Opportunity for sustainable business?

FRANKFURT AM MAİN, GERMANY
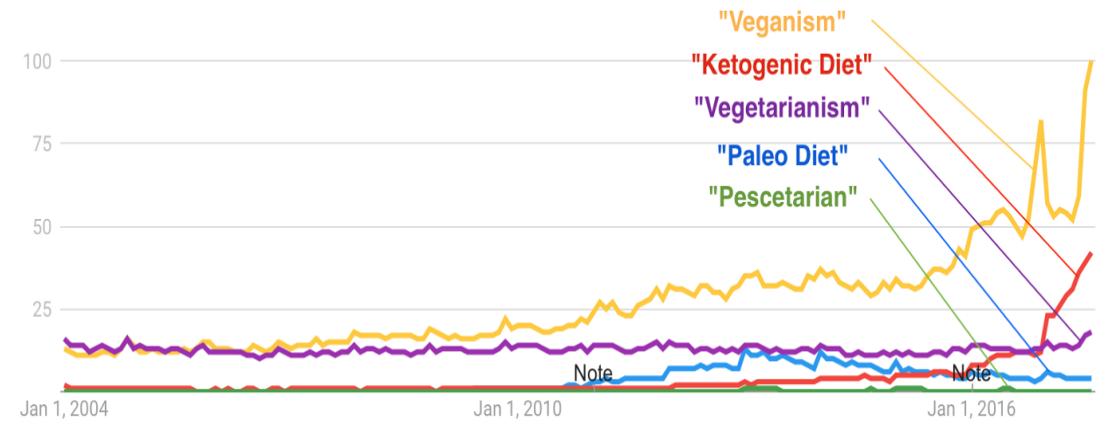
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Introduction

Hi, I am Val

According to new data, diners are increasingly ditching meat and opting for more veggie and vegan dishes instead - with meat replacement, jackfruit, seaweed, and aquafaba set to be popular this year.

It appears from the research that chefs believe consumers are more conscious about what they are eating, both from a health perspective and a sustainability point of view," Jo Smith, Web Content & Merchandising Manager, from Nisbets said in a statement sent to Plant Based News.

Environmental vegetarianism is the practice of vegetarianism when motivated by the desire to not contribute to the negative environmental impact of meat production. Livestock as a whole is estimated to be responsible for around 18% of global greenhouse gas emissions. As a result, significant reduction in meat consumption has been advocated by, among others,

As consclusion, investing in vegan/vegetarian products and venues is clearly profitable nowadays.

The alternative meat industry is expected to become a $140 billion industry in the next decade. That means it's about to get a lot more crowded.

The company "Beyond Meat" shares rode a perfect storm. Beyond Meat was the first company that only produces alternative meat to go public.

On their first trading day in May 2019, shares of Beyond Meat soared 163%.

It was the best performance for an IPO in nearly two decades.

At one point in 2019, Beyond Meat was bigger than 25% of companies in the S&P 500.

- In my survey I will compare different neighbourhoods for a new vegan/vegetarian venue opening in 5th largest and the most international city of Germany : **Frankfurt am Main.**

- Frankfurt is the financial center of the continent, the European city, the transport hub, the smallest metropolis in the world.

- Those who think of the city on the river Main, think of the airport, the European Bank, think of the Stock Exchange, the Book Fair and the skyline.

- Cities population is growing and represents cultures from all over the world – which makes it a perfect spot to target potential audience.

Data Description

- For my project, I had to find datasets regarding the geographical properties of Frankfurt. Those were available at the below mentioned "open data" website provided by governmental institutions as csv format.

- http://offenedaten.frankfurt.de/dataset/strassenverzeichnis-der-stadt-frankfurt-am-main/resource/be5982fe-ed79-42f4-acdc-57ca4737fb7a?inner_span=True

- As the dataset was not providing longitudes and latitudes I had to merge it with another dataset for german cities. from Aggdata.com The website provides free information for certain data sets for worldwide locations, registration is required there though.   https://www.aggdata.com/free/germany-postal-codes

- I prepared and cleaned the data sets in "Refinery" at watson studio on IBM cloud. Encoding to UTM, translating and dropping several rows were the necessary steps before I could start to work with the data.

Data Description 2.

▶ For my venue research, I used Foursquare API. The requests in the free package are limited and I recommend to everyone who has limited time to work on the project keep that in mind . This way, you don't have to wait till next day to send a rest again.

