Finding convenience stores' optimal locations in Montevideo

Applied Data Science Capstone by IBM/Coursera

Lucas Dávila

Convenience Store:

- Establishment with less than 400m^2.

- Open at least 18 hours per day, all year.

- Based on sales of drinks, feeding, products of watertight, bazaar.

- 300m consumption radius.

- Greatest concentration in Uruguay is given in Montevideo, its capital.

Paradigm Shift in Montevideo:

- Increasement in convenience stores' preference of use to the detriment of typical supermarket use.

- More households with less members cohabiting.

- Increasement in per capita GDP.

Data:

| neighborhood	hct_price	burg_freq	tot_dens
AGUADA	3.529	186	117.63
AIRES PUROS	4.731	186	67.20
ATAHUALPA	6.561	186	67.20
BANADOS DE CARRASCO	3.843	186	19.80
BARRIO SUR	3.843	186	100.80

Source: Instituto Nacional de Estadistica, Agencia Nacional de Viviendas, Ministerio del Interior.

- **'neighborhood'** contains the names of all 62 neighborhoods of Montevideo, Uruguay.

- **'hct_price'** stand for "common property" square meter price's mean (2009), in thousand of indexed units. It's used as a purchasing power indicator.

- **'burg_freq'** stands for robbery frequency registered in 2018. This will be used as a criminality indicator.

- **'tot_dens'** stands for population density per square hectare in Montevideo (2011), and is used as another indicator for the store establishment.

Methodology and Analysis:

First Stage:

- Creation of the ratio "common property" square meter price (red circles) against robbery frequency (green circles).

