

Capstone Project - The Battle of the Neighborhoods (Week 2)

Introduction: Business Problem

In this project, we will try to find an optimal location for a restaurant. Specifically, this report will be targeted to stakeholders interested in opening a **Japanese restaurant** in Ho Chi Minh, Vietnam.

Since there are lots of restaurants in Ho Chi Minh we will try to detect **locations that are not already crowded with restaurants**. We are also particularly interested in **areas with no Japanese restaurants in vicinity**. We would also prefer locations **as close to city center as possible**, assuming that first two conditions are met.

Data

Based on definition of our problem, factors that will influence our decision are:

- number of existing restaurants in the neighborhood (any type of restaurant)
- number of and distance to Japanese restaurants in the neighborhood, if any
- distance of neighborhood from city center

We decided to use regularly spaced grid of locations, centered around city center, to define our neighborhoods.

Following data sources will be needed to extract/generate the required information:

- centers of candidate areas will be generated algorithmically and approximate addresses of centers of those areas will be obtained using **Google Maps API reverse geocoding**
- number of restaurants and their type and location in every neighborhood will be obtained using **Foursquare API**
- coordinate of Ho Chi Minh center will be obtained using **Google Maps API geocoding** of well-known Ho Chi Minh location (Ben Thanh Market)

Neighborhood Candidates

Let's create latitude & longitude coordinates for centroids of our candidate neighborhoods. We will create a grid of cells covering our area of interest which is approx. 10x10 kilometers centered around Ho Chi Minh city center.

Let's first find the latitude & longitude of Ho Chi Minh city center, using specific, well known address and Google Maps geocoding API.



Figure 1: 504 candidate neighborhood centers generated

we now have the coordinates of centers of neighborhoods/areas to be evaluated, equally spaced (distance from every point to its neighbors is exactly the same) and within ~10km from Ben Thanh market.

Foursquare

Now that we have our location candidates, let's use Foursquare API to get info on restaurants in each neighborhood.

We're interested in venues in 'food' category, but only those that are proper restaurants - coffee shops, pizza places, bakeries etc. are not direct competitors so we don't care about those. So we will include in our list only venues that have 'restaurant' in category name, and we'll make sure to detect and include all the subcategories of specific 'Japanese restaurant' category, as we need info on 'Japanese restaurants' in the neighborhood.

Total number of restaurants:	505
Total number of Japanese restaurants:	32
Percentage of Japanese restaurants:	6.34%
Average number of restaurants in neighborhood:	14.4

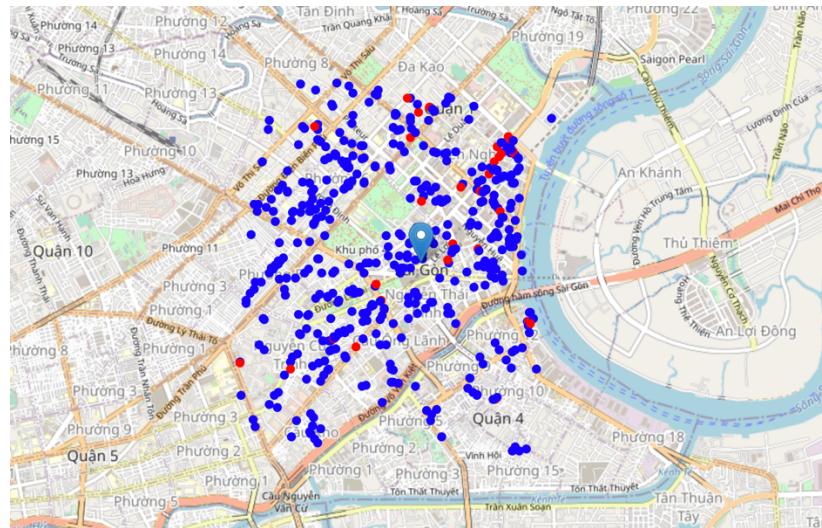


Figure 2: Restaurant (blue) and Japanese restaurant (red)

a map showing heatmap of restaurants. Also, borders of Ho Chi Minh boroughs on our map and a few circles indicating distance of 1km, 2km and 3km from Ben Thanh Market.



