# THE BATTLE OF NEIGHBOURHOODS

## Edinburgh and Glasgow

Two major cities in Scotland

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- Edinburgh and Glasgow are the two major cities in Scotland, situated one in the East side and other in the West side of the country.

  - Edinburgh is Scotland's second most populous city and the seventh most populous in the United Kingdom. Main tourism destination of Scotland.

  - Glasgow is the most populous city in Scotland, and the third most populous city in the United Kingdom. Urban and Modern Glasgow in a major centre of business and residency in Scotland.

- There is a historical rivalry between these great cities, and both competing in public services, entertainment, touristic attractions, and in attracting businesses to their constituencies.

# EDINBURGH AND GLASGOW

- This report aims to analyse these two great neighbour cities, based on data available online, their business and services, to understand the difference or commonalities of both, and their future development.

- The main objective is to understand how wide is the difference of both cities (Edinburgh and Glasgow), neighbourhoods similarities and differences, top businesses flourishing (in numbers), understanding the population and their behaviour pattern, along with type of businesses that are popular (and the least ones) in their neighbourhoods

- The target audience for this analysis are, city business developers, local authorities, local people (to understand the facilities provided by their cities and their differences), people intending to re-locate to these cities, people that look for new business opportunities.

# HOW SIMILAR (OR DIFFERENT) ARE THESE CITIES?

- The datasets used to analyse the city of Edinburgh and Glasgow comes from the following data sources:
  - City postcodes, provided by Wikipedia containing each city postcodes and their catchment neighbourhoods
  - City postcodes location (latitude, longitude), provided by freemaptools
  - Information of local businesses, types and locations for each city postcode area, obtained using Foursquare API, via a subscription to the Foursquare site.

# DATA ACQUISITION AND CLEANING

This process involved two steps:

- First step - Postcode data, with the longitude and latitude for both cities. From freemaptools website, a single CSV file containing all the postcodes for the UK. Dataset contained 3003 rows and 4 columns. The column id, was dropped.

- Second step - download information from the Wikipedia page of postcodes belonging to Edinburgh and Glasgow. BeautifulSoup library used for data extraction.

  - A pandas dataframe with three columns (postcode, post town, neighbourhood) was the result of the clean and transformation process in this step.

- From the above processes, three datasets were resulted:

  - UK Postcodes with longitude and latitude

  - Postcodes with neighbourhoods for Edinburgh

  - Postcodes with neighbourhoods for Glasgow

# DATA ACQUISITION AND CLEANING

Number of Cities' Neighbourhood groups:

- For Edinburgh, 23 neighbourhoods groups based on their postcodes were analysed.

- For Glasgow, 55 neighbourhoods groups based on their postcodes were obtained, however only 50 neighbourhood groups provided available venue data, therefore only 50 were analysed.

# DATA ACQUISITION AND CLEANING

## For the feature selection

▶ A merge of data relevant for Edinburgh and Glasgow was produced based on previous datasets. Below sample datasets

| | postcode | latitude | longitude | post town | neighborhood |
|---|---|---|---|---|---|
| 0 | EH1 | 55.952430 | -3.188400 | EDINBURGH | Old Town, GPO, St. James Centre |
| 1 | EH10 | 55.920770 | -3.209840 | EDINBURGH | A702, Bruntsfield, Morningside, Fairmilehead |
| 2 | EH11 | 55.933870 | -3.248670 | EDINBURGH | A71, Haymarket, Gorgie, Stenhouse, Sighthill, ... |
| 3 | EH12 | 55.942620 | -3.271370 | EDINBURGH | A8, Murrayfield, Corstorphine, Gyle |
| 4 | EH13 | 55.907880 | -3.241440 | EDINBURGH | Colinton, Oxgangs |
| 5 | EH14 | 55.909250 | -3.283080 | BALERNO, CURRIE, EDINBURGH, JUNIPER GREEN | Slateford, Longstone, Wester Hailes, Juniper G... |
| 6 | EH15 | 55.946860 | -3.111360 | EDINBURGH | Portobello, Duddingston |
| 7 | EH16 | 55.922210 | -3.153870 | EDINBURGH | Liberton, Cameron Toll, Craigmillar, Niddrie |
| 8 | EH17 | 55.907040 | -3.142220 | EDINBURGH | Gilmerton, Moredun, Mortonhall |
| 9 | EH2 | 55.954170 | -3.194860 | EDINBURGH | New Town, Princes Street |
| 10 | EH28 | 55.930600 | -3.386240 | NEWBRIDGE | Newbridge, Ratho |
| 11 | EH29 | 55.956520 | -3.398380 | KIRKLISTON | Kirkliston |
| 12 | EH3 | 55.954120 | -3.199670 | EDINBURGH | Queen Street, Stockbridge, West End, Tollcross... |
| 13 | EH30 | 55.984550 | -3.383360 | SOUTH QUEENSFERRY | South Queensferry |
| 14 | EH4 | 55.962530 | -3.257610 | EDINBURGH | Dean Village, Comely Bank, A90, Barnton, Cramo... |

