



Clustering European Capitals

Clustering Goals



- Identify the similarity or dissimilarity of the European Capitals based on its venues categories.
- Identify which of these capitals are more similar with the city of Toronto.

Data Acquisition



- [Wikipedia](#) page scraped to get all the European capitals. **Kosovo** capital and **Vatican city** were not included in this project.
- [Foursquare API](#) used to get a almost 700 venues for each capital.
- Duplicates were dropped.
- Total of 25322 venues collected.

Data Cleaning and Preparation



- Each Venue Category transformed in a feature.
- Similar Features were merged .
- Frequency(Mean) of each Venue Category was calculated for each capital.
- Categories that appears in the ‘Top 10 most frequent venue list’ in 40 or more capitals were disregarded.

Clustering



- K-Means Algorithm from [sklearn library](#) was used.
- European Capitals were separated into 10 different clusters

Cluster 1

	Country	Capital	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	Austria	Vienna	Plaza	Austrian Restaurant	Restaurant	Cocktail Bar	Bar	Theater	History Museum	Concert Hall	Zoo Exhibit	Italian Restaurant
1	Czech Republic	Prague	Theater	Cocktail Bar	Pub	Wine Bar	Zoo Exhibit	Clothing Store	Italian Restaurant	Plaza	Art Gallery	Restaurant
2	France	Paris	Wine Bar	Plaza	Cocktail Bar	French Restaurant	Art Museum	Garden	Bar	Tea Room	Museum	Clothing Store
3	Georgia	Tbilisi	Plaza	Caucasian Restaurant	Restaurant	Bar	Outdoor Sculpture	Wine Bar	Theater	Bakery	Pub	Shopping Mall
4	Germany	Berlin	Bar	Cocktail Bar	Wine Bar	Plaza	Clothing Store	Indie Movie Theater	History Museum	Organic Grocery	Art Museum	Art Gallery
5	Hungary	Budapest	Bar	Theater	Grocery Store	Wine Bar	Plaza	Pub	Italian Restaurant	Gastropub	History Museum	Scenic Lookout
6	Malta	Valletta	Mediterranean Restaurant	History Museum	Plaza	Beach	Bar	Italian Restaurant	Bay	Clothing Store	Restaurant	Grocery Store
7	Poland	Warsaw	Theater	Cocktail Bar	Plaza	Bar	History Museum	Beer Bar	Market	Clothing Store	Shopping Mall	Grocery Store
8	Portugal	Lisbon	Portuguese Restaurant	Plaza	Bar	Wine Bar	Theater	Scenic Lookout	Museum	History Museum	Restaurant	Garden
9	Russia	Moscow	Theater	Gourmet Shop	Plaza	Cocktail Bar	Wine Bar	Shopping Mall	Bar	Convenience Store	Gastropub	Art Museum
10	Spain	Madrid	Plaza	Bar	Spanish Restaurant	Restaurant	Tapas Restaurant	Theater	Cocktail Bar	Art Museum	Art Gallery	Grocery Store
11	Ukraine	Kiev	Cocktail Bar	Dance Studio	Theater	Hookah Bar	Bar	Wine Bar	Caucasian Restaurant	Art Gallery	Plaza	Bakery
12	United Kingdom	London	Theater	Cocktail Bar	Pub	Clothing Store	Art Gallery	Plaza	Grocery Store	Wine Bar	Movie Theater	Hotel Bar

Cluster 2

	Country	Capital	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	Andorra	Andorra la Vella	Restaurant	Ski Area	Plaza	Ski Chairlift	Bar	Pub	Clothing Store	Perfume Shop	Sporting Goods Shop	Ski Trail
1	Liechtenstein	Vaduz	Restaurant	Grocery Store	Swiss Restaurant	Bar	Ski Area	Shopping Mall	Clothing Store	Trail	Gastropub	Ski Chairlift
2	Montenegro	Podgorica	Restaurant	Bar	Cosmetics Shop	Pub	Pizza Place	Italian Restaurant	Market	Lounge	Athletics & Sports	Furniture / Home Store

