

# The Battle of Neighborhoods

## Finding the Best Place to Open a Business in Yogyakarta

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### 1. Introduction

Yogyakarta is a popular tourist destination in Indonesia, dubbed as a city of students and culture. There are more than 50 urban areas and 20 universities located in Inner Yogyakarta. Of course, choosing a location for business is one of the stressful and controversial tasks, since there is a lot of criteria that should be satisfied in order to achieve the highest revenue.

The target audience of this report is any one that is interested in opening a business but have no idea what kind of and in which area.

### 2. Data

In this project, three different datasets will be used to solve the problem: Urban Area, College Area, and Popular Venue. Urban data were obtained from the Indonesian Postal Code. A list of colleges is obtained by scraping website of Ministry of Education and Culture. After that Geocode each area using Open Street Map to obtain coordinates (latitude and longitude). Finally, Foursquare API was used to call the top 100 popular venues based on the coordinates of each area.

### 3. Methodology

#### 3.1 Data Set

##### — Urban Area Dataset

The data set contain urban area in Yogyakarta was obtained from the Indonesia Postal Code data. The raw data consists of ID, Urban, Sub District, City, Province Code, and Postal Code.

	ID	Urban	Sub District	City	Province Code	Postal Code
0	39759	Ambarketawang	Gamping	Sloman	34	55294
1	39760	Argo Mulyo	Cangkriangan	Sloman	34	55583
2	39761	Argodadi	Sedayu	Bantul	34	55752
3	39762	Argomulyo	Sedayu	Bantul	34	55752
4	39763	Argorejo	Sedayu	Bantul	34	55752

##### — College Area Data Set

The second dataset used was information on boroughs in London, scrapped from Ministry of Education and Culture website. Data contain NPSN (ID), Name of College, Address, Urban, Status, City, and Sub District.

No.	NPSN	Nama Perguruan Tinggi	Alamat	Kelurahan	Status	Kota	Kecamatan
0	1	20404598	AKADEMI ANALIS FARMASI AL ISLAM	JL. BANTUL	- SWASTA	YOGYAKARTA	MANTRIREJON
1	2	20404606	AKADEMI KEPERAWATAN AL ISLAM YOGYAKARTA	JL BANTUL DUKUH MJ I/1221 YOGYAKARTA	- SWASTA	YOGYAKARTA	MANTRIREJON
2	3	20404615	AKADEMI KETATALAKSANAAN PELAYARAN NIAGA BAHTERA	GEDONGKIWO MJ/814	- SWASTA	YOGYAKARTA	MANTRIREJON
3	4	20404642	AKADEMI SENI RUPA DAN DESAIN AKSERI	DI PANJAITAN NO 50	- SWASTA	YOGYAKARTA	MANTRIREJON
0	1	20404714	UNIVERSITAS WIDYA MATARAM	DALEM MANGKUBUMEN KT III/237	- SWASTA	YOGYAKARTA	KRATON