| | postcode | latitude | longitude | post town | neighborhood |
|---|---|---|---|---|---|
| 0 | G1 | 55.860380 | -4.246710 | GLASGOW | Merchant City |
| 1 | G11 | 55.873560 | -4.311420 | GLASGOW | Broomhill, Partick, Partickhill |
| 2 | G12 | 55.880060 | -4.300610 | GLASGOW | West End, Dowanhill, Hillhead, Hyndland, Kelvi... |
| 3 | G13 | 55.893580 | -4.346200 | GLASGOW | Anniesland, Knightswood, Yoker |
| 4 | G14 | 55.880950 | -4.348640 | GLASGOW | Whiteinch, Scotstoun |
| 5 | G15 | 55.909400 | -4.364760 | GLASGOW | Drumchapel |
| 6 | G2 | 55.863820 | -4.254900 | GLASGOW | Blythswood Hill, Anderston |
| 7 | G20 | 55.885800 | -4.281760 | GLASGOW | Maryhill, North Kelvinside, Ruchill |
| 8 | G21 | 55.880630 | -4.220690 | GLASGOW | Balornock, Barmulloch, Cowlairs, Royston, Spri... |
| 9 | G22 | 55.889980 | -4.250020 | GLASGOW | Milton, Parkhouse, Possilpark |
| 10 | G23 | 55.901930 | -4.284310 | GLASGOW | Lambhill, Summerston |
| 11 | G3 | 55.866190 | -4.272620 | GLASGOW | Anderston, Finnieston, Garnethill, Park, Woodl... |
| 12 | G31 | 55.857480 | -4.208190 | GLASGOW | Dennistoun, Haghill, Parkhead |
| 13 | G32 | 55.848400 | -4.162930 | GLASGOW | Carmyle, Tollcross, Mount Vernon, Lightburn, S... |
| 14 | G33 | 55.873510 | -4.165930 | GLASGOW | Cardowan, Carntyne, Craigend, Cranhill, Gartha... |

# DATA ACQUISITION AND CLEANING

## Data Visualisation (Mapping)

- From the data collected and processed for Edinburgh and Glasgow, a visualisation technique is used to plot the locations of the neighbourhood of these two cities.

