

Geospatial Analysis of Hong Kong for Optimal Sportswear Store Location

Author: Preston Chou

Date: February 26, 2021

Introduction

- Objective: Selecting the optimal location in Hong Kong to open a sportswear store
- Method: An area's potential will be measured through its A) number of fitness, clothing or shopping-related venues, B) most common venue types
- Intended audiences:
 - Sportswear companies looking to optimize their current location strategy
 - New start-ups looking to enter the market
 - Hong Kong sportswear market analysts

Data Sources

1. Hong Kong Constituency Areas GeoJson: Border data for each of Hong Kong's Constituency Areas and corresponding Districts
2. Nominatim Geocoder API: Coordinates of Hong Kong areas
3. Foursquare API: Venue data for each of Hong Kong's areas

Data Cleaning and Processing: Hong Kong Constituency Areas GeoJson

- We will extract the Constituency Areas and Districts from the file and put them into the columns of a new Pandas dataframe:

	Hong Kong Constituency Areas	Hong Kong Constituency District
0	Sai Wan Ho	Eastern District
1	Nam Fung	Eastern District
2	Kornhill Garden	Eastern District
3	Mount Parker	Eastern District
4	Fortress Hill	Eastern District
5	A Kung Ngam	Eastern District
6	Kam Ping	Eastern District
7	Fort Street	Eastern District
8	Tanner	Eastern District
9	Lei King Wan	Eastern District
10	Tai Koo Shing East	Eastern District

Data Cleaning & Processing: Nominatim Geocoder API Coordinate Data

- The Geocoder API returns the most accurate coordinates when the input address includes the constituency area, followed by the district and the city ('Hong Kong'). However, this input format yields more 'None' values, which we need to deal with later on.

	Hong Kong Constituency Areas	Hong Kong Constituency District	Latitude	Longitude
0	Sai Wan Ho	Eastern District	22.2824	114.222
1	Nam Fung	Eastern District	22.4427	114.026
2	Kornhill Garden	Eastern District	22.2853	114.217
3	Mount Parker	Eastern District	None	None
4	Fortress Hill	Eastern District	22.2876	114.193
5	A Kung Ngam	Eastern District	22.2845	114.235
6	Kam Ping	Eastern District	None	None
7	Fort Street	Eastern District	22.2895	114.196
8	Tanner	Eastern District	22.2903	114.197
9	Lei King Wan	Eastern District	22.2837	114.223
10	Tai Koo Shing East	Eastern District	None	None

Data Cleaning & Processing: Nominatim Geocoder API Coordinate Data (cont'd)

- The locations with no coordinates from the API belongs to 3 categories:
 1. Includes the names that contain very specific sub-area terms (e.g. North, South, East, West, Upper, Lower)
 2. Conjoins two or more names (via commas or ampersands)
 3. Names simply too obscure for the Geocoder API
- With different solutions:
 1. Eliminate sub-area terms, consolidate names to one
 2. Form separate names for this category.
 3. Input address to API as the Constituency Area name with 'Hong Kong' (more results but less accurate)

Data Cleaning & Processing: Foursquare API Venue Data

- We will input the names and coordinates of each Area into the API, acquire up to 300 venues from a 500m radius. We create a new dataframe with a row for each venue:

	Hong Kong Constituency Areas	Constituency Area Latitude	Constituency Area Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Sai Wan Ho	22.282446	114.221506	Little Kitchen	22.281781	114.221516	French Restaurant
1	Sai Wan Ho	22.282446	114.221506	海南雞專門店	22.283032	114.221937	Hainan Restaurant
2	Sai Wan Ho	22.282446	114.221506	Aldrich Bay Park (愛秩序灣公園)	22.282663	114.224877	Park
3	Sai Wan Ho	22.282446	114.221506	華記士多	22.283214	114.220707	Cantonese Restaurant
4	Sai Wan Ho	22.282446	114.221506	Ashoka Indian Restaurant (皇子印度餐廳)	22.280257	114.224753	Indian Restaurant
5	Sai Wan Ho	22.282446	114.221506	Tai Hing (太興)	22.283081	114.222627	Hong Kong Restaurant

Data Cleaning & Processing: Foursquare API Venue Data (cont'd)

- Based on this dataframe, we will produce a new dataframe with dummy values for the venue categories:

ATM	Accessories Store	Airport Service	American Restaurant	Amphitheater	Arcade	Argentinian Restaurant	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Astrologer	Athletics & Sports	Australian Restaurant	Auto Garage	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

- Not comprehensive for all categories

Data Cleaning & Processing: Foursquare API Venue Data (cont'd)

- We will only choose to keep the venue categories containing fitness, clothing or shopping-related keywords. The keywords are:
 - Sports
 - Sport
 - Sporting
 - Fitness
 - Gym
 - Studio
 - Field
 - Pool
 - Martial art
 - Court
 - Clothing
 - Fashion
 - Outdoor
 - Shoes
 - Shopping
- We add a column with the Constituency Area names, group the dummy values by sum according to the Area names
- We also add a column listing the Total number of venues for each Constituency Area

Data Analysis & Results

- This project's data analysis has 2 objectives:
 1. Determining which areas in Hong Kong have greater numbers of fitness, clothing or shopping-related venues
 - Reflected by 'Total' venue numbers column
 2. Understanding the areas' venue-makeup (e.g. more gyms, clothing stores, or shopping malls)
 - K-means clustering to categorize the areas by their venue makeup, using top 10 most common venues

