STRATEGIC BRANCH ESTABLISHMENT:

Establishing a New Coffee Shop Branch in Yogyakarta, Indonesia

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Preface

Indonesia and coffee has close relationship among each other, where as Indonesia is holding the title of fourth largest coffee producer in the world and Indonesia hold the seventh position title as the world largest coffee consumer bringing supply and demand for coffee in the country has important role on its economy's growth. In other words, both of the facts tell us explicitly that coffee has great value to Indonesian businesses and economy in many ways of business point of view.

Coffee as business idea yielding vast amount of business type, broad of product variety and business model, scalable business valuation and/or organization size, and vast target consumer and/or market. In fact, Indonesian Ministry of Industry release a publication that said even though amid coronavirus global pandemic impact, coffee related business trade balance still made a surplus of USD 211.05 million in 2020 first semester.

Indonesia in the era of digital transformation has impact on shaping business behavior due to people higher literation on technology. Businesses are likely to thrive in when using agile and intelligent strategy on their decision making processes. One of the most case of making decision is 'where to establish the business operation?', based on the case stated in prior sentence this publication will elaborate and demonstrate the process of decision making based on data.

Chapter I

Introduction

1.1 Background

Establishing a business capital is not an easy task to do for every stakeholders in any business size and there are lot of things to consider and decision to be made in this process. One of the major problem arise from is ‘where do the place that suit best?’.

Choosing a business spot is an initial step to businesses operation apart from concepting business model and business operation planning. When choosing an establishment spot we might consider potential benefit or potential risk in the future.

1.2 Business Problem

This research is an attempt to find a strategic place to establish a coffee shop within Yogyakarta, Indonesia. This section will discuss the business problems that will shape the research direction and scope, therefore below will point out the business problem that occurred.

a) Want to establish a coffee shop somewhere in Yogyakarta

b) Provide establishment location option in village level

c) Preferably presented in geological map

d) Target customers are college university students and office workers

e) Success criteria : locations with lowest competitors and highest potential customers

f) Based on domain knowledge, working place and college university mainly available in two main regency : Sleman and Kota Yogyakarta

g) Cannot afford third party data vendor

h) The data required might be scattered somewhere in open public

i) To reach highest potential customers, the location should be near to working places (office) and college universities

j) To reach lowest competitors potential, the location should have least coffee shop nearby

Analytics approach conducted in this research:

a) Geospatial analysis and visualization

b) Unsupervised task: Clustering

Chapter II
Data Definition

2.1 Data Understanding

Based on the business problem stated in prior section; location point of interest in this research will be the regions of Yogyakarta and its subdistrict and village. Therefore to generate geo visualization format, geo coordinate information is needed such as latitude and longitude of a particular location. Since no data provided at the first time, external sources needed to gather all data requirements. One of the external sources for data gathering is foursquare places API an open-source with the sandbox free tier services and Nominatim openstreetmap geocoders. Data requested from the API using version updated on July, 1st 2020.

2.2 Data Requirements

Data required to conduct research:

a. Yogyakarta's subdistrics name
b. Yogyakarta's villages
c. College universities in Yogyakarta
d. Office buildings in Yogyakarta
e. Coffee shop establishments in Yogyakarta
f. Geo location (latitude,longitude) from above data

2.3 Data Collection

Web scraping sources:

a. https://id.wikipedia.org/wiki/Daftar_kapanewon,_kemantren,_kalurahan,_dan_kelurahan_di_Daerah_Istimewa_Yogyakarta
b. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/3/71/34.ez
c. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/07/71/34.ez
d. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/8/04/34.ez
e. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/6/71/34.ez

f. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/01/71/34.ez

data from web scraping source containing informations of Yogyakarta subdistrics, villages name, and number of population data.

Nominatim-Openstreetmap requests:

a. Using geopy.Nominatim python package to get geo coordinate of a location. With this python package, latitude and longitude of Yogyakarta's subdistricts and villages are retrieved.

Foursquare API requests:

a. https://api.foursquare.com/v2/venues/explore

parameters:

- Client id
- Client secret
- Radius = 700 meters
- ll (latitude, longitude)
- version = 20200701
- limit =100
- q (query) = College%20%26%20University
- categoryId (college places) = 4d4b7105d754a06372d81259
- categoryId (office places) = 4bf58dd8d48988d124941735
- categoryId (coffee shop venues) = 4bf58dd8d48988d1e0931735

with foursquare API request, data containing coffee shop venues, college universities, and office buildings are retrieved. The format the data retrieved is JSON (Javascript Object Notation) containing geo coordinate of a venues, list of nearby venues, and other informations.