- The library used is Folium (plot in a geographical map using location  latitude and longitude) of Edinburgh and Glasgow Neighbourhoods.
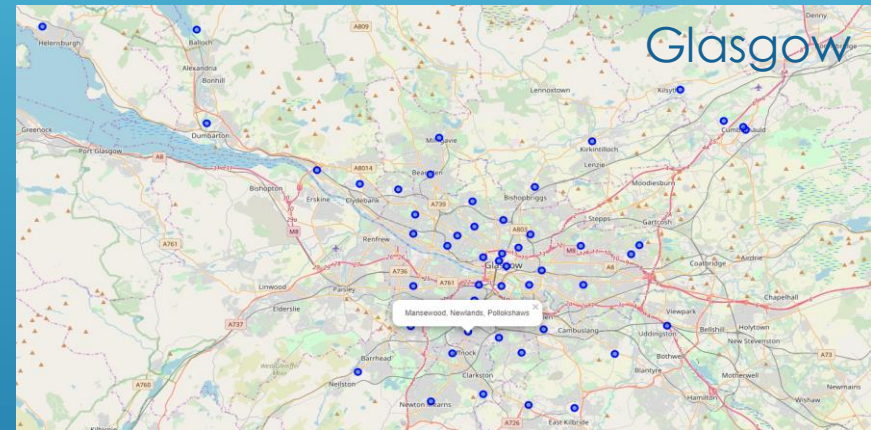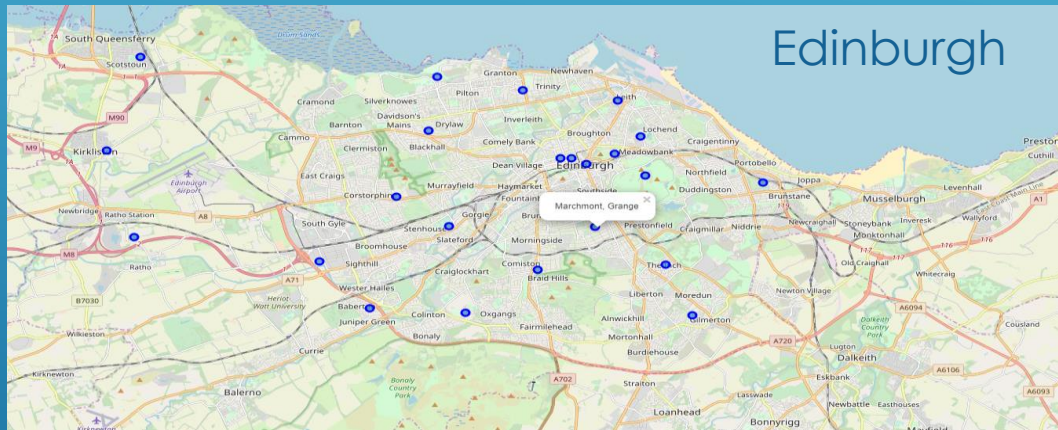


Edinburgh



Glasgow

# METHODOLOGY

## Location-based Data Gathering and Analysis (Foursquare API)

▸ information processed and obtained for each city are: list of business/services provided for each neighbourhood, number of business/services per neighbourhood, frequency of type of business/services per neighbourhood, and the 10 most common venues per neighbourhood.

Edinburgh

| | neighborhood | American Restaurant | Aquarium | Argentinian Restaurant | Art Gallery | Art Museum | Arts & Crafts Store | Asian Restaurant | Auto Garage | Baby Store | ... | Tram Station | Vegetarian / Vegan Restaurant | Whisky Bar | Wine Bar | Wine Shop |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | A702, Bruntsfield, Morningside, Fairmilehead | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | 0.000000 | 0.000000 | 0.000000 | 0.2 |
| 1 | A71, Haymarket, Gorgie, Stenhouse, Sighthill, ... | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.25 | 0.0 | ... | 0.0 | 0.000000 | 0.000000 | 0.000000 | 0.0 |
| 2 | A8, Murrayfield, Corstorphine, Gyle | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 3 | Colinton, Oxgangs | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 4 | Dean Village, Comely Bank, A90, Barnton, Cramo... | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 5 | Gilmerton, Moredun, Mortonhall | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 6 | Granton, Firth of Forth, Ferry Road | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.2 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 7 | Jobcentre Plus | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.1 | ... | 0.1 | | | | |
| 8 | Kirkliston | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 9 | Leith, Newhaven | 0.00 | 0.000000 | 0.00 | 0.037037 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 10 | Liberton, Cameron Toll, Craigmillar, Niddrie | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 11 | Marchmont, Grange | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 12 | New Town, Princes Street | 0.01 | 0.000000 | 0.01 | 0.040000 | 0.01 | 0.0 | 0.01 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 13 | Newbridge, Ratho | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 14 | Old Town, GPO, St. James Centre | 0.00 | 0.000000 | 0.01 | 0.030000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 15 | Portobello, Duddingston | 0.00 | 0.000000 | 0.00 | 0.000000 | 0.00 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |
| 16 | Queen Street, Stockbridge, West End, Tollcross... | 0.01 | 0.000000 | 0.01 | 0.020000 | 0.01 | 0.0 | 0.00 | 0.00 | 0.0 | ... | 0.0 | | | | |