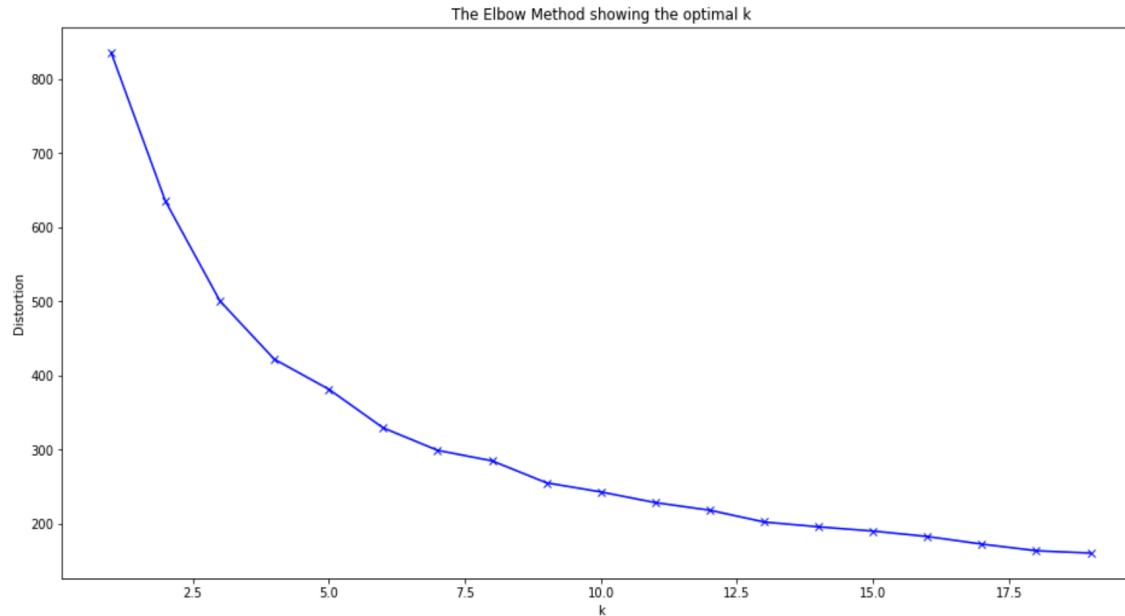
Hong Kong Constituency Areas	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0 A Kung Ngam	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center
1 Aberdeen	Athletics & Sports	Shopping Mall	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym
2 Aldrich Bay	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center
3 Allway	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center
4 Ap Lei Chau Estate	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym

Data Analysis & Results: K-Means Clustering

- We need to find an optimal number of clusters – the K-value
- Method 1: Elbow Method
 - Run K-Means clustering for a range of K-values. For each K-value, we find the average of the squared distances for each point from the center of its selected cluster
 - We plot the K-values and distortion, choosing K-value after which the line appears more linear

Data Analysis & Results: K-Means Clustering (cont'd)

- Method 1: Elbow Method (cont'd)



- The curve does not have an 'ideal', sharp elbow to easily indicate a K-value. The line does begin resembling a straight line in the 10-15 range. We should use another method to improve our decision

Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis
 - Measures the degree of separation of the clusters from each other. We calculate a score for each sample point, reflecting its distance from other clusters.
 - The scoring range runs from -1 to +1
 - -1 implies that the sample point is much closer to another cluster and is therefore incorrectly assigned
 - 0 implies that the sample point is right on the border between 2 clusters
 - +1 implies that the sample point is very close to its own assigned cluster.

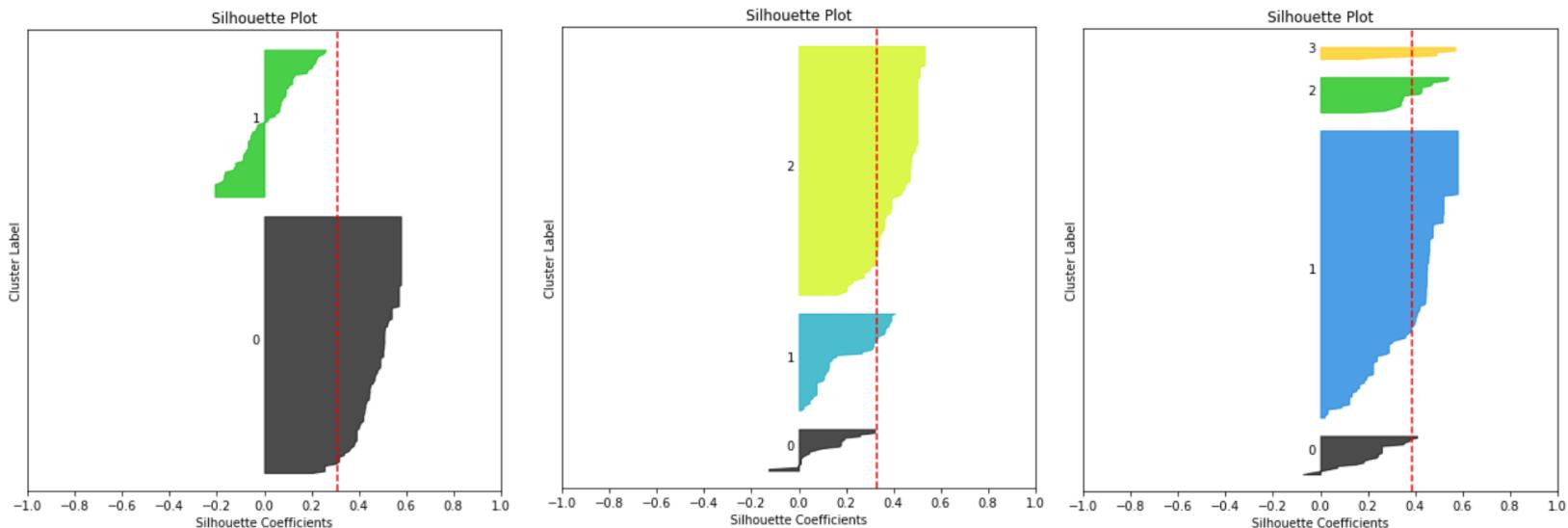
Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - We will use a range of K-values from 2 to 15
 - Each cluster has its own silhouette coefficient, and an average silhouette score is calculated for a given K-value:

```
For n_clusters = 2 Average silhouette_score = 0.30989660701186794
For n_clusters = 3 Average silhouette_score = 0.3324970097497605
For n_clusters = 4 Average silhouette_score = 0.3856071570985365
For n_clusters = 5 Average silhouette_score = 0.26582083042547267
For n_clusters = 6 Average silhouette_score = 0.2684904915157421
For n_clusters = 7 Average silhouette_score = 0.2917072742360841
For n_clusters = 8 Average silhouette_score = 0.2941787921071116
For n_clusters = 9 Average silhouette_score = 0.31486471614870215
For n_clusters = 10 Average silhouette_score = 0.34565090362621814
For n_clusters = 11 Average silhouette_score = 0.32243710050245344
For n_clusters = 12 Average silhouette_score = 0.3218181470577988
For n_clusters = 13 Average silhouette_score = 0.3463772608405005
For n_clusters = 14 Average silhouette_score = 0.34345664554056665
For n_clusters = 15 Average silhouette_score = 0.3491730880071366
```

