



THE UNIVERSITY OF  
MELBOURNE

**MAST30034 INDUSTRY PROJECT**

# VICTORIAN REAL ESTATE

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# MEET OUR TEAM



Raphaella  
Bichler



Kelman  
Chen



Jade  
Devlin



Winona  
Freihaut



Jia Williams  
Murnane

# PROJECT AIMS

## OVERALL OBJECTIVES

- Investigate cost of Victorian rental properties
- Determine appropriate listing for online real-estate
- Identify properties most likely to increase in price

# PROJECT AIMS

## MAIN ASPECTS OF INVESTIGATION



**Attributes for  
Predicting Rental  
Price**



**Forecasting  
Future Rental  
Prices**



**Assessing  
Affordability &  
Liveability**

# PROJECT TIMELINE

## Data Retrieval

Obtaining rental property data (via webscraping) and additional external datasets

## Preprocessing & Visualisation

Refining individual datasets, creating aggregated features and initial visualisations to aid analysis

## Analysis

Creating forecasting model, assessing relationships between features and determining metrics for ranking

# SECTION 2

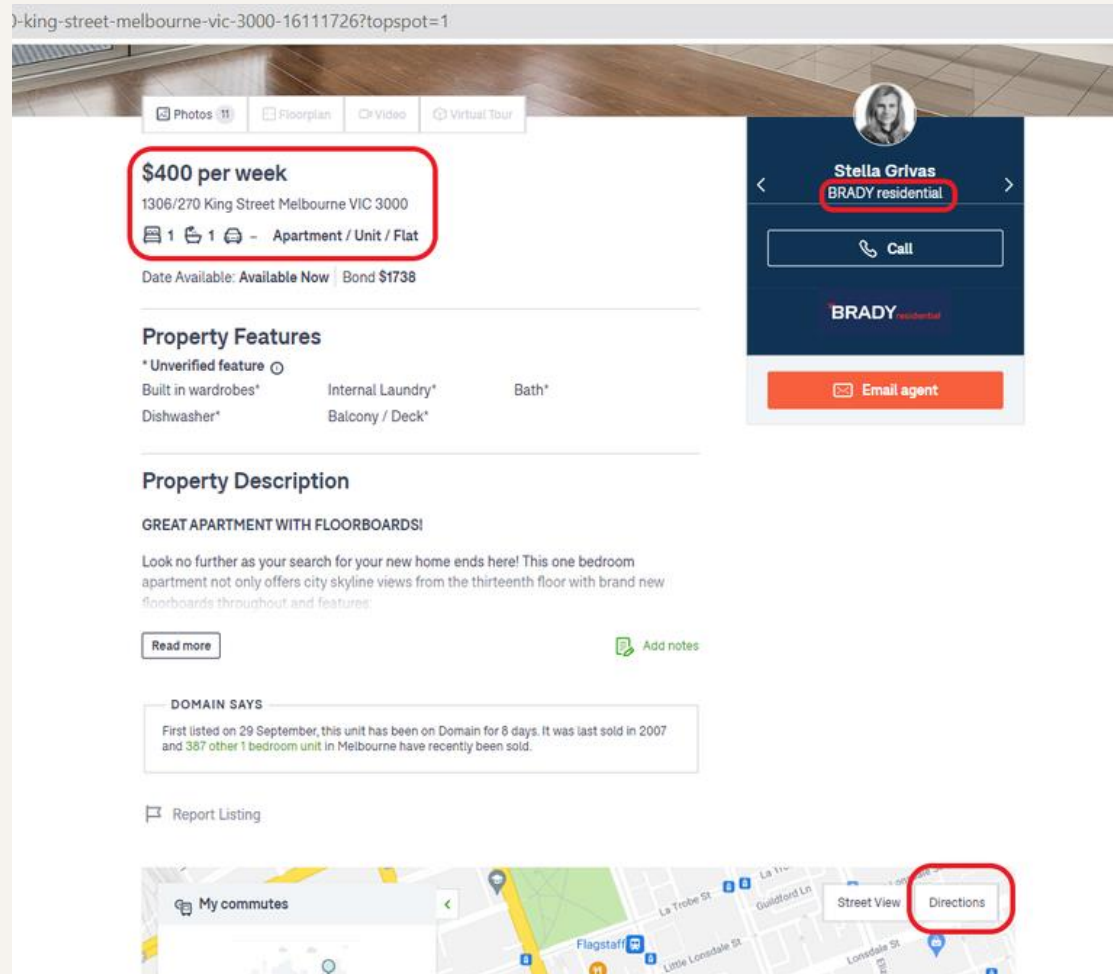
## METHODOLOGY





# PROPERTY DATA

## WEB-SCRAPING



1306/270 King Street Melbourne VIC 3000

**\$400 per week**

1306/270 King Street Melbourne VIC 3000

1 1 1 - Apartment / Unit / Flat

Date Available: Available Now | Bond \$1738

**Property Features**

\* Unverified feature

Built in wardrobes\* Internal Laundry\* Bath\*

Dishwasher\* Balcony / Deck\*

**Property Description**

**GREAT APARTMENT WITH FLOORBOARDS!**

Look no further as your search for your new home ends here! This one bedroom apartment not only offers city skyline views from the thirteenth floor with brand new floorboards throughout and features:

[Read more](#) [Add notes](#)

**DOMAIN SAYS**

First listed on 29 September, this unit has been on Domain for 6 days. It was last sold in 2007 and 387 other 1 bedroom unit in Melbourne have recently been sold.

[Report Listing](#)

[My commutes](#) [Street View](#) [Directions](#)

**Figure:** Image indicating the data scraped from www.domain.com.au for each rental property

# PROPERTY DATA

## FINAL FEATURES

### **For each rental property:**

- Address
- Weekly Cost
- Coordinates
- Number of Amenities
  - Number of Bedrooms
  - Number of Bathrooms
  - Number of Parking Spaces
- Property Type
- Agency