Figure 3: Heatmap showing density restaurants

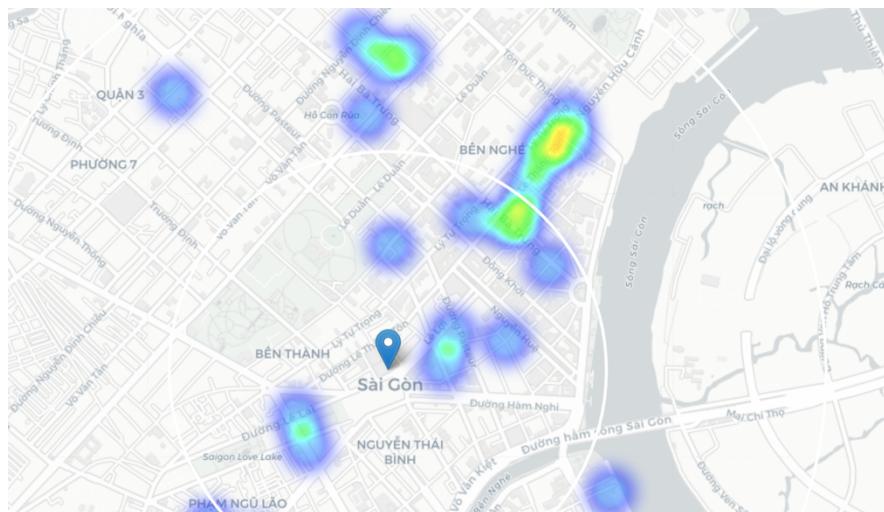


Figure 4: Figure 3: Heatmap showing density Japanese restaurants

Japanese restaurants represent a subset of ~6% of all restaurants in Ho Chi Minh.

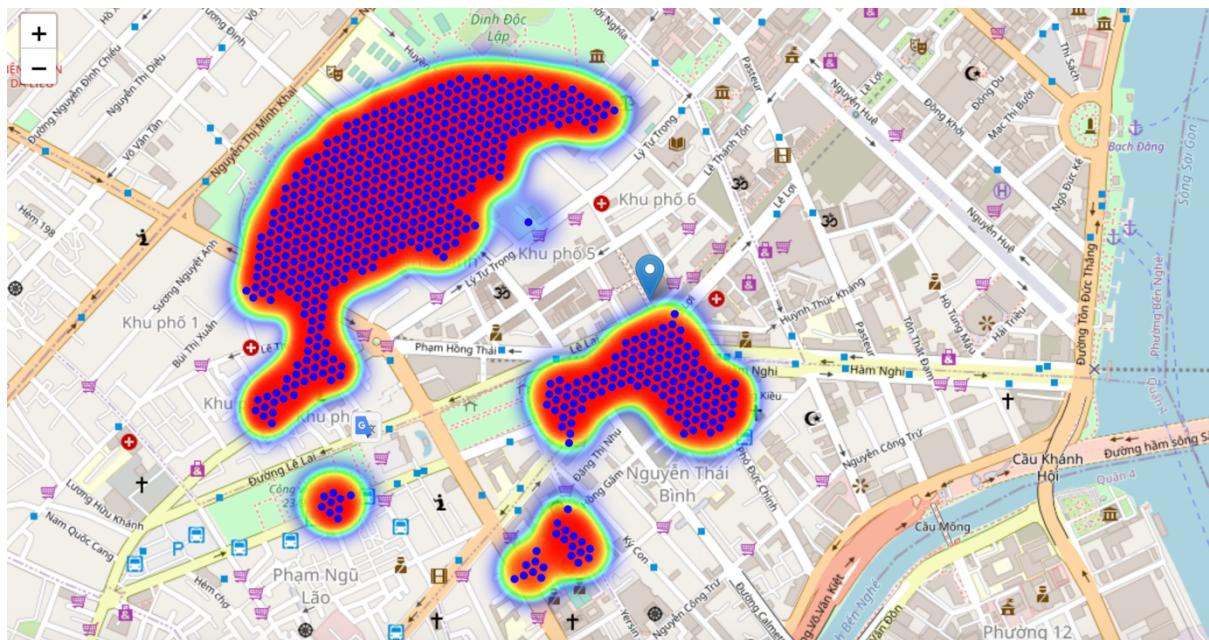
Requirement

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We define restaurants with two conditions of stackholder.

- Locations with no more than two restaurants nearby: 830
- Locations with no Japanese restaurants within 400m: 1625
- Locations with both conditions met: 644

Let's see how this looks on a map.



Addresses of centers of areas recommended for further analysis.

