'THE BEST WALKABLE SPOTS IN NEW YORK'

CAPSTONE PROJECT

FINAL REPORT

BUSINESS PROBLEM DEFINITION

Problem : « I want to live in New York City ! »

- **Requirements**
  - Everything is nearby
  - No need for a vehicle
  - Workplaces are numerous
  - Apartment Rents are low

- **Audience : who may be Interested ?**
  - Students that would like to find a job close to the place of residence
  - People who want to live without cars
  - Recommendation tools writers
  - Etc.

Question :

Can you facilitate my quest ?

DATA SOURCES

New York City Information Retrieval

- **Compositon : 5 Boroughs and 306 Neighborhoods**
  - https://geo.nyu.edu/catalog/nyu_2451_34572 : Json data parsing
- **Venues : 11 311 retrieved initially**
  - **F**oursquare : APIs
- **Walkability Scores : 5 levels *[car-dependants, Walker's Paradise]***
  - Web Site "Walk Score" (https://www.walkscore.com/) : APIs
- **Average Rental Price *: for Studio, 1BR by Neighborhoods***
  - Web Site "renthop" (https://www.renthop.com/) : HTML parsing

Data Profiles:

4 data sets, 2 APIs, 2 files, JSON and HTML formats

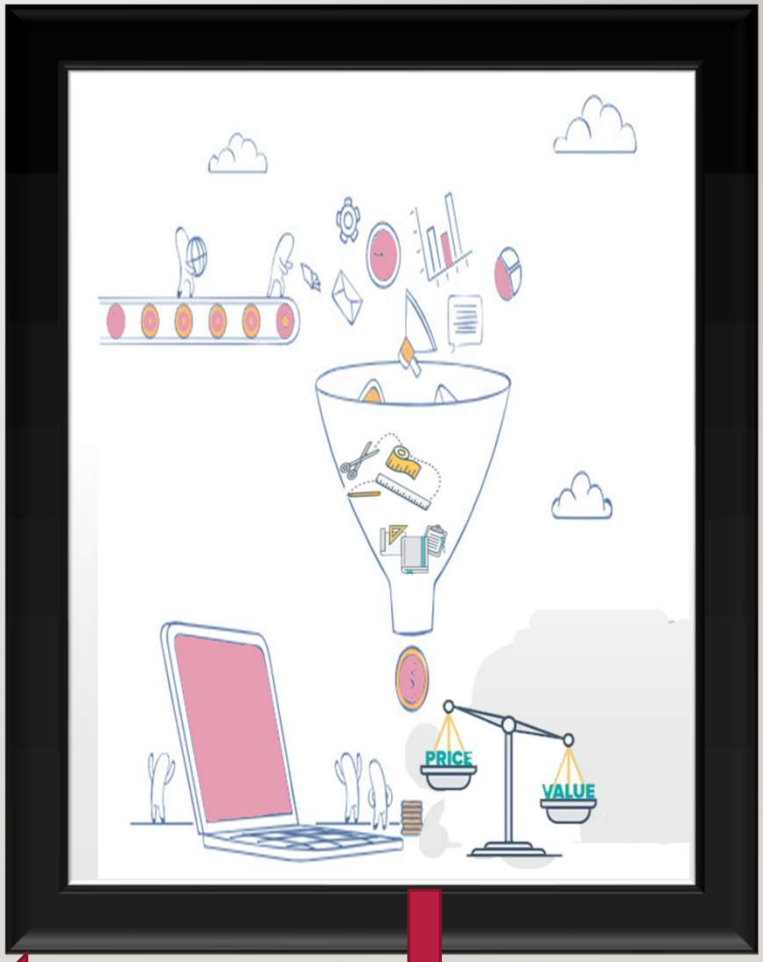
DATA PROCESSING

Input : Raw Data

- **Merging**
  - All data : 306 neighborhoods, 11300 venues, Walk Scores, Rentals
- **Cleaning**
  - Dropping or replacing unknown or no consistent values
- **Rewriting**
  - Correct data formatting : '$4,542 -> 4542'
- **Completing**
  - Complete missing fields by calculation if possible (1BR budget with mean or ratio etc.)
  - Get data from other sources (missing neighborhoods ranked by RentHop), etc.
- **Renaming**
  - Avoid confusion : rename if it makes sense or drop
- **Remapping**
  - Consistency : rescale categorical (i.e. Budget)

