>
  29.923/-95.494
 </small>
</a>
<small>
 40
 </small>
```

```
Houston
77094
United States
Texas
Harris
<a href="/maps/browse_29.771_-95.711.html" rel="nofollow">
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  29.771/-95.711
 </small>
</a>
<small>
 41
 </small>
South Houston
77587
United States
Texas
Harris
```

```
<a href="/maps/browse_29.66_-95.226.html" rel="nofollow">
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 </a>
<small>
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Houston
77001
United States
Texas
Harris
<a href="/maps/browse_29.813_-95.31.html" rel="nofollow">
 <small>
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 </small>
 </a>
```

```
<small>
 43
 </small>
Houston
77009
United States
Texas
Harris
<a href="/maps/browse_29.794_-95.367.html" rel="nofollow">
 <small>
  29.794/-95.367
 </small>
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<small>
 44
</small>
Houston
77011
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```
United States
Texas
Harris
<a href="/maps/browse_29.742_-95.307.html" rel="nofollow">
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</a>
<small>
 45
</small>
Houston
77012
United States
Texas
Harris
```

```
<a href="/maps/browse_29.715_-95.282.html" rel="nofollow">
 <small>
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<small>
 46
 </small>
Houston
77013
United States
Texas
Harris
<a href="/maps/browse_29.784_-95.23.html" rel="nofollow">
 <small>
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 </small>
 </a>
```

```
<small>
 47
 </small>
Houston
77014
United States
Texas
Harris
<a href="/maps/browse_29.98_-95.462.html" rel="nofollow">
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  29.98/-95.462
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 </a>
<small>
 48
 </small>
Houston
77015
United States
```

```
Texas
Harris
<a href="/maps/browse_29.785_-95.185.html" rel="nofollow">
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 29.785/-95.185
 </small>
</a>
<small>
 49
</small>
Houston
77016
United States
Texas
Harris
```

```
<a href="/maps/browse_29.858_-95.303.html" rel="nofollow">
 <small>
  29.858/-95.303
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Houston
77018
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Texas
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Texas
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Houston
77021
United States
Texas
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Harris
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Texas
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Houston
77023
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Texas
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Houston
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77026
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Texas
Harris
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Houston
77028
United States
Texas
Harris
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Houston
77029
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Texas
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Texas
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Houston
77033
United States
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Texas
Harris
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77034
United States
Texas
Harris
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77035
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77036
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Houston
77037
United States
Texas
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Texas
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Texas
Harris
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Houston
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Texas
Harris
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77044
United States
Texas
Harris
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77045
United States
Texas
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Houston
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United States
Texas
Harris
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Houston
77048
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Texas
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77049
United States
Texas
Harris
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77050
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Harris
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Houston
77052
United States
Texas
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Harris
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Texas
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Houston
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Texas
Harris
<a href="/maps/browse_29.797_-95.496.html" rel="nofollow">
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Houston
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Texas
Harris
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Houston
77062
United States
Texas
Harris
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77064
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United States
Texas
Harris
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Houston
77067
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United States
Texas
Harris
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Houston
77071
United States
Texas
Harris
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Texas
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84
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Houston
77075
United States
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Texas
Harris
<a href="/maps/browse_29.622_-95.26.html" rel="nofollow">
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77076
United States
Texas
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Houston
77078
United States
Texas
Harris
<a href="/maps/browse_29.85_-95.258.html" rel="nofollow">
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77082
United States
Texas
Harris
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77083
United States
Texas
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Houston
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United States
Texas
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Houston
77087
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Texas
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Houston
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United States
Texas
Harris
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United States
Texas
Harris
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Houston
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United States
Texas
Harris
<a href="/maps/browse_29.853_-95.444.html" rel="nofollow">
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Houston
77093
United States
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Texas
Harris
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Houston
77095
United States
Texas
Harris
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Houston
77096
United States
Texas
Harris
<a href="/maps/browse_29.672_-95.486.html" rel="nofollow">
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77099
United States
Texas
Harris
<a href="/maps/browse_29.671_-95.587.html" rel="nofollow">
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Houston
77204
United States
Texas
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Harris
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Houston
77205
United States
Texas
Harris
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 102
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Houston
77255
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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North Houston
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77315
United States
Texas
Harris
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Jbsa Ft Sam Houston
78234
United States
Texas
Bexar
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Grapeland
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Texas
Houston
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Kennard
75847
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Texas
Houston
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Lovelady
75851
United States
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Texas
Houston
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 31.056/-95.55
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Ratcliff
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United States
Texas
Houston
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Italy
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United States
Texas
Ellis
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77201
United States
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Houston
77202
United States
Texas
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Harris
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Houston
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United States
Texas
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Houston
77206
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Texas
Harris
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Houston
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77207
United States
Texas
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Houston
77208
United States
Texas
Harris
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Houston
77209
United States
Texas
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Houston
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Texas
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Houston
77212
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Texas
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Houston
77213
United States
Texas
Harris
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77216
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Texas
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Houston
77217
United States
Texas
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Harris
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Houston
77218
United States
Texas
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Houston
77219
United States
Texas
Harris
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Houston
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77220
United States
Texas
Harris
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Houston
77221
United States
Texas
Harris
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Houston
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United States
Texas
Harris
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Houston
77223
United States
Texas
Harris
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Houston
77224
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Texas
Harris
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Houston
77225
United States
Texas
Harris
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Houston
77226
United States
Texas
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132
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Houston
77227
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Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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Houston
77228
United States
```