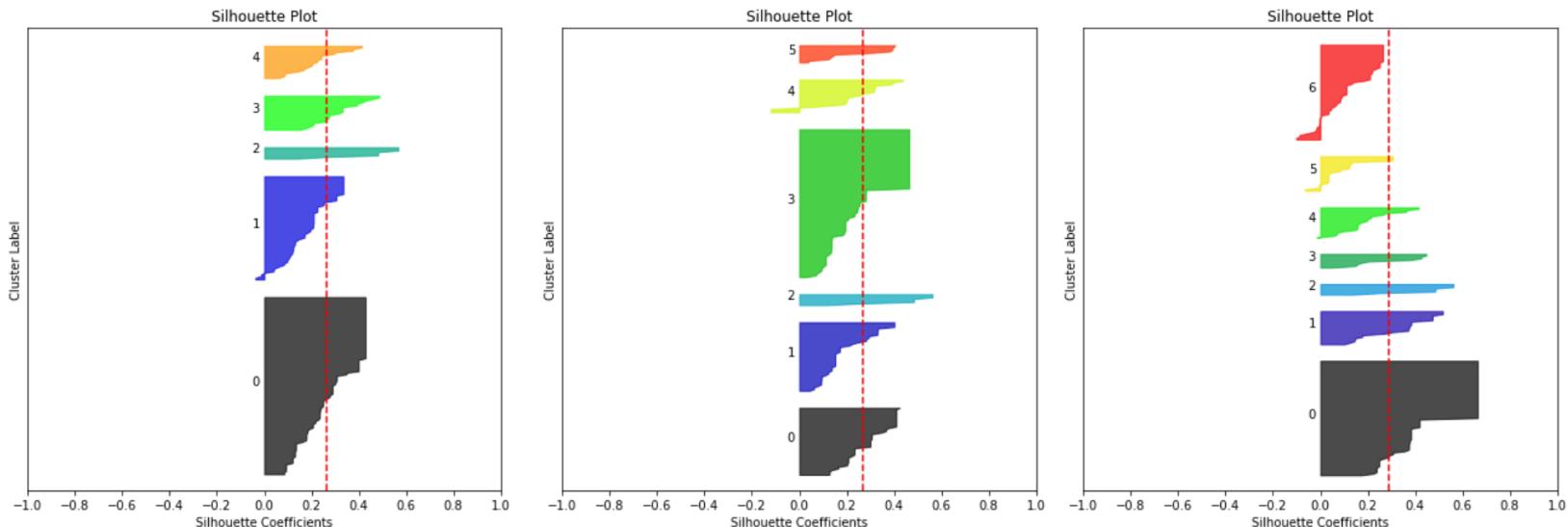
Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - Producing silhouette plots for different K-values shows the silhouette coefficient, and the thickness of the plot reflects the size of the cluster size



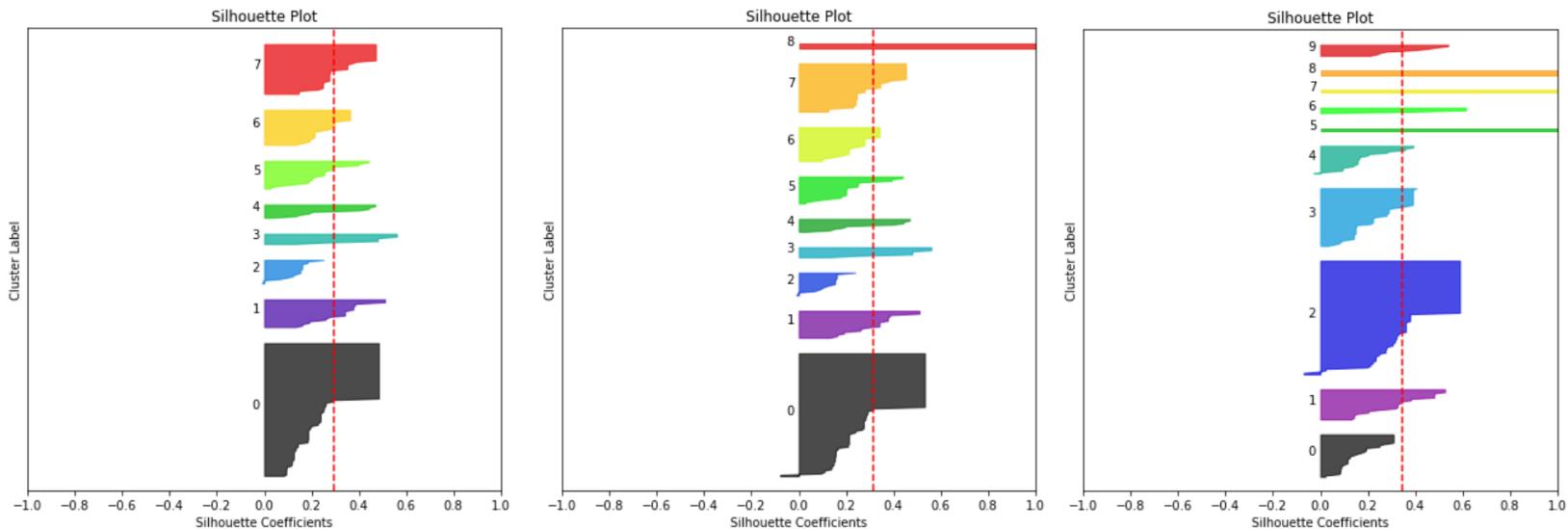
Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - Producing silhouette plots for different K-values shows the silhouette coefficient, and the thickness of the plot reflects the size of the cluster size