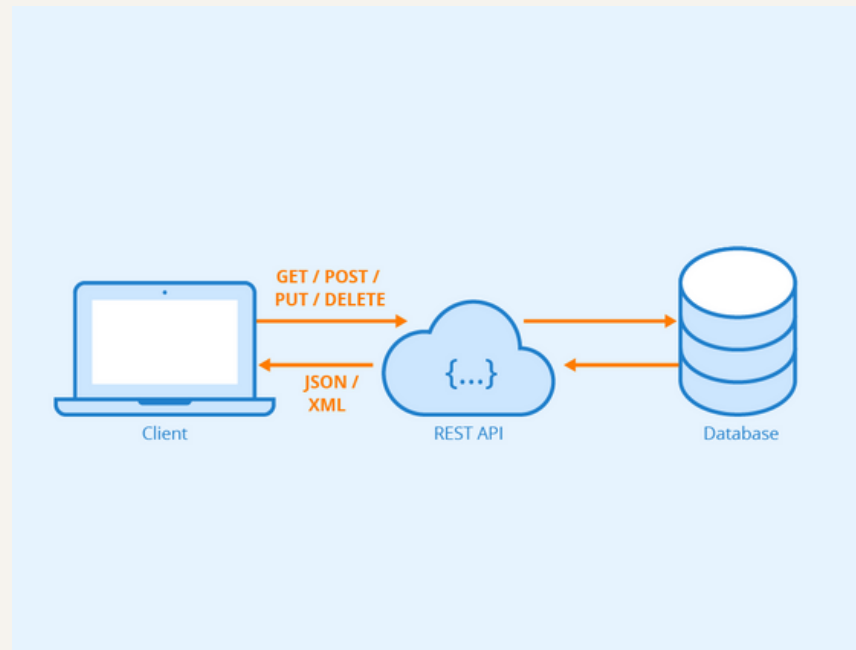




# GEOGRAPHICAL DATA

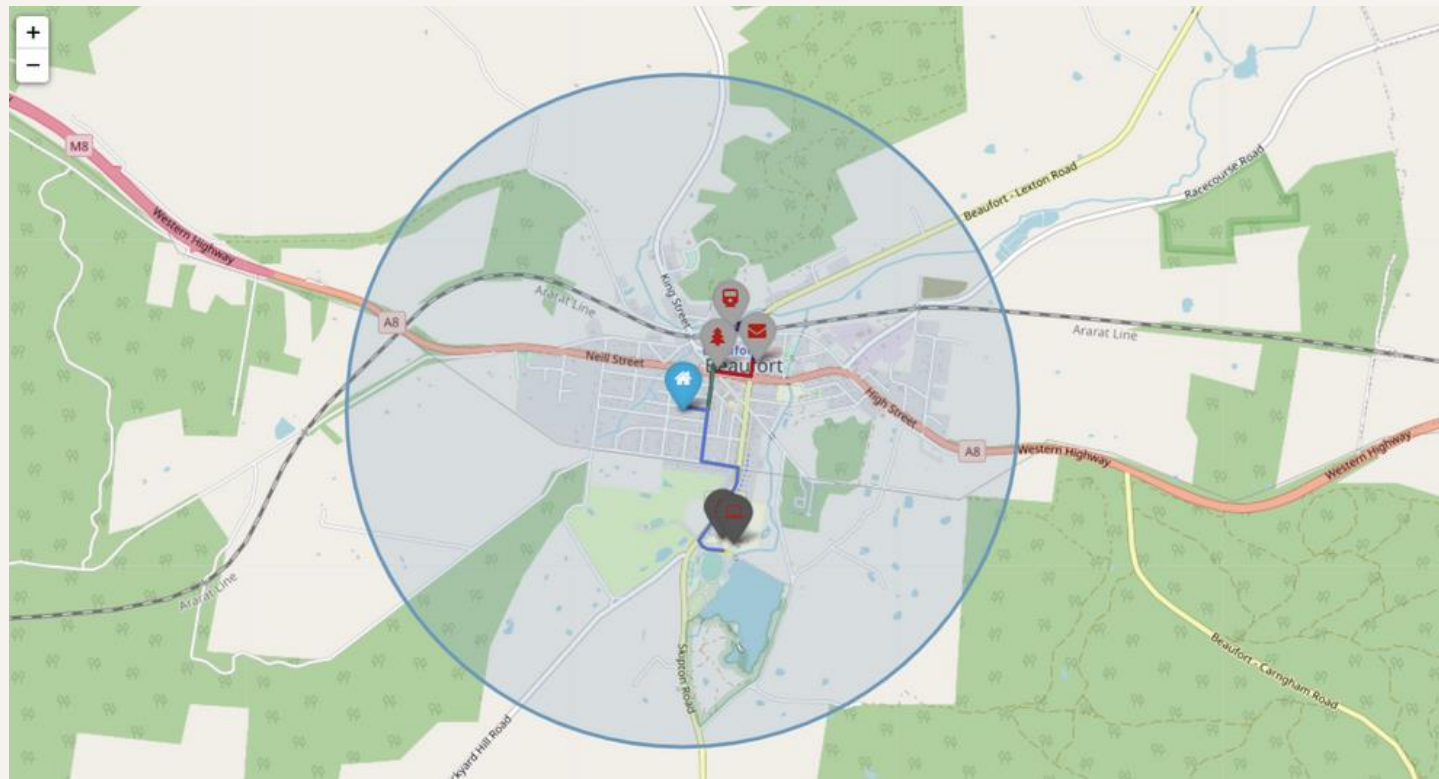
## API - OPEN ROUTE SERVICE

- Application Programming Interface
  - Used Open Route Service to access Open Street Maps



# OPEN ROUTE SERVICES

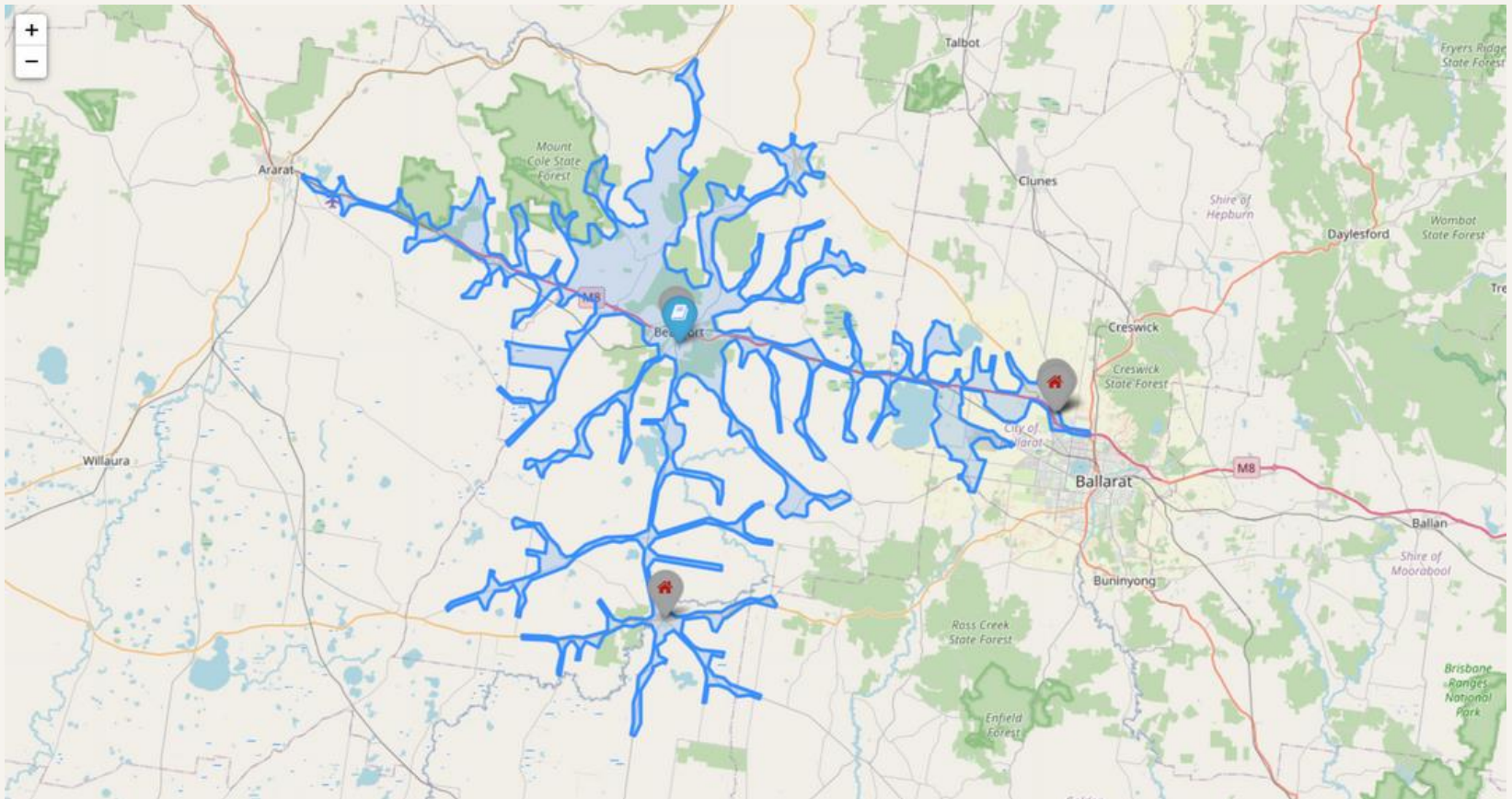
## EXAMPLE FROM PROPERTY DATA



**Figure:** The routes to the nearest park, post office, and schools (POIs) from a single rental property

# OPEN ROUTE SERVICES

## ISOCHRONES



**Figure:** Example of isochrones obtained using OpenRouteService for each rental property

# OPEN ROUTE SERVICES

## API CHALLENGES

- **API Limitations**

- Approach limited by the number of pings to API

- **API Security**

- API tokens are sensitive information
- Keys stored in as environment variables on local device