- Main idea: select the best five neighborhoods where population density is higher, and, at the same time, where this ratio is also higher.
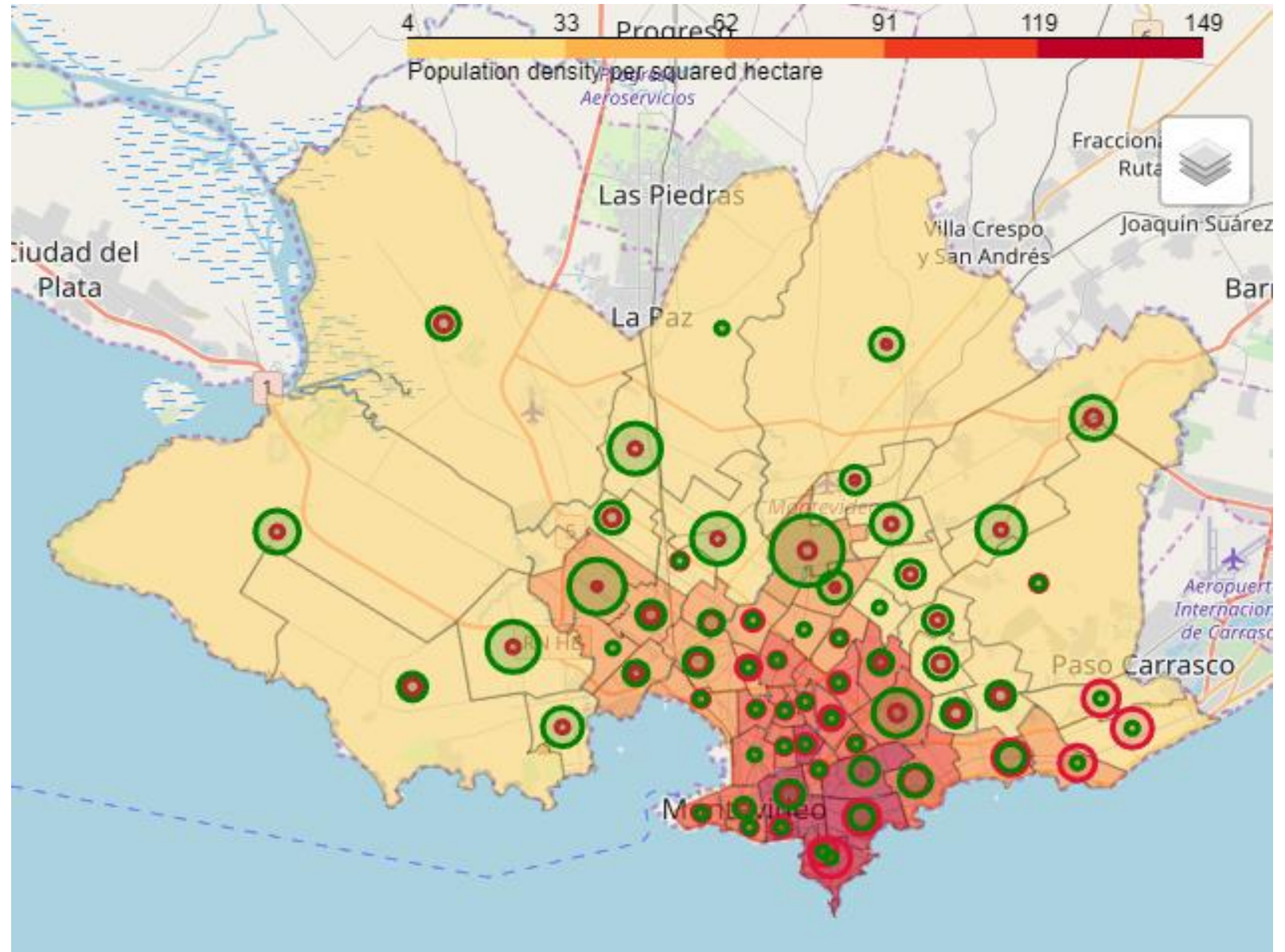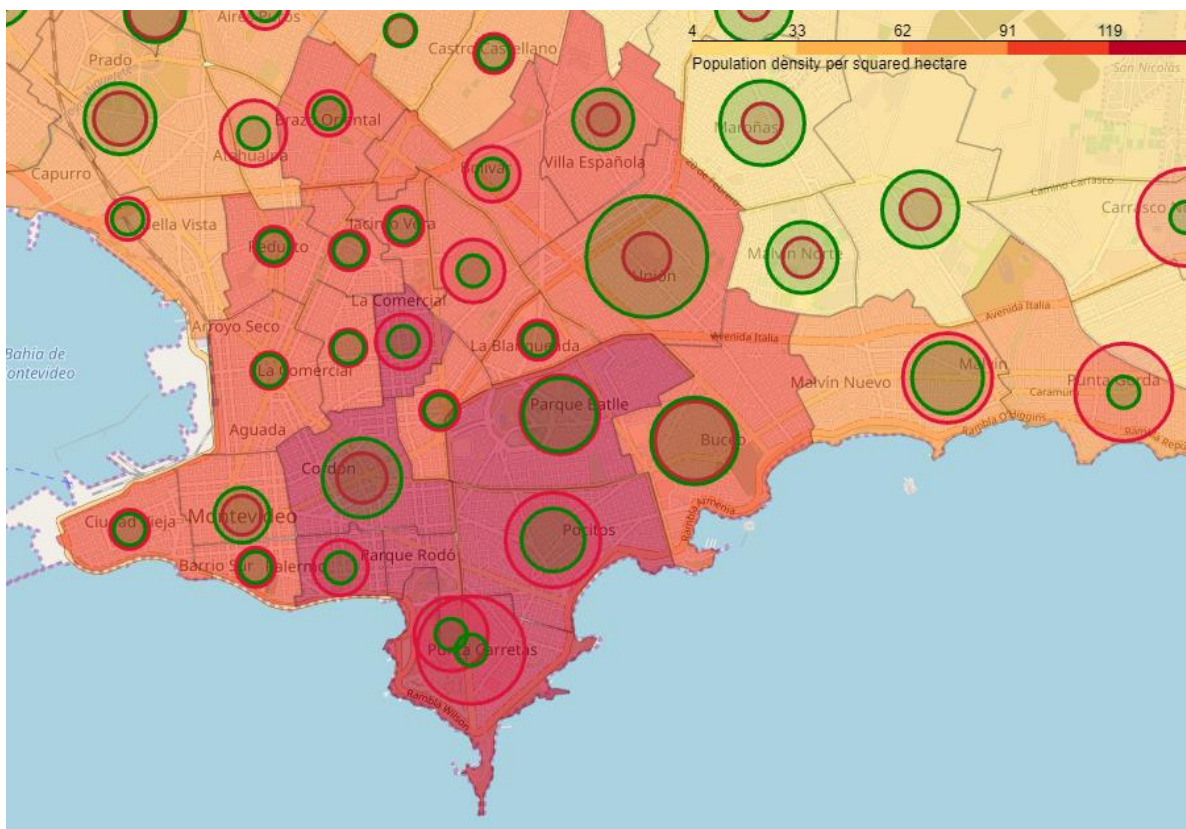
	burg_freq	hct_price	tot_dens	a1	a3	a4	a5
burg_freq	1.0***	-0.32*	-0.41**	0.36*	0.02	-0.31	-0.15
hct_price	-0.32*	1.0***	0.42	-0.26	0.03	-0.07	0.45*
tot_dens	-0.41**	0.42	1.0***	-0.87***	0.05	0.49	0.6*
a1	0.36*	-0.26	-0.87***	1.0***	-0.45	-0.47	-0.28
a3	0.02	0.03	0.05	-0.45	1.0***	-0.33	-0.2
a4	-0.31	-0.07	0.49	-0.47	-0.33	1.0***	-0.21
a5	-0.15	0.45*	0.6*	-0.28	-0.2	-0.21	1.0***