▶ Finally, I used Google Maps search to apply my 'searchnearby' fuction

▶ As I am not a native English speaker, I used the free tool Grammarly to improve my writing

▶ The community of Github and Stackflow was a big help for finishing this project as I am not skilled in coding

Methodology

This is the result of my refined data set to get the neighbourhoods and postal codes.

I realized that in the end I dont need the street and house columns so I dropped them.

The remaining result contains 4393 rows of data. To be mentioned, Frankfurt officially has 46 neighbourhoods

	House Number	Street Name	Neighbourhood	Postal Code
0	3660	Adolf-Meyer-Strasse	Kalbach-Riedberg	60438
1	3753	Alexander-Todd-Strasse	Niederursel	60438
2	44	Alte Falterstrasse	Griesheim	65933
3	53	Alt-Eschersheim	Eschersheim	60433
4	72	Alt-Seckbach	Seckbach	60389

|	Neighbourhood	Postal Code
0	Kalbach-Riedberg	60438
1	Niederursel	60438
2	Griesheim	65933
3	Eschersheim	60433
4	Seckbach	60389

Methodology 2

▶ As the first dataset does not contain coordinates, I had to merge it with another data set from agg data. The result was still not satisfying as I still had duplicates, which I dropped in the next step.

	Postal Code	City	Latitude	Longitude
0	60311	Frankfurt am Main	50.1104	8.6718
1	60316	Frankfurt am Main	50.1193	8.6980
2	60322	Frankfurt am Main	50.1319	8.6838
3	60326	Frankfurt am Main	50.1019	8.6342
4	60385	Frankfurt am Main	50.1264	8.7089

	Neighbourhood	Postal Code	City	Latitude	Longitude
0	Kalbach-Riedberg	60438	Frankfurt am Main	50.1167	8.6833
1	Niederursel	60438	Frankfurt am Main	50.1167	8.6833
109	Griesheim	65933	Frankfurt am Main	50.1001	8.6036
128	Gutleutviertel	65933	Frankfurt am Main	50.1001	8.6036
231	Nied	65933	Frankfurt am Main	50.1001	8.6036

▶ I used geolocator and folium to create a map to visualize the postal codes. It may happen, that the map is not rendering properly if you are working with too much data, I had to face this problem and luckily found a solution my shrinking my data sets.

▶ The result is shown in the next slide:

Map of Frankfurt with postal codes as markers
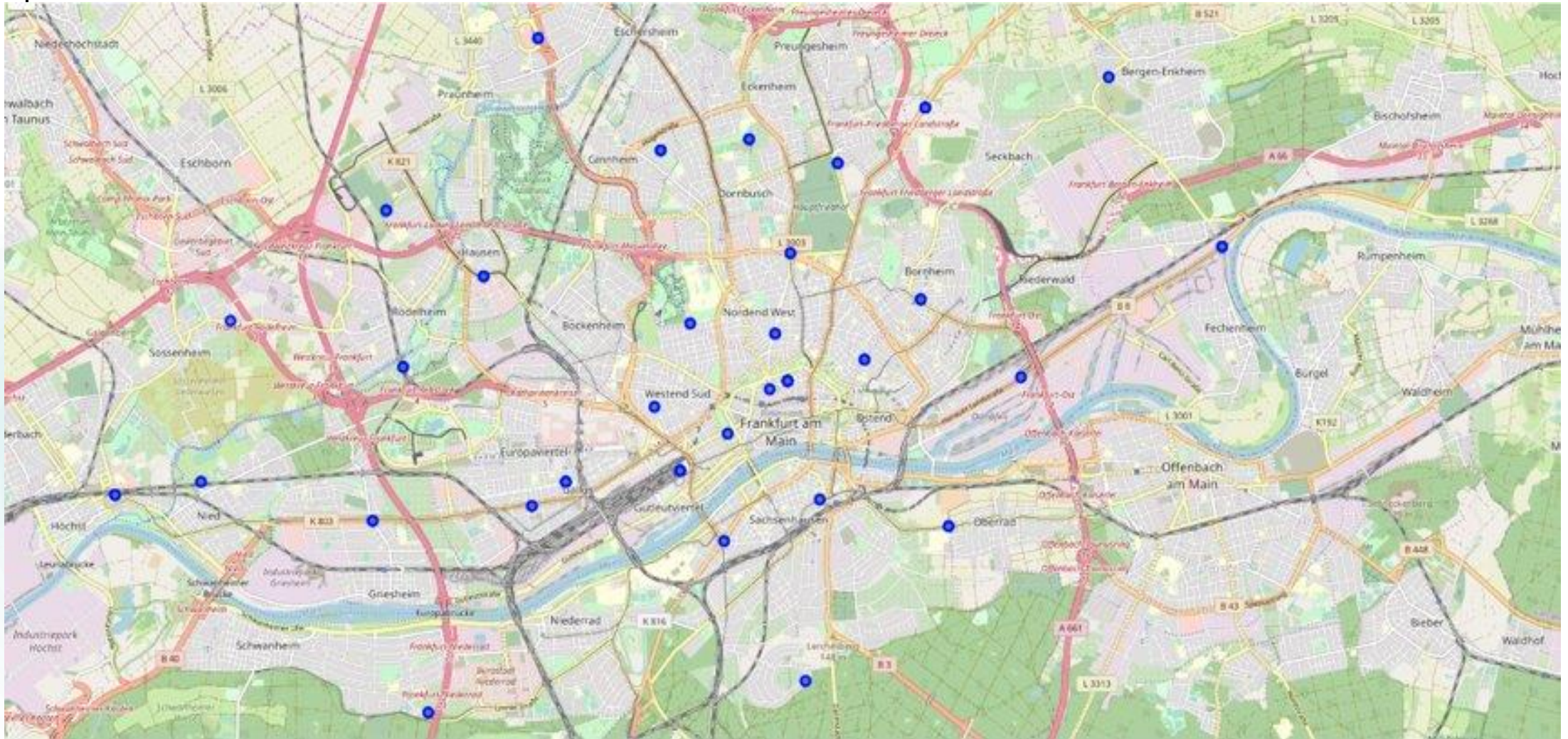
Methology 3