# ADDITIONAL SOURCES

## EXTERNAL DATA SOURCES

- **Census data** - 2011, 2016, and 2021
  - Sourced from Australian Bureau of Statistics (ABS)
- **School data** - 2022
  - Sourced from Victorian Department of Education and Training
- **SA2 data - 2021**
  - Sourced from ABS



# DATA PROCESSING

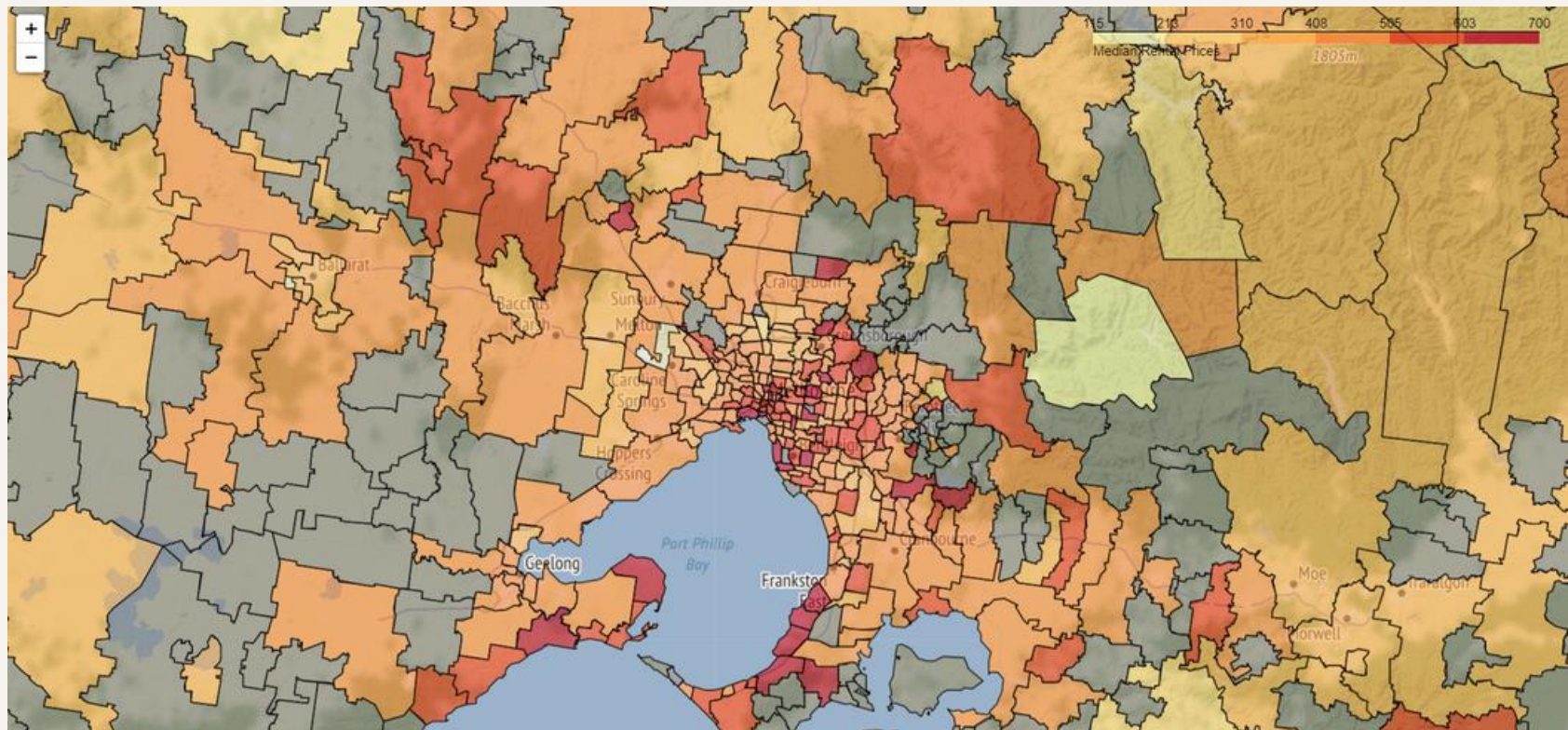
## STEPS PRIOR TO ANALYSIS

- **Preprocessing Properties**
  - Prior to ORS (reducing API pings)
- **Property Imputation**
  - Driveways >350m
  - Rockbank properties
- **Featurising Distance & Duration**
  - Numeric distance and duration to amenities converted to ordinal variables