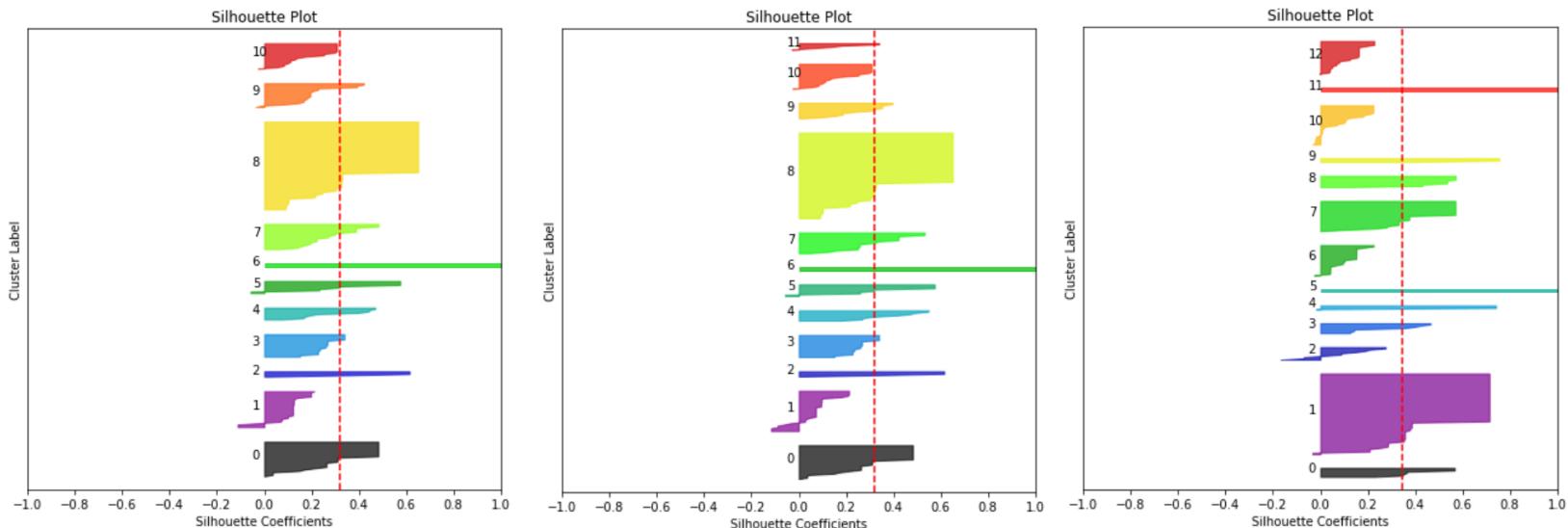
Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - Producing silhouette plots for different K-values shows the silhouette coefficient, and the thickness of the plot reflects the size of the cluster size



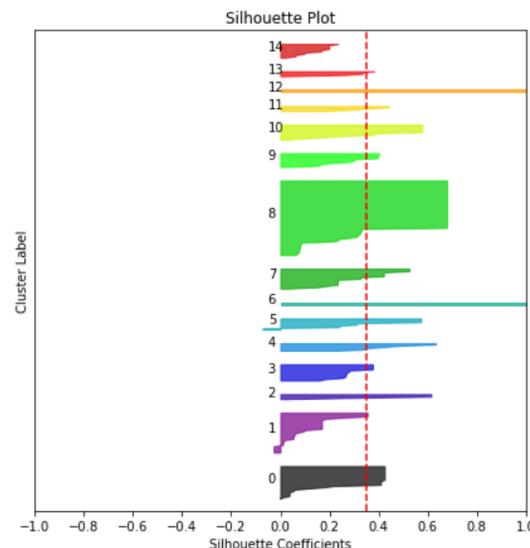
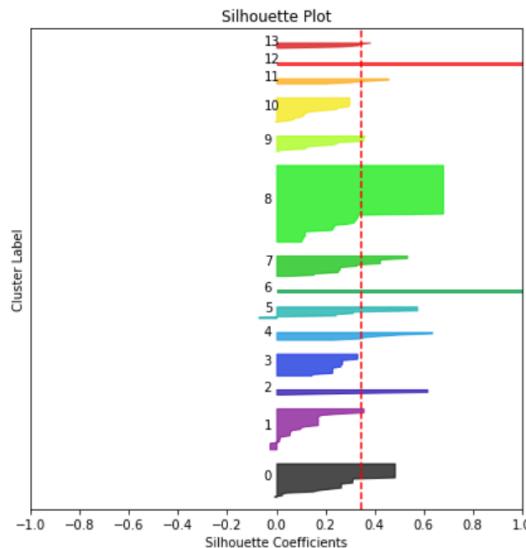
Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - Producing silhouette plots for different K-values shows the silhouette coefficient, and the thickness of the plot reflects the size of the cluster size



Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - Producing silhouette plots for different K-values shows the silhouette coefficient, and the thickness of the plot reflects the size of the cluster size



Data Analysis & Results: K-Means Clustering (cont'd)

- Method 2: Silhouette Analysis (cont'd)
 - A K-value of 15 offers a high silhouette score, but we are also concerned with the risk of overfitting
 - 13 clusters seems to also yield a good silhouette score, so we will use K-Means Clustering to segment the areas into 13 different clusters

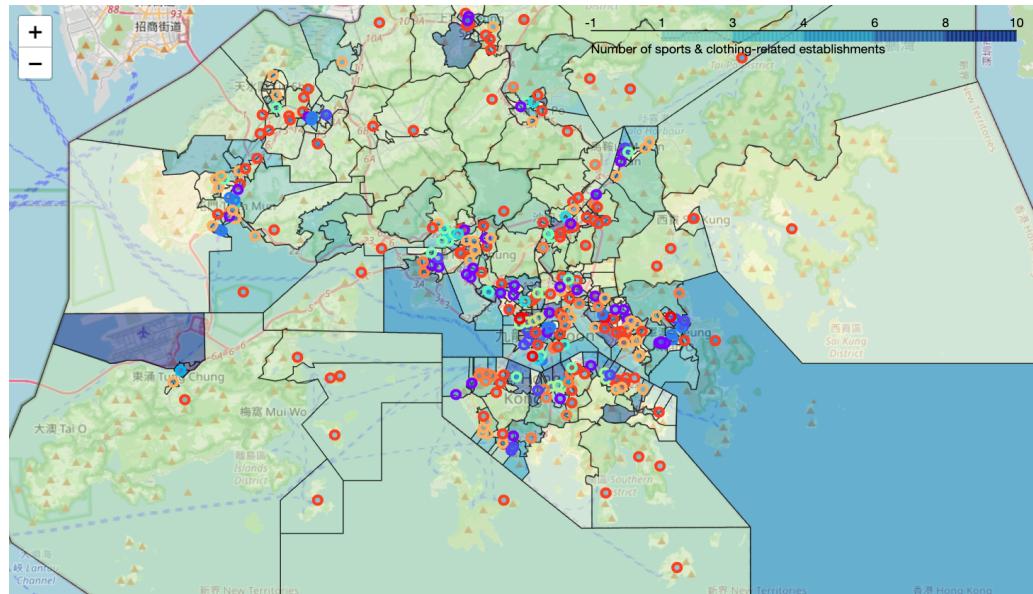
Data Analysis & Results: K-Means Clustering (cont'd)

- Using the K-Means Clustering algorithm, we assign a cluster label (from 1-13) to each Constituency Area that has total venues greater than 0
- For Constituency Areas with 0 relevant venues, we assign a cluster label of -1