▶ In the next step I used the created Foursquare account to find the venues according to Frankfurt coordinates. I used the credentials for the category "vegan/vegetarian" straight away, the credentials for each category are to be found on https://developer.foursquare.com/docs/resources/categories.

▶ It turned out that I still have to many duplicates due to many given coordinates

▶ I dropped those

in the next step

Venue	Venue Latitude	Venue Longitude	Venue category
Pommes Freunde	50.114740	8.681475	Vegetarian / Vegan Restaurant
Loris Restaurant & Cafe	50.115265	8.679416	Vegetarian / Vegan Restaurant
Pommes Freunde	50.114740	8.681475	Vegetarian / Vegan Restaurant
Loris Restaurant & Cafe	50.115265	8.679416	Vegetarian / Vegan Restaurant
Pommes Freunde	50.114740	8.681475	Vegetarian / Vegan Restaurant

▶ After reviewing the dataset, I have to mention that foursquare seem to be an outddated app, as from personal experience I know quite more places offering vegetarian/vegan food in the city of Frankfurt. For a similar project I would definitely choose another data provider

Methodology 4

▶ The venue coordinates are removed and the data frame is sorted and cleaned again

▶ The final result shows us in a total of 18 vegan/vegetarian venues

▶ We can observe that most of them are assigned as Vegan/Vegetarian venue solely, while 4 of them are assigned to japanese/chinese/indian/salad-bar restaurants. T

▶ his result shows that foursquare delivers quite unrealistic results for such a big city like Frankfurt as many other venues are offering mixed menus including at least one vegetarian/vegan cuisine. This result is useful though if purely vegetable venues are desireable

Venue category	Neighbourhood
Chinese Restaurant	1
Indian Restaurant	1
Japanese Restaurant	1
Salad Place	1
Vegetarian / Vegan Restaurant	9

Neighbourhood	Venue
Altstadt	Vevay Café
Ostend	Rohkosteria
Schwanheim	Loris Restaurant & Cafe
Ostend	Picknick Café Bar
Bahnhofsviertel	Iimori Gyoza Bar

Analyze Frankfurts venues

- In next step I send the request to Foursquare again the the Id for category "Food" to get all food venaues in Frankfurt and compare it with vegan venues dataset. Once again I remove the duplicates

The total number of venues associated with

the category food is according to Fourquare is :

596

```
fra_all_un = frankfurt_all_venues.groupby('Venue')['Id'].nunique()
fra_all_un.shape
```

```
]:  (596,)
```

	Neighbourhood	Venue	Count
0	Innenstadt	296	296
1	Westend-Sued	190	190
2	Altstadt	155	155
3	Roedelheim	155	155
4	Gallus	147	147
5	Nordend-Ost	143	143
6	Gutleutviertel	128	128
7	Eschersheim	127	127
8	Niederursel	121	121
9	Nordend-West	115	115
10	Dornbusch	113	113
11	Niederrad	111	111
12	Hoechst	108	108
13	Ostend	108	108
14	Eckenheim	107	107

Analyze Frankfurts venues

- I used the mattplotlib.pyplot to create a pie chart comparing all venues to the vegetarian/vegan ones.

