

# Capstone Battle of Neighbourhoods: Pharmacies in Lausanne

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# Introduction

## Business problem

For an investor in pharmacy business, it is important to keep optimizing the network / chain of pharmacies to improve Return on Investment (ROI).

## Background

The location factors can influence pharmacies' ROI:

- Competing pharmacies in the neighbourhood
- Proximity to hospitals
- Proximity to high-traffic venues such as train stations and popular shops can
- Location in residential neighbourhood

## Objective

Perform analysis of the pharmacies density and neighbourhoods to inform investors decision on opening a pharmacy in Lausanne, Switzerland.

# Data

## Lausanne

- Capital city and biggest city of the canton (state) of Vaud, Switzerland
- Area of appr. 41 square kilometres with the population of about 140,000

## Pharmacies

The geolocation data on 50 pharmacies was obtained from FourSquare.

Out[222]:

	name	categories	address	lat	lng	labeledLatLngs	distance	cc	city	state	country	formattedAddress	postalCode	cross Street	id
0	Pharmacie 24	Pharmacy	Montchoisi	46.514192	6.633228	[[{"label": "display", "lat": 46.5141915693392, "lng": 6.633228}]]	850	CH	Lausanne	Vaud	Suisse	[Montchoisi, Lausanne]	NaN	NaN	4e723fd2b99345f8e86f27cb
1	Pharmacie Amavita	Pharmacy	NaN	46.512115	6.625829	[[{"label": "display", "lat": 46.51211470642447, "lng": 6.625829}]]	1202	CH	La Harpe	NaN	Schweiz	[La Harpe]	NaN	NaN	4e78689e7d8b90e4420885cc
2	Pharmacie des Bergières	Pharmacy	Avenue Bergières 42	46.530844	6.619640	[[{"label": "display", "lat": 46.530844, "lng": 6.619640}]]	1417	CH	Lausanne	Vaud	Suisse	[Avenue Bergières 42, 1004 Lausanne]	1004	NaN	4f71a3d2e4b068eb3df7fe40
3	Pharmacie Nouvelle	Pharmacy	Rue Centrale 15	46.521084	6.634121	[[{"label": "display", "lat": 46.521084, "lng": 6.634121}]]	136	CH	Lausanne	Vaud	Suisse	[Rue Centrale 15, 1003 Lausanne]	1003	NaN	55e9bd42498e815d56588490
4	Pharmacie Amavita	Pharmacy	NaN	46.512764	6.655341	[[{"label": "display", "lat": 46.512764, "lng": 6.655341}]]	2006	CH	Perraudettaz	NaN	Schweiz	[Perraudettaz]	NaN	NaN	50863041e4b0b298d3d27526
5	Pharmacie Pulliérane	Pharmacy	Rue de la Poste 26	46.512580	6.657969	[[{"label": "display", "lat": 46.51258023499169, "lng": 6.657969}]]	2192	CH	Pully	Vaud	Suisse	[Rue de la Poste 26, 1009 Pully]	1009	NaN	4d1dfc1a5c4ca1cd55338c3d
6	Pharmacie Internationale	Pharmacy	Place St François 6	46.519965	6.633381	[[{"label": "display", "lat": 46.51996483333332, "lng": 6.633381}]]	213	CH	Lausanne	Vaud	Suisse	[Place St François 6, 1002 Lausanne]	1002	NaN	4ca02e907c096dcbfb1ae5d1