Glasgow

| | neighborhood | American Restaurant | Art Gallery | Asian Restaurant | Athletics & Sports | Auto Garage | BBQ Joint | Bagel Shop | Bakery | Bar | ... | Tennis Court | Thai Restaurant | Theater | Toy / Game Store | Trail | Train Station |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Alexandria, Arrochar, Aldochlay, Ardlui, Ballo... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | 0.0 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 1 | Anderston, Finnieston, Garnethill, Park, Woodl... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.025 | 0.000000 | 0.150000 | ... | 0.0 | 0.000000 | 0.025000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | Anniesland, Knightswood, Yoker | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | 0.0 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 3 | Arden, Carnwadric, Deaconsbank, Giffnock, Kenn... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | 0.0 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 4 | Auldhouse, East Kilbride | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | | | | | | |
| 5 | Baillieston, Bargeddie, Chryston, Garrowhill, ... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | | | | | | |
| 6 | Baldernock, Milngavie, Mugdock | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.090909 | 0.090909 | ... | | | | | | |
| 7 | Balfron, Balmaha, Blanefield, Croftamie, Dryme... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | | | | | | |
| 8 | Balornock, Barmulloch, Cowlairs, Royston, Spri... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | | | | | | |
| 9 | Barrhead, Neilston, Uplawmoor | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | ... | | | | | | |
| 10 | Battlefield, Govanhill, Mount Florida, Strathb... | 0.000000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.000000 | 0.000 | 0.000000 | 0.400000 | ... | 0.2 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.200000 |

# METHODOLOGY

## Location-based Data Gathering and Analysis (Foursquare API)

▶ information processed and obtained for each city are: list of business/services provided for each neighbourhood, number of business/services per neighbourhood, frequency of type of business/services per neighbourhood, and the 10 most common venues per neighbourhood.