- We can observe that the share is very small and there is a big opportunity for an investment having very less competitors.

Percentage share of vegetarian/vegan restaurants in Frankfurt

Vegetarian/Vegan Food Venues

2.9%

97.1%

Other Food Venues
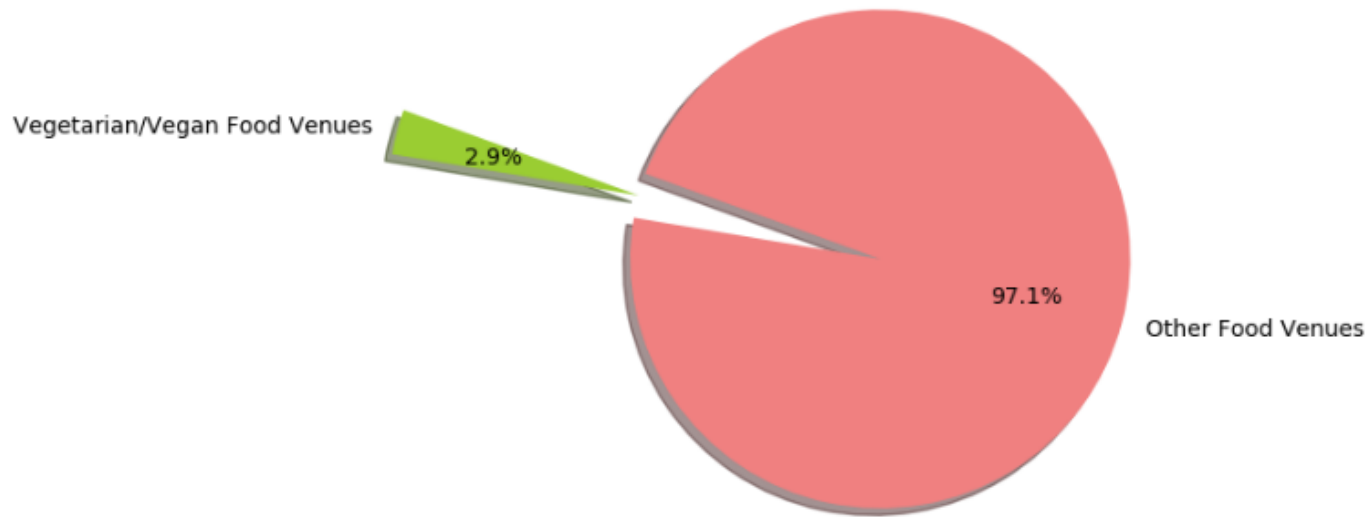
Analyze Frankfurts venues.

▶ By using "onehot" we can define the types of restaurants offering certain food per each neighbourhood. I did it for both, vegetarian/vegan and other not specificly plant based restaurants

	Neighbourhood	Chinese Restaurant	Indian Restaurant	Japanese Restaurant	Salad Place	Vegetarian / Vegan Restaurant
0	Altstadt	0.0	0.000000	0.0	0.000000	1.000000
1	Bahnhofsviertel	0.5	0.000000	0.5	0.000000	0.000000
2	Dornbusch	0.0	0.000000	0.0	0.000000	1.000000
3	Gutleutviertel	0.0	0.000000	0.0	0.000000	1.000000
4	Innenstadt	0.0	0.333333	0.0	0.333333	0.333333