- 'a1', 'a3', 'a4', and 'a5' are categorical variables that represent neighborhoods from the lighter yellow area to the dark purple area or the center zone, being 'a1' the furthest area from the center and 'a5' the dark purple or the center itself.

- **P-value correlation analysis:**
  - Significative positive correlation between the periphery and criminality rate
  - Significative positive correlation between the center and purchasing power.

BEST ZONE FOR A CONVENIENCE STORE: 'a5' (centric zone).

Second Stage: Clustering

- "Cluster 0":

	hct_price	burg_freq	tot_dens
count	2.000000	2.0	2.000000
mean	9.064000	186.0	146.600000

	neighborhood	hct_price	burg_freq	tot_dens	Latitud	Longitud	Price_Burglary_Ratio	Cluster Labels
51	PUNTA CARRETAS	10.763	186	148.6	-34.92030	-56.16154	0.057866	0
43	PARQUE RODO	7.365	186	144.6	-34.91862	-56.16416	0.039597	0

	neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
51	PUNTA CARRETAS	Hotel	Deli / Bodega	Steakhouse	Restaurant	Modern European Restaurant	Coffee Shop	Gym / Fitness Center	Café	Sushi Restaurant	BBQ Joint
43	PARQUE RODO	Hotel	Steakhouse	Coffee Shop	Park	Restaurant	BBQ Joint	Bakery	Pizza Place	Sushi Restaurant	Café

- Great frequency of hotels.
- Mean of 9.064 thousand of indexed units for "common property" square meter price.
- Mean of 186 robbery reports.
- Mean of 146.6 persons per square hectare.

"Cluster 1":

	hct_price	burg_freq	tot_dens
count	3.000000	3.000000	3.000000
mean	6.766333	247.000000	139.766667

	neighborhood	hct_price	burg_freq	tot_dens	Latitud	Longitud	Price_Burglary_Ratio	Cluster Labels
48	POCITOS	9.367	369	148.6	-34.90853	-56.15087	0.025385	1
42	PALERMO	5.437	186	144.6	-34.91150	-56.17860	0.029231	1
28	LA COMERCIAL	5.495	186	126.1	-34.88732	-56.17040	0.029543	1

	neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
48	POCITOS	Gym / Fitness Center	Italian Restaurant	Coffee Shop	Restaurant	Dessert Shop	Ice Cream Shop	Pizza Place	Brewery	Café	Vegetarian / Vegan Restaurant
42	PALERMO	Bar	Restaurant	Italian Restaurant	Pub	Other Great Outdoors	Bakery	Gym	Coffee Shop	Scenic Lookout	Gym / Fitness Center
28	LA COMERCIAL	Restaurant	BBQ Joint	Ice Cream Shop	Sandwich Place	Electronics Store	Department Store	Pharmacy	Coffee Shop	Music Venue	Middle Eastern Restaurant