Hong Kong Constituency Areas	Hong Kong Constituency Areas for Geocoder	Hong Kong Constituency District	Latitude	Longitude	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	Total	Cluster	
0	Sai Wan Ho	Sai Wan Ho	Eastern District	22.282446	114.221506	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center	0.0	-1
1	Nam Fung	Nam Fung	Eastern District	22.442702	114.026020	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	5.0	3
2	Kornhill Garden	Kornhill Garden	Eastern District	22.285267	114.216780	Clothing Store	Shopping Mall	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	3.0	2
3	Fortress Hill	Fortress Hill	Eastern District	22.287563	114.193315	Gym	Dance Studio	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Gym / Fitness Center	3.0	11

Data Analysis & Results: Geospatial Analysis

- A map generated through Folium displays our results.
- Using choropleth, shadings of blue indicate venue numbers for each area (darker = more numerous)
- Circle markers show each area's name, district and cluster label; the color indicates the area's cluster



Data Analysis & Results: Cluster Observation

- Filtering our dataframe, we can include only areas for each cluster
- This way, we can observe the most important and discriminating features of each cluster

Cluster 1

	Hong Kong Constituency Areas	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	Total
23	Healthy Village	Athletics & Sports	Climbing Gym	Shopping Mall	Gym	Gym Pool	Boxing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	4.0
27	Hiu Lai	Athletics & Sports	Shopping Mall	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
34	Jordan Valley	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center	1.0
35	Shun Tin	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center	1.0
68	San Hui	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	Gym / Fitness Center	1.0

Data Analysis & Results: Cluster Observation (cont'd)

Cluster 2

Hong Kong Constituency Areas	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	Total
2 Kornhill Garden	Clothing Store	Shopping Mall	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	3.0
26 Upper Ngau Tau Kok Estate	Shopping Mall	Athletics & Sports	Clothing Store	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	4.0
84 Charming	Clothing Store	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	3.0
96 Tai Nan	Clothing Store	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	2.0
99 Kowloon Station	Clothing Store	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	2.0
108 Tsing Yi South	Shopping Mall	Athletics & Sports	Sporting Goods Shop	Clothing Store	Gym / Fitness Center	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	5.0

Cluster 3

Hong Kong Constituency Areas	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	Total
1 Nam Fung	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	5.0
15 Lok Hong	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	5.0
33 Kowloon Bay	Athletics & Sports	Shopping Mall	Clothing Store	Gym / Fitness Center	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
70 Tuen Mun Rural	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	4.0
74 Yan Tin	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	4.0
85 East Tsim Sha Tsui & King's Park	Shopping Mall	Athletics & Sports	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	3.0

Data Analysis & Results: Cluster Observation (cont'd)

Cluster 4

	Hong Kong Constituency Areas	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	Total
45	Tung Chung Central	Sporting Goods Shop	Clothing Store	Yoga Studio	Gym / Fitness Center	Shopping Mall	Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	10.0
48	Tung Chung North	Sporting Goods Shop	Clothing Store	Yoga Studio	Gym / Fitness Center	Shopping Mall	Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	10.0
79	Tung Chung South	Sporting Goods Shop	Clothing Store	Yoga Studio	Gym / Fitness Center	Shopping Mall	Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	10.0
327	Victoria Park	Sporting Goods Shop	Clothing Store	Martial Arts School	Pool	Gym / Fitness Center	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	7.0

Cluster 5

	Hong Kong Constituency Areas	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	Total
60	Tuen Mun Town Centre	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	4.0
148	Sha Tin Town Centre	Shopping Mall	Clothing Store	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	7.0
207	Un Chau	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	5.0
229	Prince	Shopping Mall	Sporting Goods Shop	Clothing Store	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	7.0
244	Tai Po Central	Shopping Mall	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	5.0
345	Tsuen Wan South	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	5.0
346	Fuk Loi	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	6.0
358	Luk Yeung	Shopping Mall	Pool	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	5.0

Data Analysis & Results: Cluster Observation (cont'd)

Cluster 6

	Hong Kong Constituency Areas	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	Total
170	Whampoa West	Gym / Fitness Center	Shopping Mall	Pool	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	3.0
195	Lai Kok	Gym / Fitness Center	Shopping Mall	Pool	Tennis Court	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	5.0
199	Mei Foo South	Gym / Fitness Center	Shopping Mall	Pool	Tennis Court	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	5.0
202	Mei Foo Central	Gym / Fitness Center	Shopping Mall	Pool	Tennis Court	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	5.0
216	Whampoa East	Gym / Fitness Center	Shopping Mall	Pool	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	3.0
219	Mei Foo North	Gym / Fitness Center	Shopping Mall	Pool	Tennis Court	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	5.0

Cluster 7

	Hong Kong Constituency Areas	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	Total
10	City Garden	Shopping Mall	Gym / Fitness Center	Sporting Goods Shop	Gym	Yoga Studio	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	5.0
65	Kin Sang	Shopping Mall	Sports Club	Shopping Plaza	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	4.0
80	Tsim Sha Tsui Central	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
87	Tsim Sha Tsui West	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
110	Cheung On	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
140	Chui Tin	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
147	Tai Wai	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	2.0
169	Ma On Shan Town Centre	Shopping Mall	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	3.0

Data Analysis & Results: Cluster Observation (cont'd)

Cluster 8

	Hong Kong Constituency Areas	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	Total
8	Tai Koo Shing East	Clothing Store	Gym / Fitness Center	Yoga Studio	Shopping Mall	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
9	Tai Koo Shing West	Clothing Store	Gym / Fitness Center	Yoga Studio	Shopping Mall	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
20	Kornhill	Clothing Store	Shopping Mall	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	4.0
24	Quarry Bay	Clothing Store	Gym / Fitness Center	Yoga Studio	Shopping Mall	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
90	Cherry	Clothing Store	Shopping Mall	Gym / Fitness Center	Sporting Goods Shop	Yoga Studio	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0

Cluster 9

	Hong Kong Constituency Areas	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	Total
89	Mong Kok West	Sporting Goods Shop	Shopping Mall	Athletics & Sports	Gym / Fitness Center	Outdoor Supply Store	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	10.0
91	Mong Kok South	Sporting Goods Shop	Shopping Mall	Athletics & Sports	Gym / Fitness Center	Outdoor Supply Store	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	10.0
95	Mong Kok North	Sporting Goods Shop	Shopping Mall	Athletics & Sports	Gym / Fitness Center	Outdoor Supply Store	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	10.0
97	Mong Kok East	Sporting Goods Shop	Athletics & Sports	Clothing Store	Shopping Mall	Outdoor Supply Store	Gym / Fitness Center	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	7.0

Data Analysis & Results: Cluster Observation (cont'd)