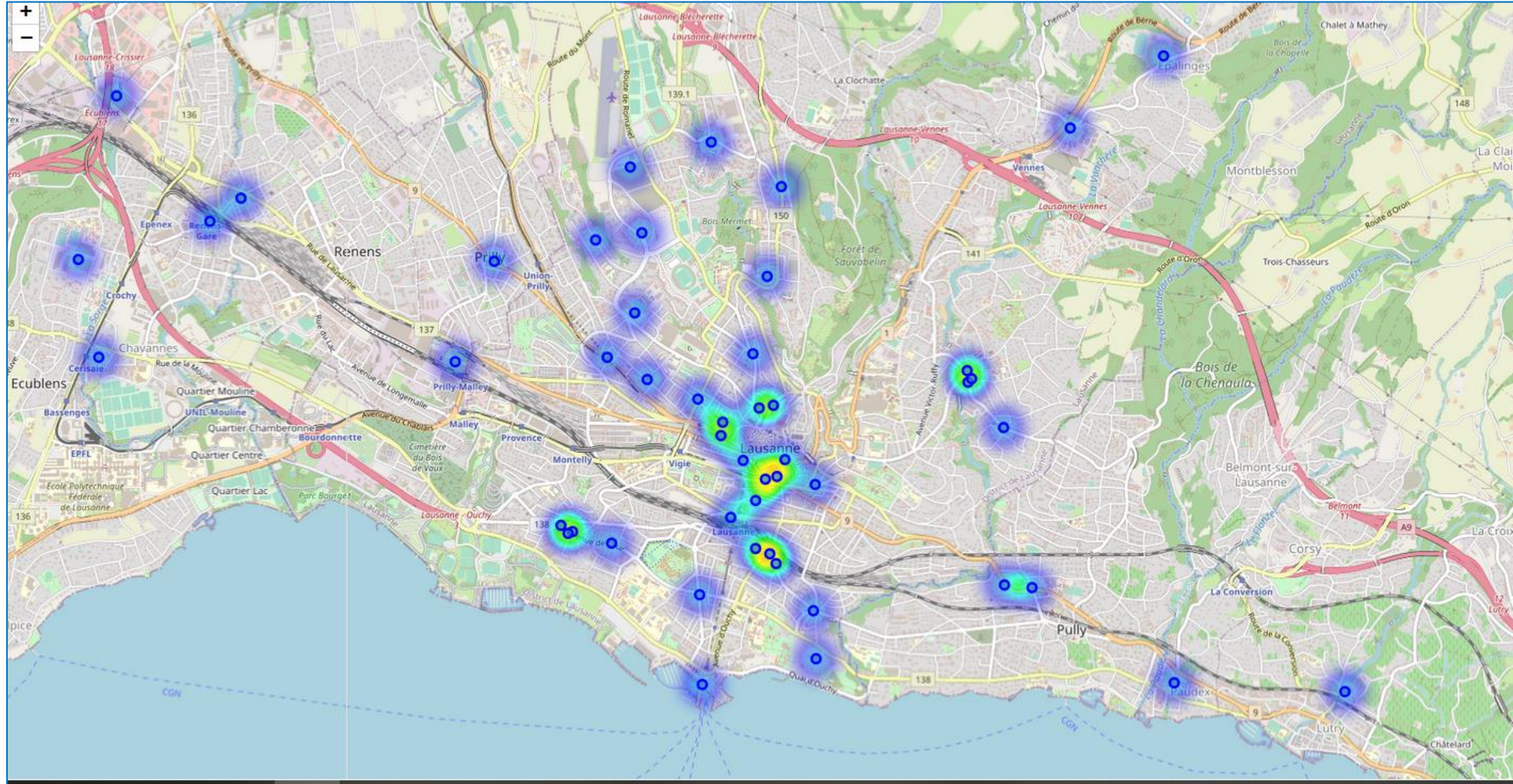
*Data on pharmacies revenue and profitability would be important to inform decision. Because such data are not available, the assumption is made that all pharmacies have acceptable revenue and profitability.*

# Methods

1. Machine learning technique Heatmap plugin using Kernel Density Estimation was used to create a density map of pharmacies
2. Based on the pharmacy density map:
  - Five neighbourhoods with high density were selected as reference locations
  - Ten neighbourhoods with low density were selected as candidate-locations for opening a new pharmacy
3. The data on 15 selected neighbourhoods will be obtained from FourSquare using explore query
4. Most frequent venues were determined by analysing the frequencies by neighbourhood
5. Data on top 10 most common venues by neighbourhood were used clustering
6. Machine leaning techniques K-means Clustering was used to cluster neighbourhoods
7. Neighbourhoods in a cluster with the highest number of reference locations were considered as high potential candidate-locations

# Results: Lausanne pharmacies' density map

Heatmap plugin using Kernel Density Estimation was used to create a density map of 50 pharmacies





# Results: Heatmap-informed neighbourhoods selection

- 5 areas with highest pharmacy density selected as reference-location (“successful” neighbourhood)
- 10 residential areas without pharmacies were selected as candidate-neighbourhoods for opening a new pharmacy business
- The location of all selected neighbourhoods were obtained from FourSquare

	latitude	longitude	Neighborhood
0	46.523655	6.627958	Pharmacie de la Tour, Lausanne
1	46.520073	6.633325	Pharmacie Internationale, Lausanne
2	46.524637	6.633160	Pharmacie Gamma, Lausanne
3	46.514287	6.633366	Pharmacie 24, Lausanne
4	46.526477	6.652110	Pharmacie de Chailly SA, Lausanne
5	46.535834	6.591936	renens-village, Vaud
6	46.512649	6.561130	ecole de saint sulpice, Vaud
7	46.540542	6.602383	Avenue du Château 73, Prilly, Vaud
8	46.540542	6.602383	Avenue du Château 73, Prilly, Vaud
9	46.516299	6.641442	Avenue de Rumine 30, Lausanne, Vaud
10	46.509824	6.655224	Avenue Charles Ferdinand Ramuz 29, Pully, Vaud
11	46.506627	6.652333	Avenue Général-Guisan 24, Pully, Vaud
12	46.520556	6.661260	Avenue de la Rosiaz, Pully, Vaud
13	46.554164	6.634814	Route de Lausanne 33, Le Mont-sur-Lausanne, Vaud
14	46.536118	6.648725	Route de Berne 24, lausanne, Vaud