Cluster 4

	Country	Capital	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	Armenia	Yerevan	Restaurant	Pub	Plaza	Grocery Store	Shopping Mall	Clothing Store	Bakery	Theater	Museum	Italian Restaurant
1	Azerbaijan	Baku	Lounge	Restaurant	Pub	Movie Theater	Tea Room	Grocery Store	Shopping Mall	Concert Hall	Italian Restaurant	Big Box Store
2	Belarus	Minsk	Shopping Mall	Big Box Store	Movie Theater	Theater	Grocery Store	Restaurant	Hookah Bar	Bookstore	Concert Hall	Bar
3	Estonia	Tallinn	Restaurant	Museum	Grocery Store	History Museum	Scenic Lookout	Wine Bar	Shopping Mall	Movie Theater	Trail	Beach
4	Ireland	Dublin	Pub	Museum	Clothing Store	Theater	Restaurant	Grocery Store	Movie Theater	Italian Restaurant	Art Gallery	History Museum
5	Lithuania	Vilnius	Art Gallery	Museum	Bar	Restaurant	Grocery Store	Theater	Pub	Plaza	Clothing Store	Cocktail Bar
6	Moldova	Chișinău	Pub	Bar	Theater	Electronics Store	Romanian Restaurant	Bakery	Athletics & Sports	Mobile Phone Shop	Lake	Plaza
7	Romania	Bucharest	Theater	Pub	Restaurant	Multiplex	Lounge	Art Gallery	Italian Restaurant	Plaza	History Museum	Shopping Mall
8	Slovakia	Bratislava	Art Gallery	Pub	Theater	Wine Bar	Bar	Plaza	Clothing Store	Vegetarian / Vegan Restaurant	Brewery	Italian Restaurant
9	Turkey	Ankara	Pub	Bar	Theater	Dance Studio	Shopping Mall	Music Venue	Grocery Store	History Museum	Art Gallery	Restaurant

Cluster 5



	Country	Capital	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	Luxembourg	Luxembourg	Italian Restaurant	Campground	French Restaurant	Bar	Shopping Mall	Restaurant	Bakery	Castle	Pizza Place	Scenic Lookout

Cluster 6



	Country	Capital	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	Denmark	Copenhagen	Grocery Store	Cocktail Bar	Theater	Music Venue	Scandinavian Restaurant	Plaza	Wine Bar	Beer Bar	Bar	Bakery
1	Finland	Helsinki	Grocery Store	Scandinavian Restaurant	Bar	Theater	Art Museum	Bakery	History Museum	Dance Studio	Wine Bar	Pizza Place
2	Iceland	Reykjavik	Bar	Grocery Store	Seafood Restaurant	Pool	Restaurant	Theater	Pizza Place	Art Museum	Scandinavian Restaurant	Burger Joint
3	Norway	Oslo	Grocery Store	Bar	History Museum	Theater	Bakery	Cocktail Bar	Ski Lodge	Music Venue	Movie Theater	Burger Joint
4	Sweden	Stockholm	Scandinavian Restaurant	Grocery Store	Plaza	Theater	Museum	Movie Theater	Art Gallery	History Museum	Bakery	Cocktail Bar
5	Switzerland	Bern	Plaza	Bar	Swiss Restaurant	Grocery Store	Restaurant	Italian Restaurant	Shopping Mall	Movie Theater	Bakery	Scenic Lookout

Cluster 7



	Country	Capital	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	Monaco	Monaco	Beach	French Restaurant	Italian Restaurant	Bar	Restaurant	Museum	Art Museum	Clothing Store	Garden	Mediterranean Restaurant

Cluster 8



	Country	Capital	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	Albania	Tirana	Bar	Shopping Mall	Italian Restaurant	Cocktail Bar	Plaza	Restaurant	Eastern European Restaurant	Nightclub	Lounge	Pizza Place
1	Bosnia and Herzegovina	Sarajevo	Shopping Mall	Restaurant	Eastern European Restaurant	Bar	History Museum	Pub	Grocery Store	Plaza	Italian Restaurant	Hookah Bar
2	Kazakhstan	Astana	Shopping Mall	Restaurant	Electronics Store	Italian Restaurant	Asian Restaurant	Grocery Store	Hotel Bar	Plaza	Eastern European Restaurant	Bar