```
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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Houston
77229
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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Houston
77230
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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Houston
77231
United States
Texas
Harris
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Houston
77233
United States
Texas
Harris
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Houston
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United States
Texas
Harris
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Houston
77235
United States
Texas
Harris
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Houston
77236
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Texas
Harris
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 29.834/-95.434
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Houston
77237
United States
Texas
Harris
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  29.834/-95.434
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 142
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{\tt Houston}
77238
United States
Texas
Harris
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Houston
77240
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Texas
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  29.834/-95.434
 </small>
 </a>
<small>
 144
 </small>
Houston
77241
United States
```

```
Texas
Harris
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 29.834/-95.434
 </small>
</a>
<small>
 145
</small>
Houston
77242
United States
Texas
Harris
```

```
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  29.834/-95.434
 </small>
 </a>
<small>
 146
 </small>
Houston
77243
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
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 147
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```

```
Houston
77244
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
</a>
<small>
 148
</small>
Houston
77245
United States
Texas
```

```
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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  29.834/-95.434
 </small>
 </a>
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 149
 </small>
Houston
77248
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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  29.834/-95.434
 </small>
```

```
</a>
<small>
 150
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Houston
77249
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
</a>
<small>
 151
</small>
Houston
```

```
77251
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
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<small>
 152
 </small>
Houston
77252
United States
Texas
Harris
```

```
<a href="/maps/browse_29.763_-95.363.html" rel="nofollow">
  29.763/-95.363
 </small>
 </a>
<small>
 153
 </small>
Houston
77253
United States
Texas
Harris
<a href="/maps/browse_29.763_-95.363.html" rel="nofollow">
 <small>
  29.763/-95.363
 </small>
 </a>
```

```
<small>
 154
 </small>
Houston
77254
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 155
 </small>
Houston
77256
United States
```

```
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
 29.834/-95.434
 </small>
</a>
<small>
 156
</small>
Houston
77257
United States
Texas
Harris
```

```
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 157
 </small>
Houston
77258
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 158
 </small>
```

```
Houston
77259
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
</a>
<small>
 159
</small>
Houston
77261
United States
Texas
```

```
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 160
 </small>
Houston
77262
United States
Texas
Harris
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 <small>
  29.834/-95.434
```

```
</small>
 </a>
<small>
 161
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Houston
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United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 162
 </small>
Houston
```

```
77265
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 163
 </small>
Houston
77266
United States
Texas
Harris
```

```
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 164
 </small>
Houston
77267
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
```

```
<small>
 165
</small>
Houston
77268
United States
Texas
Harris
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  29.834/-95.434
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</a>
<small>
 166
 </small>
Houston
77269
```

```
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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 29.834/-95.434
 </small>
</a>
<small>
 167
</small>
Houston
77270
United States
Texas
Harris
```

```
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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 </small>
 </a>
<small>
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 </small>
Houston
77271
United States
Texas
Harris
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  29.834/-95.434
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 169
```

```
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Houston
77272
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
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 </small>
</a>
<small>
 170
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Houston
77273
United States
Texas
```

```
Harris
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 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 171
 </small>
Houston
77274
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
```

```
29.834/-95.434
 </small>
 </a>
<small>
 172
 </small>
Houston
77275
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 173
 </small>
Houston
```

```
77277
United States
Texas
Harris
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  29.834/-95.434
 </small>
</a>
<small>
 174
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Houston
77279
United States
Texas
Harris
```

```
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 </small>
 </a>
<small>
 175
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Houston
77280
United States
Texas
Harris
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  29.834/-95.434
 </small>
 </a>
```

```
<small>
 176
 </small>
Houston
77282
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
</a>
<small>
 177
</small>
Houston
77284
```

```
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
 29.834/-95.434
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</a>
<small>
 178
</small>
Houston
77287
United States
Texas
Harris
```

```
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 </a>
<small>
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 </small>
Houston
77288
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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  29.834/-95.434
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 </a>
<small>
```

```
180
 </small>
Houston
77289
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
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 </small>
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<small>
 181
</small>
Houston
77290
United States
```

```
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
 </a>
<small>
 182
 </small>
Houston
77291
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
```

```
<small>
  29.834/-95.434
 </small>
 </a>
<small>
 183
 </small>
Houston
77292
United States
Texas
Harris
<a href="/maps/browse_29.744_-95.333.html" rel="nofollow">
 <small>
  29.744/-95.333
 </small>
 </a>
<small>
 184
 </small>
```

```
Houston
77293
United States
Texas
Harris
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
 <small>
  29.834/-95.434
 </small>
</a>
<small>
 185
</small>
Houston
77299
United States
Texas
Harris
```

```
<a href="/maps/browse_29.834_-95.434.html" rel="nofollow">
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 </small>
 </a>
<small>
 186
 </small>
Crockett
75835
United States
Texas
Houston
<a href="/maps/browse_31.321_-95.393.html" rel="nofollow">
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  31.321/-95.393
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 </a>
```

```
<small>
 187
 </small>
Latexo
75849
United States
Texas
Houston
<a href="/maps/browse_31.395_-95.474.html" rel="nofollow">
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  31.395/-95.474
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 </a>
<small>
 188
 </small>
Houston
77297
```

```
United States
   Texas
   Harris
   <a href="/maps/browse_29.763_-95.363.html" rel="nofollow">
    <small>
    29.763/-95.363
    </small>
   </a>
  >
>
>
>
<div id="pageFooter">
info@geonames.org
<img align="middle" alt="ant" border="0" hspace="40" src="/img/smallant.gif"/>
>
 <a href="/">
 GeoNames Home
 </a>
 <span class="separator">
```

```
</span>
    <a href="/postal-codes/">
    Postal Codes
    </a>
    <span class="separator">
    </span>
    <a href="/export/">
    Download / Webservice
    </a>
    <span class="separator">
    </span>
    <a href="http://forum.geonames.org">
    </a>
    <span class="separator">
    </span>
    <a href="http://geonames.wordpress.com">
    Blog
    </a>
    <span class="separator">
    </span>
    <a href="/sitemap.html">
    Sitemap
    </a>
   </div>
 </body>
</html>
```