# VISUALISATIONS

## MEDIAN RENTAL PRICE IN METROPOLITAN AREAS

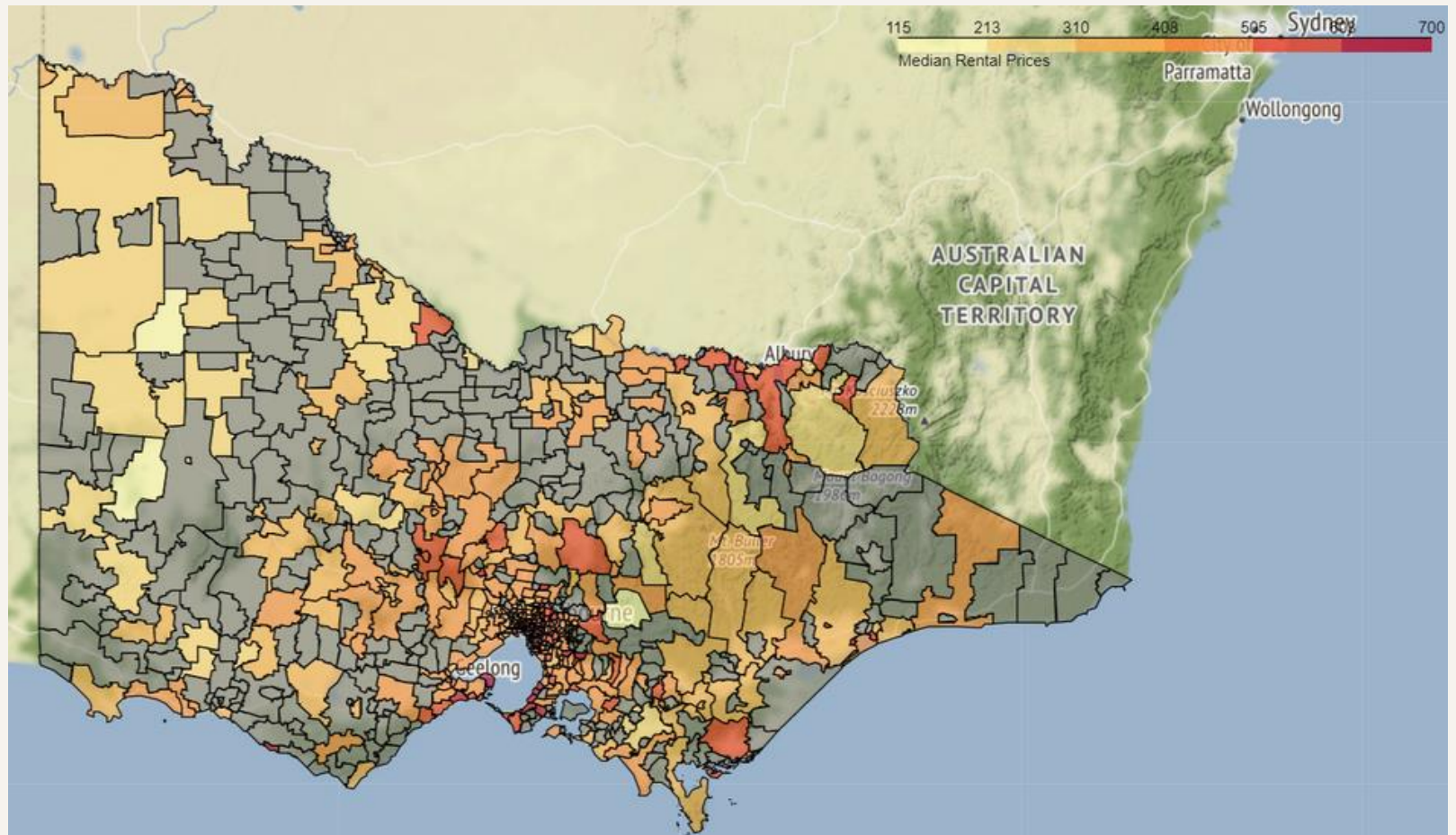


**Figure:** Heatmap of the median rental price of properties in Melbourne Metropolitan and outer Metropolitan areas



# VISUALISATIONS

## MEDIAN RENTAL PRICE ACROSS VICTORIA



**Figure:** Heatmap of the median rental price of properties across Victoria

# SECTION 3

## ANALYSIS



# ATTRIBUTES

## MOST USEFUL ATTRIBUTES FOR PREDICTING PROPERTY PRICE

- **Metrics Used**

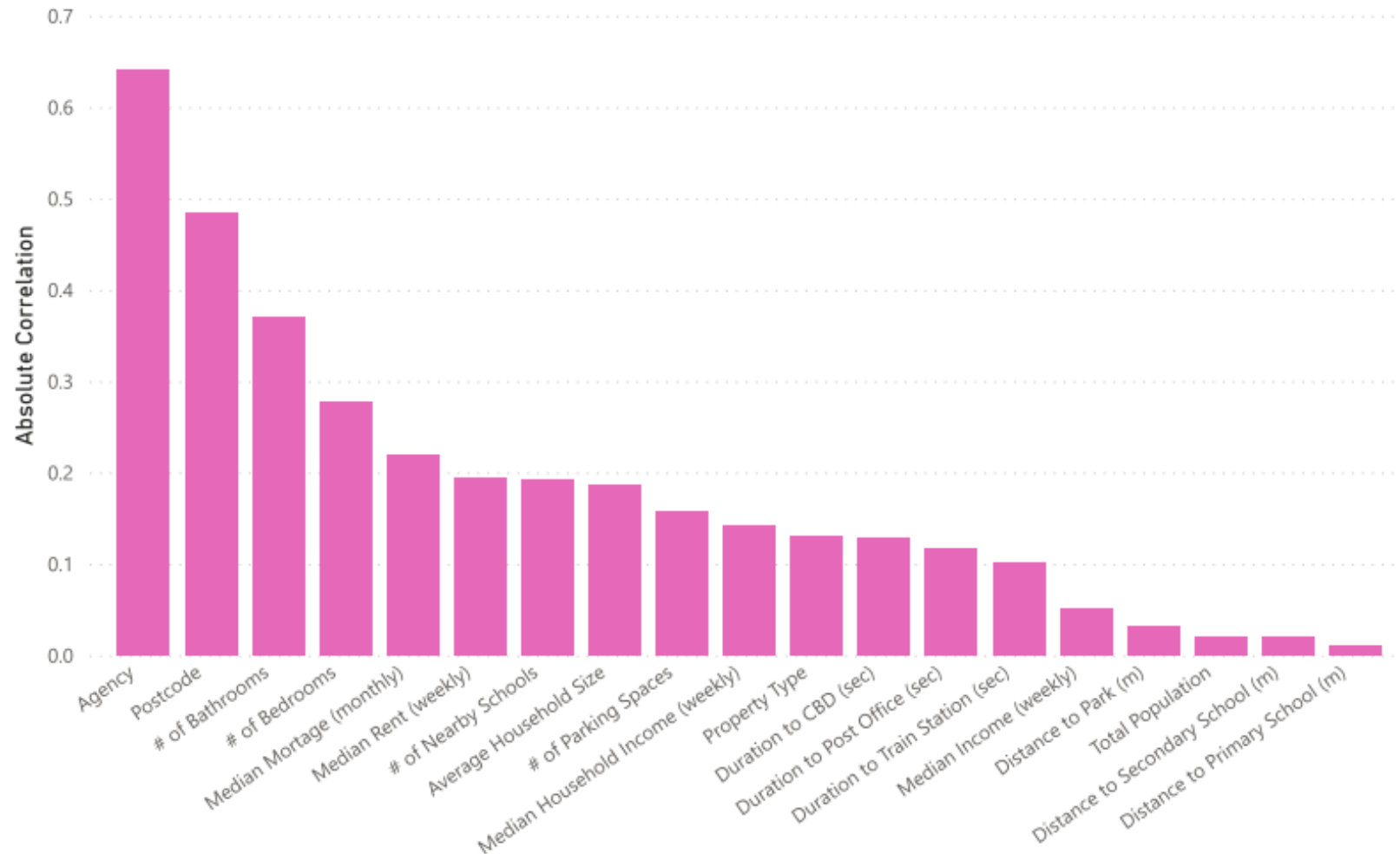
- Pearson Correlation (continuous-continuous cases)
- Correlation Ratio (continuous-categorical cases)

- **Features Considered**

- Internal property features (rental cost, number of facilities)
- External features (census data, categorised distances/durations from ORS)

