

For Coursera - IBM Data Science professional certificate

Capstone project

Finding the best place in Stockholm for a new office



Introduction

STOCKHOLM is the capital and most populous urban area of Sweden as well as in Scandinavia. It is the cultural, media, political, and economic centre of Sweden. The city stretches across fourteen islands, and while this makes the city incredibly beautiful it also puts serious constraints on the city's logistics.

Stockholm offers a great variety of co-working spaces, office hotels and office spaces both in the city centre as well as business districts outside of city.

CITY

The inner city which is referred to as "Innanför tullarna" (Inside of the toll stations) by Stockholmers is made up by five smaller parts or city districts listed below.

City, Norrmalm is considered the Central Business District of Stockholm and has the highest concentration of businesses in Stockholm. The CBD obviously has the most expensive leases, but it also has the best communications to the rest of Stockholm and Arlanda, Sweden's biggest airport (20 min by express train from Central Station).

Kungsholmen is a part of Stockholm that has become more and more popular recently, both as a residential area but also as a place to do your business. A popular business district within Kungsholmen is Lindhagen where Swedish construction giant Skanska have located their HQ.

Östermalm is the most exclusive part of Stockholm. This is where you will find the most exclusive stores, restaurants, night clubs and of course the most high-end office spaces. If you're dealing with high profile customers, Östermalm is probably where you'll want to locate your office.

Södermalm has a high concentration of creatives and creative companies such as ad agencies, media and photographers. Södermalm is also where a large portion of the Swedish gaming industry is established. DICE, Mojang, Avalanche Studios and Paradox are all located in Södermalm.

Gamla stan or Old town which it's often referred to in English is as the name suggest the oldest part of Stockholm. Tourists flock to this part of Stockholm due to its rich history and many sights such as the royal castle. The Old Town is also where the Swedish Riksdag (Parliament) is located, so high-profile management consultants and law firms are often located close to Old Town and Rosenbad where the government have their seat.

OUTSIDE OF CITY CENTRE

Kista is an important business centre, located approximately 10 kilometers north of the inner city. Kista is the home of the Swedish telecommunication industry and Ericsson have their HQ located here. Due to Ericsson presence in the area many international telecommunication and tech companies have chosen to locate their Swedish offices in Kista. Nokia, Huawei, Microsoft, IBM, Samsung and many more all have their Swedish HQs in Kista. Although there are many big companies located in Kista there is really not much going on after office hours.

An up and coming business center in the Stockholm region is **Solna**, which lies in between the inner city and Kista. One of Sweden's biggest banks, Swedbank, recently relocated their entire business here. Vattenfall, the huge state-owned power company also recently built new office and relocated their business to Solna. In general, the rents are lower in Solna, but you still have great communications to the rest of Stockholm by subway, commuter train and busses.

Business problem

Company "Zzz" is expanding and looking for a new suitable office location in Stockholm area.

There are many factors the stakeholders need to consider. Depending on what kind of business you run and who your customers are, different parts of Stockholm might be more or less suitable for your office location.

The right office is also a key to attracting and retaining top talent. A perfect office space makes for productive and happy employees and eating right, exercising, taking care of oneself - that's a societal trend that businesses should embrace. Office location matters because people don't want a long commute and wish to be close to home or at least close to public transport. Another thing that employees appreciate is being near restaurants and coffee shops. Parks, green spaces and retailers close the list of places employees want their offices to be near (source: <https://startups magazine.co.uk/article-five-steps-finding-perfect-office-space>).

Leveraging Foursquare data will help company "Zzz" find the most suitable office location offering the employees proximity to public transport, restaurants, coffee shops, green spaces and gyms.

Data

To perform this analysis, we will use the following data:

- List of the districts (neighbourhoods) in Stockholm and their coordinates - partial list of districts found on https://en.wikipedia.org/wiki/Category:Districts_of_Stockholm, however as this list is incomplete I added a few major districts like Kista, Nacka, Solna.

	Neighbourhood
0	Abrahamsberg, Stockholm
1	Akalla, Stockholm
2	Akeshov, Stockholm
3	Alvik, Stockholm
4	Alvsjo, Stockholm
...	...
62	Ullsunda, Stockholm
63	Vallingby, Stockholm
64	Vasaplan, Stockholm
65	Vasastan, Stockholm
66	Vastberga, Stockholm

- List of prices per square meter manually obtained from websites advertising office spaces – there is no one full report with such prices available anywhere. Sources: <https://www.instantoffices.com/>, <https://www.matchoffice.com/>, <https://workaround.io/>, <https://objektvision.se/>. The prices depend on whether the office is located in the city center – Central Business District (1), in the city but outside the CBD (2), or outside the city (3). The three different price “zones” were included in the data set with prices.