Let's read the table in page and turn it into a data frame

```
Houston = []
          latlong = data[1::2]
          latlong
          zip_code = []
          for ele in data:
              if len(ele) > 2:
                  zip_code.append(ele[2])
          Houston_zip = []
          for ele in range(len(zip_code)):
              Houston_zip.append(int(zip_code[ele]))
          Houston_zip # One part of our data is good to go
          Houston_latitude = []
          Houston_longitude = []
          for ele in range(len(latlong)):
              for elem in latlong[ele]:
                  k = elem.split('/')
                  Houston_latitude.append(float(k[0]))
                  Houston_longitude.append(float(k[1]))
          # Now we have all three columns required
          Houston_data = pd.DataFrame({'Zip Code': Houston_zip, 'Latitude' : Houston_latitude,'
                                        columns=['Zip Code','Latitude','Longitude'])
          {\tt Houston\_data}
Out[139]:
               Zip Code
                         Latitude Longitude
          0
                  77002
                            29.759
                                      -95.359
          1
                  77092
                            29.832
                                      -95.472
          2
                  77005
                            29.718
                                      -95.426
                            29.741
          3
                  77006
                                      -95.392
          4
                  77007
                            29.774
                                      -95.403
          5
                  77019
                            29.752
                                      -95.405
          6
                  77024
                            29.770
                                      -95.520
          7
                  77025
                            29.689
                                      -95.434
          8
                  77027
                            29.740
                                      -95.446
          9
                  77030
                            29.704
                                      -95.401
          10
                  77032
                            29.937
                                      -95.330
          11
                  77040
                            29.874
                                      -95.528
          12
                  77042
                            29.740
                                      -95.559
          13
                            29.685
                  77054
                                      -95.402
          14
                  77056
                            29.745
                                      -95.468
          15
                  77057
                            29.742
                                      -95.490
```