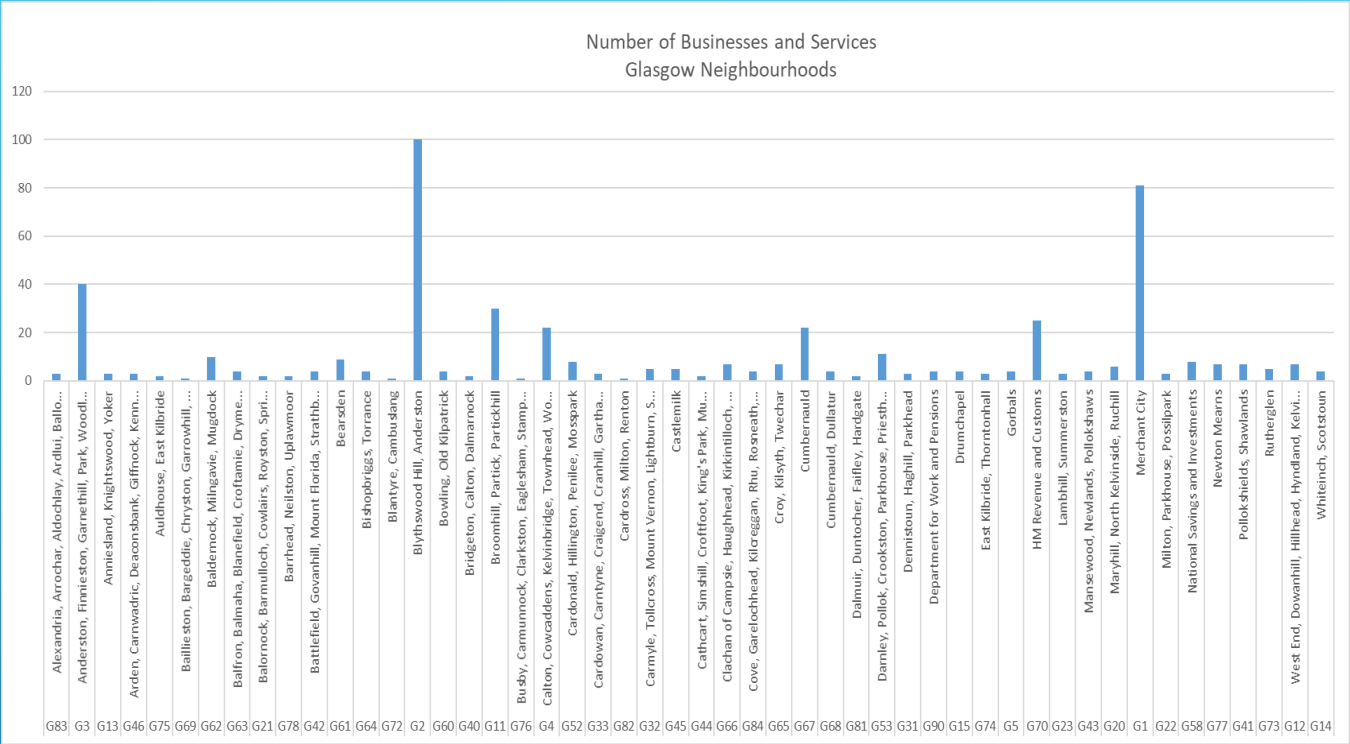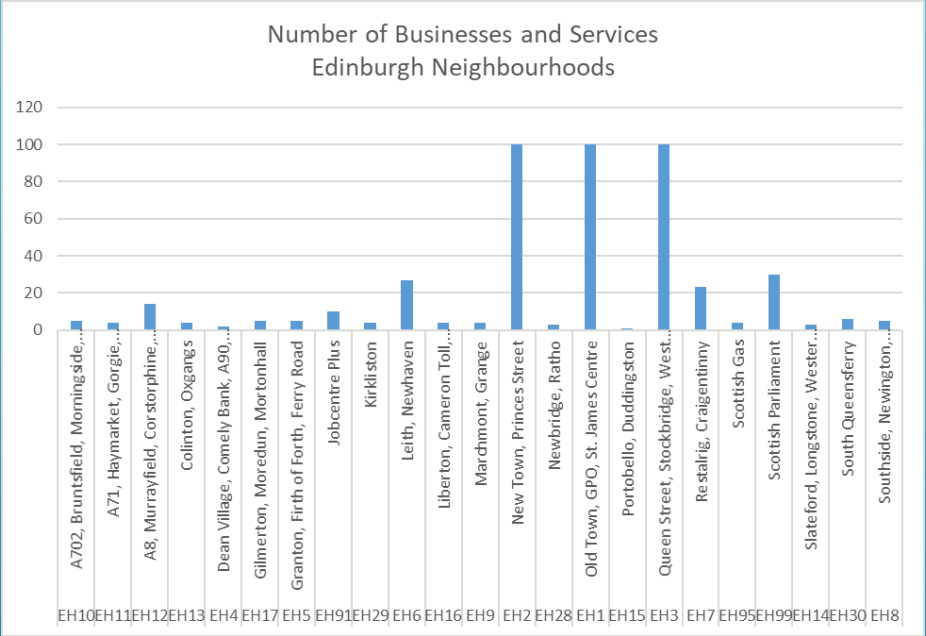

Edinburgh



Glasgow

# METHODOLOGY

**Segmentation and Clustering (K-Means)**

▶ K-Means is an unsupervised learning algorithm used for clustering problems, and popular for cluster analysis in data mining. Various real-world applications, e.g.: customer segmentation, pattern recognition, and, data compression.

▶ The number of clusters used in this project is 5 (K value).

▶ The datasets for Edinburgh and Glasgow used with the K-mean algorithm, were:

  ▶ Each city dataset that was previously grouped in rows by neighbourhood, and by taking the mean of the frequency of occurrence of each business/services category.

  ▶ A new data frame created by using the K-means cluster labels results and the top 10 venues for each city's neighbourhood.
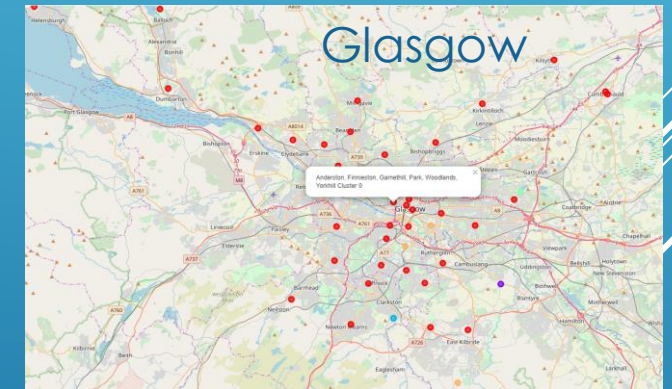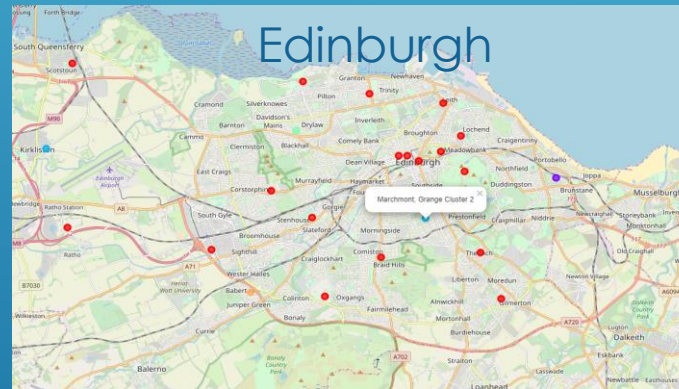
METHODOLOGY