# ATTRIBUTES

Absolute Correlation Between Rental Property Price and Various Attributes



**Figure:** The absolute correlation between internal/external attributes and rental property price

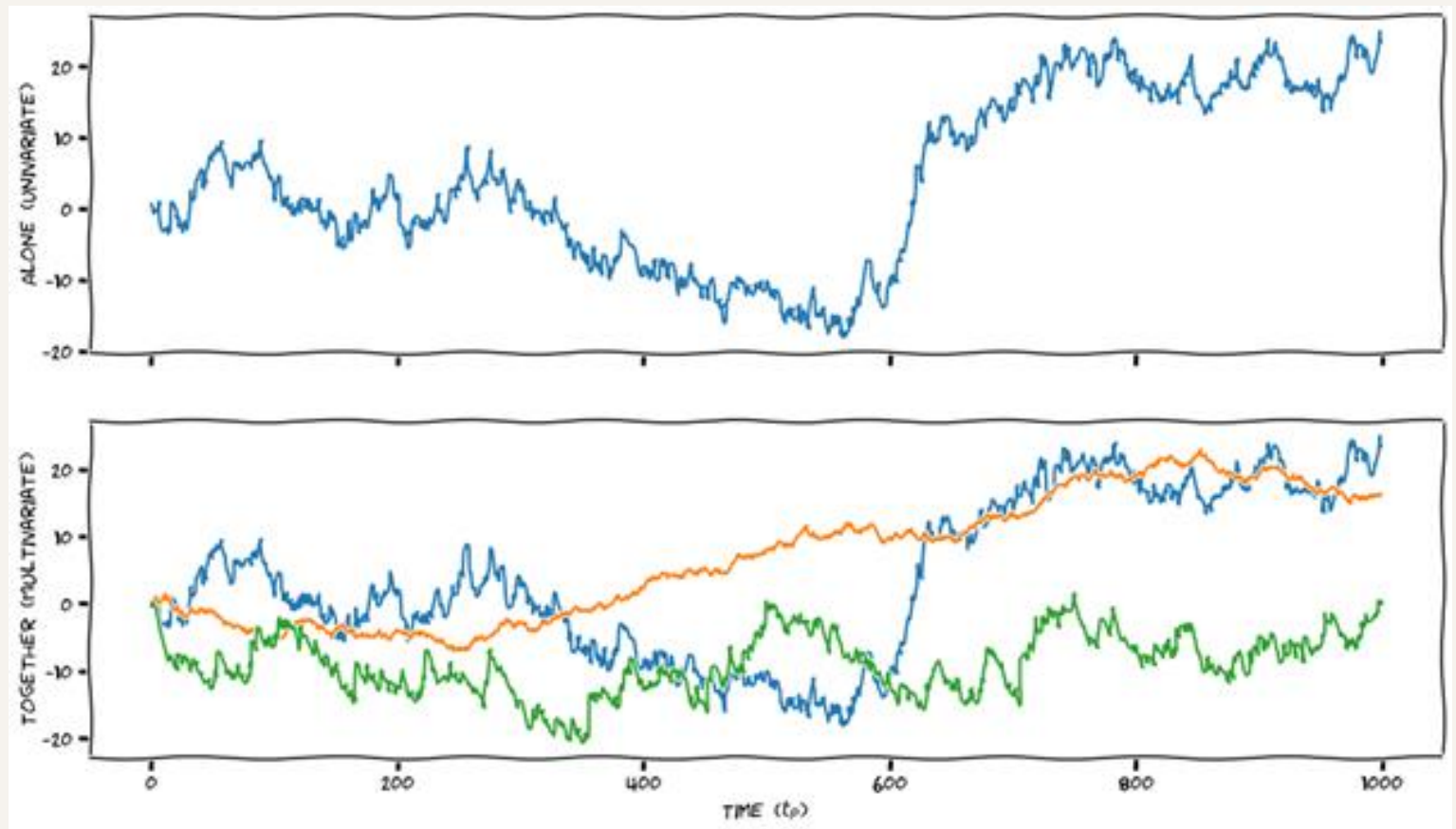
# FORECASTING

## PROCESS OVERVIEW

- Utilised census and property data by postcode
  - Linear interpolation implemented to impute census data between 2011-2016 and 2016-2021
- Features extrapolated using multivariate time series
  - Vector AutoRegression (VAR)

# FORECASTING

## TIME SERIES GRAPHS



**Figure:** Example of a multivariate time series graph

# FORECASTING

## MEASURING GROWTH RATE

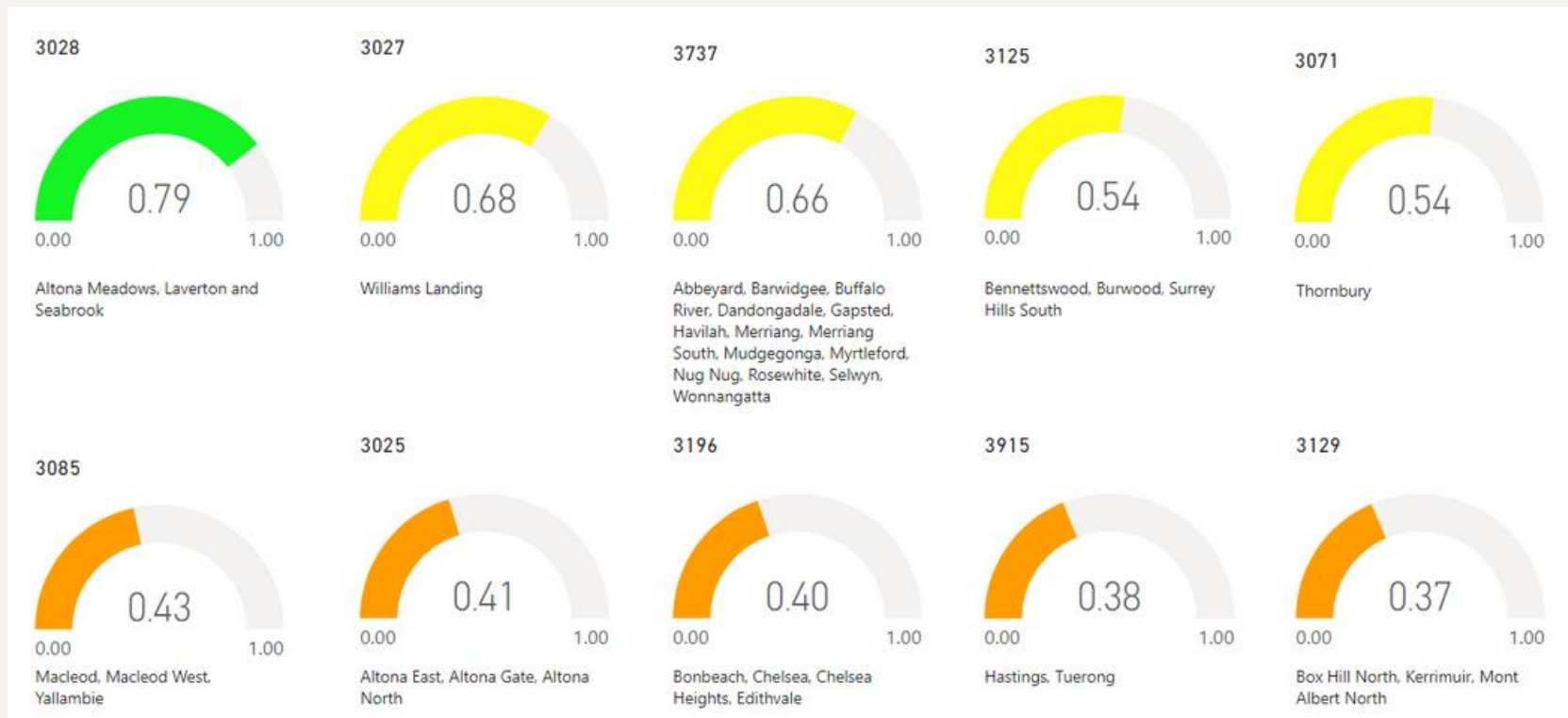
- Growth rate of a postcode was defined as:
  - The difference in the forecast median rental price (in 2026) and the current median rental price
  - Taken as proportion of current median rental price

$$\frac{(\text{predicted rental price} - \text{current rental price})}{\text{current rental price}}$$