16 17 18 19	77058 77060 77061 77070	29.572 29.933 29.665 29.978	-95.100 -95.398 -95.279 -95.580
20	77074	29.690	-95.511
21	77077	29.748	-95.603
22	77079	29.774	-95.598
23	77090	30.017	-95.447
24	77098	29.735	-95.412
25	77003	29.749	-95.339
26	77004	29.725	-95.363
27	77008	29.799	-95.412
28 29	77010 77017	29.754 29.686	-95.361 -95.255
		29.000	-90.200
158	77261	29.834	-95.434
159	77262	29.834	-95.434
160	77263	29.834	-95.434
161	77265	29.834	-95.434
162	77266	29.834	-95.434
163	77267	29.834	-95.434
164	77268	29.834	-95.434
165	77269	29.834	-95.434 -95.434
166 167	77270 77271	29.834 29.834	-95.434 -95.434
168	77272	29.834	-95.434
169	77273	29.834	-95.434
170	77274	29.834	-95.434
171	77275	29.834	-95.434
172	77277	29.834	-95.434
173	77279	29.834	-95.434
174	77280	29.834	-95.434
175	77282	29.834	-95.434
176	77284	29.834	-95.434
177	77287	29.834	-95.434
178	77288	29.834	-95.434
179	77289	29.834	-95.434
180 181	77290 77201	29.834	-95.434 -95.434
182	77291 77292	29.834 29.744	-95.434 -95.333
183	77293	29.744	-95.434
184	77299	29.834	-95.434
185	75835	31.321	-95.393
186	75849	31.395	-95.474
187	77297	29.763	-95.363

[188 rows x 3 columns]

So based on the above table Houston has 188 zip codes

1.3 Methodology

Clustering as an unsupervised machine learning technique can help us in grouping similar zip codes and construct different clusters of neighborhood for Houston metropolitan area. In this analysis we use kmeans method for clustering. We use K = 15 as it is prevalent knowledge in Houston that, houston consists of 15 super neighborhoods.

1.3.1 Let's Create the map of Houston

```
In [140]: #!conda install -c conda-forge geopy --yes # uncomment this line if you haven't comp
                            from geopy.geocoders import Nominatim
                            address = 'Houston, TX'
                            geolocator = Nominatim()
                            location = geolocator.geocode(address)
                            latitude = location.latitude
                            longitude = location.longitude
                            print('The geographical coordinate of Houston are {},{}.'.format(latitude,longitude)
/anaconda3/lib/python3.6/site-packages/geopy/geocoders/osm.py:143: UserWarning: Using Nominating
     UserWarning
The geographical coordinate of Houston are 29.7589382, -95.3676974.
In [141]: map_Houston = folium.Map(location=[latitude,longitude],zoom_start=10)
                            map_Houston
Out[141]: <folium.folium.Map at 0x1a200bb8d0>
Now let's also show different zip code and their area
In [142]: for lat, lng, zip_code in zip(Houston_data['Latitude'], Houston_data['Longitude'], Houston_d
                                        label = '{}'.format(zip_code)
                                        label = folium.Popup(label, parse_html=True)
                                        folium.CircleMarker(
                                                    [lat, lng],
                                                   radius=3,
                                                   popup=label,
                                                   color='blue',
                                                   fill=True,
                                                   fill_color='#3186cc',
                                                   fill_opacity=0.7,
                                                   parse_html=False).add_to(map_Houston)
                            map_Houston
```

```
Out[142]: <folium.folium.Map at 0x1a200bb8d0>
```