Openstreetmap Geojson:

a. Yogyakarta Province Geojson

Geojson used for showing boundary of a particular location

2.4 Data Quality

a. Actuality

- Population data are taken with the update on 2020 2nd semester or June 2020
- Foursquare API places with the update on July, 1st 2020

b. Factuality

- Population data are taken from official Yogyakarta government sites
- Places date are taken from Foursquare places endpoint
- Geo coordinate are taken from Nominatim Openstreetmap opensource map provider

Chapter III

Methodology

3.1 Data Preparation

Source: webscraping

Raw Data	Feature Engineering/Action Taken	Result Data
Source: webscraping urls [b-f] • Not productive age yet • Productive age • Not productive age • Number of woman within categories per village • Number of man within categories per village • Grand total woman within categories per subdistricts • Grand total man within categories per subdistricts • Grand total man/woman within villages per village • Village name categories	• Feature selection • Extracting information	• Productive age • Grand total man/woman within villages per village • Village name categories • Dataframe name: **top_5_demographics**
Source: webscraping urls [a]	• Feature selection • Extracting	• Sleman and Kota Yogyakarta Region

• Yogyakarta's territory • Regencies table • Subdistricts table • Villages table	information • String data type method • List data type manipulation • converting into pandas dataframe • concatenating two main regions dataframe • correcting wrong villages name	• Two main region's subdistricts and villages • Dataframe name: **full_regency**

Source : Nominatim API request

Source: **Nominatim Requests** • **full_regency** villages name data	• Endpoint request • Combine resulting data into **full_regency**	• Geo coordinate (latitude,longitude) for villages data
Source: **full_regency**	• Recalibrating geo coordinate latitude longitude	• Correct coordinate

Source: Foursquare API endpoint requests

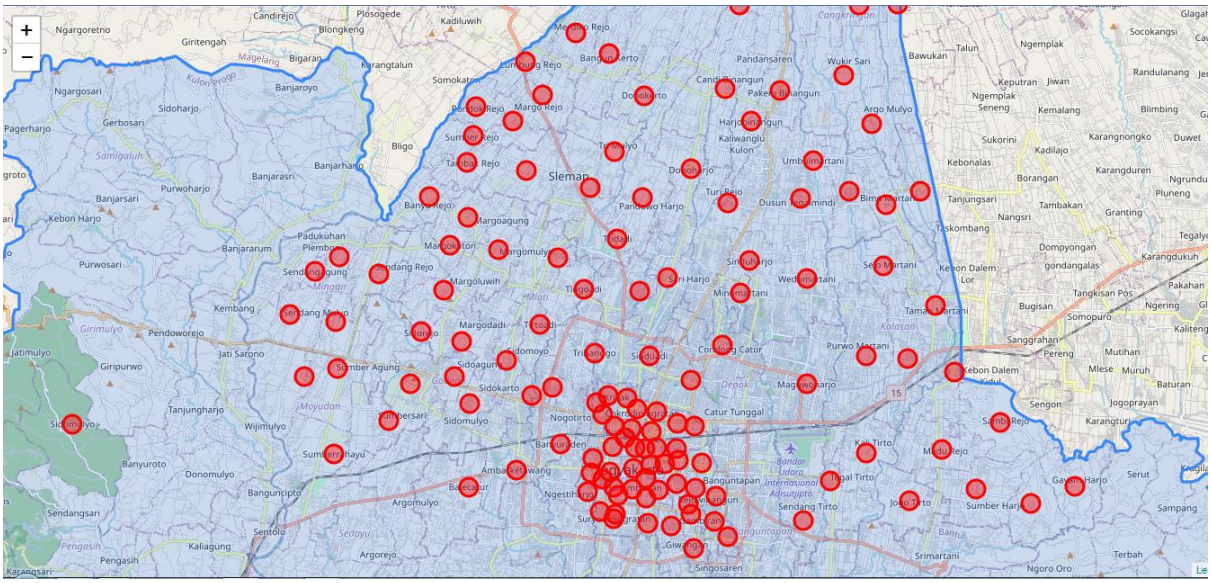
Source: **Explore endpoint requests** • **full_regency** villages latitude longitude data Response in JSON • venues name • venues category • venues distance • venues lat,lon • venues unique id • venues city • venues postal • venues country • venues city • venues icon • etc	• Endpoint request • Feature selection • Aggregated sum of venues in latitude, longitude given	• Total coffee shop nearby coordinate given • Total office building nearby coordinate given • Total college university nearby coordinate given