# 1. Business-thrived neighbourhoods



Number of Businesses and Services
Edinburgh Neighbourhoods



Number of Businesses and Services
Glasgow Neighbourhoods

# RESULTS

# 2. Most common business types



Edinburgh Top Most Common Venue



Glasgow Top Most Common Venue

# RESULTS

# 2. Segmenting and clustering neighbourhoods

## Edinburgh





Most popular venues in Edinburgh Neighbourhoods

# RESULTS

## 2. Segmenting and clustering neighbourhoods

Glasgow





Most popular venues in Glasgow Neighbourhoods
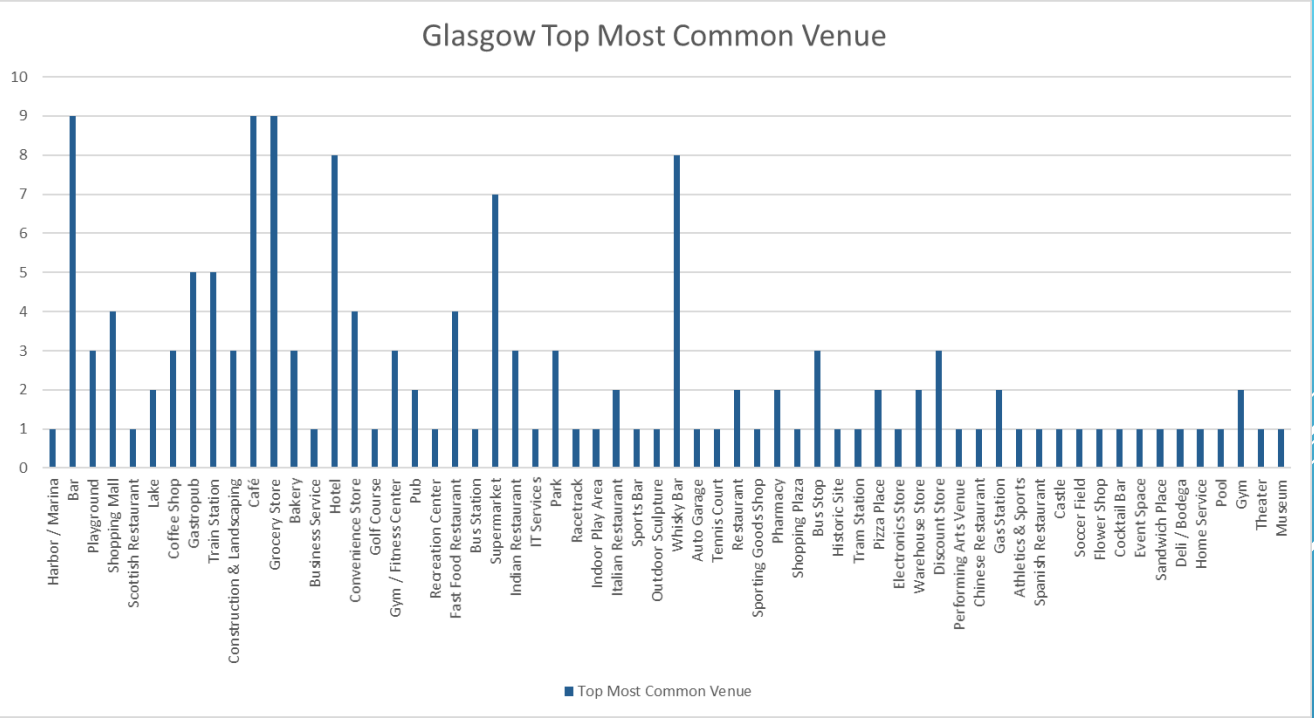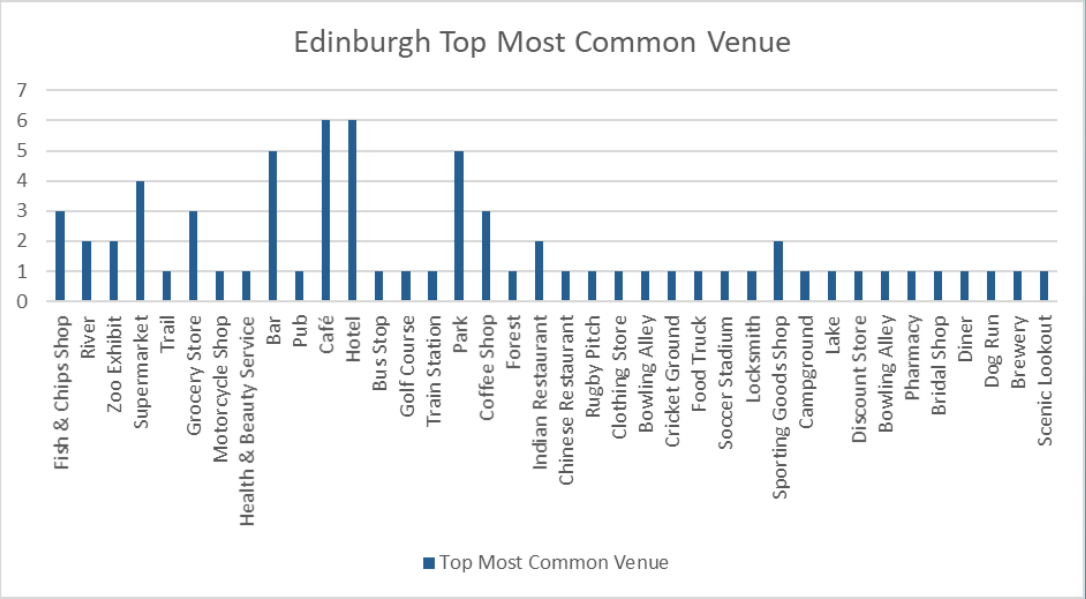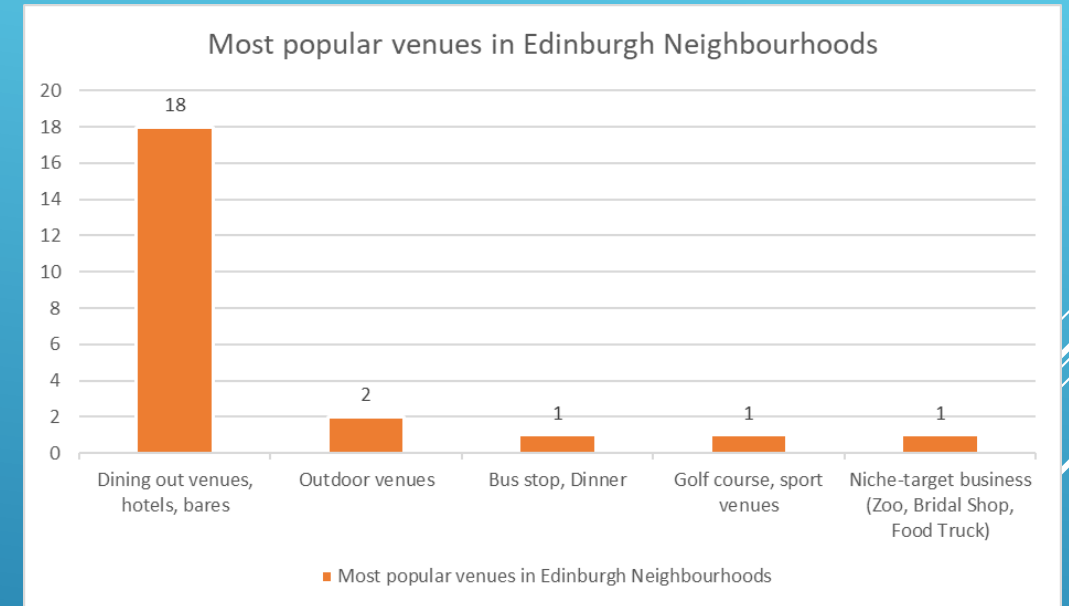
# RESULTS