Output :

81 NeighBorhoods, 3508 venues, Walk Scores and Average Prices



METHODOLOGY

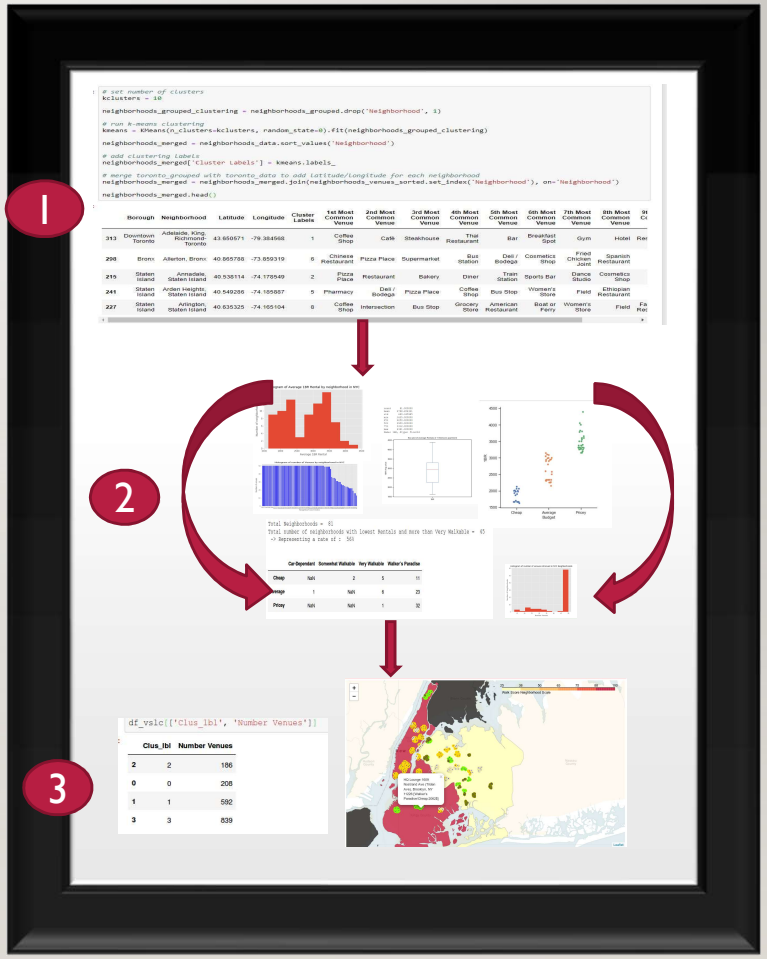
Follow the way !

- **Step 1**
  - Data Set build and mapped in *pandas Data Frames ready for analysis*
- **Step 2**
  - Exploration and Analysis
    - Calculation : means, densities etc.
    - Data visualization (histograms, bar plot, maps, heatmaps etc.)
- **Step 3**
  - Selection of Areas
  - Modeling Locations Clustering

Results

Display Maps and Interactive Heatmaps indicating locations :

'Best Walkable Spots in New York City within a 500m radius'



ANALYSIS - EXPLORATION

Extracted Data : 81 Neighborhhods, 3508 Venues

- **NYC Neighborhoods and Venues are 'Highly Walkable' > 97%**
  - *Very Walkable or Walker's Paradise ~ 97%*

- **NYC Neighborhoods : High Density of Potential Workplaces**
  - Maximum Venues : 50 venues in 87% of Neighborhoods

- **NYC '1BR' Prices represent a High Budget**
  - Min = 1625, Max = Mean = 2798, Median = 2950

Results

Easy to find Areas in NYC with High Walkability and Potential Workplace but Expansive !