3.2 Data Modeling

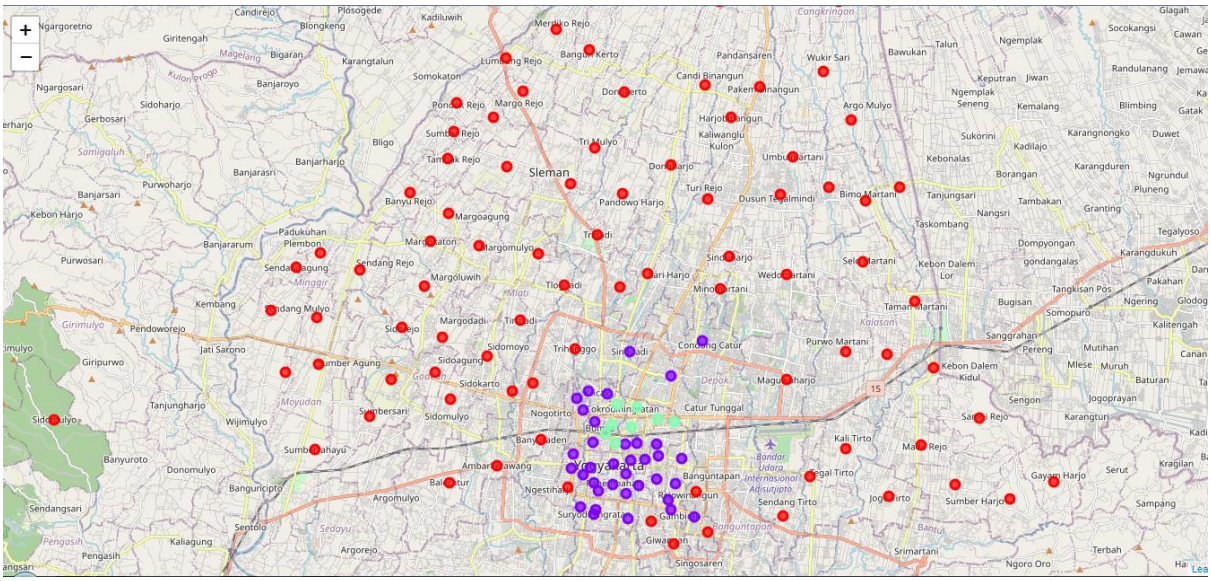
Clustering

Source: **Full_regency dataframe** • Total number of college universities • Total_number of office buildings • Total coffee shop venues	• Unsupervised Machine Learning Task: Clustering. Algorithm used: Kmeans • Attempt to find best K cluster using elbow method. Result : n_cluster = 3	• Cluster label for villages

Spatial Visualization of Yogyakarta



Spatial Visualization of Cluster



Chapter IV

Results

4.1 Clustering Results

Cluster 1

Regency	Sub_District	Village	Latitude	Longitude	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Cluster_Label
Sleman	Berbah	Jogotirto	-7.8129504	110.4720599	2	0	1	0
Sleman	Berbah	Kalitirto	-7.7951322	110.4553582	4	0	0	0
Sleman	Berbah	Sendangtirto	-7.8204215	110.4313663	8	0	2	0
Sleman	Berbah	Tegaltirto	-7.8054225	110.4417249	13	0	0	0
Sleman	Cangkringan	Argomulyo	-7.6706097	110.4574592	0	0	0	0
Sleman	Cangkringan	Glagaharjo	-7.6252955	110.4676811	0	0	0	0
Sleman	Cangkringan	Kepuharjo	-7.6254682	110.4525964	1	0	1	0
Sleman	Cangkringan	Wukirsari	-7.6520334	110.4468055	0	0	0	0
Sleman	Depok	Maguwoharjo	-7.7686938	110.4327364	7	1	4	0
Sleman	Gamping	Ambarketawang	-7.8014489	110.3218737	11	0	5	0
Sleman	Gamping	Balecatur	-7.8078411	110.3037379	8	1	1	0
Sleman	Gamping	Banyuraden	-7.79162	110.3388925	2	0	2	0
Sleman	Gamping	Nogotirto	-7.7702585	110.3358139	7	1	4	0
Sleman	Gamping	Trihanggo	-7.7571187	110.3517176	12	1	5	0
Sleman	Godean	Sidoagung	-7.76618085	110.298346	3	1	3	0

Sleman	Godean	Sidoarum	-7.7732136	110.3276793	3	1	10	0
Sleman	Godean	Sidokarto	-7.77627705	110.304159	11	0	6	0
Sleman	Godean	Sidoluhur	-7.76895085	110.2815757	3	0	2	0
Sleman	Godean	Sidomoyo	-7.7600099	110.3182508	0	0	0	0
Sleman	Godean	Sidomulyo	-7.7839938	110.152508	0	0	0	0
Sleman	Godean	Sidorejo	-7.7492391	110.2856145	1	0	0	0
Sleman	Kalasan	Purwomartani	-7.75818705	110.4555707	2	0	0	0
Sleman	Kalasan	Selomartani	-7.72417035	110.4619782	1	0	0	0
Sleman	Kalasan	Tamanmartani	-7.7391953	110.4817909	0	0	3	0
Sleman	Kalasan	Tirtomartani	-7.75929095	110.4712909	9	2	3	0
Sleman	Minggir	Sendangagung	-7.726428	110.2451237	1	0	0	0
Sleman	Minggir	Sendangarum	-7.74538965	110.2528654	0	0	0	0
Sleman	Minggir	Sendangmulyo	-7.7426899	110.2353842	0	0	0	0
Sleman	Minggir	Sendangrejo	-7.7272268	110.2694529	0	0	1	0
Sleman	Minggir	Sendangsari	-7.7210165	110.2543945	0	0	1	0
Sleman	Mlati	Sendangadi	-7.7337165	110.3689073	3	2	6	0
Sleman	Mlati	Sumberadi	-7.7212094	110.3378185	2	0	3	0
Sleman	Mlati	Tirtoadi	-7.7464001	110.3310165	2	0	1	0
Sleman	Mlati	Tlogoadi	-7.7329	110.3475649	4	0	3	0

