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Capstone Project Report

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Contenu

Section 1: Introduction 1

Background 1

Project Idea 2

Data Description 3

Top Sites from FourSquare Website 3

Supplemental Geographical Data 4

FourSquare Restaurent Recommendation Data 6

Results - Data Visualisation 10

Crimes in casablanca 10

Conclusion 12

Section 1: Introduction

I will clearly define in this section the idea of my choosing, where I leverage the Foursquare location data to solve the imagined business opportunity.

Background

If you want to travel to a foreign city such as Casablanca, you have to do a lot of work to prepare for such an event.

Searching the different travel sites is very painful because they do not offer all the necessary information at the same time.

Of course you have to see the areas around the place you want to visit that could be rife with crime, including muggings, car theft and assault, for example. Approach the place from any direction other than the north and you could put your life in danger. That's when my idea comes in.

Imagine the following scenario:

1. You do not like to travel without preparation and planning your trip.

2. You want to travel to Casablanca to participate in a Data Science project

3. You would to stay in Casablanca Three days after the end of the event to explore the city and its region

4. You do not know anyone in this city to give you good plans and to show you the best places

5. On your last trip you were agerated and you lost your papers and your money so you became too susceptible

6. You do not have much time to search all the travel sites because the conference starts very soon

So What do you do ... ?

Project Idea

I thought it would be interesting to give the traveler a map of the area where he will work, with the best places he can eat, go out and distract himself while showing him crime data in the neighborhoods.

1. The user chooses his destination 'Casablanca' for example

2. Look for the busiest places in the city on FourSquare

3. The list is compiled by geographic data.

4. We select the best places in the environment.

5. Obtaining crime data in the region

6. The user is presented with a crime map and best locations combined.

7. It is also presented the future probability that a crime will occur near or around selected sites.

There are many data science aspect of this project including:

1. Data Acquisition

2. Data Cleansing

3. Data Analysis

4. Machine Learning

5. Prediction

Now that the work is over the traveler can explore Casablanca and feel much safer.

Section **2: Data**

Data Description

In this section, I will describe the data used to solve the problem as described previously.

As noted below in the Further Development Section, it is possible to attempt quite complex and sophisticated scenarios when approaching this problem. However, given the size of the project and for simplicity only the following scenario will be addressed:

1. Query the FourSqaure website for the top sites in Casablanca
2. Use the FourSquare API to get supplemental geographical data about the top sites
3. Use the FourSquare API to get top restaurent recommendations closest to each of the top site
4. Use open source Casablanca Crime data to provide the user with additional crime data

Top Sites from FourSquare Website

Although FourSquare provides a comprehensive API, one of the things that API does not easily support is a mechanism to directly extract the top N sites / venues in a given city. This data, however, is easily available directly from the FourSquare Website. To do this simply go to www.foursquare.com, enter the city of your choise and select Top Picks from *I'm Looking For* selection field.

Using BeautifulSoup and Requests the results of the Top Pick for Casablanca was retrieved. A sample venue is shown below:

```
<div class="venueDetails">
```

```
    <div class="venueName">
        <h2>
    <a href="/v/Sidibad-park/42b75880f964a52090251fe3" target="_blank">Sindibad
Park
    </a>
</h2>
    </div>
    <div class="venueMeta">
        <div class="venueScore positive" style="background-color: #00B551;"
title="7.7/10 - People like this place">7.7</div>
        <div class="venueAddressData">
            <div class="venueAddress">Km 2 Avenue la corniche St, Ain Diab
Casablanca</div>
            <div class="venueData"><span class="venueDataItem"><span
class="categoryName">Park</span><span class="delim"> • </span></span>
            </div>
        </div>
    </div>
</div>
```

From this HTML the following data can be extracted:

- Venue Name
- Venue Score
- Venue Category
- Venue HREF
- Venue ID [Extracted from the HREF]

A sample of the extracted data is given below:

id	score	category	name	h
42b75880f964a52090251fe3	7.7	Park	Sindibad Park	/v/sindibad-park/42b75880f964a
4b9511c7f964a520f38d34e3	8.6	Trail	UAE Place	/v/UAE-Place/4b951
49e9ef74f964a52011661fe3	7.6	Art Museum	The Art Institute of Morocco	/v/the-art-institute-Morocco/49e9ef74f

We will have a closer look at this data gather later on when the supplemental geographical data has been added.