	Neighbourhood	African Restaurant	American Restaurant	Apple Wine Pub	Argentinian Restaurant	Asian Restaurant	Austrian Restaurant	Bagel Shop	Bakery	Bistro	...	Taco Place	Tapas Restaurant	Taverna	Thai Restaurant
0	Altstadt	0.012903	0.0	0.0	0.0	0.019355	0.012903	0.0	0.025806	0.012903	...	0.0	0.0	0.006452	0.045161
1	Bahnhofsviertel	0.010204	0.0	0.0	0.0	0.081633	0.000000	0.0	0.102041	0.020408	...	0.0	0.0	0.000000	0.020408
2	Bergen-Enkheim	0.000000	0.0	0.0	0.0	0.333333	0.000000	0.0	0.000000	0.000000	...	0.0	0.0	0.000000	0.333333
3	Berkersheim	0.000000	0.0	0.0	0.0	0.000000	0.000000	0.0	0.333333	0.000000	...	0.0	0.0	0.000000	0.000000
4	Bockenheim	0.000000	0.0	0.0	0.0	0.059701	0.000000	0.0	0.134328	0.000000	...	0.0	0.0	0.000000	0.000000

Analyze Frankfurts venues

▶ In the below dataframe we can see the 10 most common venues of Frankfurt sorted by neighbourhood

• We can apply those results to our business idea by either choose the most common cuisine and transform it into vegetarian/venue place or choose a venue that is not very common yet.

	Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	Altstadt	Café	German Restaurant	Italian Restaurant	French Restaurant	Indian Restaurant	Steakhouse
1	Bahnhofsviertel	Middle Eastern Restaurant	Asian Restaurant	Bistro	African Restaurant	Irish Pub	Diner
2	Bergen-Enkheim	Asian Restaurant	Italian Restaurant	Wings Joint	Falafel Restaurant	Deli / Bodega	Dim Sum Restaurant
3	Bockenheim	Italian Restaurant	Café	German Restaurant	French Restaurant	Pizza Place	Bakery
4	Bornheim	German Restaurant	Italian Restaurant	Café	Vietnamese Restaurant	Irish Pub	Spanish Restaurant

K-mean Cluster for Frankfurt

- Using the K-mean function with kclusters = 5, we determined the cluster labels

- array([2, 2, 0, 2, 2, 2, 2, 2, 2, 4],

- To apply the clusters for Frankfurt venues, in the first place I had to clean and merge 2 datasets to get a dataframe that combines both: neighbourhoods and cluster labels

	Neighbourhood	Venue	Venue Latitude	Venue Longitude	Venue category	Id	Cluster Labels	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	Altstadt	35	35	35	35	35	0	Café	German Restaurant	Italian Restaurant	French Restaurant	Indian Restaurant	Steakhouse	Soup Place	Restaurant	Burger Joint	African Restaurant
1	Bahnhofsviertel	25	25	25	25	25	0	Middle Eastern Restaurant	Asian Restaurant	Bistro	African Restaurant	Irish Pub	Diner	Chinese Restaurant	Japanese Restaurant	Café	Restaurant
2	Bergen-Enkheim	2	2	2	2	2	5	Asian Restaurant	Italian Restaurant	Wings Joint	Falafel Restaurant	Deli / Bodega	Dim Sum Restaurant	Diner	Doner Restaurant	Donut Shop	Eastern European Restaurant
3	Bockenheim	14	14	14	14	14	5	Italian Restaurant	Café	German Restaurant	French Restaurant	Pizza Place	Bakery	Sushi Restaurant	Steakhouse	Ramen Restaurant	Wings Joint
4	Bornheim	10	10	10	10	10	0	German Restaurant	Italian Restaurant	Café	Vietnamese Restaurant	Irish Pub	Spanish Restaurant	Malga	Wings Joint	English Restaurant	Dim Sum Restaurant
5	Dornbusch	6	6	6	6	6	0	German Restaurant	Burger Joint	Turkish Restaurant	Vietnamese Restaurant	Café	Latin American Restaurant	Dim Sum Restaurant	Diner	Doner Restaurant	Donut Shop
6	Eckenheim	5	5	5	5	5	0	Thai Restaurant	Greek Restaurant	Café	Fast Food Restaurant	French Restaurant	Eastern European Restaurant	Deli / Bodega	Dim Sum Restaurant	Diner	Friterie
7	Eschersheim	10	10	10	10	10	5	Italian Restaurant	German Restaurant	Tapas Restaurant	Indian Restaurant	Mexican Restaurant	Café	African Restaurant	Bagel Shop	Austrian Restaurant	Doner Restaurant
8	Fechenheim	3	3	3	3	3	5	American Restaurant	Restaurant	Italian Restaurant	Wings Joint	Falafel Restaurant	Deli / Bodega	Dim Sum Restaurant	Diner	Doner Restaurant	Donut Shop
9	Flughafen	1	1	1	1	1	6	Restaurant	Wings Joint	English Restaurant	Czech Restaurant	Deli / Bodega	Dim Sum Restaurant	Diner	Doner Restaurant	Donut Shop	Eastern European Restaurant
10	Frankfurter Berg	7	7	7	7	7	0	Café	Restaurant	Italian Restaurant	Food	Fast Food Restaurant	Sushi Restaurant	Wings Joint	Eastern European Restaurant	Deli / Bodega	Dim Sum Restaurant