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Sleman	Moyudan	Sumberagung	-7.7629521	110.2536653	5	0	7	0
Sleman	Moyudan	Sumberarum	-7.7661535	110.2408898	3	0	1	0
Sleman	Moyudan	Sumberrahayu	-7.795372	110.2523454	0	0	0	0
Sleman	Moyudan	Sumbersari	-7.78265475	110.2732611	0	0	0	0
Sleman	Ngaglik	Donoharjo	-7.6875954	110.3886959	4	0	2	0
Sleman	Ngaglik	Minomartani	-7.7345297	110.4075393	3	2	2	0
Sleman	Ngaglik	Sardonoharjo	-7.7005804	110.4026509	1	0	4	0
Sleman	Ngaglik	Sariharjo	-7.7287731	110.3798034	4	3	6	0
Sleman	Ngaglik	Sinduharjo	-7.7221769	110.4109855	3	1	0	0
Sleman	Ngaglik	Sukoharjo	-7.6986524	110.4302895	10	3	8	0
Sleman	Ngemplak	Bimomartani	-7.70115725	110.463005	5	0	2	0
Sleman	Ngemplak	Sindumartani	-7.695977	110.4759792	0	0	2	0
Sleman	Ngemplak	Umbulmartani	-7.68444	110.4352525	1	1	3	0
Sleman	Ngemplak	Wedomartani	-7.7291658	110.4328328	6	0	0	0
Sleman	Ngemplak	Widodomartani	-7.69616745	110.4490018	1	1	2	0
Sleman	Pakem	Candibinangun	-7.65739945	110.4017249	0	0	0	0
Sleman	Pakem	Hargobinangun	-7.59551805	110.4307599	6	1	9	0
Sleman	Pakem	Harjobinangun	-7.6694491	110.4114568	2	1	2	0

Sleman	Pakem	Pakembinangun	-7.6579966	110.4224758	4	2	4	0
Sleman	Pakem	Purwobinangun	-7.6255927	110.4072227	1	0	0	0
Sleman	Prambanan	Bokoharjo	-7.7642 8525	110.4892454	10	0	2	0
Sleman	Prambanan	Gayamharjo	-7.8075 4245	110.5353072	0	0	0	0
Sleman	Prambanan	Madurejo	-7.7937 1975	110.484334	4	0	2	0
Sleman	Prambanan	Sambirejo	-7.7835 024	110.5066974	0	0	2	0
Sleman	Prambanan	Sumberharjo	-7.8086 3675	110.4973449	0	0	2	0
Sleman	Prambanan	Wukirharjo	-7.8142 312	110.5181983	0	0	0	0
Sleman	Seyegan	Margoagung	-7.7058 5145	110.3034038	3	0	1	0
Sleman	Seyegan	Margodadi	-7.7333 8605	110.2940325	0	0	1	0
Sleman	Seyegan	Margokaton	-7.7165 055	110.296628	1	0	2	0
Sleman	Seyegan	Margoluwih	-7.7528 3635	110.3009377	0	0	0	0
Sleman	Seyegan	Margomulyo	-7.7181 1375	110.3152181	1	0	0	0
Sleman	Sleman	Caturharjo	-7.6882 33	110.3257783	1	0	0	0
Sleman	Sleman	Pandowoharjo	-7.6983 1385	110.3698756	3	0	0	0
Sleman	Sleman	Tridadi	-7.7139 519	110.3605194	3	6	6	0
Sleman	Sleman	Triharjo	-7.6945 594	110.3502065	5	4	4	0
Sleman	Sleman	Trimulyo	-7.6812 0925	110.3594467	0	0	1	0
Sleman	Tempel	Banyurejo	-7.6981	110.2886183	0	0	1	0