Supplemental Geographical Data

Using the `id` field extracted from the HTML it is then possible to get further supplemental geographical details about each of the top sites from FourSquare using the following sample API call:

```
# Get the properly formatted address and the latitude and longitude
url =
'https://api.foursquare.com/v2/venues/{}?client_id={}&client_secret={}&v={}'.forma
t(
    venue_id,
    cfg['client_id'],
    cfg['client_secret'],
    cfg['version'])

result = requests.get(url).json()
result['response']['venue']['location']
```

The requests returns a JSON object which can then be queried for the details required. The last line in the sample code above returns the following sample JSON:

```
{
   "city":"Casablanca",
   "lng":-87.62323915831546,
   "crossStreet":"Avenue la courniche ",
   "neighborhood":"Morocco Mall",
   "postalCode":"20200",
   "cc":"MAR",
   "formattedAddress":[
      "Km 2 Avenue la corniche St, Ain Diab ",
      "Casablanca, IL 20200",
      "Morocco"
   ],
   "state":"IL",
   "address":" Km 2 Avenue la corniche St, Ain Diab Casablanca ",
   "country":"Morocco"
}
```

From this the following attributes are extracted:

- Venue Address
- Venue Postalcode
- Venue City
- Venue Latitude
- Venue Longitude

Data Analysis and Visualisation

An initial look at the data shows that there are 30 rows of data [as expected] each with 10 attributes. The variable types are all correct except the Venue Rating or Score which will be converted to a float. After converting the score column to a float it can clearly be seen that we have the top venues with a mean of `9.532`.

```
df_top_venues.shape
(30, 10)

df_top_venues.dtypes
id              object
score           object
category        object
name            object
address         object
postalcode      object
city            object
href            object
latitude       float64
longitude      float64
dtype: object

df_top_venues.score.describe()
count    30.000000
mean      9.523333
std       0.072793
min       9.400000
25%       9.500000
50%       9.500000
75%       9.600000
max       9.700000
Name: score, dtype: float64
```

We are now ready to get the top restaurents within 500 meters of each of the top sites.

FourSquare Restaurent Recommendation Data

Using the the list of all `id` values in the Top Sites DataFrame and the FourSquare `categoryID` that represents all food venues we now search for restaurants within a 500 meter radius.

```
# Configure additional Search parameters
categoryId = '4d4b7105d754a06374d81259'
radius = 500
limit = 15

url =
'https://api.foursquare.com/v2/venues/search?client_id={}&client_secret={}&ll={},{
}&v={}&categoryId={}&radius={}&limit={}'.format(
    cfg['client_id'],
    cfg['client_secret'],
    ven_lat,
    ven_long,
    cfg['version'],
    categoryId,
    radius,
    limit)

results = requests.get(url).json()
```

The requests returns a JSON object which can then be queried for the restaurant details required.

From this JSON the following attributes are extraced and added to the Dataframe:

- Restaurant ID
- Restaurant Category Name
- Restaurant Category ID
- Restaurant Nest_name
- Restaurant Address
- Restaurant Postalcode
- Restaurant City
- Restaurant Latitude
- Restaurant Longitude
- Venue Name
- Venue Latitude
- Venue Longitude

The only piece of data that is missing is the Score or Rating of the Restaurant. To get this we need to make another FourSquare API query using the id of the Restaurant:

```
# Get the restaurant score and href
rest_url =
'https://api.foursquare.com/v2/venues/{}?client_id={}&client_secret={}&v={}'.forma
t(
    rest_id,
    cfg['client_id'],
    cfg['client_secret'],
    cfg['version'])

result = requests.get(rest_url).json()
rest_score = result['response']['venue']['rating']
```

Using just the data in this DataFrame we will be able to generate maps displaying the chosen Top List Venue and the best scored surrounding restaurants.

Looking at the data we get an interesting insight into the range of restuarants that are included. From a list of 30 top venues only 28 actually had more than 10 to provide the user with a real choice. In total there were 387 restaurants found of which 240 were unique occuring only once in the data. There were 72 categories of restaurants. The mean score of all the restaurants wa `8.23` with a manimum value of `9.5` and a minimum value of `5.3`.