In next step we cluster the zip codes into 15 clusters (Choice of k=15 is arbitrary)

```
In [143]: num_clusters = 15
                          kmeans = KMeans(n_clusters=num_clusters,random_state=0).fit(Houston_data[['Latitude']
                          Houston_data['Cluster_label'] = kmeans.labels_
                          Lat = []
                          Long = []
                          for i in range(len(kmeans.cluster_centers_)):
                                     Lat.append(kmeans.cluster_centers_[i][0])
                                     Long.append(kmeans.cluster_centers_[i][1])
                          cluster_id = ['Cluster {}'.format(i) for i in range(15)]
                          centers = pd.DataFrame({'Cluster ID':cluster_id,'Cluster Center Lat':Lat,'Cluster Center Lat,'Cluster Center 
                          Houston_data[Houston_data.Cluster_label==4]
                          Houston_data
Out [143]:
                                        Zip Code Latitude Longitude
                                                                                                                           Cluster_label
                          0
                                                77002
                                                                         29.759
                                                                                                    -95.359
                                                                                                                                                            7
                           1
                                                77092
                                                                        29.832
                                                                                                    -95.472
                                                                                                                                                            3
                          2
                                                77005
                                                                        29.718
                                                                                                   -95.426
                                                                                                                                                          11
                          3
                                                77006
                                                                        29.741
                                                                                                                                                            7
                                                                                                   -95.392
                                                                                                   -95.403
                                                                                                                                                            7
                          4
                                                77007
                                                                        29.774
                                                77019
                          5
                                                                        29.752
                                                                                                                                                            7
                                                                                                   -95.405
                          6
                                                77024
                                                                        29.770
                                                                                                                                                            5
                                                                                                   -95.520
                          7
                                                77025
                                                                        29.689
                                                                                                   -95.434
                                                                                                                                                          11
                          8
                                                                        29.740
                                                77027
                                                                                                   -95.446
                                                                                                                                                          11
                          9
                                                77030
                                                                         29.704
                                                                                                   -95.401
                                                                                                                                                           7
                          10
                                                77032
                                                                         29.937
                                                                                                                                                          12
                                                                                                   -95.330
                          11
                                                77040
                                                                        29.874
                                                                                                   -95.528
                                                                                                                                                          10
                           12
                                                77042
                                                                        29.740
                                                                                                   -95.559
                                                                                                                                                            5
                           13
                                                77054
                                                                        29.685
                                                                                                   -95.402
                                                                                                                                                          11
                           14
                                                77056
                                                                        29.745
                                                                                                   -95.468
                                                                                                                                                          11
                           15
                                                                        29.742
                                                                                                                                                          11
                                                77057
                                                                                                    -95.490
                           16
                                                77058
                                                                        29.572
                                                                                                   -95.100
                                                                                                                                                            6
                           17
                                                77060
                                                                         29.933
                                                                                                   -95.398
                                                                                                                                                          12
                                                                                                                                                            9
                          18
                                                77061
                                                                        29.665
                                                                                                   -95.279
                           19
                                                77070
                                                                        29.978
                                                                                                   -95.580
                                                                                                                                                          10
                          20
                                                77074
                                                                                                                                                          11
                                                                        29.690
                                                                                                   -95.511
                                                                                                                                                            5
                          21
                                                77077
                                                                        29.748
                                                                                                   -95.603
                          22
                                                                                                                                                            5
                                                77079
                                                                        29.774
                                                                                                   -95.598
                                                                                                                                                          14
                          23
                                                77090
                                                                        30.017
                                                                                                   -95.447
                           24
                                                77098
                                                                         29.735
                                                                                                   -95.412
                                                                                                                                                            7
                                                                                                                                                            7
                          25
                                                77003
                                                                        29.749
                                                                                                   -95.339
                                                77004
                                                                        29.725
                                                                                                                                                            7
                           26
                                                                                                   -95.363
```

```
27
         77008
                   29.799
                              -95.412
                                                      3
                   29.754
                                                      7
28
         77010
                              -95.361
                                                      9
29
         77017
                   29.686
                              -95.255
. .
                       . . .
                                   . . .
           . . .
                                                    . . .
158
         77261
                   29.834
                              -95.434
                                                      3
                              -95.434
                                                      3
159
         77262
                   29.834
160
         77263
                   29.834
                              -95.434
                                                      3
161
         77265
                   29.834
                              -95.434
                                                      3
         77266
                   29.834
                              -95.434
                                                      3
162
                                                      3
163
         77267
                   29.834
                              -95.434
                                                      3
164
         77268
                   29.834
                              -95.434
                              -95.434
                                                      3
165
         77269
                   29.834
                                                      3
         77270
                   29.834
                              -95.434
166
                                                      3
167
         77271
                   29.834
                              -95.434
                                                      3
168
         77272
                   29.834
                              -95.434
                                                      3
         77273
                   29.834
                              -95.434
169
170
         77274
                   29.834
                              -95.434
                                                      3
                                                      3
         77275
                   29.834
                              -95.434
171
         77277
                   29.834
                              -95.434
                                                      3
172
173
         77279
                   29.834
                              -95.434
                                                      3
                                                      3
174
         77280
                   29.834
                              -95.434
                                                      3
175
         77282
                   29.834
                              -95.434
176
                                                      3
         77284
                   29.834
                              -95.434
                   29.834
                                                      3
177
         77287
                              -95.434
178
         77288
                   29.834
                              -95.434
                                                      3
                                                      3
179
         77289
                   29.834
                              -95.434
                                                      3
         77290
                   29.834
                              -95.434
180
                                                      3
181
         77291
                   29.834
                              -95.434
                                                      7
                   29.744
182
         77292
                              -95.333
183
         77293
                   29.834
                              -95.434
                                                      3
                                                      3
         77299
                   29.834
                              -95.434
184
185
         75835
                   31.321
                              -95.393
                                                      8
186
         75849
                   31.395
                              -95.474
                                                      8
         77297
                   29.763
                                                      7
187
                              -95.363
```

