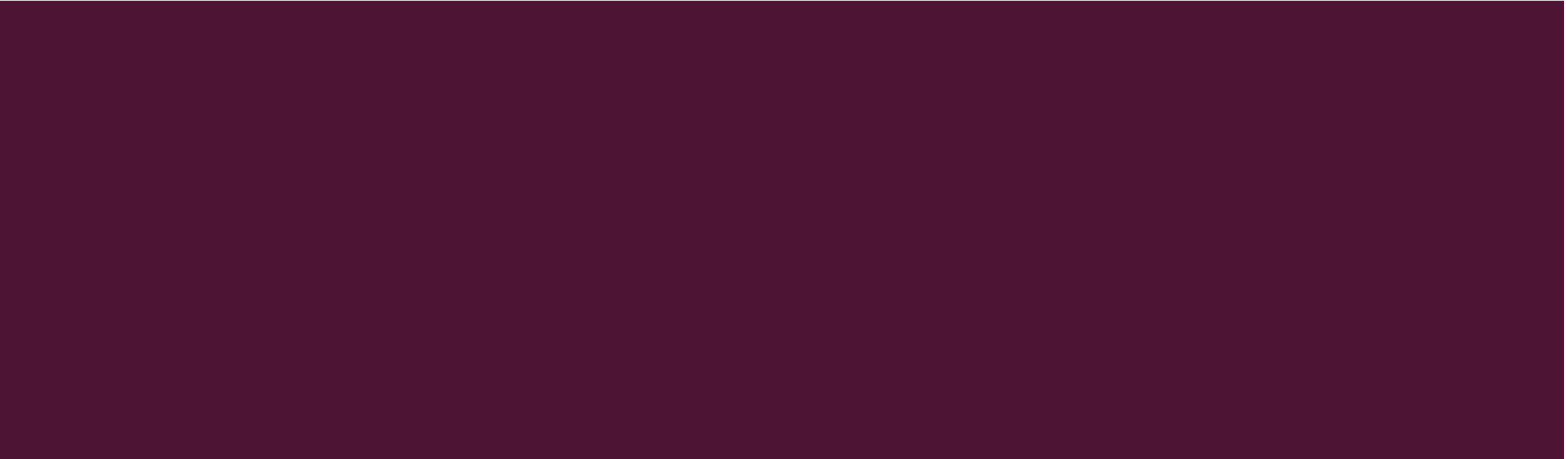# CAPSTONE PROJECT: EINDHOVEN CLUSTERS

DIFFERENCE BETWEEN VARIOUS REGIONS AND CONSEQUENCES FOR BUSINESS

INTRODUCTION

- Eindhoven is one of the fastest growing regions in Europe due to its status as the "Brainport"

- The city attracts talent from across the globe to come live and work

- This growth brings with it the possibility of increased economic output which is good for businesses in the city

- However, if you were a business in the city, where would you expand to or want to establish yourself?

- The aim of this project is to identify the areas in the city that are most identical using K-means clustering.

DATA (1/2)

- Two data sources are used:
  - Eindhoven local directory database
  - Foursquare API venue data

	Postcode	Neighborhood	District Code	District Name	Latitude	Longitude
0	5612.0	Limbeek-Noord	4	Stadsdeel Woensel-Zuid	51.450079	5.462462
1	5641.0	't Hofke	3	Stadsdeel Tongelre	51.448921	5.518855
2	5644.0	Kerstroosplein	2	Stadsdeel Stratum	51.419342	5.495323
3	5622.0	Barrier	4	Stadsdeel Woensel-Zuid	51.463883	5.460216
5	5624.0	Prinsejagt	5	Stadsdeel Woensel-Noord	51.463879	5.458593
6	5621.0	Woensel-West	4	Stadsdeel Woensel-Zuid	51.452878	5.456117
8	5643.0	Kruidenbuurt	2	Stadsdeel Stratum	51.419250	5.500829
9	5614.0	Tuindorp	2	Stadsdeel Stratum	51.429579	5.494769
10	5632.0	Heesterakker	5	Stadsdeel Woensel-Noord	51.484700	5.498735
11	5615.0	Bloemenplein	2	Stadsdeel Stratum	51.427301	5.486916
18	5629.0	Blixembosch-West	5	Stadsdeel Woensel-Noord	51.490877	5.465886

Overview of local directory data

DATA (2/2)

- The Foursquare API data did not have a lot of venue data for all postal codes.