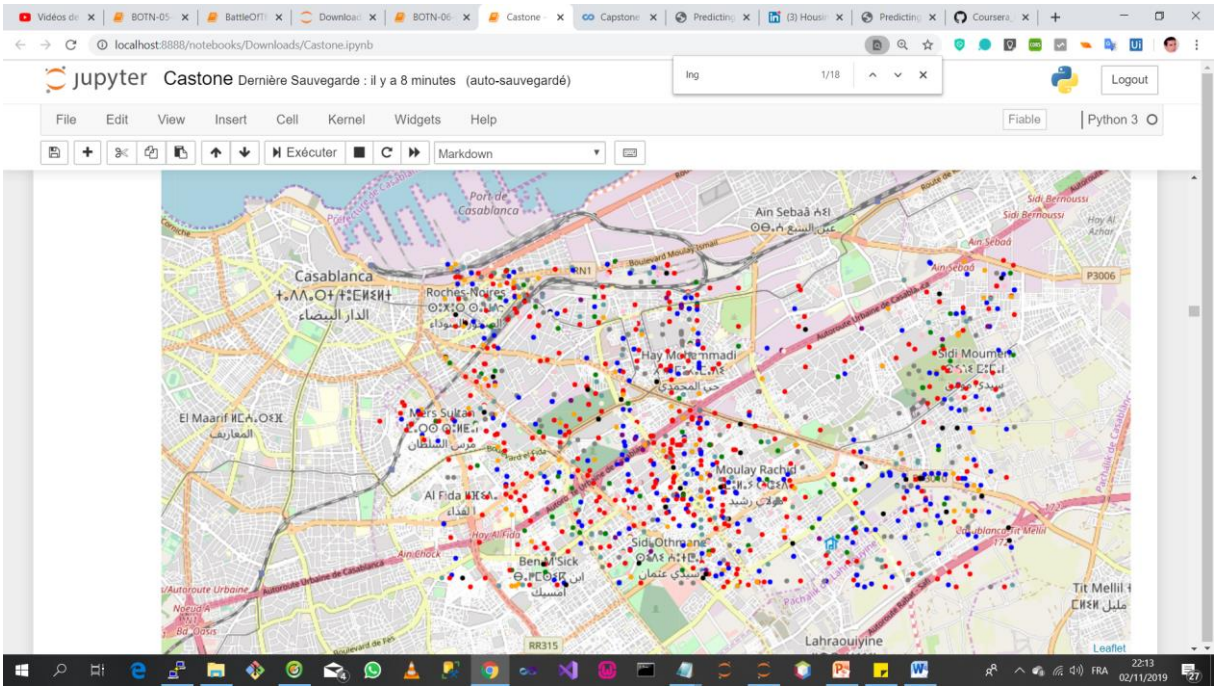
Coffee Shops (52) and Pizza Places (29) were the top two most frequently occurring categories but Pie Shops (9.4000) and French Restaurants (9.4000) were the restaurant categories with the highest average score.

```
# What is the shape of the Restaurants DataFrame
df_restaurant.shape
(387, 13)

# Get a count of the top venues that had more than 10 restaurant within 500 meters
#  The number of unique restaurants
#  The number of unique restaurant categories
df_restaurant.venue_name.nunique()
28
df_restaurant.name.nunique()
240
df_restaurant.category.nunique()
72

# Look at the data types
df_restaurant.dtypes
id                  object
score              float64
category            object
categoryID          object
name                object
address             object
postalcode          object
city                object
latitude           float64
longitude          float64
venue_name          object
venue_latitude     float64
venue_longitude    float64
dtype: object

# Describe the Score attribute
df_restaurant.score.describe()
count    387.000000
mean       8.286563
std        0.930138
min        5.300000
25%        7.800000
50%        8.500000
75%        9.000000
max        9.500000
Name: score, dtype: float64

df_restaurant.groupby('category')['name'].count().sort_values(ascending=False)[:10
]
category
Coffee Shops                        52
Pizza Places                        29
Cafés                               24
Bakeries                            15
Burger Joints                       15
Gastropubs                          15
New American Restaurants            15
Mexican Restaurants                 14
Breakfast Spots                     13
Fast Food Restaurants               13
```