[188 rows x 4 columns]

and we visualize the resulting clusters

```
# add markers to the map
          markers_colors = []
          for lat, lon, zip_code, cluster in zip(Houston_data['Latitude'], Houston_data['Longi
              label = folium.Popup(str(zip_code) + ' Cluster ' + str(cluster), parse_html=True
              folium.CircleMarker(
                   [lat, lon],
                  radius=2,
                  popup=label,
                  color=rainbow[cluster-1],
                  fill=True,
                  fill_color=rainbow[cluster-1],
                  fill_opacity=0.7).add_to(map_clusters)
          map_clusters
Out[144]: <folium.folium.Map at 0x1a203d9b00>
Now, let's get the top 50 venues that are in each cluster (if exists) within a radius of 5 miles.
First, let's create the GET request URL. Name your URL url.
Define Foursquare Credentials and Version
In [145]: CLIENT_ID = 'INZNX14GS3IMP5RBM5U0552GMEZTOFP12GOUAHZ010AIPLPU' # your Foursquare ID
```

```
CLIENT_SECRET = 'ZOPPSDLYKDHPNCOK5BZQR2VUZSHHINGQSSEXNQGBI5140DIN' # your Foursquare
          VERSION = '20180605' # Foursquare API version
          print('Your credentails:')
          print('CLIENT_ID: ' + CLIENT_ID)
          print('CLIENT_SECRET:' + CLIENT_SECRET)
Your credentails:
CLIENT_ID: INZNX14GS3IMP5RBM5U0552GMEZT0FP12GOUAHZ010AIPLPU
CLIENT_SECRET: ZOPPSDLYKDHPNCOK5BZQR2VUZSHHINGQSSEXNQGBI5140DIN
```

First, let's create the GET request URL for cluster 0. Name your URL url.

```
In [146]: LIMIT = 100
          radius = 5000 * 1.64
          url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v
              CLIENT_ID,
              CLIENT_SECRET,
              VERSION,
              centers.iloc[0,0],
              centers.iloc[0,1],
              radius,
              LIMIT)
```

```
Send the GET request and examine the resutls
In [147]: results = requests.get(url).json()
          results
Out[147]: {'meta': {'code': 400,
            'errorDetail': 'll must be of the form XX.XX,YY.YY (received Cluster 0,29.813875)'
            'errorType': 'param_error',
            'requestId': '5bed7991f594df23abfcfd22'},
           'response': {}}
   We know that all the information is in the items key. Before we proceed, let's borrow the
get_category_type function from the Foursquare.
In [148]: # function that extracts the category of the venue
          def get_category_type(row):
              try:
                  categories_list = row['categories']
              except:
                  categories_list = row['venue.categories']
              if len(categories_list) == 0:
                  return None
              else:
                  return categories_list[0]['name']
   Now we are ready to clean the json and structure it into a pandas dataframe.
In [149]: venues = results['response']['groups'][0]['items']
          nearby_venues = json_normalize(venues) # flatten JSON
          # filter columns
          filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venue.lo
          nearby_venues =nearby_venues.loc[:, filtered_columns]
          # filter the category for each row
          nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1)
```

nearby_venues.columns = [col.split(".")[-1] for col in nearby_venues.columns]

KeyError

clean columns

nearby_venues

Traceback (most recent call last)

This was the venues in 5 miles radius from center of cluster 0

1.4 Explore other clusters in Houston

Let's create a function to repeat the same process to all the clusters

```
In []: def getNearbyVenues(names, latitudes, longitudes, radius=5000*1.64):
            venues_list=[]
            for name, lat, lng in zip(names, latitudes, longitudes):
                print(name)
                # create the API request URL
                url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secre
                    CLIENT_ID,
                    CLIENT_SECRET,
                    VERSION,
                    lat,
                    lng,
                    radius,
                    LIMIT)
                # make the GET request
                results = requests.get(url).json()["response"]['groups'][0]['items']
                # return only relevant information for each nearby venue
                venues_list.append([(
                    name,
                    lat,
                    lng,
                    v['venue']['name'],
                    v['venue']['location']['lat'],
                    v['venue']['location']['lng'],
                    v['venue']['categories'][0]['name']) for v in results])
            nearby_venues = pd.DataFrame([item for venue list in venues_list for item in venue
            nearby_venues.columns = ['Neighborhood',
```

```
'Neighborhood Latitude',
                           'Neighborhood Longitude',
                           'Venue',
                           'Venue Latitude',
                           'Venue Longitude',
                           'Venue Category']
            return(nearby_venues)
1.4.1 Now let's start exploring cluster 1 - cluster 14
In [ ]: Houston_venues = getNearbyVenues(names=centers['Cluster ID'],
                                         latitudes = centers['Cluster Center Lat'],
                                         longitudes = centers['Cluster Center Long'])
        Houston_venues.head()
  Let's check how many venues were returned for each cluster
In [ ]: Houston_venues.groupby('Neighborhood').count()
We will drop clusters with less than 100 venues
In [ ]: Houston_venues.drop(Houston_venues[Houston_venues['Neighborhood']=='Cluster 1'].index,
        Houston_venues.drop(Houston_venues[Houston_venues['Neighborhood'] == 'Cluster 2'].index,
        Houston_venues.drop(Houston_venues[Houston_venues['Neighborhood'] == 'Cluster 4'].index,
        Houston_venues.drop(Houston_venues[Houston_venues['Neighborhood'] == 'Cluster 8'].index,
        Houston_venues.drop(Houston_venues[Houston_venues['Neighborhood'] == 'Cluster 13'].index
In [ ]: Houston_venues.head()
In [ ]: Houston_venues.groupby('Neighborhood').count()
Let's find out how many unique categories can be curated from all the returned venues
In [ ]: print('There are {} uniques categories.'.format(len(Houston_venues['Venue Category'].u.
1.5 Analyze Each cluster
In []: # one hot encoding
        Houston_onehot = pd.get_dummies(Houston_venues[['Venue Category']], prefix="", prefix_"
        # add neighborhood column back to dataframe
        Houston_onehot['Neighborhood'] = Houston_venues['Neighborhood']
        # move neighborhood column to the first column
        fixed_columns = [Houston_onehot.columns[-1]] + list(Houston_onehot.columns[:-1])
        Houston_onehot = Houston_onehot[fixed_columns]
        Houston_onehot.head()
```