- There's not a clear pattern about venues distribution.
- Mean of 6.77 thousand of indexed units for "common property" square meter price.
- Mean of 247 robbery reports.
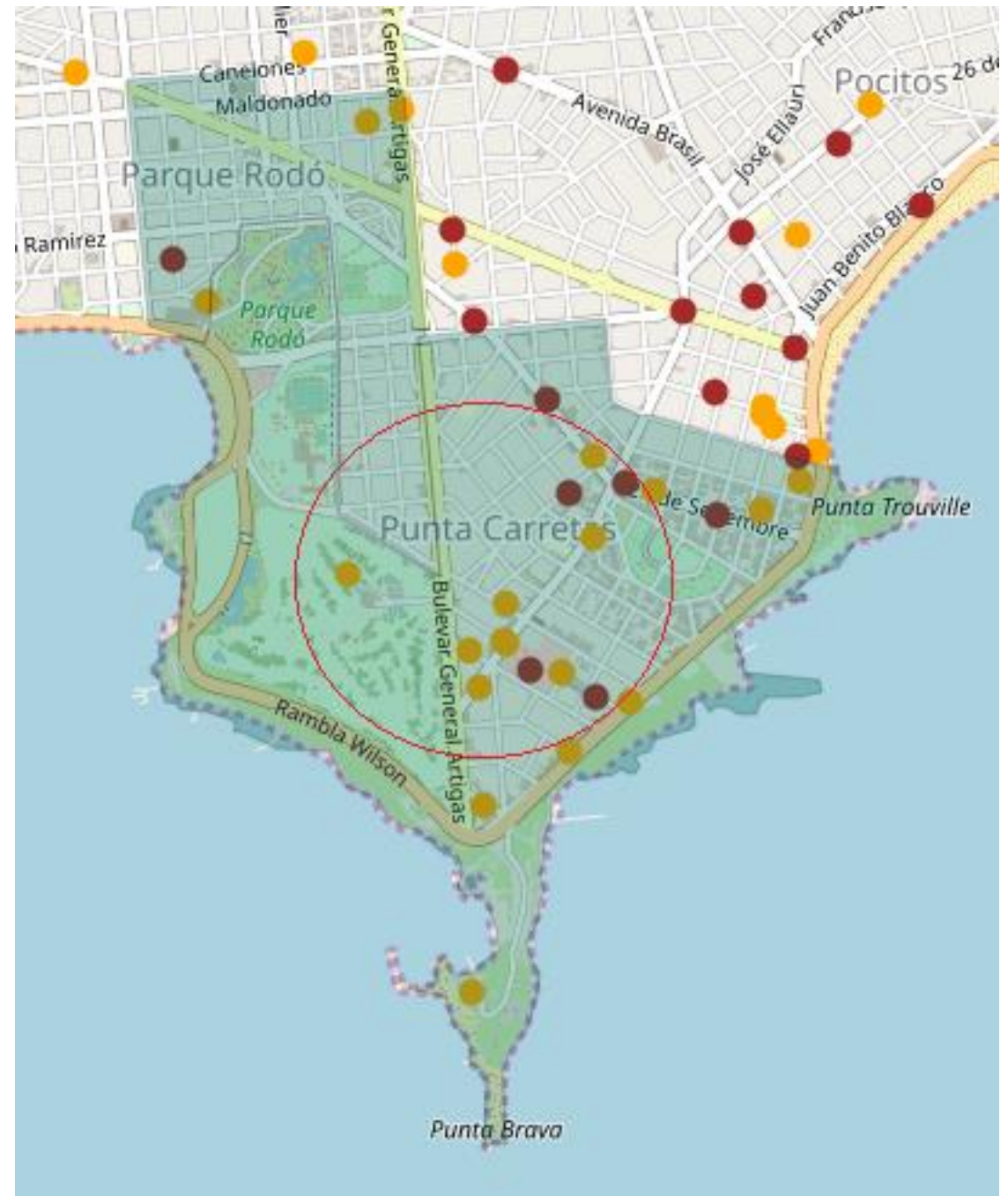- Mean of 140 persons per square hectare.

BEST CLUSTER FOR A CONVENIENCE STORE: 'Cluster 0':
- Hotel concentration is related with a significative flow of high/medium high-income level population.
- More purchase power than in 'Cluster 1'.
- Less criminality.

Third Stage: Mapping

- Yellow dots: Hotels.
- Red dots: Already installed convenience stores.

Results:

- The best area for establish a convenience store seems to be the center or south-center area of Punta Carretas:
  - Great purchase power.
  - Relatively low level of criminality.
  - One of the greatest population densities in Montevideo.
  - Concentrates a high number of hotels.

Discussion and Conclusion:

- Foursquare maps aren't very used here in Uruguay and the disposable information may not be actualized.

- It's possible to add some others evaluation criteria besides the three considered in this work, like transit flow or closeness to social centers.

- Database created for this report collects information from different ages, being the less actualized indicator from 2009.

- Others indicators for purchase power or criminality can be proposed, as well as being less restrictive about the three factors considered.

The stakeholders could use this project and change these filters according to their preferences about criminality, purchase power, population density, proximity of other venues, and so on. With this versatility any investor who want to establish a new convenience store could adjust the parameters based on its own standards.