- In total, only 10 postal codes are present in the venue data

- This leaves us with a limited scope to conduct our research

- Letter codes are removed from the postal code data to leave the postal region which will be used as the basis of analysis for this project.

	name	categories	lat	lng	postalCode	city
0	Yoghurt Barn Eindhoven	Frozen Yogurt Shop	51.440187	5.478956	5611 DB	Eindhoven
1	De Bierbrigadier	Beer Store	51.436422	5.476816	NaN	Eindhoven
2	DENF Coffee	Coffee Shop	51.439165	5.474124	NaN	Eindhoven
3	De Vooruitgang	Restaurant	51.439171	5.478755	5611 EB	Eindhoven
4	The Student Hotel	Hotel	51.441995	5.480799	5611 AA	Eindhoven

Overview of local directory data

EXPLORING THE DATA

Postcode	city	Afghan Restaurant	Asian Restaurant	Bagel Shop	Bar	Bed & Breakfast	Beer Store	Bookstore	Breakfast Spot	Brewery	...
5654	1	1	1	1	1	1	1	1	1	1	...
5652	1	1	1	1	1	1	1	1	1	1	...
5644	1	1	1	1	1	1	1	1	1	1	...
5617	7	7	7	7	7	7	7	7	7	7	...
5616	8	8	8	8	8	8	8	8	8	8	...
5615	7	7	7	7	7	7	7	7	7	7	...
5614	1	1	1	1	1	1	1	1	1	1	...
5613	4	4	4	4	4	4	4	4	4	4	...

Spread of venues over postal codes

categories	
Restaurant	6
French Restaurant	5
Bar	4
Coffee Shop	4
Brewery	3
...	...
Gastropub	1
Asian Restaurant	1
Grocery Store	1
Gym	1