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Sleman	Tempel	Lumbungrejo	-7.6470831	110.3254578	3	0	5	0
Sleman	Tempel	Margorejo	-7.6594994	110.3319138	1	0	2	0
Sleman	Tempel	Merdikorejo	-7.6360625	110.3447612	0	0	0	0
Sleman	Tempel	Mororejo	-7.6693605	110.3205163	1	0	0	0
Sleman	Tempel	Pondokrejo	-7.6640245	110.3065501	2	0	0	0
Sleman	Tempel	Sumberejo	-7.6750035	110.3056002	0	0	0	0
Sleman	Tempel	Tambakrejo	-7.6849665	110.3032194	0	0	0	0
Sleman	Turi	Bangunkerto	-7.6440249	110.3573944	0	0	1	0
Sleman	Turi	Donokerto	-7.6597927	110.3707183	0	0	2	0
Sleman	Turi	Girikerto	-7.6095043	110.4003064	0	0	0	0
Sleman	Turi	Wonokerto	-7.6148047	110.3772611	0	0	0	0
Kota Yogyakarta	Kotagede	Purbayan	-7.8267595	110.4026556	5	3	8	0
Kota Yogyakarta	Kotagede	Rejowinangun	-7.8114664	110.3982926	5	8	3	0
Kota Yogyakarta	Umbulharjo	Sorosutan	-7.8224405	110.380925	8	3	2	0
Kota Yogyakarta	Umbulharjo	Giwangan	-7.8310545	110.3895136	3	0	4	0
Kota Yogyakarta	Wirobrajan	Patangpuluhan	-7.8097895	110.3489382	8	5	6	0

Aggregated Cluster 1 to Subdistrict level

Sub_District	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Customer_to_Competitor_r
Berbah	27	0	3	9
Gamping	40	3	17	2.529411765
Kalasan	12	2	6	2.333333333
Umbulharjo	11	3	6	2.333333333
Wirobrajan	8	5	6	2.166666667
Sleman	12	10	11	2
Depok	7	1	4	2
Kotagede	10	11	11	1.909090909
Prambanan	14	0	8	1.75
Ngemplak	13	2	9	1.666666667
Ngaglik	25	9	22	1.545454545
Seyegan	5	0	4	1.25
Pakem	13	4	15	1.133333333
Godean	21	2	21	1.095238095
Mlati	11	2	13	1
Moyudan	8	0	8	1
Cangkringan	1	0	1	1
Tempel	7	0	8	0.875
Minggir	1	0	2	0.5
Turi	0	0	3	0

Cluster 2

Regency	Sub_District	Village	Latitude	Longitude	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Cluster_Label
Sleman	Cangkringan	Umbulharjo	-7.8143777	110.3873737	20	9	12	1
Sleman	Depok	Caturtunggal	-7.76739765	110.3884916	28	16	30	1
Sleman	Depok	Condongcatur	-7.7541293	110.4006194	4	13	13	1
Sleman	Mlati	Sinduadi	-7.7582322	110.3727371	32	5	13	1
Kota Yogyakarta	Danurejan	Bausasran	-7.79936195	110.3731806	15	27	9	1

Kota Yogyakarta	Danurejan	Tegalpanggung	-7.7934268	110.3711352	13	26	17	1
Kota Yogyakarta	Gedongtengen	Pringgokusuman	-7.792505	110.3586344	8	16	17	1
Kota Yogyakarta	Gondokusuman	Baciro	-7.7934704	110.3829725	27	18	4	1
Kota Yogyakarta	Gondomanan	Ngupasan	-7.80468305	110.3712478	16	18	12	1
Kota Yogyakarta	Gondomanan	Prawirodirjan	-7.800 84825	110.3664578	17	24	21	1
Kota Yogyakarta	Jetis	Bumijo	-7.7848352	110.3594767	18	27	15	1
Kota Yogyakarta	Kotagede	Prenggan	-7.8207434	110.3974193	9	6	15	1
Kota Yogyakarta	Kraton	Panembahan	-7.8086288	110.3661821	12	15	17	1
Kota Yogyakarta	Kraton	Kadipaten	-7.807 83795	110.3591871	17	10	13	1
Kota Yogyakarta	Kraton	Patehan	-7.810 90445	110.3607098	17	10	9	1
Kota Yogyakarta	Mantrijeron	Gedongkiwo	-7.8171586	110.3540101	16	3	9	1
Kota Yogyakarta	Mantrijeron	Suryodiningratan	-7.819 75655	110.3591406	14	5	19	1
Kota Yogyakarta	Mantrijeron	Mantrijeron	-7.818 06685	110.3597312	14	6	20	1
Kota Yogyakarta	Mergangsan	Brontokusuman	-7.8216755	110.3720775	9	9	18	1
Kota Yogyakarta	Mergangsan	Keparakan	-7.811 90505	110.3713592	39	17	13	1
Kota Yogyakarta	Mergangsan	Wirogunan	-7.8088261	110.376306	41	7	9	1
Kota Yogyakarta	Ngampilan	Ngampilan	-7.802 18335	110.3576152	27	10	5	1
Kota Yogyakarta	Ngampilan	Notoprajan	-7.804 76795	110.3549974	30	9	6	1
Kota Yogyaka	Pakualaman	Gunungketur	-7.799	110.3786366	27	25	13	1