Reference - locations

Candidate - locations

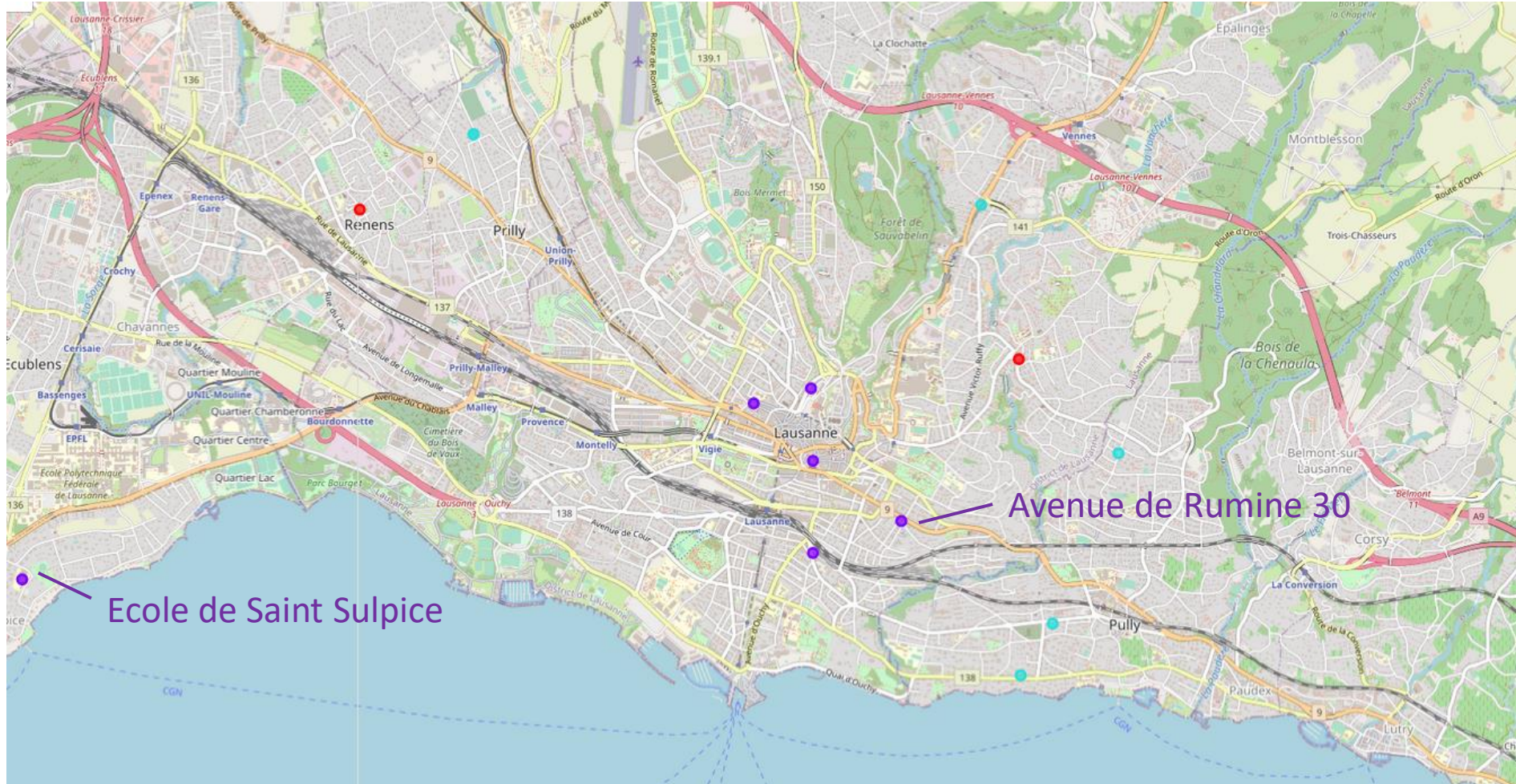
# Results: Neighbourhoods' analysis

- 386 venues for the selected neighbourhoods were obtained from FourSquare using explore queries
- 94 unique categories were identified
- Frequency of venues was used to identify most common venues
- Data on top 10 most common venues by neighbourhoods was used for clustering analysis.