Cluster 10

	Hong Kong Constituency Areas	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	Total
12	Yue Wan	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
16	Upper Yiu Tung	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
19	Heng Fa Chuen	Sporting Goods Shop	Shopping Mall	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	2.0
21	Sau Mau Ping Central	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
22	Lam Tin	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
30	Sau Mau Ping North	Shopping Mall	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0

Cluster 11

	Hong Kong Constituency Areas	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	Total
3	Fortress Hill	Gym	Dance Studio	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Gym / Fitness Center	3.0
36	Kai Yip	Paintball Field	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
58	Yau Oi North	Soccer Field	Pool	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	2.0
101	Cheung Hong	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
112	Cheung Hang	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	Gym	1.0
139	Keng Hau	Pool	Gym	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	Clothing Store	College Gym	Cycle Studio	Dance Studio	2.0

Data Analysis & Results: Cluster Observation (cont'd)

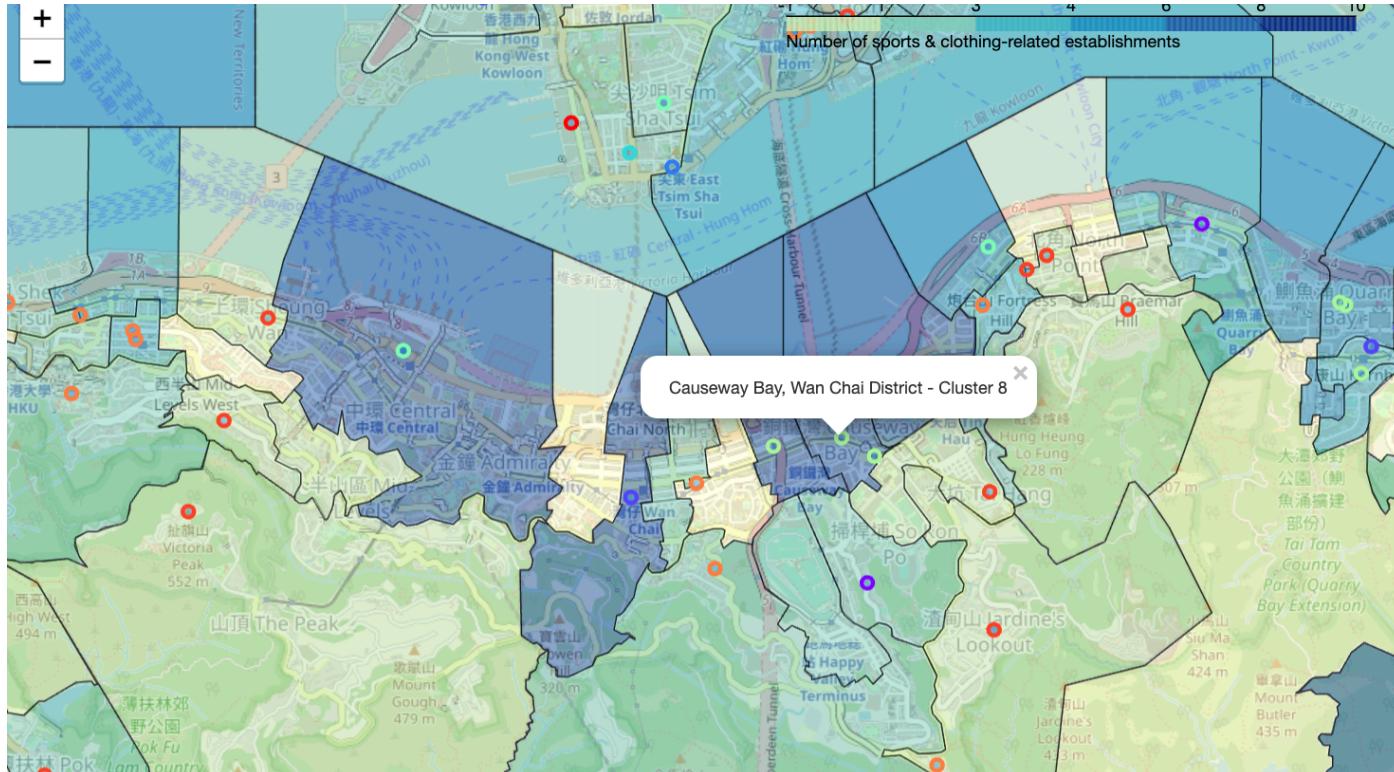
Cluster 12

Hong Kong Constituency Areas		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	Total
32	To Tai	Shopping Mall	Clothing Store	Sporting Goods Shop	Soccer Field	Climbing Gym	Pool	Yoga Studio	Gym	Boxing Gym	College Gym	8.0
50	Yuet Wah	Clothing Store	Gym	Sporting Goods Shop	Soccer Field	Shopping Mall	Pool	Yoga Studio	Boxing Gym	Climbing Gym	College Gym	7.0
53	Po Lok	Shopping Mall	Clothing Store	Sporting Goods Shop	Soccer Field	Climbing Gym	Pool	Yoga Studio	Gym	Boxing Gym	College Gym	8.0
57	Kwun Tong Central	Clothing Store	Sporting Goods Shop	Soccer Field	Climbing Gym	Shopping Mall	Gym	Yoga Studio	Gym / Fitness Center	Boxing Gym	College Gym	7.0
262	Wah Ming	Clothing Store	Sporting Goods Shop	Climbing Gym	Shopping Mall	Paintball Field	Gym	Yoga Studio	Gym / Fitness Center	Boxing Gym	College Gym	7.0