And let's examine the new dataframe size.

```
In [ ]: Houston_onehot.shape
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

Let's confirm the new size

```
In [ ]: Houston_grouped.shape
```

Let's print each neighborhood along with the top 10 most common venues

```
In []: num_top_venues = 20

for hood in Houston_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = Houston_grouped[Houston_grouped['Neighborhood'] == hood].T.reset_index()
    temp.columns = ['venue','freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_topprint('\n'))
```

Let's put that into a *pandas* **dataframe** First, let's write a function to sort the venues in descending order.

Now let's create the new dataframe and display the top 20 venues for each neighborhood.

```
In [151]: num_top_venues = 20
    indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
    columns = ['Neighborhood']
    for ind in np.arange(num_top_venues):
        try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
        except:
```

```
columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = Houston_grouped['Neighborhood']

for ind in np.arange(Houston_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(Houston_grouped.shape[0])
```

1.6 Result

Based on the clustering of zip codes in Houston and then using the center of each cluster to find 100 venues in 5 miles radius, the following table is yielded. The following table lists the top 20 venues for each cluster.

In [153]: neighborhoods_venues_sorted

Out[153]:	Neighborhood 1st Most	Common Venue 2nd Most	Common Venue \
0	Cluster 0 Mexica	an Restaurant Di	scount Store
1	Cluster 10	Coffee Shop Mexica	n Restaurant
2	Cluster 11	Burger Joint Ic	e Cream Shop
3	Cluster 12 Mexica	an Restaurant	Hotel
4	Cluster 14 Seafoo	od Restaurant Mexica	n Restaurant
5	Cluster 2	Hotel	Cocktail Bar
6	Cluster 3	Burger Joint	Coffee Shop
7	Cluster 5	Grocery Store Mexica	n Restaurant
8	Cluster 6 Sush	hi Restaurant G	rocery Store
9	Cluster 7	Pizza Place	Coffee Shop
10	Cluster 9 Mexica	an Restaurant	Burger Joint
	3rd Most Common Venue	4th Most Common Venue	s 5th Most Common Venue \
0	Sandwich Place	Seafood Restaurant	Ice Cream Shop
1	Burger Joint	Fast Food Restaurant	Asian Restaurant
2	American Restaurant	Sushi Restaurant	Steakhouse
3	Burger Joint	Seafood Restaurant	Sandwich Place
4	American Restaurant	Fast Food Restaurant	Italian Restaurant
5	Coffee Shop	Mexican Restaurant	American Restaurant
6	BBQ Joint	Sports Bar	Bar
7	Park	Fast Food Restaurant	Burger Joint
8	Mexican Restaurant	Coffee Shop	Science Museum
9	Park	Bar	Cocktail Bar
10	Fast Food Restaurant	Vietnamese Restaurant	Seafood Restaurant
	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue \
0	BBQ Joint	Pharmacy	Pizza Place
1	Hotel	Pharmacy	
2	Clothing Store	Café	r
3	Rental Car Location	Discount Store	Pharmacy