Cluster 9



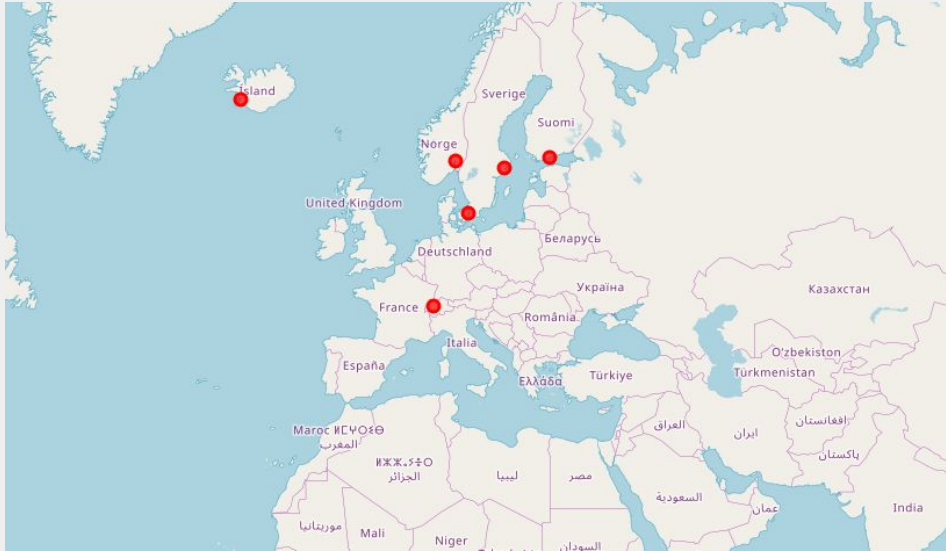
	Country	Capital	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Greece	Athens	Bar	Theater	Cocktail Bar	Clothing Store	Plaza	Movie Theater	Greek Restaurant	Electronics Store	Historic Site	History Museum

Cluster 10

	Country	Capital	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	Belgium	Brussels	Bar	Plaza	Sandwich Place	Italian Restaurant	Tea Room	Concert Hall	Wine Bar	Art Museum	Cocktail Bar	History Museum
1	Bulgaria	Sofia	Bar	Bakery	Restaurant	Theater	Italian Restaurant	Cocktail Bar	Dance Studio	Dessert Shop	Art Gallery	Plaza
2	Croatia	Zagreb	Bar	Plaza	Restaurant	Theater	Grocery Store	Dessert Shop	Museum	Trail	BBQ Joint	Pub
3	Cyprus	Nicosia	Bar	Music Venue	Restaurant	Theater	Art Gallery	Nightclub	Soccer Field	Dance Studio	Sandwich Place	History Museum
4	Latvia	Riga	Bar	Restaurant	Shopping Mall	Concert Hall	Clothing Store	History Museum	Bakery	Museum	Theater	Eastern European Restaurant
5	Netherlands	Amsterdam	Bar	Marijuana Dispensary	Restaurant	Museum	Yoga Studio	Art Museum	Clothing Store	Plaza	Music Venue	Sandwich Place
6	North Macedonia	Skopje	Bar	Lounge	Restaurant	Grocery Store	Shopping Mall	Market	Bakery	Plaza	BBQ Joint	Pizza Place
7	Serbia	Belgrade	Bar	Restaurant	Art Gallery	Theater	Museum	Cosmetics Shop	Jazz Club	Pizza Place	Plaza	Farmers Market
8	Slovenia	Ljubljana	Bar	Convenience Store	Restaurant	Plaza	Grocery Store	Theater	Pub	Art Gallery	Trail	Eastern European Restaurant

Comparison with Toronto

Capital	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 Toronto	Grocery Store	Bar	Theater	Movie Theater	Art Gallery	Music Venue	Clothing Store	Gastropub	Beer Bar	Italian Restaurant



- Model Classified Toronto in the Cluster Number 6.

Conclusion and Future Ideias



- Built a model to cluster the European Capitals by its Venues Categories.
- Identified which European capitals Toronto has more similarity based on its venues.
- Future Ideas include: Change the number of clusters, utilize other cluster algorithms, utilize other parameters for comparison like quality living or cost living.