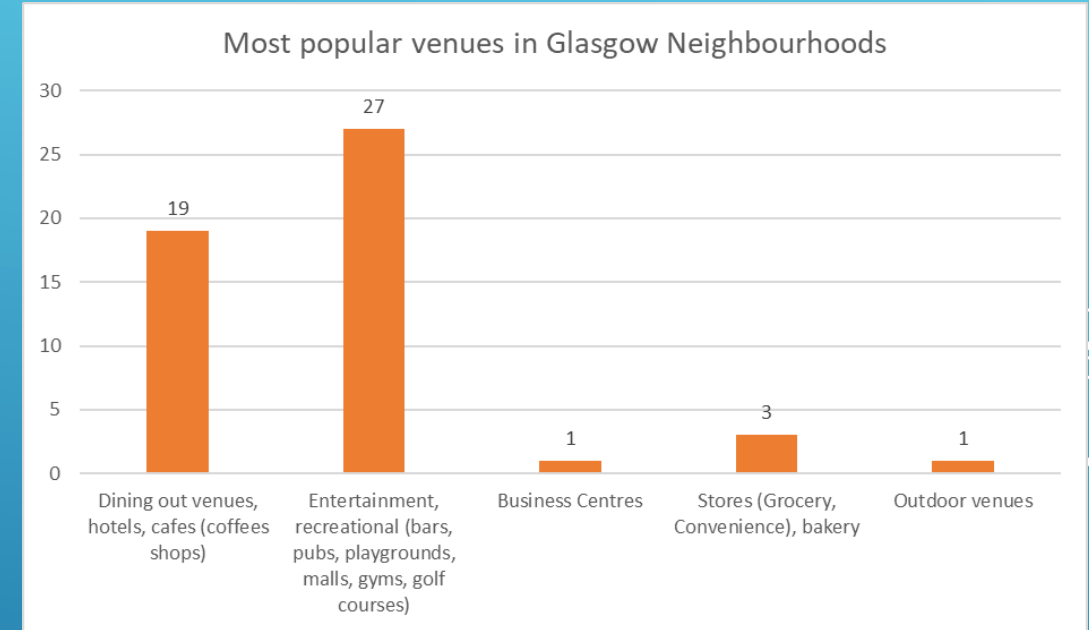- Edinburgh and Glasgow, are two major cities of Scotland. Glasgow, as the largest city in Scotland provides a large data set of business types compare to Edinburgh, however the difference between these two cities were not as wider as expected.

- The most popular business and services provided by both cities are of similar nature: dining-out venues, restaurants, bars, pubs, cafes and hotels. Clearly explained, as both are major touristic destinations of Scotland.

- The difference, explained from the data, is in the scale and number of neighbourhoods and target people:

  - Edinburgh, as being the main historical and touristic destination of Scotland, has a preference for business related to the tourism industry, such as dining-out, entertainment, outdoors venues, sightseeing, parks and lakes , follow by services and businesses that target their local population, such as supermarkets, niche-target businesses, grocery shops and others.

  - Glasgow as being a larger city, and the more residential city between them, although coincide with Edinburgh in entertainment and dining out venues as the most popular business and services, expands its top interest in venues like supermarkets, malls and playgrounds, therefore orientated more to entertain their local residents. The second most popular business venues includes hotels, cafes, and dining-out venues. Follow by other niche-businesses and outdoor places.

# DISCUSSION

- Both cities offer great business and services to their population and visitors.

  - If a new investor is interested in setup a business in any of these cities, probably targeting tourism could be ideal in a city like Edinburgh, and targeting the entertainment of local population could be ideal for Glasgow.

- In both cities, the number of businesses increase the closer is to the city centre.

  - If new business and service is developed, it will be ideal to target areas that are further than the city centre, however for this it is necessary to understand the size of the population and age targets, which are not covered as part of this analysis.

- Businesses in the city centre due to the larger number will experience higher competition in both cities.

# DISCUSSION

- From the data analysis, it was understood the similarities of businesses between Edinburgh and Glasgow, but also their difference, and target customers for each of them.
  - Edinburgh resulted a more tourism-focus due to its high tourism industry, while Glasgow as being a large city for Scottish residents aims to target the local population largely.
- Although the questions to the problem were answered, there were more questions raised ,such as:
  - how the population is segmented?
  - what is the difference in age and gender between the two cities?
  - and others, such as size of population and incomes?
- Answering the above could have helped to understand the nature of existing businesses, potential new ones, their numbers and popularities.
- Although the first steps to analyse the difference of these two cities were provided and achieved in this project, further gathering of information, and analysis of data, will bring more answers, better understanding of patterns present in these two cities, predicting their growth, and others, these could be expanded in future work.

# CONCLUSIONS