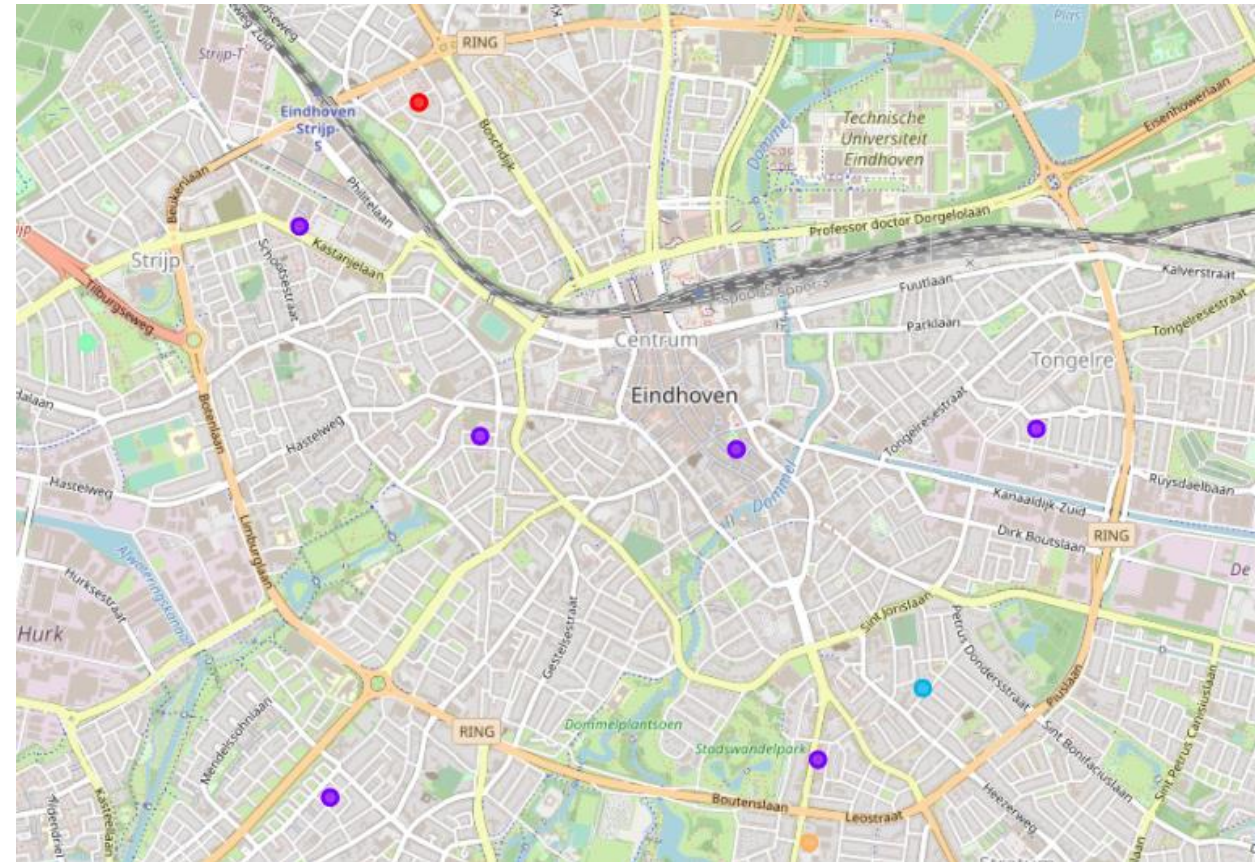Frequency of venue categories

REGION PROFILES

- The most common venues for each postal code is found and categorized based on their frequency per postal code

- This will be the information used to identify similar locations.

	Postcode	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	5611	Restaurant	French Restaurant	Brewery	Hotel	Café	Pub	Multiplex	Coffee Shop	Breakfast Spot	Bar
1	5612	College Gym	Cigkofte Place	Vegetarian / Vegan Restaurant	Cocktail Bar	Food Court	Flea Market	Fish & Chips Shop	Fast Food Restaurant	Ethiopian Restaurant	Electronics Store
2	5613	Supermarket	History Museum	Café	Restaurant	Vegetarian / Vegan Restaurant	Department Store	Coffee Shop	College Gym	Concert Hall	Deli / Bodega
3	5614	Movie Theater	Vegetarian / Vegan Restaurant	French Restaurant	Flea Market	Fish & Chips Shop	Fast Food Restaurant	Ethiopian Restaurant	Electronics Store	Drugstore	Discount Store
4	5615	Theater	Asian Restaurant	Supermarket	Bar	French Restaurant	Fast Food Restaurant	Chinese Restaurant	Electronics Store	Discount Store	Concert Hall
5	5616	Movie Theater	Supermarket	Sporting Goods Shop	Electronics Store	Grocery Store	Restaurant	Climbing Gym	Coffee Shop	Concert Hall	Clothing Store
6	5617	Deli / Bodega	Ice Cream Shop	Office	Skate Park	Rock Club	Restaurant	Hotel Bar	Vegetarian / Vegan Restaurant	Coffee Shop	College Gym
7	5644	History Museum	Vegetarian / Vegan Restaurant	French Restaurant	Flea Market	Fish & Chips Shop	Fast Food Restaurant	Ethiopian Restaurant	Electronics Store	Drugstore	Discount Store
8	5652	Supermarket	Vegetarian / Vegan Restaurant	Clothing Store	Flea Market	Fish & Chips Shop	Fast Food Restaurant	Ethiopian Restaurant	Electronics Store	Drugstore	Discount Store
9	5654	French Restaurant	Asian Restaurant	Cocktail Bar	Food Court	Flea Market	Fish & Chips Shop	Fast Food Restaurant	Ethiopian Restaurant	Electronics Store	Drugstore

Postal codes with their most frequent venues

RESULTS

- 5 separate clusters are identified

- Cluster 1 (purple/dark blue) appears to be predominant for regions within the city ring

- The other clusters are close to the edges of the city ring or beyond it

CONCLUSION

- Regions within the city ring tend to be similar

- The closer you get to the edges of the city ring or beyond it, the more unique the composition of the regions are

- For an established business within the city ring, it is therefore strategically similar to expand within the ring. Regions further away are unique compared to one another and require a different approach for expansion.

- However, the venue data limits the scope of this project and the final conclusions may differ if a different venue data source is used.