- 65A Cách Mạng Tháng Tám, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 3.3km from Ben Thanh Market
- Chợ Bến Thành, Quận 1, Hồ Chí Minh => 0.5km from Ben Thanh Market
- 80 Trương Định, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.8km from Ben Thanh Market
- 52 Trịnh Văn Cẩn, Phường Cầu Ông Lãnh, Quận 1, Hồ Chí Minh => 2.9km from Ben Thanh Market
- 39-39A Đường Nguyễn Trung Trực, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.0km from Ben Thanh Market
- 90 Đ. Nguyễn Trãi, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 3.8km from Ben Thanh Market
- 116 Nguyễn Du, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.6km from Ben Thanh Market
- Unnamed Road, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.5km from Ben Thanh Market
- 97 Phạm Ngũ Lão, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 1.3km from Ben Thanh Market
- 13 Huyền Trân Công Chúa, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.3km from Ben Thanh Market
- 237 Phạm Ngũ Lão, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 3.7km from Ben Thanh Market
- 21 Lê Công Kiều, Phường Nguyễn Thái Bình, Quận 1, Hồ Chí Minh => 1.2km from Ben Thanh Market
- 20 Bùi Thị Xuân, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 3.8km from Ben Thanh Market
- 13 Lê Thị Riêng, Phường Phạm Ngũ Lão, Quận 1, Hồ Chí Minh => 3.3km from Ben Thanh Market
- 110Bis Nguyễn Du, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.1km from Ben Thanh Market
- 80 Trương Định, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.3km from Ben Thanh Market
- 14C Cách Mạng Tháng Tám, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.7km from Ben Thanh Market
- 116 Nguyễn Du, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.1km from Ben Thanh Market
- 11 Phạm Ngũ Lão, Phường Nguyễn Thái Bình, Quận 1, Hồ Chí Minh => 0.8km from Ben Thanh Market
- Tao Dan tennis center, Trương Định, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.9km from Ben Thanh Market
- 8 Trịnh Văn Cẩn, Phường Cầu Ông Lãnh, Quận 1, Hồ Chí Minh => 2.5km from Ben Thanh Market
- 120 Nguyễn Du, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.0km from Ben Thanh Market
- 16 Huyền Trân Công Chúa, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.5km from Ben Thanh Market
- 1 Huyền Trân Công Chúa, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.5km from Ben Thanh Market
- 79 Trương Định, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.1km from Ben Thanh Market
- 34 Huyền Trân Công Chúa, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.7km from Ben Thanh Market
- 9 Truong Dinh Street, Ward 6, District 3, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.8km from Ben Thanh Market
- 1, 55B Nguyễn Thị Minh Khai, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.2km from Ben Thanh Market
- 75 Đường Trần Hưng Đạo, Phường Nguyễn Thái Bình, Quận 1, Hồ Chí Minh => 1.0km from Ben Thanh Market
- 75, Truong Dinh street,, District 1,, Ho Chi Minh City, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.4km from Ben Thanh Market
- Unnamed Road, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.6km from Ben Thanh Market

108 Nguyễn Du, Phường Bến Thành, Quận 1, Hồ Chí Minh => 2.2km from Ben Thanh Market
Bến xe bến thành, 23 Phạm Ngũ Lão, Phường Nguyễn Thái Bình, Quận 1, Hồ Chí Minh => 0.6km from Ben Thanh Market
306 Cach Mang Thang Tam Street, Ward 10, District 3, Ho Chi Minh City, Phường Bến Thành, Quận 1, Hồ Chí Minh => 3.4km from Ben Thanh Market
99 Phó Đức Chính, Phường Nguyễn Thái Bình, Quận 1, Hồ Chí Minh => 1.2km from Ben Thanh Market

We have created 30 addresses representing centers of zones containing locations with low number of restaurants and no Japanese restaurants nearby, all zones being fairly close to city center (all less than 4km from Ben Thanh Market)

Results and Discussion

Our analysis shows that although there is a great number of restaurants in Ho Chi Minh (~500 in our initial area of interest which was 10x10km around Ben Thanh Market), there are pockets of low restaurant density fairly close to city center.

After directing our attention to this more narrow area of interest (covering approx. 5x5km south-east from Ben Thanh Market) we first created a dense grid of location candidates (spaced 100m apart); those locations were then filtered so that those with more than two restaurants in radius of 250m and those with a Japanese restaurant closer than 400m were removed.

Those location candidates were then clustered to create zones of interest which contain greatest number of location candidates. Addresses of centers of those zones were also generated using reverse geocoding to be used as markers/starting points for more detailed local analysis based on other factors.

Result of all this is 30 zones containing largest number of potential new restaurant locations based on number of and distance to existing venues - both restaurants in general and Japanese restaurants particularly.

Conclusion

Purpose of this project was to identify Ho Chi Minh areas close to center with low number of restaurants (particularly Japanese restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Japanese restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general boroughs that justify further analysis, and then generated extensive collection of locations which satisfy some basic requirements regarding existing nearby restaurants. Clustering of those locations was then performed in order to create major zones of interest (containing greatest number of potential locations) and addresses of those zone centers were created to be used as starting points for final exploration by stakeholders.

Final decision on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or water), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.