	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
0	Avenue Charles Ferdinand Ramuz 29, Pully, Vaud	Swiss Restaurant	Park	Gay Bar	Pizza Place	Middle Eastern Restaurant	Sandwich Place	Italian Restaurant	Sports Club	Ice Cream Shop	Supermarket
1	Avenue Général-Guisan 24, Pully, Vaud	Park	Swiss Restaurant	Middle Eastern Restaurant	Pizza Place	Gas Station	Bus Station	Sandwich Place	Sports Club	Ice Cream Shop	Supermarket
2	Avenue de Rumine 30, Lausanne, Vaud	Bar	Hotel	French Restaurant	Italian Restaurant	Plaza	Supermarket	Park	Middle Eastern Restaurant	Sandwich Place	Bakery
3	Avenue de la Rosiaz, Pully, Vaud	Park	Bus Station	Middle Eastern Restaurant	Sushi Restaurant	General Entertainment	Gas Station	Rental Service	Train Station	Fast Food Restaurant	Supermarket
4	Avenue du Château 73, Prilly, Vaud	Train Station	Grocery Store	Swiss Restaurant	Supermarket	Indian Restaurant	Italian Restaurant	Diner	Restaurant	Bus Stop	Pool
5	Pharmacie 24, Lausanne	Hotel	Italian Restaurant	Bar	French Restaurant	Plaza	Restaurant	Park	Café	Gym	Yoga Studio
6	Pharmacie Gamma, Lausanne	Bar	Italian Restaurant	Hotel	Plaza	French Restaurant	Supermarket	Platform	Art Museum	Breakfast Spot	Department Store
7	Pharmacie Internationale, Lausanne	Bar	French Restaurant	Italian Restaurant	Plaza	Gym	Pizza Place	Japanese Restaurant	Hotel	Restaurant	Burger Joint
8	Pharmacie de Chailly SA, Lausanne	Supermarket	Metro Station	Sushi Restaurant	Hotel	Thai Restaurant	Department Store	Park	Plaza	Cafeteria	Gym / Fitness Center
9	Pharmacie de la Tour, Lausanne	Bar	French Restaurant	Plaza	Japanese Restaurant	Pizza Place	Italian Restaurant	Burger Joint	Café	Coffee Shop	Lounge
10	Route de Berne 24, Lausanne, Vaud	Scenic Lookout	Gas Station	Supermarket	Zoo Exhibit	Swiss Restaurant	Park	College Gym	Lake	Plaza	Aquarium
11	Route de Lausanne 33, Le Mont-sur-Lausanne, Vaud	Supermarket	Asian Restaurant	Gas Station	Diner	Falafel Restaurant	Coffee Shop	College Gym	College Lab	Creperie	Cupcake Shop
12	ecole de saint sulpice, Vaud	Café	Beach	Hotel	College Lab	Chocolate Shop	Bar	Swiss Restaurant	Bus Station	French Restaurant	English Restaurant
13	renens-village, Vaud	Supermarket	Gym	Italian Restaurant	Fast Food Restaurant	Pool	Department Store	Bus Station	Shopping Mall	Electronics Store	Brazilian Restaurant

# Results: Neighbourhoods clustering

Results of clustering using Machine Learning Technique K-means Clustering are visualized below



Two neighbourhoods

- Avenue de Rumine 30
- Ecole de Saint Sulpice

are in the cluster with the highest number of reference locations and therefore selected as high potential candidate-locations to open a new pharmacy.



# Comparison of K-means clustering with different parameters

- Additional analysis was performed to evaluate the sensitivity of decision making / conclusion
- Clustering with different k-clusters parameter (4 and 5) leads to the same conclusion on two high-potential neighbourhoods



# Limitations

- The information on pharmacies revenue and profitability that would be very important to inform decision was not available
- The limitation of the approach based on FourSquare search and explore queries is the level of information that can be obtained from FourSquare for the selected city. Only 50 pharmacies were obtained through this search, which does not reflect the real situation for Lausanne. Repeating search queries using the range of Radius as parameter did not help to improve the data obtained.
- Additional data such as population and demographics by neighbourhoods, location and density of GP (General Medicine Practitioners) offices, which was not available for the analysis could impact the results and conclusions.

# Conclusion

- The analysis of the locations using Machine Learning techniques Kernel Density Estimation-based Heatmap plugin and K-means Clustering leveraging data obtained from FourSquare can inform investor's decision on location for a new business.
- In this project, such analysis allowed to identify high-potential neighbourhoods as potential location to open a new pharmacy business in Lausanne.