K-mean Cluster for Frankfurt

1.We are able to apply the cluster labels to the veg. Venues dataframe. Many neighbourhoods have no veg. Venues at all, we still have to consider them in our datafram.

	Neighbourhood	Cluster Labels	Venue
0	Altstadt	0	3.0
1	Bahnhofsviertel	0	2.0
2	Bergen-Enkheim	5	0.0
3	Bockenheim	5	0.0
4	Bornheim	0	0.0
5	Dornbusch	0	2.0
6	Eckenheim	0	0.0
7	Eschersheim	5	0.0
8	Fechenheim	5	0.0
9	Flughafen	6	0.0
10	Frankfurter Berg	0	0.0
11	Gallus	0	0.0
12	Ginnheim	2	0.0

2. We determine which neighbourhoods have the lowest number of veg. Venues. This information is useful for stackholders in case we want choose a neighbourhood with litte no none competition.

	Neighbourhood	Cluster Labels	Venue
2	Bergen-Enkheim	5	0.0
3	Bockenheim	5	0.0
4	Bornheim	0	0.0
6	Eckenheim	0	0.0
7	Eschersheim	5	0.0
8	Fechenheim	5	0.0
9	Flughafen	6	0.0
10	Frankfurter Berg	0	0.0
11	Gallus	0	0.0
12	Ginnheim	2	0.0
13	Griesheim	0	0.0
14	Gutleutviertel	0	1.0
15	Harheim	0	0.0
16	Hausen	5	0.0
17	Heddernheim	5	0.0
18	Hoechst	0	0.0
20	Kalbach-Riedberg	0	0.0

3. Here we can observe how many neighbourhoods belong to each cluster label, this additional information once again help us to choose the right location. s

Cluster Labels	Neighbourhood
0	21
1	2
2	2
3	1
4	1
5	9
6	2

Results: Suitable neighbourhood for investment.

▶ Depending on business model, it is up to stakeholder to descide either to choose a popular neighbourhood or one that have no competitors.

▶ In my example I will cosider neighbourhoods with less competition which are following:

```
]:  where_to_open = frankfurt_merged_clean.loc[fra
    where_to_open['Neighbourhood']

223]:  2          Bergen-Enkheim
       3             Bockenheim
       7             Eschersheim
       8             Fechenheim
       16               Hausen
       17            Heddernheim
       23         Nieder-Eschbach
       31            Preungesheim
       37              Seckbach
    Name: Neighbourhood, dtype: object
```

Discussion

▶ In the early stage of data study we could already see that the choice for an vegetarian/vegan venue opening is big, there are barely venues (less then 3%) in the whole city. Indeed almost every neighbourhood would be a good choice and it is up to the stakeholder to decide either to open a venue in a popular, lively neighbourhood and have more competitors or choose a quite neighbourhood which could guarantee residents as loyal customers.

▶ What is lacking at this point is a systematic, quantitative way to identify and distinguish is the information whether the "normal" venues offer vegetarian/vegan dishes or not.

▶ Further step would be to investigate the menues and see which ones a a popular choice for plant based lovers as well and determine which are considered as a good alternative.

Conclusion

Apps and tools like Foursquare API are usefull to have an insight into venues worldwide.

In the beginning I mentioned that we about to use segmentation and clustering hoping to determine:

► The similarity or dissimilarirty of neighbourhoods regarding the variety of food venues.

► Classification of area by popular food venues and where to find the best spot for opening a new venue.

We managed to reach that goal, the results are disappointing though due to the lack of information provided by Foursquare. As I mentioned before the app is not updated in my perspective. Personally. I know the city very well and have a good overview regarding plant based venues. It may be possible, that Foursquare is just not as popular among german citizens. For a similar project I for sure use another venue provider.

Thank you for reviewing and all the best for other certification of yours and eat healthy:) We did it:)