# FORECASTING

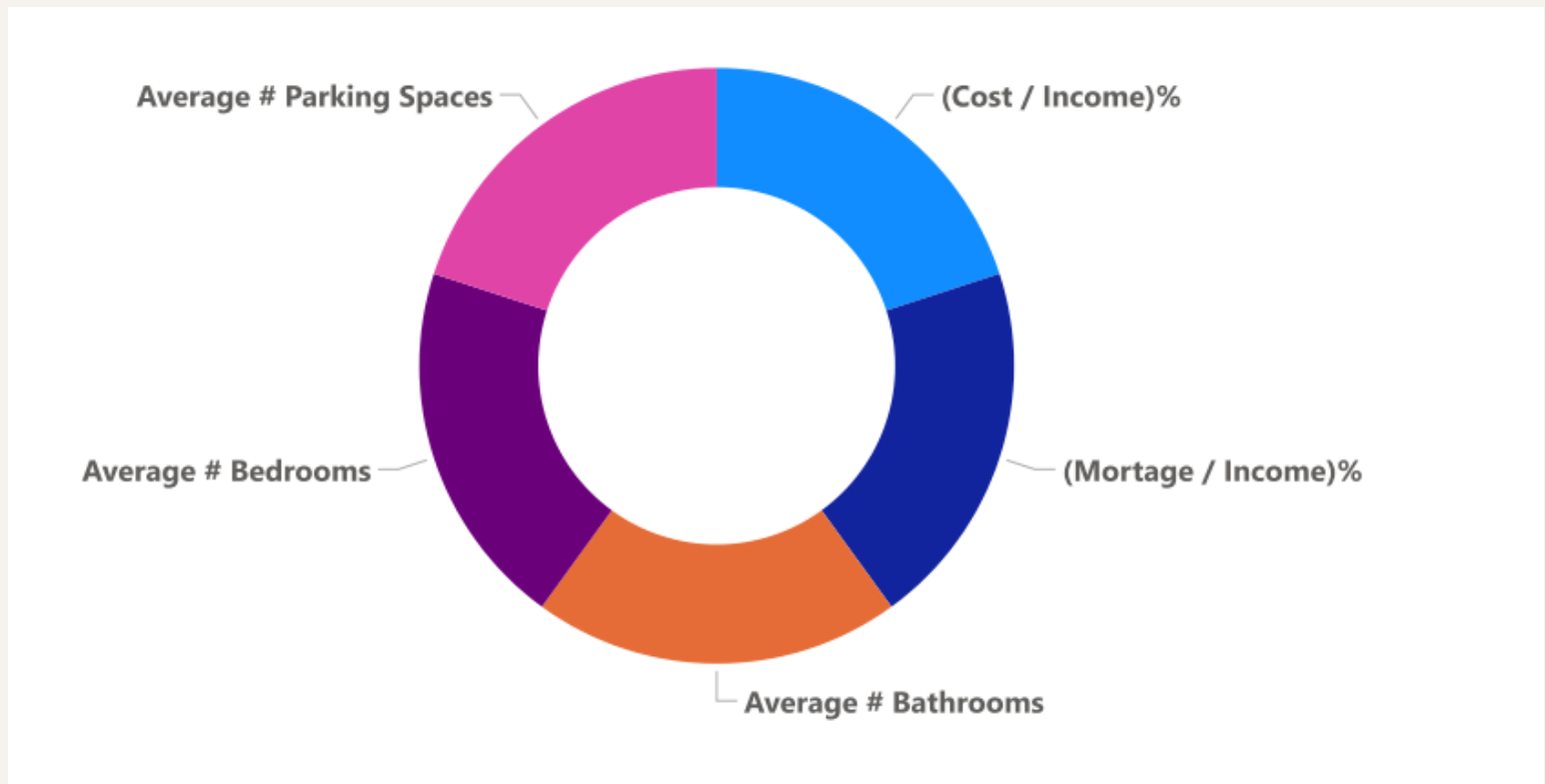
## HIGHEST PREDICTED GROWTH RATE



**Figure:** The 10 Victorian postcodes with the highest predicted growth rate in 2026

# AFFORDABILITY

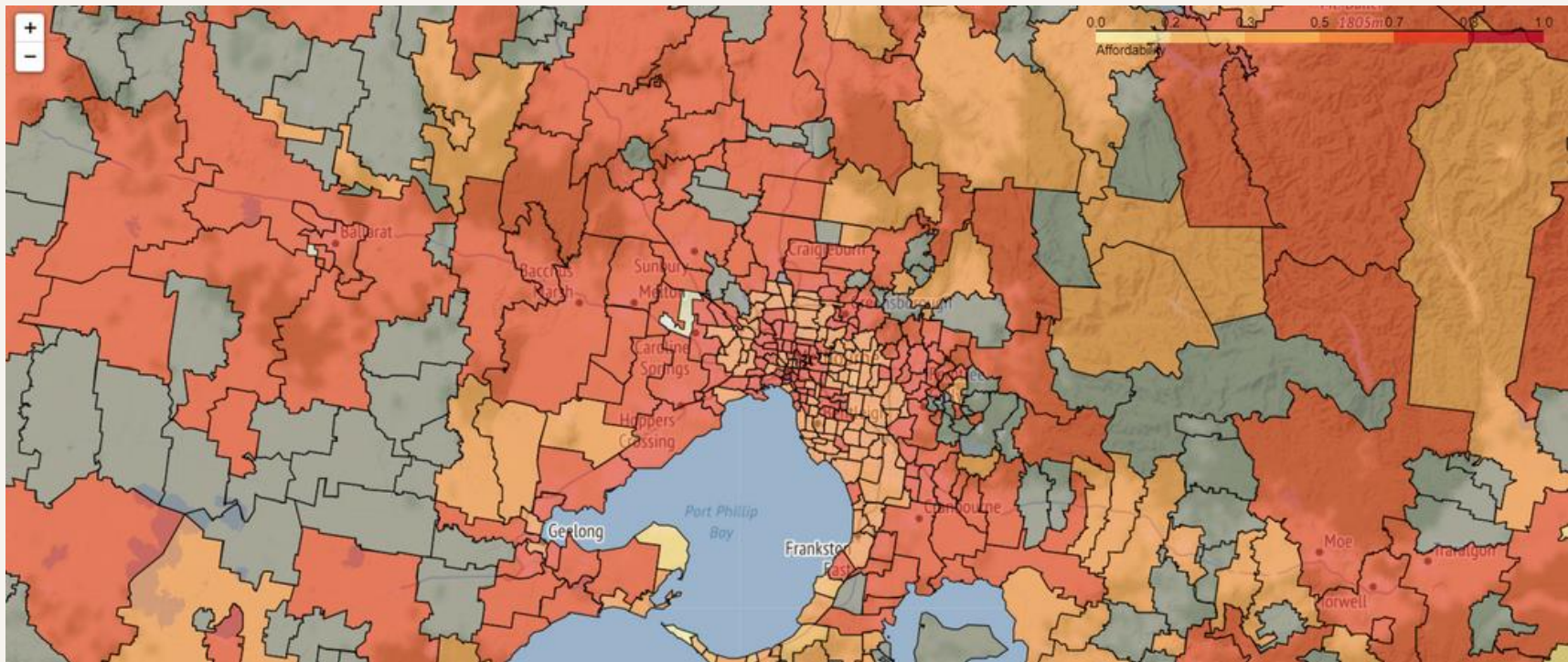
## AFFORDABILITY METRIC



**Figure:** The features used for calculating the affordability metric

# AFFORDABILITY

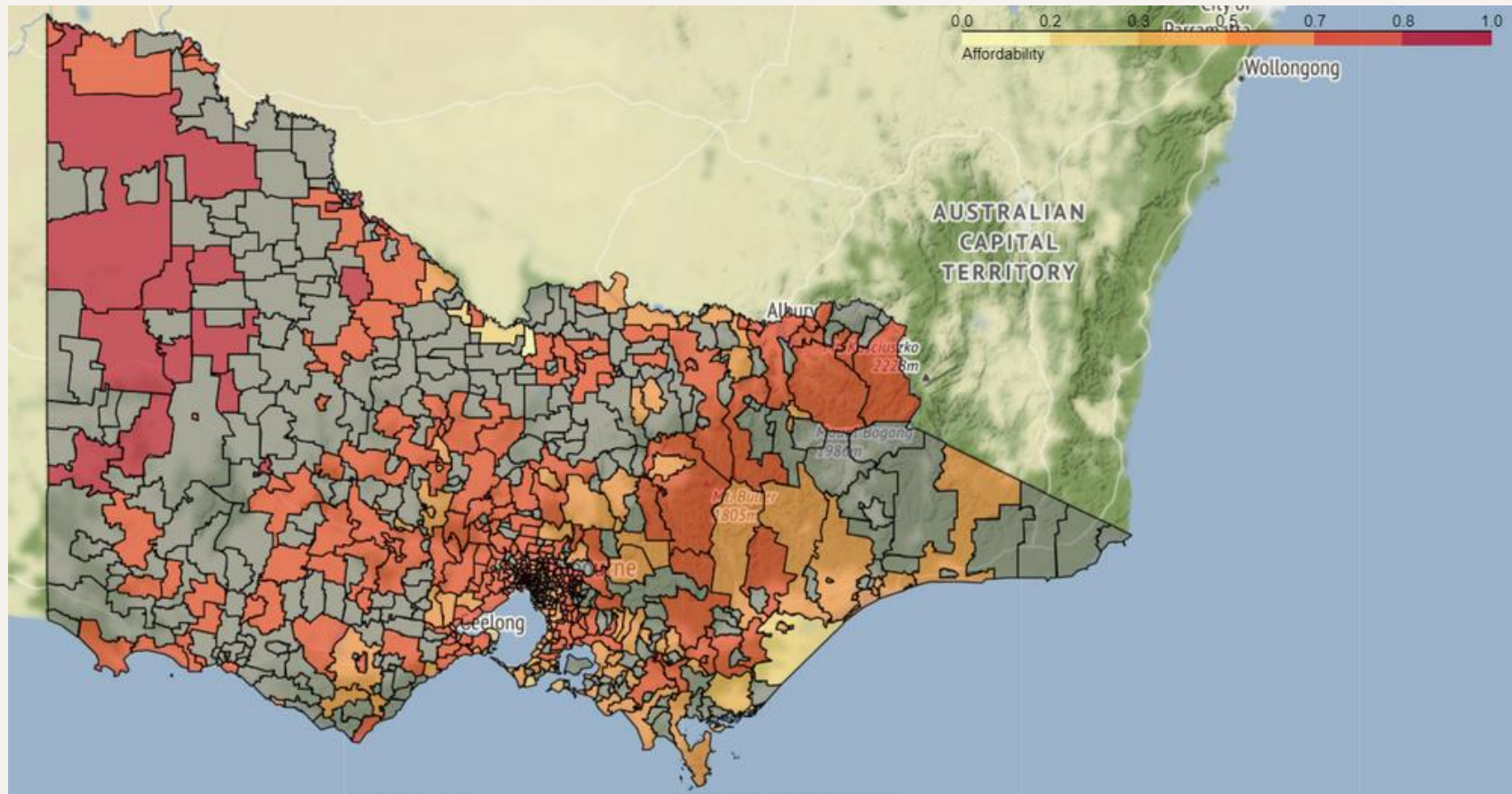