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Kota Yogyakarta	Pakualaman	Purwokinanti	-7.792 98975	110.37 545	6	23	12	1
Kota Yogyakarta	Tegalrejo	Bener	-7.776 13145	110.35 23934	18	5	4	1
Kota Yogyakarta	Tegalrejo	Karangwaru	-7.774 26865	110.36 41123	28	12	11	1
Kota Yogyakarta	Tegalrejo	Kricak	-7.773 404	110.35 69328	13	8	5	1
Kota Yogyakarta	Tegalrejo	Tegalrejo	-7.780 45495	110.35 5073	24	14	2	1
Kota Yogyakarta	Umbulharjo	Pandeyan	-7.818 31055	110.38 84081	14	7	9	1
Kota Yogyakarta	Umbulharjo	Warungboto	-7.808 21305	110.39 02059	26	7	15	1
Kota Yogyakarta	Umbulharjo	Mujamuju	-7.798 6723	110.39 27106	29	30	3	1
Kota Yogyakarta	Umbulharjo	Semaki	-7.797 8461	110.38 37372	25	28	5	1
Kota Yogyakarta	Umbulharjo	Tahunan	-7.806 7426	110.38 31715	13	9	7	1
Kota Yogyakarta	Wirobrajan	Pakuncen	-7.796 96465	110.35 11308	20	9	3	1
Kota Yogyakarta	Wirobrajan	Wirobrajan	-7.802 6238	110.35 04467	22	4	3	1

Aggregated Cluster 2 to Subdistrict level

Sub_District	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Customer_to_Competitor_r
Gondokusuman	27	18	4	11.25
Wirobrajan	42	13	6	9.166666667
Ngampilan	57	19	11	6.909090909
Tegalrejo	83	39	22	5.545454545
Umbulharjo	107	81	39	4.820512821
Pakualaman	33	48	25	3.24
Danurejan	28	53	26	3.115384615
Mergangsan	89	33	40	3.05
Jetis	18	27	15	3

Mlati	32	5	13	2.846153846
Cangkringan	20	9	12	2.416666667
Gondomanan	33	42	33	2.272727273
Kraton	46	35	39	2.076923077
Depok	32	29	43	1.418604651
Gedongtengen	8	16	17	1.411764706
Mantrijeron	44	14	48	1.208333333
Kotagede	9	6	15	1

Cluster 3

Regency	Sub_District	Village	Latitude	Longitude	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Cluster_Label
Kota Yogyakarta	Danurejan	Suryatmajan	-7.79283925	110.3673405	13	34	44	2
Kota Yogyakarta	Gedongtengen	Sosromenduran	-7.78933775	110.3633763	12	33	46	2
Kota Yogyakarta	Gondokusuman	Demangan	-7.78487125	110.3900292	34	31	35	2
Kota Yogyakarta	Gondokusuman	Klitren	-7.783821	110.3833898	28	28	29	2
Kota Yogyakarta	Gondokusuman	Kotabaru	-7.7868301	110.3734326	33	42	31	2
Kota Yogyakarta	Gondokusuman	Terban	-7.7792947	110.3755437	18	50	50	2
Kota Yogyakarta	Jetis	Cokrodiningratan	-7.7784096	110.3679234	17	26	34	2
Kota Yogyakarta	Jetis	Gowongan	-7.7859455	110.3659155	22	42	50	2

Cluster 3 aggregated to subdistrict level

Sub_District	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Customer_to_Competitor_r
Gondokusuman	113	151	145	1.820689655
Jetis	39	68	84	1.273809524
Danurejan	13	34	44	1.068181818
Gedongtengen	12	33	46	0.97826087