	Neighbourhood	Rent_psm	Distance from Centre
0	Abrahamsberg, Stockholm	1275	2
1	Akalla, Stockholm	1275	3
2	Akeshov, Stockholm	1275	2
3	Alvik, Stockholm	1275	2
4	Alvsjo, Stockholm	1275	2
...
62	Ullsunda, Stockholm	1275	2
63	Vallingby, Stockholm	1275	3
64	Vasaplan, Stockholm	4950	1
65	Vasastan, Stockholm	3300	1
66	Vastberga, Stockholm	1275	2

- List of neighbourhoods' coordinates - geo-coordinates of the districts in Stockholm obtained via geocoder

	Neighbourhood	Latitude	Longitude
0	Aspudden	59.3080	17.9961
1	Djurgården	59.3263	18.1132
2	Fredhäll	59.3294	18.0008
3	Fruängen	59.2851	17.9620
4	Gamla stan	59.3257	18.0719
...
61	Traneberg	59.3359	17.9856
62	Ullsunda	59.3369	17.9639
63	Vällingby	59.3671	17.8691
64	Åkeshov	59.3397	17.9287
65	Äppelviken	59.3268	17.9719

- Venues of the districts and neighbourhoods - to find the best location out of many districts and neighbourhoods in Stockholm I will leverage Foursquare data via Foursquare API.

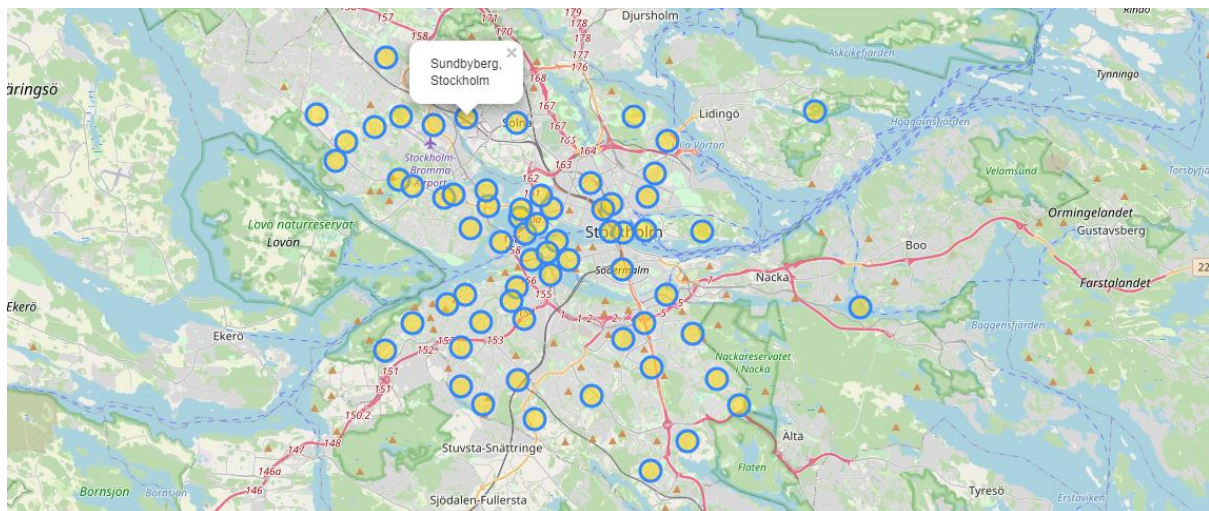
	name	categories	lat	lng
0	Science Fiction Bokhandeln	Bookstore	59.324047	18.070682
1	Tradition	Scandinavian Restaurant	59.325940	18.073710
2	Stortorget	Plaza	59.324973	18.070727
3	19 Glas Bar & Matsal	Wine Bar	59.324633	18.068670
4	Gustaf III-statyn	Outdoor Sculpture	59.326780	18.075030
...
95	Gamla riksdagshuset	Building	59.324846	18.065033
96	Zum Franziskaners Bakfickan	Beer Bar	59.322278	18.074248
97	Räntmästartrappan (B)	Bus Stop	59.322098	18.074320
98	Djurgården 8	Boat or Ferry	59.323895	18.078907
99	Birger Jarls torg	Plaza	59.325062	18.063885

Methodology

The first step to finding the best office location, was creating a list of Stockholm neighbourhoods. Unfortunately, there is no complete list available anywhere, so a partial list was obtained from https://en.wikipedia.org/wiki/Category:Districts_of_Stockholm and completed by adding missing but important neighbourhoods like Nacka, Solna and Kista.

After the list of Stockholm neighbourhoods was completed, I needed to know the office prices. Again, there is no ready to use data set available with office rental prices in Stockholm, so I researched office prices on different pages listing office spaces for rent, office hotels and shared spaces: <https://www.instantoffices.com/>, <https://www.matchoffice.com/>, <https://workaround.io/>, <https://objektvision.se/>. The average prices depend mostly on where the office is located: either Central Business District (1), in the city but outside the CBD (2), or outside the city (3). The information about the three different price “zones” was also included in the final data set with prices per square meter per neighbourhood.