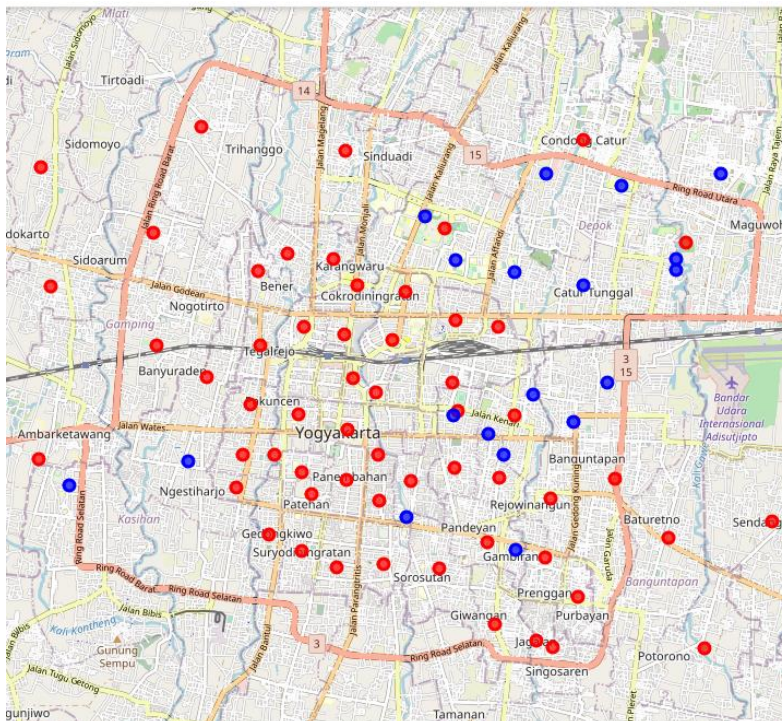
### 3.2 Visualization

The two datasets are merged to form a new dataset that combines the necessary information in one dataset. The coordinates of the area are be obtained using Open Street Maps geocoding to get the final dataset.

AREA IN INNER YOGYAKARTA

	Name	Category	Sub District	City	Latitude	Longitude
40	WARUNGBOTO	URBAN	UMBULHARJO	YOGYAKARTA	-7.808213	110.390206
51	GOWONGAN	URBAN	JETIS	YOGYAKARTA	-7.785946	110.365915
26	PATEHAN	URBAN	KRATON	YOGYAKARTA	-7.810904	110.360710
55	PRENGGAN	URBAN	KOTAGEDE	YOGYAKARTA	-7.820743	110.397419
17	PATANGPULUHAN	URBAN	WIROBRAJAN	YOGYAKARTA	-7.809790	110.348938
13	CONDONG CATUR	URBAN	DEPOK	SLEMAN	-7.755753	110.403552
19	TEGALREJO	URBAN	TEGALREJO	YOGYAKARTA	-7.787677	110.352656
61	UNIVERSITAS TEKNOLOGI YOGYAKARTA	COLLEGE	MLATI	SLEMAN	-7.804717	110.390992
67	UNIVERSITAS GADJAH MADA	COLLEGE	DEPOK	SLEMAN	-7.767706	110.378530
69	UPN VETERAN YOGYAKARTA	COLLEGE	DEPOK	SLEMAN	-7.762812	110.409439

Below is the geo-visualization of the urban and college in Yogyakarta. Many College are located near the north-east of Inner Yogyakarta



### 3.3 Foursquare API

The new dataset is used to generate the 100 most popular venues for each area using the Foursquare API. This returns a json file containing all the venues in each place which is converted to a pandas dataframe. This dataframe contains all the popular venues along with their coordinates and category.

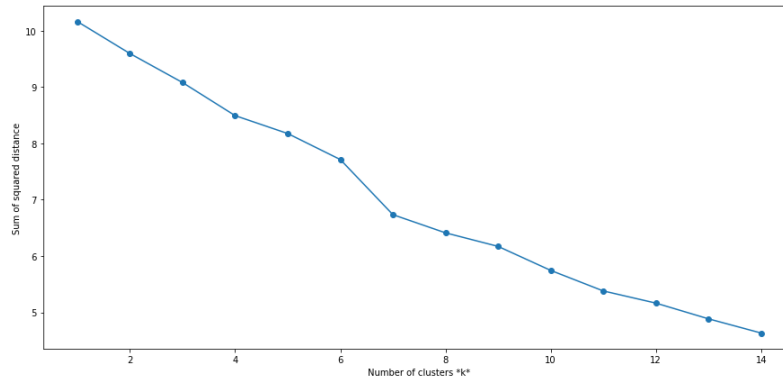
	Place	Latitude	Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
76	MAGUWO HARJO	-7.771769	110.419557	House Of Stripes (H.O.St)	-7.775084	110.422133	Men's Store
1160	SEKOLAH TINGGI PARIWISATA AMPTA YOGYAKARTA	-7.778416	110.403523	Pos Ketan Legenda 1967 Yogyakarta	-7.775935	110.403362	Dessert Shop
169	NGAMPILAN	-7.798428	110.358617	Ayaartta Hotel Malioboro	-7.801391	110.357013	Hotel
400	KOTABARU	-7.786830	110.373433	Siomay Telkom	-7.785969	110.374875	Snack Place
450	SEMAKI	-7.797846	110.383737	GOR Among Rogo	-7.798383	110.385104	Basketball Stadium
926	KEPARAKAN	-7.811905	110.371359	Roti Van Java	-7.814846	110.368199	Bakery
1325	UPN VETERAN YOGYAKARTA	-7.762812	110.409439	Gule Kepala Ikan Bank Jo	-7.761373	110.411037	Indonesian Restaurant
1050	PRENGGAN	-7.820743	110.397419	Sate Sapi & Lontong Sayur Pak Cipto	-7.821682	110.400752	Asian Restaurant
165	NGAMPILAN	-7.798428	110.358617	Pusat Pembuatan Bakpia Pathok 25	-7.796764	110.357977	Snack Place
1331	UPN VETERAN YOGYAKARTA	-7.762812	110.409439	Planet Futsal Yogyakarta	-7.760396	110.408393	Soccer Stadium