Top villages to consider

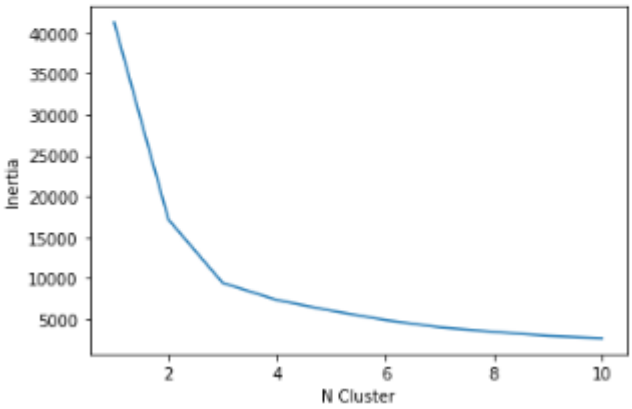
Sub_District_x	Village	Latitude	Longitude	Number_College_Venues	Number_Office_Venues	Number_Coffee_Venues	Cluster_Label	Customer_to_Competitor_r	Total_Population x1000
Tegalrejo	Tegalrejo	-7.78045495	110.355073	24	14	2	1	19	6.54
Berbah	Tegaltirto	-7.8054225	110.4417249	13	0	0	0	14	8.833
Gondokusuman	Baciro	-7.7934704	110.3829725	27	18	4	1	11.25	8.927
Wirobrajan	Pakuncen	-7.79696465	110.3511308	20	9	3	1	9.666666667	7.712
Wirobrajan	Wirobrajan	-7.8026238	110.3504467	22	4	3	1	8.666666667	6.749
Ngampilan	Ngampilan	-7.80218335	110.3576152	27	10	5	1	7.4	7.367
Ngampilan	Notoprajan	-7.80476795	110.3549974	30	9	6	1	6.5	5.798
Tegalrejo	Bener	-7.77613145	110.3523934	18	5	4	1	5.75	3.529
Berbah	Kalitirto	-7.7951322	110.4553582	4	0	0	0	5	9.692
Tegalrejo	Kricak	-7.773404	110.3569328	13	8	5	1	4.2	9.443
Berbah	Sendangtirto	-7.82044215	110.4313663	8	0	2	0	4	12.59
Berbah	Jogotirto	-7.8129504	110.4720599	2	0	1	0	2	7.8

Elaboration

To solve the business problem, this research using unsupervised machine learning taks named clustering technique with Kmeans algorithm as the approach. Kmeans is one of unsupervised algorithm that works by assigning similarity of data characteristics to the cluster center (centroid), kmeans is highly dependant on distance metrics to determine the similarity between data points and when assigning data points to its centroid. Kmeans algorithm need number of clusters as essential parameter to get the clustering done. Since there is no initial business problem stated on how many cluster to find, this research using elbow method from inertia (density) of a cluster to find best cluster.

```
[41283.48091603054,
 17180.796726190478,
 9430.934865900384,
 7349.295977011496,
 6033.778365045807,
 4885.949741315595,
 4006.184756532719,
 3451.7106767549394,
 2962.193342391304,
 2668.693342391304]
```

Inertia of n_cluster



From the elbow method conducted above, the best number of cluster for this dataset is 3, therefore Kmeans with n_clusters of 3 will be implied to the dataset. Dataset contain three features of every villages, which are number of college university, number of office building, and number for coffee shop (competitors) nearby.

Result of clustering that applied to are shown above table. To get better understanding to analyze cluster label results, a particular heuristic method used which is calculating sum of potential customer to competitor ratio.

$$r = \frac{SUM\left(\begin{array}{c}\text{Number of College}\\+\\\text{Number of Office}\end{array}\right)}{\text{Number of Competitor}}$$

- ratio of potential customers to competitors in cluster 1 = 17 : 10
- ratio of potential customers to competitors in cluster 2 = 29 : 10
- ratio of potential customers to competitors in cluster 3 = 3 : 2

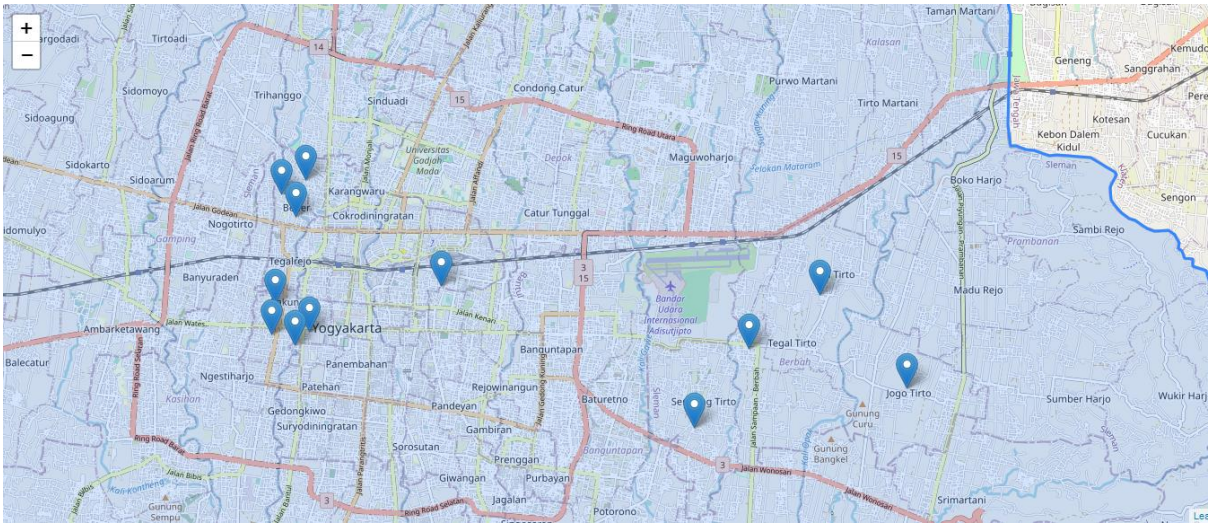
In summary, the **formula means the higher the ratio is the better will be** for the business because the business will have more potential customers and less competitors nearby location. Cluster 1 has moderate customer to competitor ratio, cluster 2 has most customer to competitor ratio, and cluster 3 has least customer to competitor ratio. At a glance cluster 2 and cluster 1 village location is worth taking, but further analysis might have more clarity and more satisfy the problem solution.