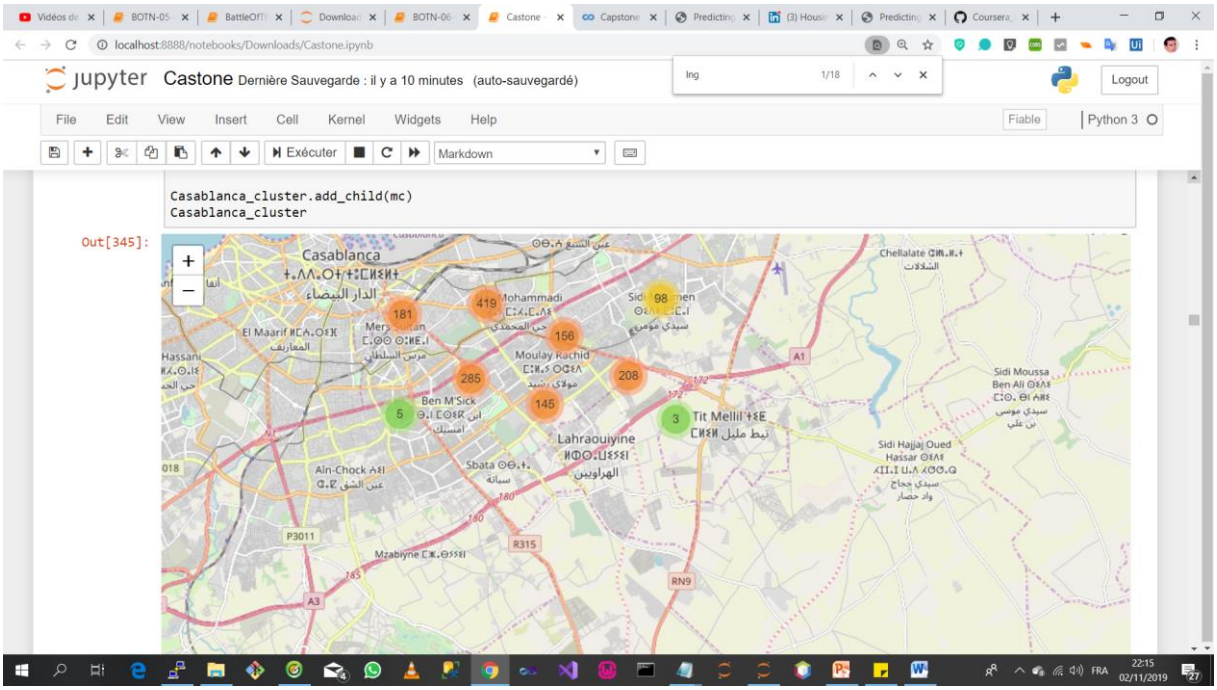
```
df_restaurant.groupby('category')['score'].mean().sort_values(ascending=False)[:10
]
category
Pie Shops                            9.4000
French Restaurants                   9.4000
Molecular Gastronomy Restaurants     9.3000
Filipino Restaurants                 9.2000
Cuban Restaurants                    9.1000
Ice Cream Shops                      9.0625
Mediterranean Restaurants            9.0600
Korean Restaurants                   9.0000
Latin American Restaurants           9.0000
Fish & Chips Shops                   9.0000
```