## AFFORDABILITY IN METROPOLITAN AREAS



**Figure:** Heatmap of the affordability of Melbourne Metropolitan and outer Metropolitan areas

# AFFORDABILITY

## AFFORDABILITY ACROSS VICTORIA

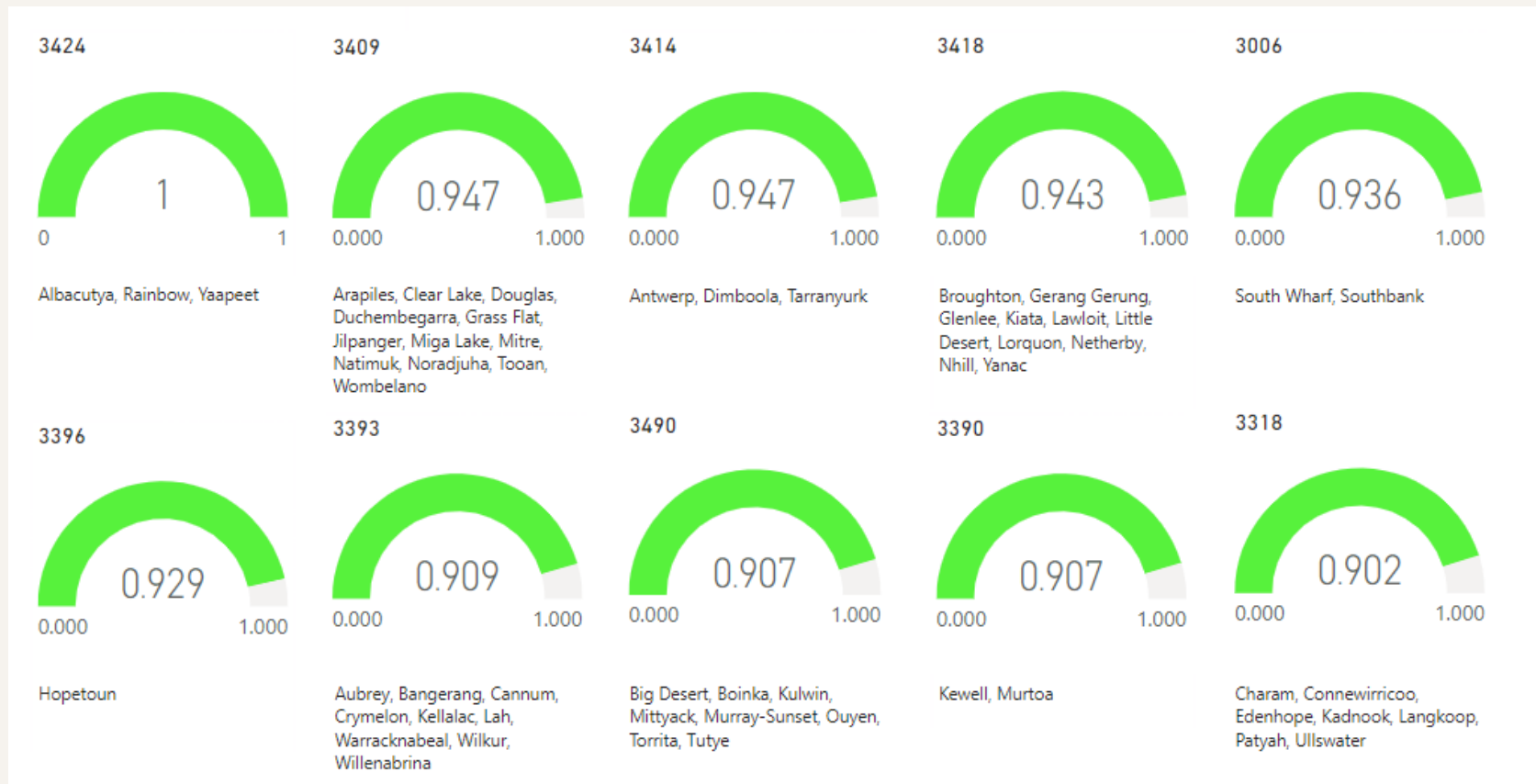


**Figure:** Heatmap of the affordability of Victorian postal regions



# AFFORDABILITY

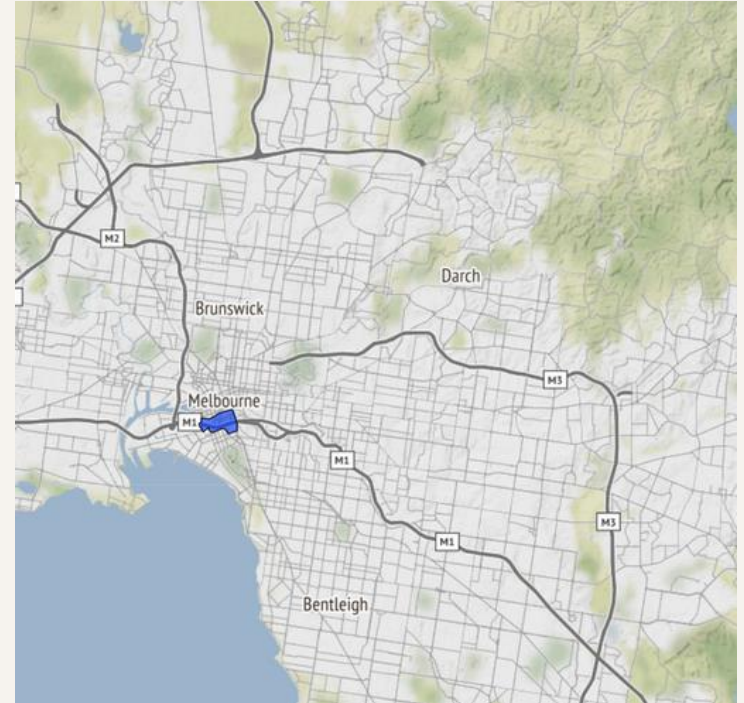
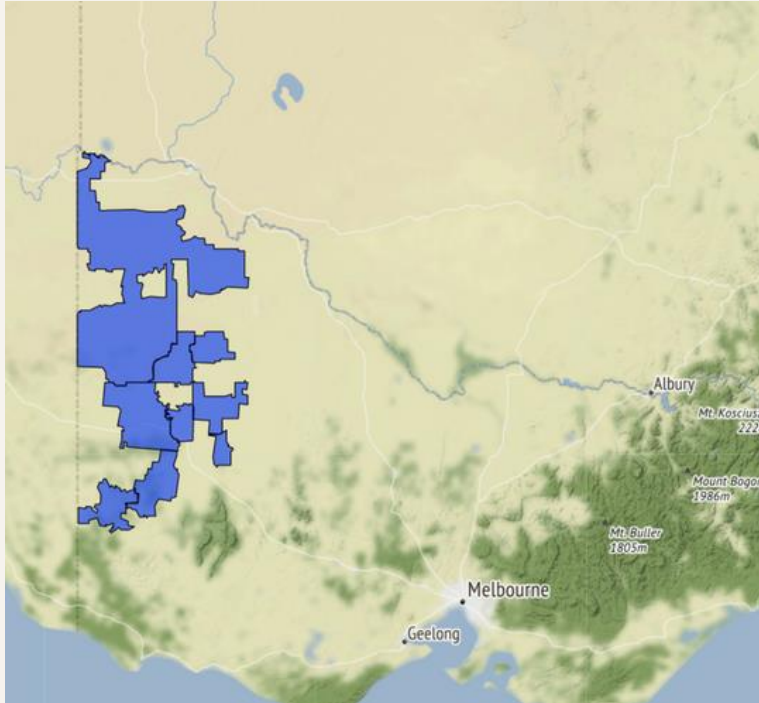