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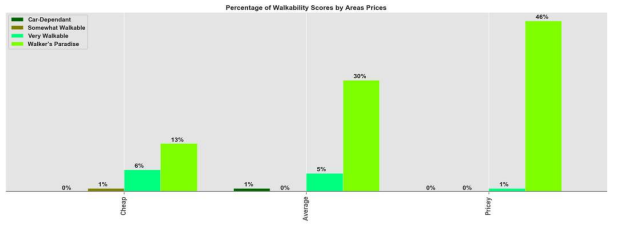
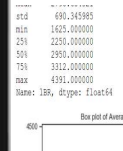
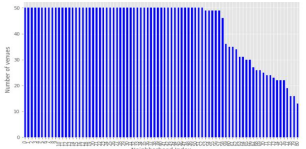
Table of Percentages of Neighborhood Walkability Scores by Areas Prices

	Car-Dependant	Somewhat Walkable	Very Walkable	Walker's Paradise
Cheap	NaN	2	6	14
Average	1	NaN	7	28
Pricey	NaN	NaN	1	40







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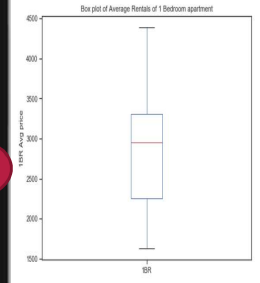
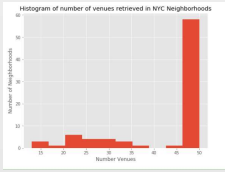




VISUAL EXPLORATION

Maps

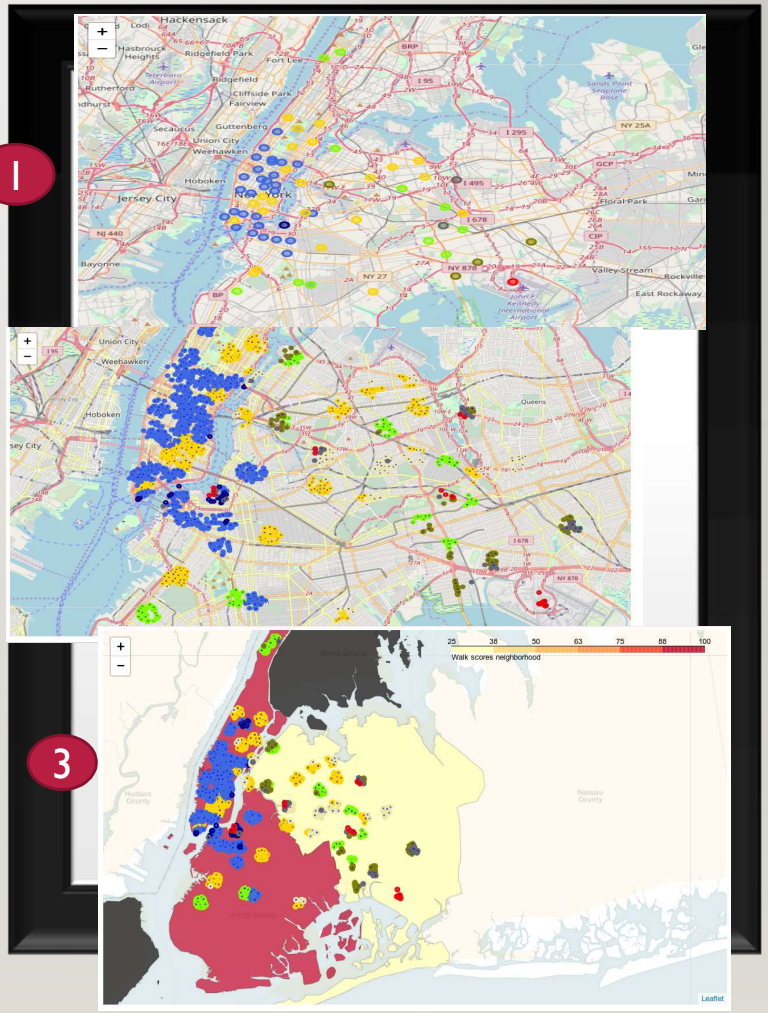
- **NYC Neighborhoods Map Localisation**
  - Neighborhoods are displayed with colors according to category
- **NYC Venues Map Localisation**
  - Venues are also displayed with same colors as Neighborhoods