Using the customer to competitor ratio and from the table shown above, we may conclude **best sub-districts** which are;

- Gondokusuman with 11.25
- Wirobrajan with 9.17
- Berbah 9.0
- Ngampilan 6.9
- Tegalrejo 5.6

Due to the business objective to provide location options at the village level, we will deep dive from the best subdistricts into village level. Above table is showing the top villages with highest customer to competitor ratio with addition of total population in the village.

Yogyakarta is a province where the population is mostly immigrants like college students, entrepreneurs, workers, and others. **The total population in the village data can be a gross minimum of potential customers to the establishment**.



(Recommended Location for Establishment)

Chapter V
Discussion

5.1 Discussion

The top ten villages recommendation are Tegalrejo, Tegaltirto, Baciro, Pakuncen, Wirobrajan, Ngampilan, Notoprajan, Bener, Kalitirto, Kricak, Sendangtirto, Jogotirto. The results choosen from several consideration such as finest cluster customer to competitor ratio, finest subdistrict customer to competitor ratio, and finally the finest village customer to competitor ratio. High value of customer to competitor ratio is one of the factors leading to business success and generating provit, other factors of successful business such as quality of product, operation management, asset management, etc are beyond consideration of this research.

Despite the results might have answered the business problem and questions, the results may be accepted or rejected by the decision maker of the business stakeholders due to other factors such as the location captialization is too expensive or beyond affordable or the location is just not suit to open coffee shop business.

5.2 Possible Flaw

- Foursquare API isnt that powerful in Indonesia, hence the location of venues are not fully show its potentials.
- Venues response of Foursquare API might not relevant to the query's categoryId
- Consideration factors to determine a cluster too simple, only three (college venues, office venues, and coffee shop venues)
- Location with better customer to competitor ratio might be exist and not choosen due to angle of point of view.
- Different Kmeans parameter might yield different results. Like n_init, centroid algorithm, and n_cluster

Chapter VI
Conclusion

6.1 Conclusion

Attempting to find strategic location to establish coffee shop within Yogyakarta in village level position can be done with geo spatial visualization combined with unsupervised machine learning task: clustering technique. The results of this research paper are: Tegalrejo with customer to competitor ratio 19.0, Tegaltirto with customer to competitor ratio 14.0, Baciro with customer to competitor ratio 11.25, Pakuncen with customer to competitor ratio 9.7, Wirobrajan with customer to competitor ratio 8.7, Ngampilan with customer to competitor ratio 7.4, Notoprajan with customer to competitor ratio 6.5, Bener with customer to competitor ratio 5.75, Kalitirto with customer to competitor ratio 5.0, Kricak with customer to competitor ratio 4.2, Sendangtirto with customer to competitor ratio 4, and Jogotirto with customer to competitor ratio 2.

6.2 Further Research

- using google places API
- increase clustering consideration factor (variables)
- further research on different clustering algorithms
- add more risk factor beside number of competitor

References

Urls:

a. https://id.wikipedia.org/wiki/Daftar_kapanewon,_kemantren,_kalurahan,_dan_kelurahan_di_Daerah_Istimewa_Yogyakarta
b. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/3/71/34.ez
c. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/07/71/34.ez
d. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/8/04/34.ez
e. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/6/71/34.ez
f. https://kependudukan.jogjaprov.go.id/statistik/penduduk/golonganusia/15/produktif/01/71/34.ez

tools:

a. Python 3
b. Jupyter environment
c. Google colabs
d. Foursquare API
e. Nominatim openstreetmap
f. Github

Python libraries and packages:

a. Pandas
b. Numpy
c. Matplotlib
d. Folium
e. Beautiful soup
f. Json
g. Requests
h. Scikit-learn

i. Joblib
j. Pickle

Project file:

a. Strategic_Branch_Estabilishment.ipynb
b. Top5_subdistricts_demographics_webscrape.ipynb
c. Coffee_NewBranch_Kmeans_cluster.pkl
d. YK_geojson.geojson
e. Strategic_place_to_establish.html
f. Summary villages recommendation.csv
g. Village Cluster Map.html
h. Productive_population_15to64_of_top5_subdistricts.csv
i. Complete_data_strategic_establishment.csv
j. Final_Data_SLE_YK.csv
k. Sleman_Yogyakarta_village.html