Results - Data Visualisation

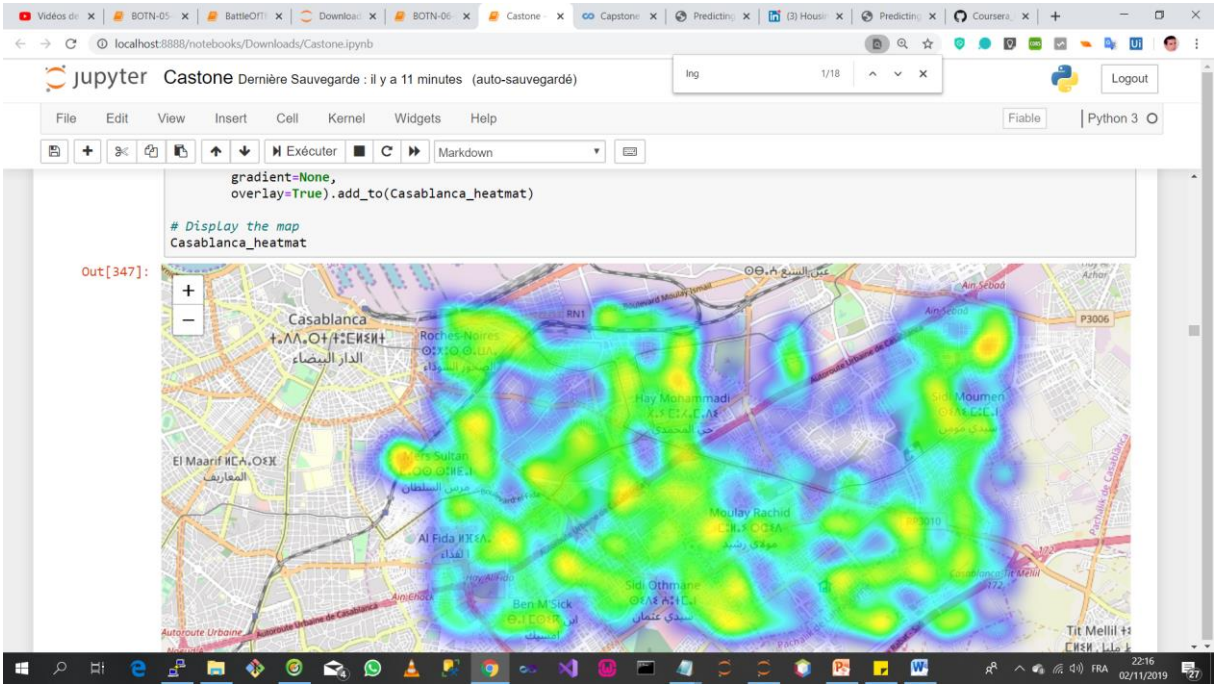
Crimes in casablanca



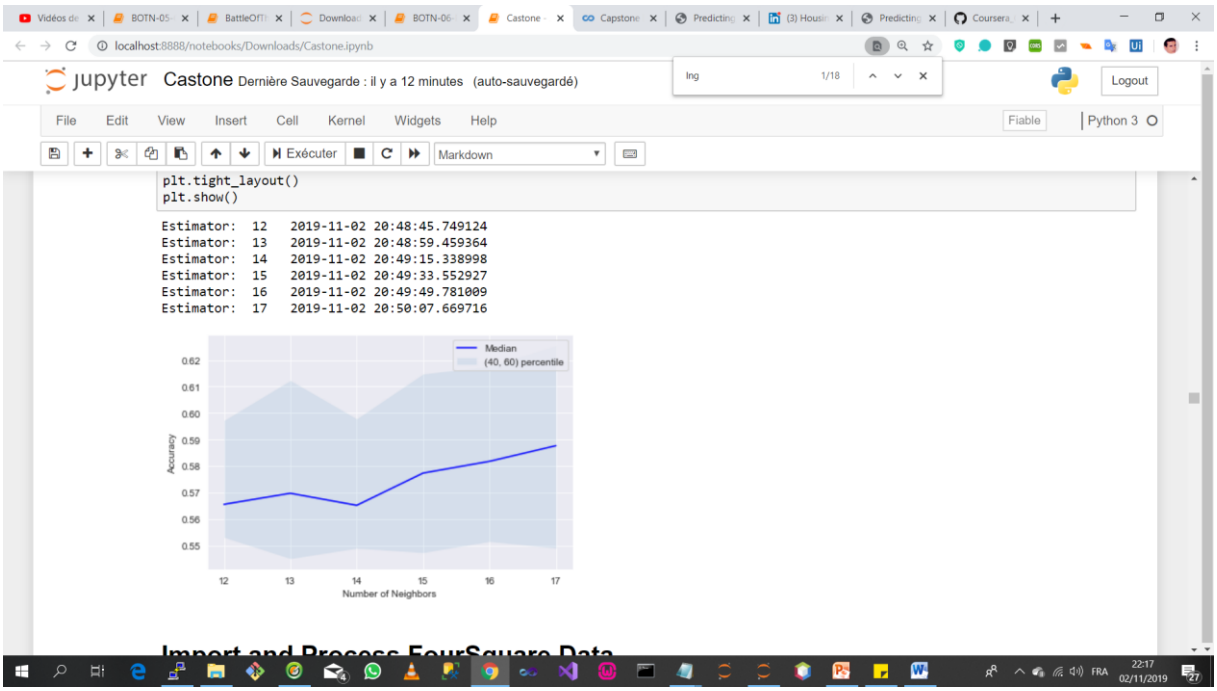
Clustured data on folium MAP



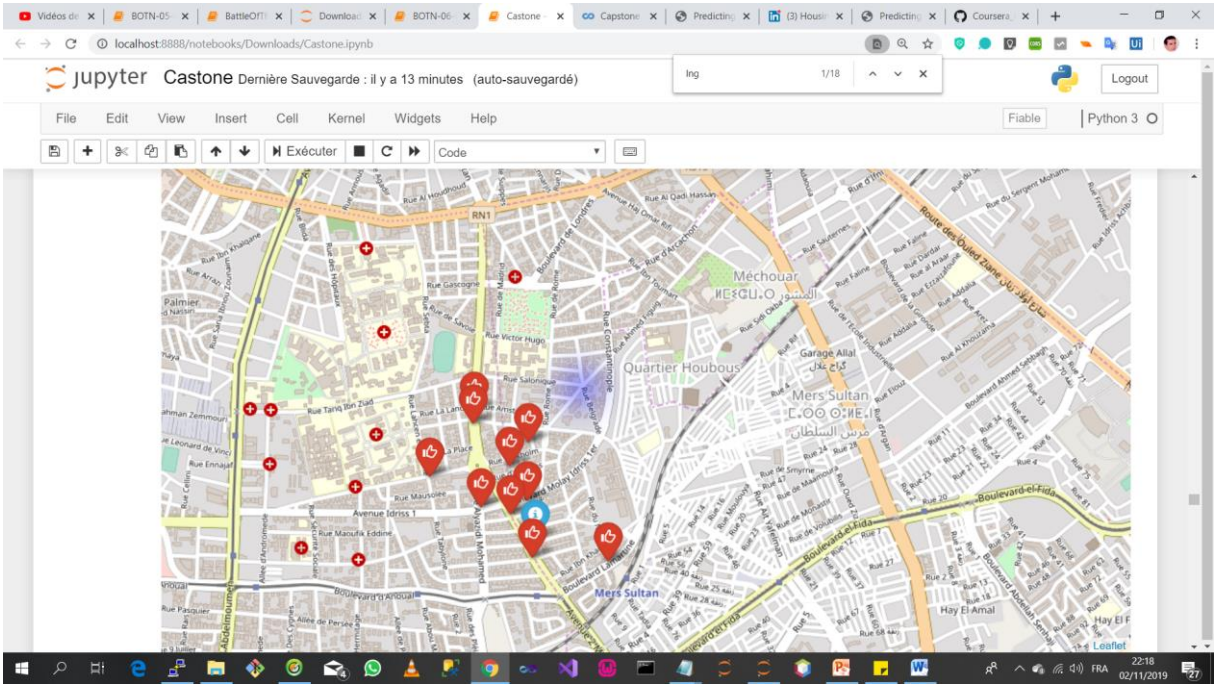
HeatMAP Visualisation



Modeling for Future Prediction - Decision Forest using a Random Forest



Combine Prediction on HeatMap with location of nearests Restaurants in Casablanca



Conclusion

Although all of the goals of this project were met there is definitely room for further improvement and development as noted below. However, the goals of the project were met and, with some more work, could easily be devleoped into a fully phledged application that could support the cautious traveller in an unknown location.

Of the contributing data the Chicago Crime data is the one where more data would be good to have. Also not every city in the world makes this data freely available so that is a drawback.

FourSquare proved to be a good source of data but frustrating at times. Despite having a Developer account I regularly exceeded my hourly limit locking me out for the day. This is why Pickle was used to store the captured data.

The following are suggestions how this project could b efurther developed:

1. Best time to visit each venue
2. Suggestions for morning, afternoon, evening and night time
3. Daily itineraries
4. Route planning and transportation
5. Time lapse of the crime in the area of the venue
6. Favourite dining preferences could be used to choose the restaurants