Heatmaps

- **NYC Venues on Heatmap**
  - NYC Venues are displayed in areas of NYC classified by colors according to WS Neighborhood scale

Results

Easy way to identify and navigate across NYC sections to find interesting places in neighborhoods.



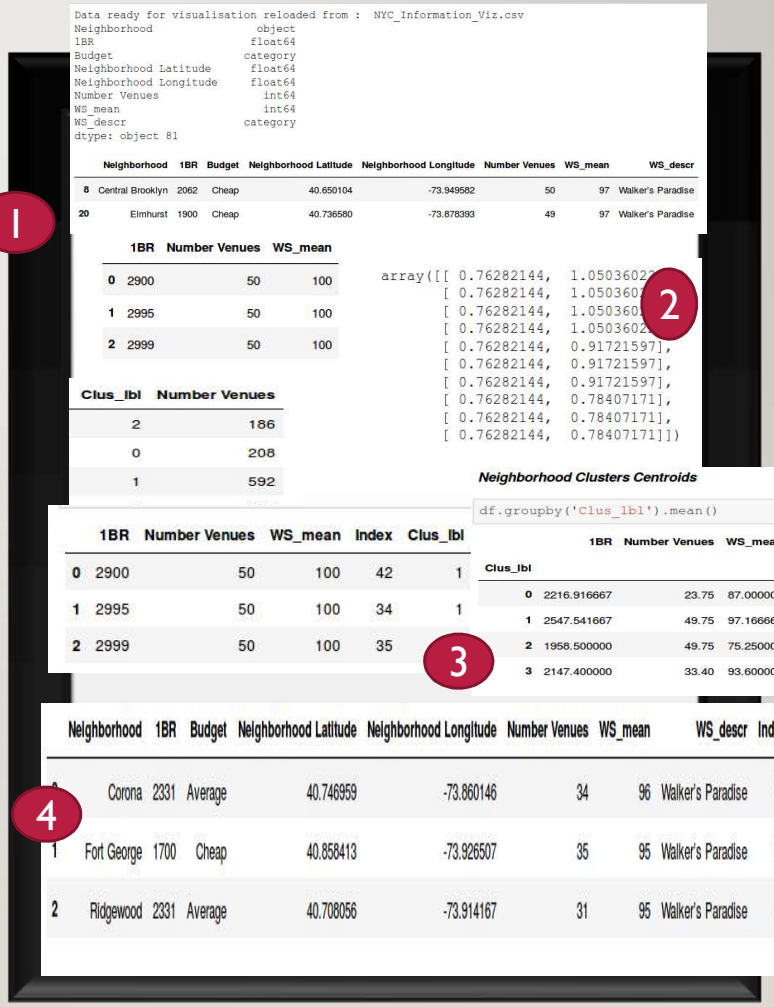
CLUSTERING

Classify Automatically Neighborhoods and Venues

- **Data and Features Sets Definition**
  - Keep only number typed features, drop categorical or string.
  - Ex. '1BR' prices, 'Walk Score number, Venue number and drop others (Budget, etc.)
- **Normalization/ Standardization over the Standard deviation**
  - Setting values on the same scale to avoid biasing clustering measure
    - Ex: prices in [1000-4000] ws_scores in [0-100], venue number in [0-50]
- **Modeling**
  - Generating Cluster Labels to ***4 clusters with 'K-Means'***
  - Cluster Centroids definition
- **Labels Aggregation in DataFrames (Neighborhoods and Venues)**
  - Resulting Data set can be filtered/sorted to be printed out or displayed on Maps/Heatmaps