### 3.4 Modelling

One hot encoding is done on the venues data. (One hot encoding is a process by which categorical variables are converted into a form that could be provided to ML algorithms to do a better job in prediction). The Venues data is then grouped by the area and the mean of the venues are calculated, finally the 10 common venues are calculated for each of the area.

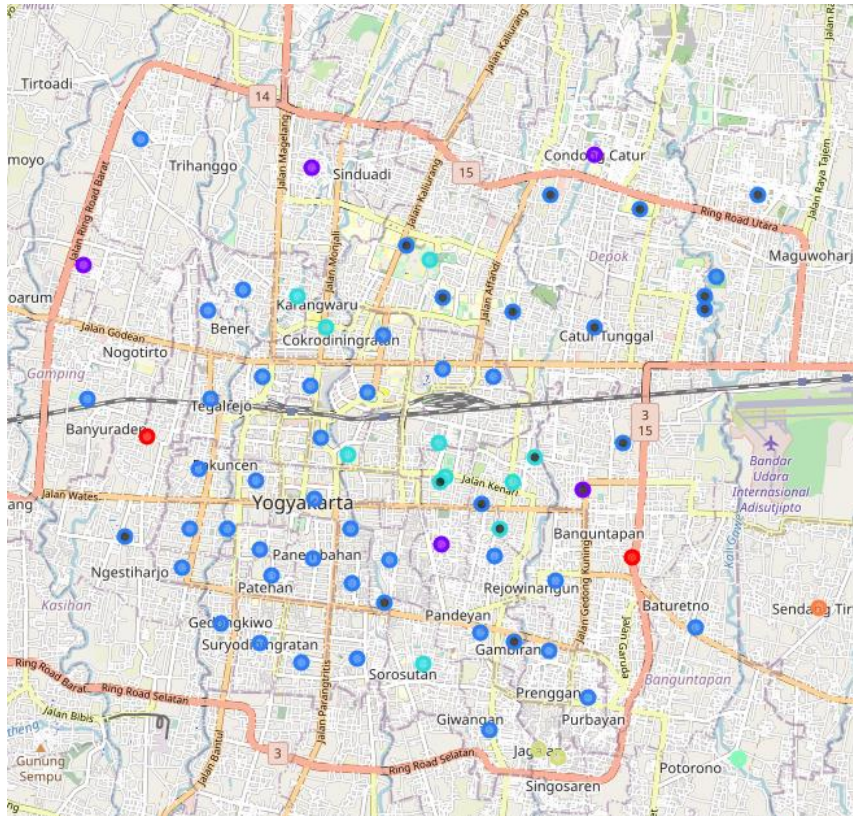
	Name	Category	Sub District	City	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
54	REJOWINANGUN	URBAN	KOTAGEDE	YOGYAKARTA	-7.811466	110.398293	2	Convenience Store	Noodle House	Soup Place	Fast Food Restaurant	Food Truck	Clothing Store	Hotel	Indonesian Restaurant	Department Store	Dessert Shop
60	UNIVERSITAS PGRI YOGYAKARTA	COLLEGE	KASHAN	BANTUL	-7.805787	110.341402	2	Convenience Store	Department Store	Café	Office	Buffet	Dessert Shop	Fair	Fish & Chips Shop	Field	Fast Food Restaurant
5	BATURETNO	URBAN	BANGUNTAPAN	BANTUL	-7.817654	110.416941	2	Soup Place	Pool	Convenience Store	Cupcake Shop	Dance Studio	Flea Market	Fish & Chips Shop	Field	Fast Food Restaurant	Farm Market
37	TAHUNAN	URBAN	UMBULHARJO	YOGYAKARTA	-7.806743	110.383172	1	Breakfast Spot	Indonesian Restaurant	Asian Restaurant	Electronics Store	Flea Market	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Farm Market
29	BACIRO	URBAN	GONDOKUSUMAN	YOGYAKARTA	-7.793470	110.382973	3	Asian Restaurant	Noodle House	American Restaurant	Gastropub	Coffee Shop	Fast Food Restaurant	Food Truck	Stadium	Soccer Stadium	(
44	KARANGWARU	URBAN	TEGALREJO	YOGYAKARTA	-7.774269	110.364112	3	Asian Restaurant	Hotel	Convenience Store	Soup Place	Diner	Furniture / Home Store	Kids Store	Steakhouse	Flea Market	Javan Restaurant
21	BENER	URBAN	TEGALREJO	YOGYAKARTA	-7.776131	110.352393	2	Ice Cream Shop	Chinese Restaurant	Playground	Gym	Dessert Shop	Massage Studio	Juice Bar	Field	Fast Food Restaurant	Farm Market
14	CATUR TUNGAL	URBAN	DEPOK	SLEMAN	-7.789545	110.381781	3	Food Court	Javanese Restaurant	Asian Restaurant	Flea Market	Coffee Shop	College Academic Building	Café	Juice Bar	Plaza	S P
32	KOTABARU	URBAN	GONDOKUSUMAN	YOGYAKARTA	-7.786830	110.373433	2	Coffee Shop	Café	Cosmetics Shop	Hotel	Asian Restaurant	Food Truck	Fast Food Restaurant	Seafood Restaurant	Snack Place	Books
46	COKRODININGRATAN	URBAN	JETIS	YOGYAKARTA	-7.778410	110.367923	3	Asian Restaurant	Coffee Shop	Hotel	Indonesian Restaurant	Beer Garden	Convenience Store	Pizza Place	Seafood Restaurant	Shabu-Shabu Restaurant	Farm Market