Cluster 13

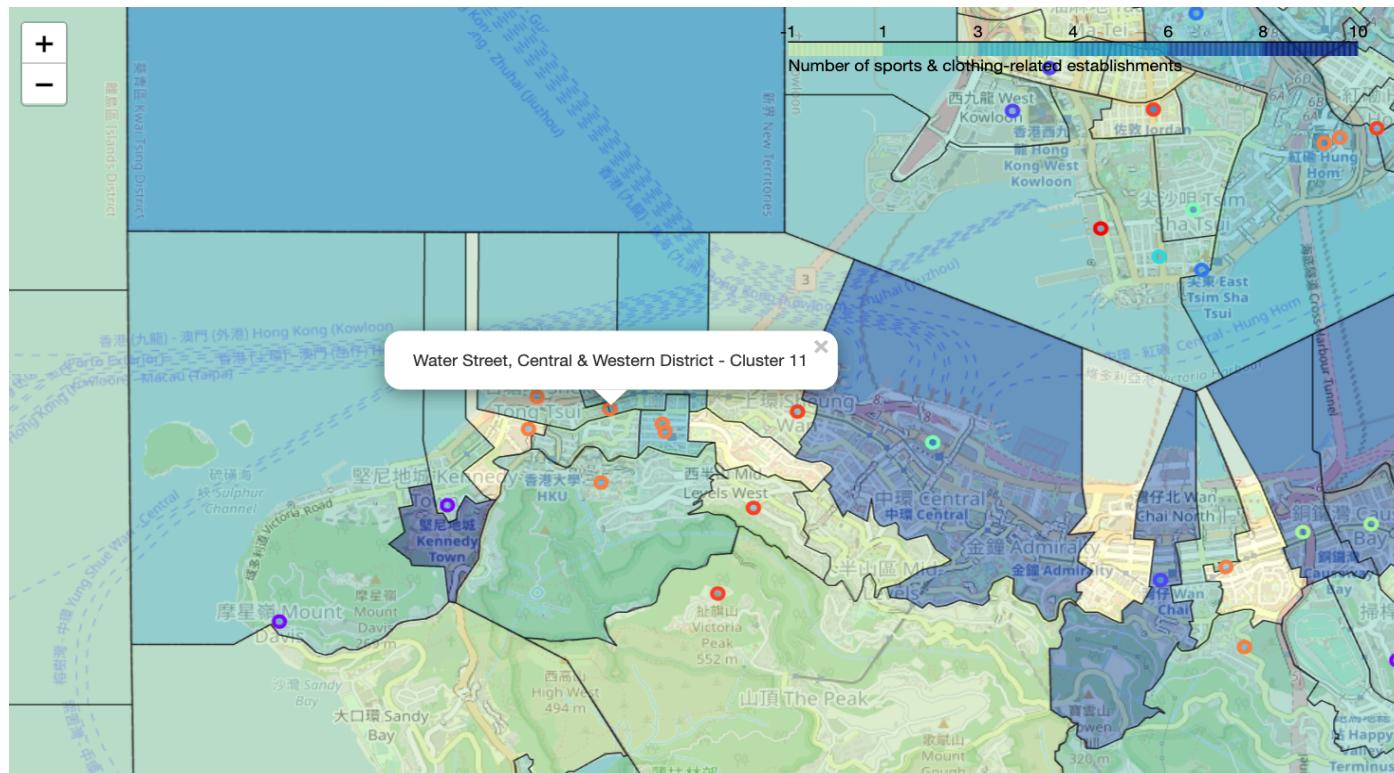
Hong Kong Constituency Areas		1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue	Total
13	Fei Tsui	Shopping Mall	Clothing Store	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	7.0
31	Lower Ngau Tau Kok Estate	Shopping Mall	Athletics & Sports	Clothing Store	Gym / Fitness Center	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
92	Tai Kok Tsui South	Shopping Mall	Clothing Store	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
94	Tai Kok Tsui North	Shopping Mall	Clothing Store	Gym / Fitness Center	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	6.0
127	Po Lam	Shopping Mall	Clothing Store	Yoga Studio	Gym Pool	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	Gym	4.0
360	Kwun Lung	Shopping Mall	Clothing Store	Sporting Goods Shop	Yoga Studio	Gym / Fitness Center	Boxing Gym	Climbing Gym	College Gym	Cycle Studio	Dance Studio	9.0

Discussion of Geospatial Analysis



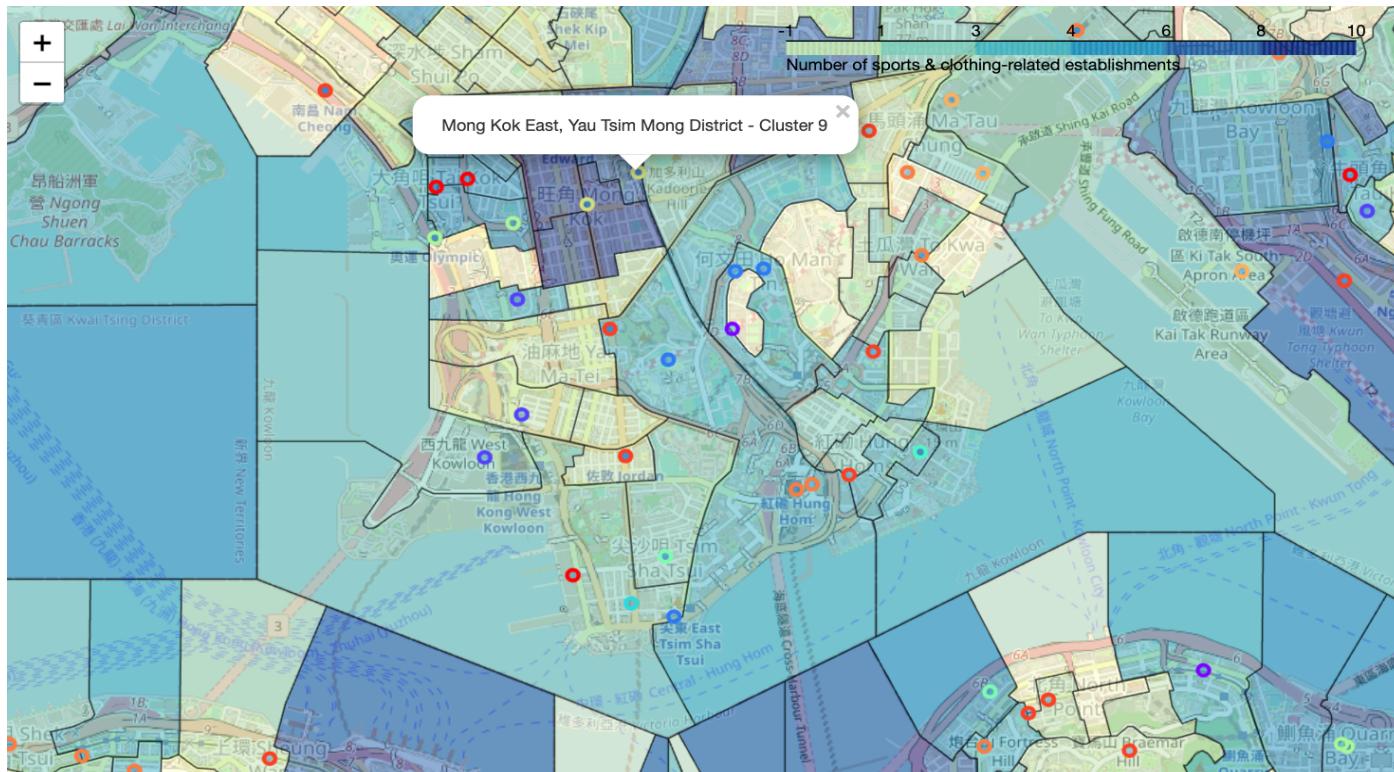
- Areas along the northern edge of Hong Kong island have darker shading, as the areas are widely known to be extremely urban, affluent, commercial and densely populated
- The high occurrence of cluster 7 and 8 labels (in which shopping-related outlets are most common) shows high occurrence of shopping malls and gyms to meet the needs of higher-income, white-collar people
- Sportswear stores in these areas can be smaller, higher-end, and focused on “athleisure” and general-purpose products. The high rent is an important consideration for a successful store location.