Results

Labeled Data are grouped in differentiated sets according to « similarity » measure computed by K-Means



RESULTS

Output of Clustering Process

- **Filtering, Sorting and Grouping Data Automatically**
  - By '1BR' prices, 'Walk Score' number, Venue number
- **Printing Selection of Areas Addresses**
  - Choice of criteria
  - based on neighborhoods and venues localization
- **Displaying Areas**
  - Interactive Maps
  - Interactive Heatmaps

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	Neighborhood	1BR	Budget	Neighborhood Latitude	Neighborhood Longitude	Number Venues	WS_mean	WS_descr	Index	Clus_lbl
0	Corona	2331	Average	40.746959	-73.860146	34	96	Walker's Paradise	62	0
1	Fort George	1700	Cheap	40.858413	-73.926507	35	95	Walker's Paradise	61	0
2	Ridgewood	2331	Average	40.708056	-73.914167	31	95	Walker's Paradise	64	0

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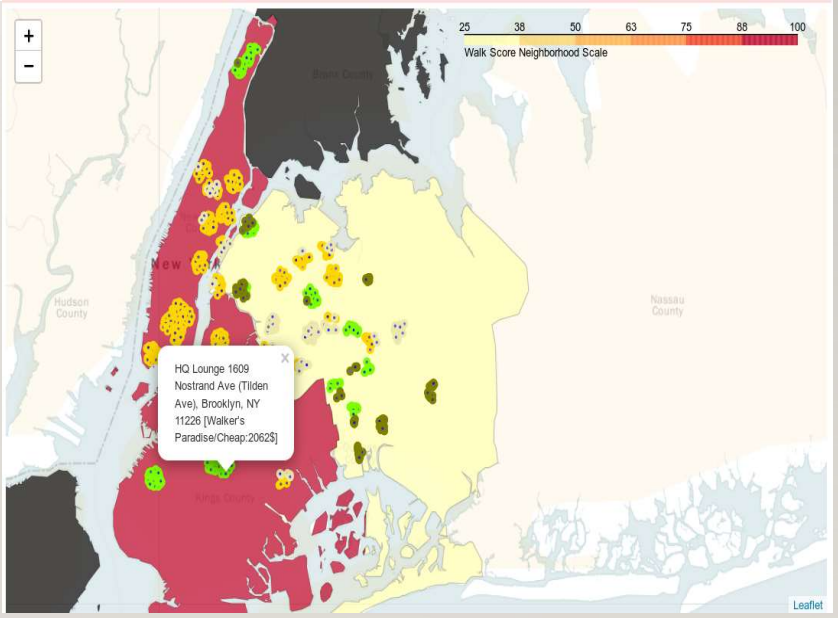

Results

Labelled Data are grouped in differentiated sets.

Navigation across different targeted groups is facilitated.

CONCLUSIONS

- **Study of Data and Features to classify automatically Areas of NYC**
  - Print textual list of NYC Areas according to required criteria
  - Print Interactive Maps/Heatmaps to facilitate the search of interesting places
- **K-Means Modeling**
  - Good performance for this use-case with these data
  - **Constraints**:
    - Fixing Clusters number
    - Using a limited number of parameters (Walk Score, Number of Venues, Rent Price)
    - Rescaling of parameters at the same magnitude order (equivalent weighting)
- **Questions and Future**
  - How to compute automatically the number of clusters ?
  - What about the behavior if adding more features ?
  - And what if defining different importance to the different features (differentiated weighting)

- END -