Determining Optimal Food Truck Locations
Evaluating Neighborhoods in Austin, Texas

Introduction

The audience for this data science problem will be owners and operators of traveling food trucks. As food truck operators enter a new city and a new market, a persistent question will be: where to park the foodtruck for maximum revenue. We will attempt to use data science and data from Foursquare to allow foodtruck operators to make a data-informed decision about where to park their food truck.

In this project we will determine the optimal Austin neighborhood to park a new food truck in. We will understand each Austin neighborhood's proximity to popular nightlife spots, as well as how saturated the food truck market is in the given neighborhood.

Data

In order to solve this problem we will firstly need data on Austin neighborhoods.As no dataset readily exists for Austin, Texas we'll have to scrape Wikipedia for neighborhood information. This Wikipedia page contains a list of Austin neighborhoods. Clicking a neighborhood shows that most pages have a *Coordinates* section at the top which links to a geohack page.

Food trucks perform best in areas with a lot of nighlife spots. So we'll want to measure how many bars and nightlife spots are close to each neighborhood. We'll also want to measure how many foodtrucks are already in certain neighborhoods, to find neighborhoods that are less competitive. All of this data can be obtained through the Foursquare API.

Here is an example of using the Foursquare API in Python to retrieve nightlife spots near Austin, Texas.

use-foursquare.py

```
#! /usr/bin/python
import pandas as pd
import requests

def venues(latitude, longitude, category):
    """ Returns venues within a 1 km radius of a location """
    url = 'https://api.foursquare.com/v2/venues/explore?client_id={}' \
          '&client_secret={}&ll={},{}&v=20201120&categoryId={}' \
          '&radius=1000&limit=50'.format(client_id, client_secret, \
                                         latitude, longitude, category)
    results = requests.get(url).json()
    if results['meta']['code'] == '429':
        raise ValueError('Foursquare Quota Exceeded')
    return pd.json_normalize(results['response']['groups'][0]['items'])

df_nl = venues(30.3076863, -97.8934851, '4d4b7105d754a06376d81259')
```

And here is the resulting information:

Venue	Latitude	Longitude
The Common Interest	30.366192	-97.729144
Slick Willie's Family Pool	30.366677	-97.729049
Water 2 Wine	30.362011	-97.742086
Nosh & Bevvy	30.365414	-97.728802
Buddy's	30.368978	-97.727205

Methodology

Overall Methodology

Our overall methodology for this project will be to:

1. Procure a list of neighborhoods in Austin, Texas
2. Determine the number of nightlife spots in each neighborhood
3. Determine the number of food trucks in each neighborhood
4. Find the neighborhood with many bars and few food trucks
5. Within that neighborhood, locate the largest cluster of bars
6. Find the ideal parking spot as the midpoint of that cluster

Procure a List of Neighborhoods in Austin, Texas

As stated in the Data section, This Wikipedia page has a list of Austin neighborhoods, each neighborhood having its own Wikipedia page. I found that the number of neighborhoods was low enough, and the pages differed enough, that a semi-manual process for procuring this list was ideal. I've created CSV file of Austin neighborhoods which can be found at this link.

Determine the Number of Nightlife Spots

Foursquare has a *Nightlife* category. The challenge with using that broad category is that it includes things like hotel bars and sports bars, which typically also serve food. So to get the most accurate results, we'll select the subcategories of *Nightlife* that don't likely serve food.

These are: *Beach Bar*, *Beer Bar*, *Beer Garden*, *Champagne Bar*, *Cocktail bar*, *Dive Bar*, *Gay Bar*, *Hookah Bar*, *Karaoke Bar*, *Pub*, *Sake Bar*, *Speakeasy*, *Tiki Bar*, *Whisky Bar*, *Wine Bar*, *Brewery*, *Lounge*, *Nightclub*, and *Other Nightlife*.

We'll use the Explore API Endpoint in Foursquare and set the limit to 50 (max) and the radius to 1 km.

Determine the Number of Food Trucks

Foursquare has a *Food Truck* category we can use to enumerate food trucks in a given neighborhood. Similar to nightlife, we'll use the Explore API Endpoint in Foursquare and set the limit to 50 (max) and the radius to 1 km.