```
4
             Coffee Shop
                                         Pharmacy
                                                                Grocery Store
5
             Beer Garden
                                   Ice Cream Shop
                                                                       Theater
6
      Italian Restaurant
                                       Taco Place
                                                                  Beer Garden
7
             Pizza Place
                                              Pub
                                                             Asian Restaurant
8
                   Bakery
                             American Restaurant
                                                                          Park
9
      Mexican Restaurant
                           Vietnamese Restaurant
                                                          American Restaurant
10
                               Convenience Store
                                                    Cajun / Creole Restaurant
        9th Most Common Venue
0
                 Burger Joint
1
             Sushi Restaurant
2
           Mexican Restaurant
3
                    Donut Shop
4
                Smoothie Shop
5
                         Plaza
6
           Mexican Restaurant
7
    Cajun / Creole Restaurant
8
                  Cocktail Bar
9
                       Brewery
10
               Breakfast Spot
                                         . . .
       11th Most Common Venue
                                    12th Most Common Venue
0
          American Restaurant
                                                       Park
1
          American Restaurant
                                       Fried Chicken Joint
2
                    Smoke Shop
                                                     Bakery
3
    Cajun / Creole Restaurant
                                    Furniture / Home Store
4
                                Cajun / Creole Restaurant
               Breakfast Spot
5
               Sandwich Place
                                                Steakhouse
6
         Fast Food Restaurant
                                      Gym / Fitness Center
7
    Latin American Restaurant
                                     Vietnamese Restaurant
8
               Cosmetics Shop
                                                        Spa
9
                   Beer Garden
                                                   Wine Bar
10
                        Bakery
                                                       Park
                                   14th Most Common Venue
      13th Most Common Venue
0
        Gym / Fitness Center
                                         Department Store
                               Cajun / Creole Restaurant
1
          Italian Restaurant
2
               Shopping Mall
                                       Seafood Restaurant
3
           Electronics Store
                                              Flea Market
4
                   Steakhouse
                                            Jewelry Store
5
                  Restaurant
                                            Historic Site
6
                                       Seafood Restaurant
                     Wine Bar
7
    Mediterranean Restaurant
                                             Noodle House
8
                Liquor Store
                                           Sandwich Place
9
                 Concert Hall
                               Cajun / Creole Restaurant
10
                    BBQ Joint
                                           Discount Store
```

15th Most Common Venue 16th Most Common Venue

```
0
             Video Game Store
                                             Taco Place
1
                 Deli / Bodega
                                            Pizza Place
2
    Cajun / Creole Restaurant
                                    Fried Chicken Joint
3
               Ice Cream Shop
                                          Grocery Store
4
                  Pizza Place
                                                    Park
5
                        Lounge
                                           Concert Hall
6
                          Park
                                           Cocktail Bar
7
                 Liquor Store
                                                    Café
8
          Sporting Goods Shop
                                Furniture / Home Store
             Baseball Stadium
9
                                           Burger Joint
10
          Sporting Goods Shop
                                             Sports Bar
     17th Most Common Venue 18th Most Common Venue
                                                          19th Most Common Venue
       Fast Food Restaurant
0
                                Fried Chicken Joint
                                                                       Steakhouse
1
                  Donut Shop
                                       Grocery Store
                                                           Vietnamese Restaurant
2
                                                                    Jewelry Store
              Deli / Bodega
                                    Department Store
3
        American Restaurant
                               Fast Food Restaurant
                                                                          Brewery
4
                                                                        Bookstore
                  Donut Shop
5
                                                              Italian Restaurant
    New American Restaurant
                                        Dessert Shop
6
                                                                      Pizza Place
                  Donut Shop
                                             Brewery
7
           Department Store
                                           Bookstore
                                                       Middle Eastern Restaurant
8
         Chinese Restaurant
                                      Breakfast Spot
                                                                      Pizza Place
9
                  Steakhouse
                                      Breakfast Spot
                                                                          Theater
                                                                            Hotel
10
                 Coffee Shop
                                      Ice Cream Shop
   20th Most Common Venue
0
            Grocery Store
1
             Liquor Store
2
        Electronics Store
3
       Chinese Restaurant
4
         Toy / Game Store
5
                    Church
6
       Chinese Restaurant
7
       Seafood Restaurant
```

[11 rows x 21 columns]

Burger Joint

American Restaurant

Art Museum

1.7 Discussion

8

9

10

The resulted table would be of a great help to any business person in need of a geolocation analysis of venues in greater Houston metropolitan area. For example, if you as a business person want to open up a Mexican Restaurant it is strong evidence that cluster 0,9,12 are the best clusters in houston for mexican restaurant. These clusters include zip codes that can be found using **Houston_data** table. Further analysis can be made when the selection of cluster is done. There, we could analyze a neighborhood by clustering the zip codes in neighborhood and do the same

analysis that we did here to get one step closer to a better zip code to establish the venue.

1.8 Conclusion

Based on the above table and map of clusters provided above, any person who wants to establish a venue can decide where is the best cluster and where are the best zip codes to establish his or her venue.