To identify groups (clusters) with similar characteristics, the unsupervised learning method to our data, namely K-Means algorithm, was applied to our data. To identify the optimal number of clusters, the Elbow method is used. It can be seen from the graph that 7 clusters are the best choice.



#### 4. Result

Based on the venue categories, K-Means clustering was conducted to group the urban and college into 7 different clusters based on their similarity. The color dots below represent different clusters.



Cluster	Color
0	Purple
1	Red
2	Blue
3	Light Blue
4	Green
5	Brown
6	Orange

From that visualization there are three main cluster (1, 2, and 3) and four secondary cluster (0, 4, 5, 6).



Main Cluster

Cluster 1: Lively Area (Restaurant, Convenience Store, Field, Farm,...)

	Name	Category	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
10	NOGOTIRTO	URBAN	1	Convenience Store	Indonesian Restaurant	Eastern European Restaurant	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Farm	Fair	Event Space
12	SINDUADI	URBAN	1	Indonesian Restaurant	Asian Restaurant	Convenience Store	Shoe Store	Noodle House	Nightclub	Coffee Shop	Electronics Store	Field	Fast Food Restaurant
13	CONDONG CATUR	URBAN	1	Indonesian Restaurant	Café	Asian Restaurant	Bakery	Coffee Shop	Yoga Studio	Electronics Store	Fish & Chips Shop	Field	Fast Food Restaurant
37	TAHUNAN	URBAN	1	Breakfast Spot	Indonesian Restaurant	Asian Restaurant	Electronics Store	Flea Market	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Farm
	Name	Category	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
57	SEKOLAH TINGGI TEKNIK LINGKUNGAN	COLLEGE	1	Indonesian Restaurant	Asian Restaurant	Convenience Store	Snack Place	Event Space	Arcade	Seafood Restaurant	Soup Place	Food Court	Campground

Cluster 2: Busy Area (Fast Food, Café, Store, Boutique, ...)