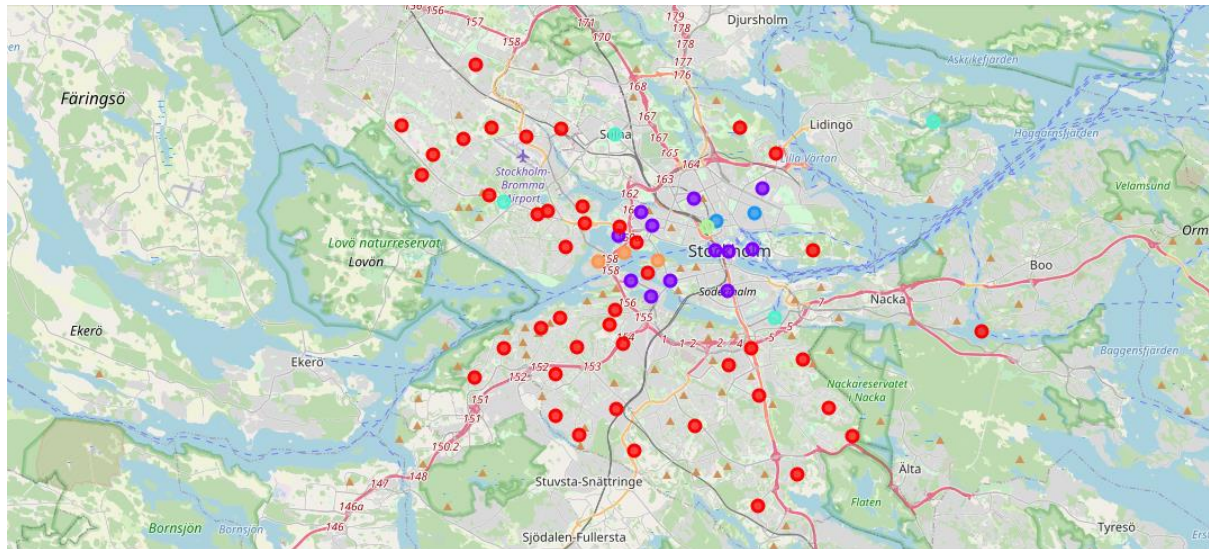
To explore the neighbourhoods Foursquare API will be used. However, to be able to use the Foursquare API, we will need each neighbourhood coordinates: latitude and longitude. The geo-coordinates of the neighbourhoods in Stockholm were obtained via geocoder and populated into the dataframe. As the last step here a map of Stockholm neighbourhoods was created via folium:



In the next step all neighbourhoods were explored using Foursquare *explore* function. Foursquare API was used to get venues (limit was set to 200) within 700 meters radius in each of the neighbourhoods. Data from the generated json file was then extracted into a data frame. Venue names, categories were then explored, together with top 10 venues for each neighbourhood.

Lastly, the venue data frame was merged with the prices data frame to perform clustering of the neighbourhoods. The silhouette score was used to determine the optimal number of clusters (6) and K-means machine learning technique was used for creating clusters of

neighbourhoods. Once clusters were generated, they were then visualized on a map using folium:



Results

Six clusters resulting from this analysis show available locations for the new office:

Cluster one (red): Stockholm suburbs, with low prices, limited venues ~20

Cluster two (purple): inside city, high price but not the most exclusive locations, lots of venues ~50 to 100

Cluster three (blue): city centre, easily accessible, highest price, lots of venues ~100

Cluster four (bright neon blue): outside city, mid to low prices, accessible via metro, bus, tram, some neighbourhoods with good amount of venues

Cluster five (light green): only one neighbourhood – the central business district, the highest price in Stockholm, very high amount of venues of all categories

Cluster six (orange): three neighbourhoods located near each other, top venues are beach, marina, pier, not considered as office location.

Discussion

As mentioned in the introduction, when choosing a new office location company must take into consideration a number of factors. Based on the above findings, if price is not an issue, our company might consider opening the new office in one of the central locations in cluster three or five. Those are the most exclusive locations, easily accessible both for customers and employees, with lots of venues available such as restaurants, cafés and gyms.

If the company would like to be located close to the centre, but does not want to pay the highest rent, neighbourhoods from cluster two will be perfect. Cluster two neighbourhoods

have a variety of venues from cafés and restaurants, to parks, gyms, after work entertainment options, and are easily accessible from any other point in the Stockholm area.

For any rather new company, with lower budget, the new emerging business districts like Solna, Kista or Hammarby are going to be perfect. Still easily accessible thanks to public transport, rents are significantly lower than in the central neighbourhoods, and less than in city centre but still plenty of venues available for employees.

Conclusion

In this project, by collecting data, leveraging Foursquare data and using machine learning techniques to find similarities between neighbourhoods, we mapped and explored Stockholm locations to help our company find the best spot for new office. The results and options were presented to the stakeholders, and the answer proposed by this analysis is – neighbourhoods from cluster two are the perfect location for our new office.