Find the Neighborhood with Many Bars and Few Foodtrucks

To accomplish this, we'll create a new index, called the *Foodtruck-to-Nightlife Ratio (FNR)*. The formula for this ratio will be:

$$FNR = \frac{N_{foodtrucks}}{N_{nightlife}} \tag{1}$$

As you can tell from the formula the number of nightlife spots cannot be zero, or this ratio cannot be calculated. Actually we'll want to avoid neighborhoods with one or two nightlife spots, so we'll create a threshold below which we won't consider the neighborhood. I've set this threshold at *five* nightlife spots for this project.

Within that Neighborhood, Find the Largest Cluster of Bars

We'll use the *DBSCAN (Density-based spatial clustering of applications with noise)* method for creating clusters. Benefits of using DBSCAN are that we don't have to know how many clusters to create, and it will properly reject noise – bars that are not close to any other bars.

Find the Ideal Parking Spot as the Midpoint of that Cluster

Once we've identified our cluster of bars to target, we'll average the latitudes and longitudes of those bars, to find the ideal place to park our food truck.

Results

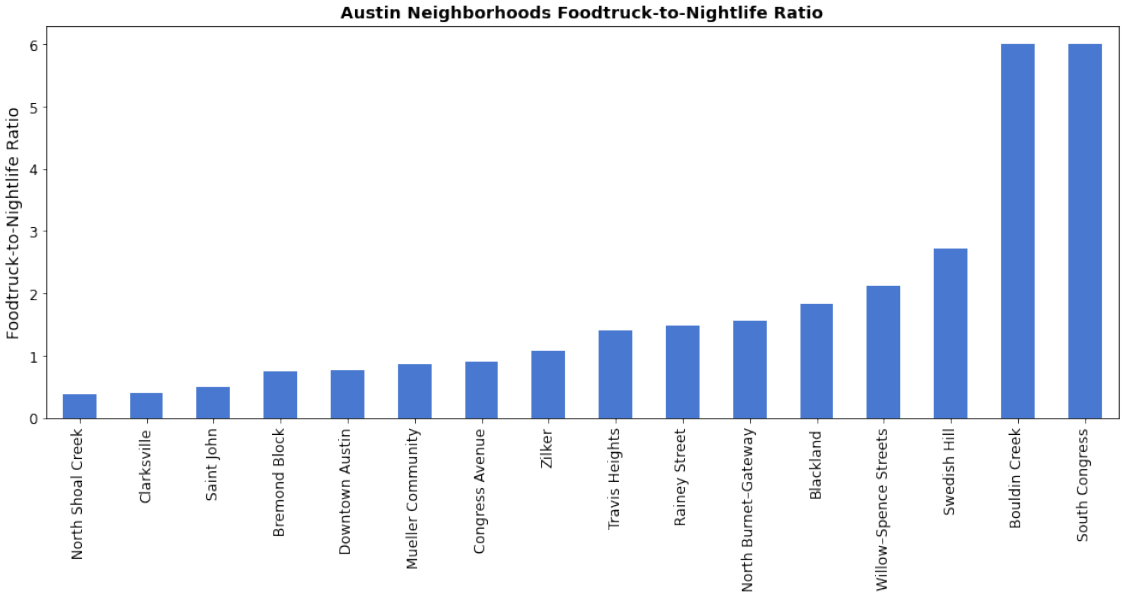
Enumerating Neighborhoods

After getting the list of Austin neighborhoods, and using Foursquare to read the number of nightlife spots and the number of food trucks in each location, the Foodtruck-to-Nightlife Ratio was able to be calculated. After removing the neighborhoods with less than five bars, our results were as follows:

Neighborhood	Latitude	Longitude	Nightlife	Food Truck	FNR
North Shoal Creek	30.365300	-97.733500	8	3	0.375000
Clarksville	30.280833	-97.762222	5	2	0.400000
Saint John	30.330000	-97.698000	6	3	0.500000
Bremond Block	30.270556	-97.746389	158	117	0.740506
Downtown Austin	30.271000	-97.743000	169	130	0.769231
Mueller Community	30.289444	-97.702636	7	6	0.857143
Congress Avenue	30.267778	-97.742500	182	163	0.895604
Zilker	30.250000	-97.766667	15	16	1.066667
Travis Heights	30.241667	-97.741667	5	7	1.400000
Rainey Street	30.259444	-97.738333	120	177	1.475000
North Burnet–Gateway	30.393000	-97.721000	9	14	1.555556
Blackland	30.280991	-97.722097	6	11	1.833333
Willow–Spence Streets	30.259167	-97.734444	82	174	2.121951
Swedish Hill	30.275000	-97.729444	14	38	2.714286
Bouldin Creek	30.249344	-97.755253	10	60	6.000000
South Congress	30.250000	-97.750000	9	54	6.000000

Determining the Best Neighborhood

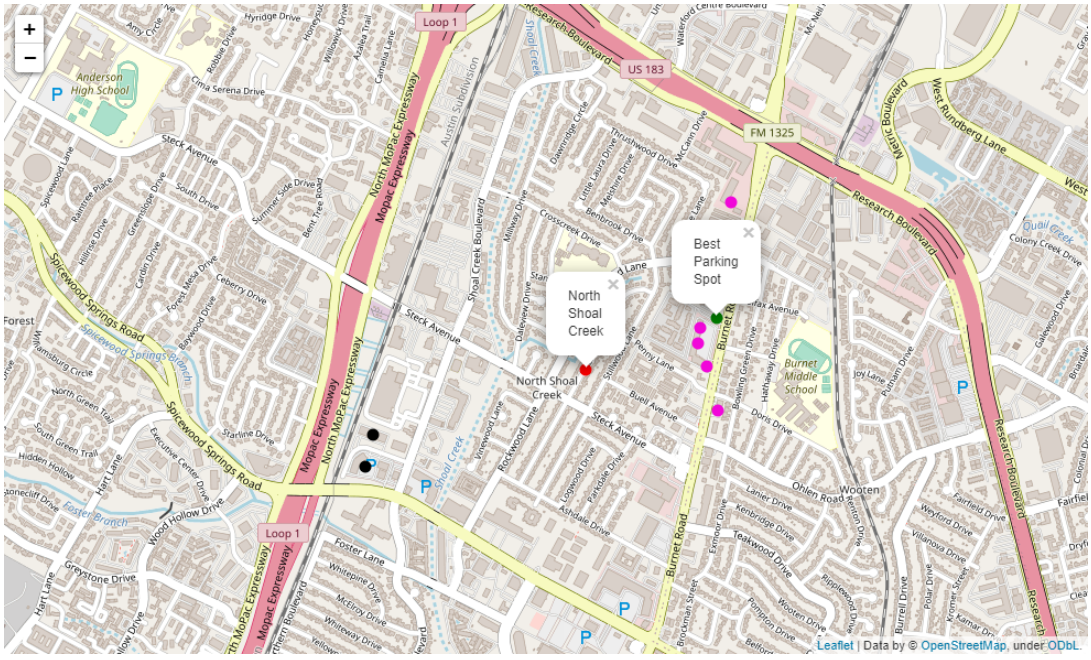
The bar chart below shows the Foodtruck-to-Nightlife ratio of Austin neighborhoods. As we can see, **North Shoal Creek** has the lowest ratio. There are, however, other neighborhoods with similar ratios, in case we find an issue with North Shoal Creek.



Finding the Best Parking Spot in the Neighborhood

We use the *DBSCAN* method to put the nightlife spots into clusters, and filter out the noise. As we can see from the map below, there are several "loner" nightlife spots (shown in black), but a definite cluster of bars off of Burnet Road (shown in pink).

Our ideal parking location is the average of the cluster of bars, and is shown by the green dot on the map. We use geopy to determine the address of that location is *8524, Burnet Road, Wooten, Austin, Travis County, Texas, 78757, United States of America*.



Discussion

TBD

Conclusion

In conclusion, **North Shoal Creek** will be the best neighborhood to park our food truck in Austin, Texas. The ideal parking space in North Shoal Creek will be **8524, Burnet Road, Wooten, Austin, Travis County, Texas, 78757, United States of America**.