	Name	Category	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
40	WARUNGBOTO	URBAN	2	Fast Food Restaurant	Convenience Store	Seafood Restaurant	Indonesian Restaurant	Spa	Javanese Restaurant	Bakery	Coffee Shop	Garden	Electronics Store
53	GIWANGAN	URBAN	2	Soup Place	Indonesian Restaurant	Market	Farm	Noodle House	Electronics Store	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market
56	PURBAYAN	URBAN	2	Boutique	Food Court	Jewelry Store	Farmers Market	Neighborhood	Art Gallery	Dessert Shop	Fair	Flea Market	Fish & Chips Shop
52	PANDEYAN	URBAN	2	Soup Place	Café	Art Museum	Bakery	Breakfast Spot	Coffee Shop	Beach	Indonesian Restaurant	Arts & Crafts Store	Diner
45	PRAWIRODIRJAN	URBAN	2	Indonesian Restaurant	Asian Restaurant	Historic Site	Art Gallery	Department Store	Chinese Restaurant	Clothing Store	Restaurant	Seafood Restaurant	Performing Arts Venue
23	NGAMPILAN	URBAN	2	Snack Place	Hotel	Indonesian Restaurant	Noodle House	Chinese Restaurant	Convenience Store	Market	Diner	Dessert Shop	Hostel
43	PANEMBAHAN	URBAN	2	Indonesian Restaurant	Historic Site	BBQ Joint	Javanese Restaurant	Food Court	Diner	Castle	Asian Restaurant	Snack Place	Boutique
22	GEDONGKIWO	URBAN	2	Café	Gym	Supermarket	Convenience Store	Coffee Shop	Food Truck	Asian Restaurant	BBQ Joint	Italian Restaurant	Soup Place
8	SIDOARUM	URBAN	2	Department Store	Fast Food Restaurant	Food Truck	Grocery Store	Noodle House	Chinese Restaurant	Yoga Studio	Electronics Store	Field	Farmers Market
39	TERBAN	URBAN	2	Café	Soup Place	Noodle House	Hotel	Indonesian Restaurant	Seafood Restaurant	Pizza Place	Cosmetics Shop	Breakfast Spot	Snack Place

	Name	Category	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
62	AKADEMI KOMUNIKASI YOGYAKARTA	COLLEGE	2	Indonesian Restaurant	Convenience Store	Soup Place	History Museum	Grocery Store	Fried Chicken Joint	French Restaurant	Mobile Phone Shop	Fast Food Restaurant	Noodle House
74	UNIVERSITAS COKROAMINOTO	COLLEGE	2	Convenience Store	Department Store	Coffee Shop	Grocery Store	Bakery	Supermarket	Indonesian Restaurant	Dessert Shop	Electronics Store	Fish & Chips Shop
58	STMIK AKAKOM	COLLEGE	2	Café	Food Truck	BBQ Joint	Yoga Studio	Electronics Store	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Farm
68	UNIVERSITAS NEGERI YOGYAKARTA	COLLEGE	2	Arcade	Indonesian Restaurant	Food Court	Asian Restaurant	Fast Food Restaurant	Japanese Restaurant	Concert Hall	Café	Pool	Breakfast Spot
59	UNIVERSITAS MUHAMMADIYAH YOGYAKARTA	COLLEGE	2	Department Store	Fast Food Restaurant	BBQ Joint	Diner	Yoga Studio	Event Space	Flea Market	Fish & Chips Shop	Field	Farmers Market
67	UNIVERSITAS GADJAH MADA	COLLEGE	2	Convenience Store	Indonesian Restaurant	Asian Restaurant	Javanese Restaurant	Soup Place	Café	Salon / Barbershop	Modern European Restaurant	Coffee Shop	College Academic Building
75	UNIVERSITAS SARJANAWIYATA TAMANSISWA	COLLEGE	2	Fried Chicken Joint	Pharmacy	Hotel	Indonesian Restaurant	Café	Asian Restaurant	Fast Food Restaurant	Javanese Restaurant	Coffee Shop	Electronics Store
71	UNIVERSITAS SANATA DHARMA	COLLEGE	2	Hotel	Asian Restaurant	Indonesian Restaurant	Café	Bookstore	Restaurant	Coffee Shop	Javanese Restaurant	Department Store	Chinese Restaurant
63	INSTITUT PERTANIAN STIPER	COLLEGE	2	Indonesian Restaurant	Cosmetics Shop	Café	Breakfast Spot	Asian Restaurant	Gym / Fitness Center	Restaurant	Coffee Shop	Event Space	Field
64	POLITEKNIK API	COLLEGE	2	Coffee Shop	Noodle House	Convenience Store	BBQ Joint	Bubble Tea Shop	Sports Club	Karaoke Bar	Indonesian Restaurant	Dim Sum Restaurant	Department Store

Cluster 3: Culinary Area (Asian Restaurant, Hotel, Coffe Shop, .....