Discussion of Geospatial Analysis (cont'd)



- Cluster 11 labels on the western end of the northern edge (e.g. Sai Ying Pun, Hong Kong University, Kennedy Town) reflect a demand for fitness lifestyles amongst those who live in the more residential areas on Hong Kong island
- Stores in these areas should still cater for the demands of consumers with more spending power, but their product offerings can be more fitness-focused compared to their downtown counterparts.

Discussion of Geospatial Analysis (cont'd)



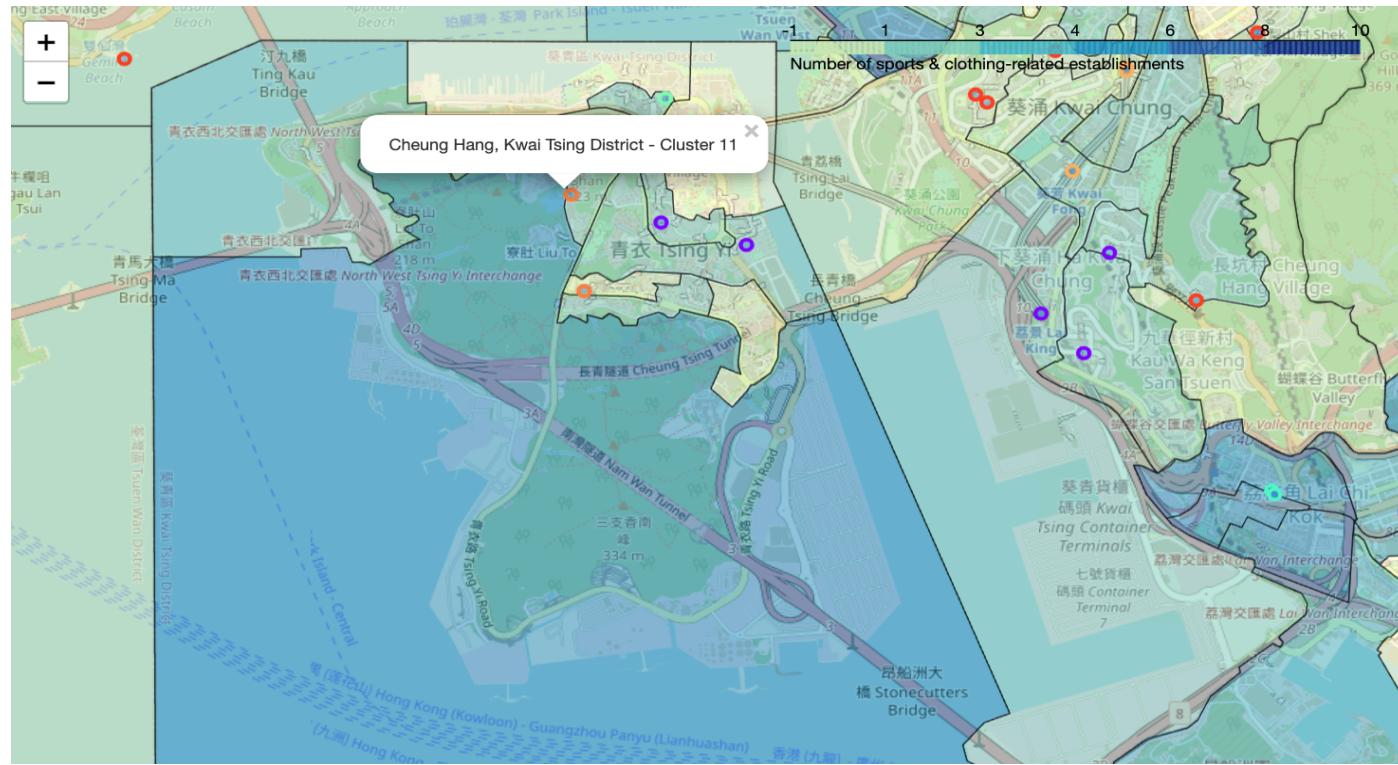
- Some areas in Kowloon side have darker shading as they are densely populated and popular amongst younger crowds (residents and consumers alike)
- Cluster 2 and 9 labels imply that younger demographics have demand for fashion and sports clothing outlets. By extension, we can hypothesize that areas with younger audiences (often due to lower rent and vibrant "hip" environments) are promising sportswear store locations
- Stores in these locations should reflect local tastes, such as by being more trendy, affordable and fitness-focused.

Discussion of Geospatial Analysis (cont'd)



- Kwun Tong also has darker shading - cluster 12 labels indicating shopping centers and clothing stores
- This may be attributed to its dense and residential population
- The relatively affordable property prices make Kwun Tong a less expensive store location, but the lower average income of its residents will reduce their purchasing power
- A unique characteristic of cluster 12 areas is the higher number of soccer fields
- We may consider offering more soccer-related sportswear products to cater to local demands.

Discussion of Geospatial Analysis (cont'd)



- In Tsing Yi, cluster 1 and 11 labels reveal a high number of fitness-related venues (e.g. Pools, Boxing Gyms, Fitness Centers, Climbing Gyms)
- This is likely attributed to Tsing Yi's more spacious and residential environment
- Stores in this area can be larger, fitness-focused and family-oriented. Partnerships with local fitness-outlets can also be promising.

Conclusion

- We now have a granular understanding of which areas have fitness and fashion-ecosystems
 - Areas with more venues imply greater interest in fitness and fashion, as well as more economic potential
 - We understand the specific types of venues in each area. Some areas emphasize on fashion and shopping, others on sports and fitness
 - All these insights are useful for a successful sportswear store expansion strategy
- For further analysis we can continue exploring other important factors:
 - Population density
 - Average income for residents
 - Foot traffic
 - Economic trends
 - More granular features of the venues (e.g. high or low-end, specific sports)