	Name	Category	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
50	SOROSUTAN	URBAN	3	Javanese Restaurant	Convenience Store	Asian Restaurant	Café	Diner	Food	Dessert Shop	Department Store	Flea Market	Fish & Chips Shop
46	COKRODININGRATAN	URBAN	3	Asian Restaurant	Coffee Shop	Hotel	Indonesian Restaurant	Beer Garden	Convenience Store	Pizza Place	Seafood Restaurant	Shabu-Shabu Restaurant	Farmers Market
35	SEMAKI	URBAN	3	Asian Restaurant	Coffee Shop	Soccer Stadium	Stadium	Food Truck	Food Court	Javanese Restaurant	Basketball Stadium	Indonesian Restaurant	Restaurant
0	AMBARKETAWANG	URBAN	3	Park	Asian Restaurant	Javanese Restaurant	Market	Yoga Studio	Electronics Store	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market
29	BACIRO	URBAN	3	Asian Restaurant	Noodle House	American Restaurant	Gastropub	Coffee Shop	Fast Food Restaurant	Food Truck	Stadium	Soccer Stadium	Gym
	Name	Category	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
61	UNIVERSITAS TEKNOLOGI YOGYAKARTA	COLLEGE	3	Asian Restaurant	Hotel	Pharmacy	Indonesian Restaurant	Café	Fast Food Restaurant	Javanese Restaurant	Spa	Fried Chicken Joint	Yoga Studio
72	AKADEMI PERIKANAN YOGYAKARTA	COLLEGE	3	Asian Restaurant	Pet Store	Hotel	Indonesian Restaurant	Seafood Restaurant	Department Store	Food Truck	Diner	Electronics Store	Fast Food Restaurant
73	UNIVERSITAS AHMAD DAHLAN	COLLEGE	3	Asian Restaurant	Food Truck	Convenience Store	Radio Station	Food Court	Stadium	Soccer Stadium	Coffee Shop	Javanese Restaurant	Basketball Stadium

Secondary Cluster

Cluster 0: Village Area (Lake, Field, Farmer Market,.....)

	Name	Category	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
1	NGESTIHARJO	URBAN	0	Arcade	Sporting Goods Shop	Electronics Store	Lake	Yoga Studio	Eastern European Restaurant	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market
15	MAGUWOHARJO	URBAN	0	Lake	Yoga Studio	Flower Shop	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Fair	Event Space	Electronics Store

#### Cluster 4: Recreation Area

	Name	Category	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
6	POTORONO	URBAN	4	Food & Drink Shop	Recreation Center	Yoga Studio	Eastern European Restaurant	Field	Fast Food Restaurant	Farmers Market	Farm	Fair	Event Space

#### Cluster 5: Tourist Area

	Name	Category	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
2	JAGALAN	URBAN	5	Restaurant	Historic Site	Candy Store	Yoga Studio	Field	Fast Food Restaurant	Farmers Market	Farm	Fair	Event Space

#### Cluster 6: Quiet Area

	Name	Category	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
16	SENDANG TIRTO	URBAN	6	Bowling Alley	Food	Flower Shop	Flea Market	Fish & Chips Shop	Field	Fast Food Restaurant	Farmers Market	Farm	Fair

### 5. Discussion

The clustering results show that suitable business places are in clusters 1, 2, and 3. Most of the college area is included in cluster 2 (Busy Area) so that if a business is opened targeting students as consumers business such as café, department store or restaurant becomes good choice. If you want to open a restaurant business that makes tourists as main consumers, clusters 1 and 3 can be the best choice.

### 6. Conclusion

To conclude, the basic data analysis was performed to identify the most optimal area for opening busines in the Yogyakarta. During the analysis, several important statistical features of the urban and college are were explored and visualized. Furthermore, clustering helped to highlight the group of optimal areas. Finally, cluster 1, 2, and 3 were chosen as the most attractive options for the further analysis.