## TOP 10 MOST AFFORDABLE VICTORIAN POSTCODES



**Figure:** Image displaying the top 10 most affordable postcodes across Victoria and their respective standardised affordability metric

# AFFORDABILITY

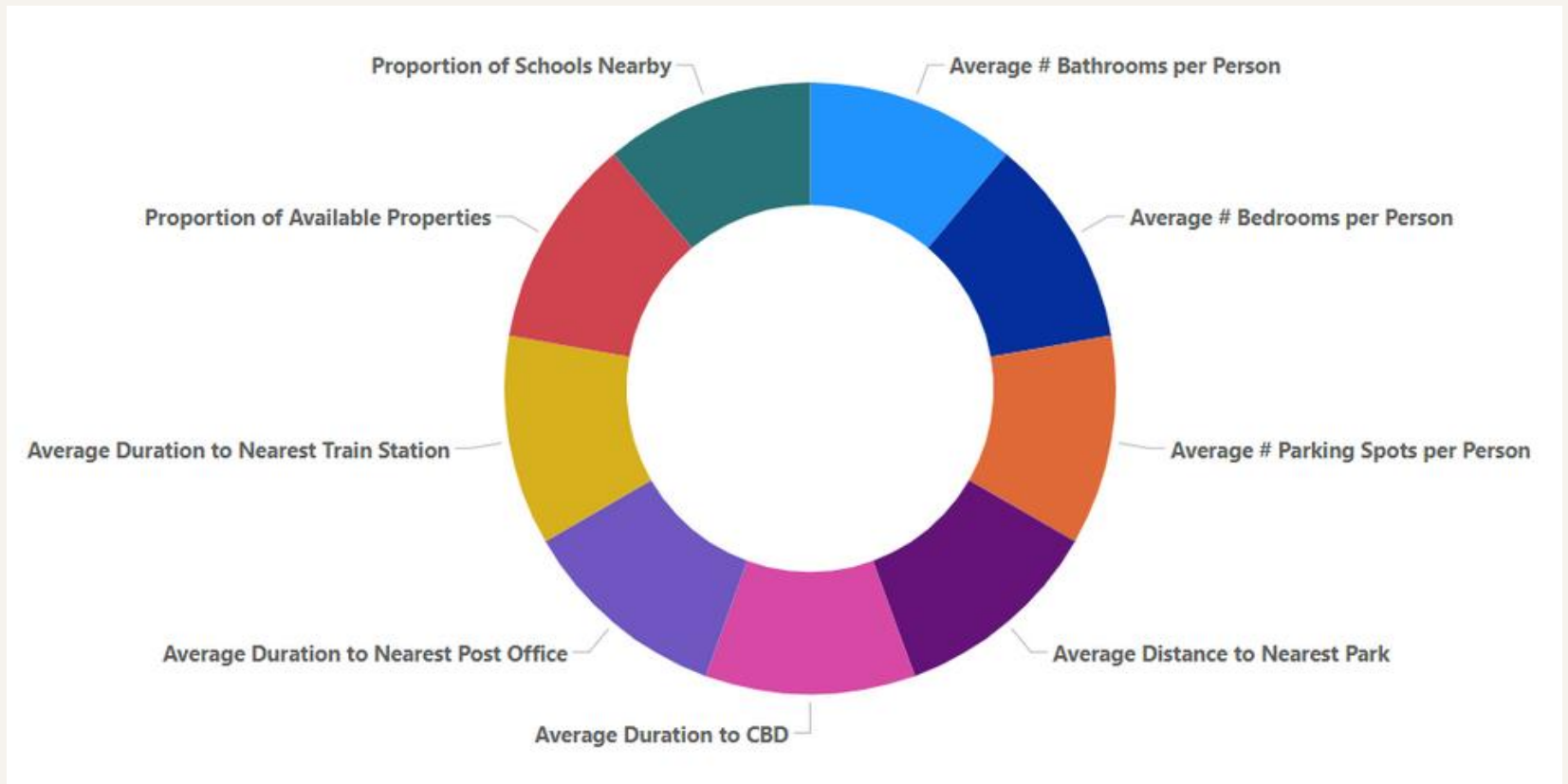
## TOP 10 MOST AFFORDABLE VICTORIAN POSTCODES



**Figure:** Visual representation of the top 10 most affordable postcodes across Victoria

# LIVEABILITY

## LIVEABILITY METRIC

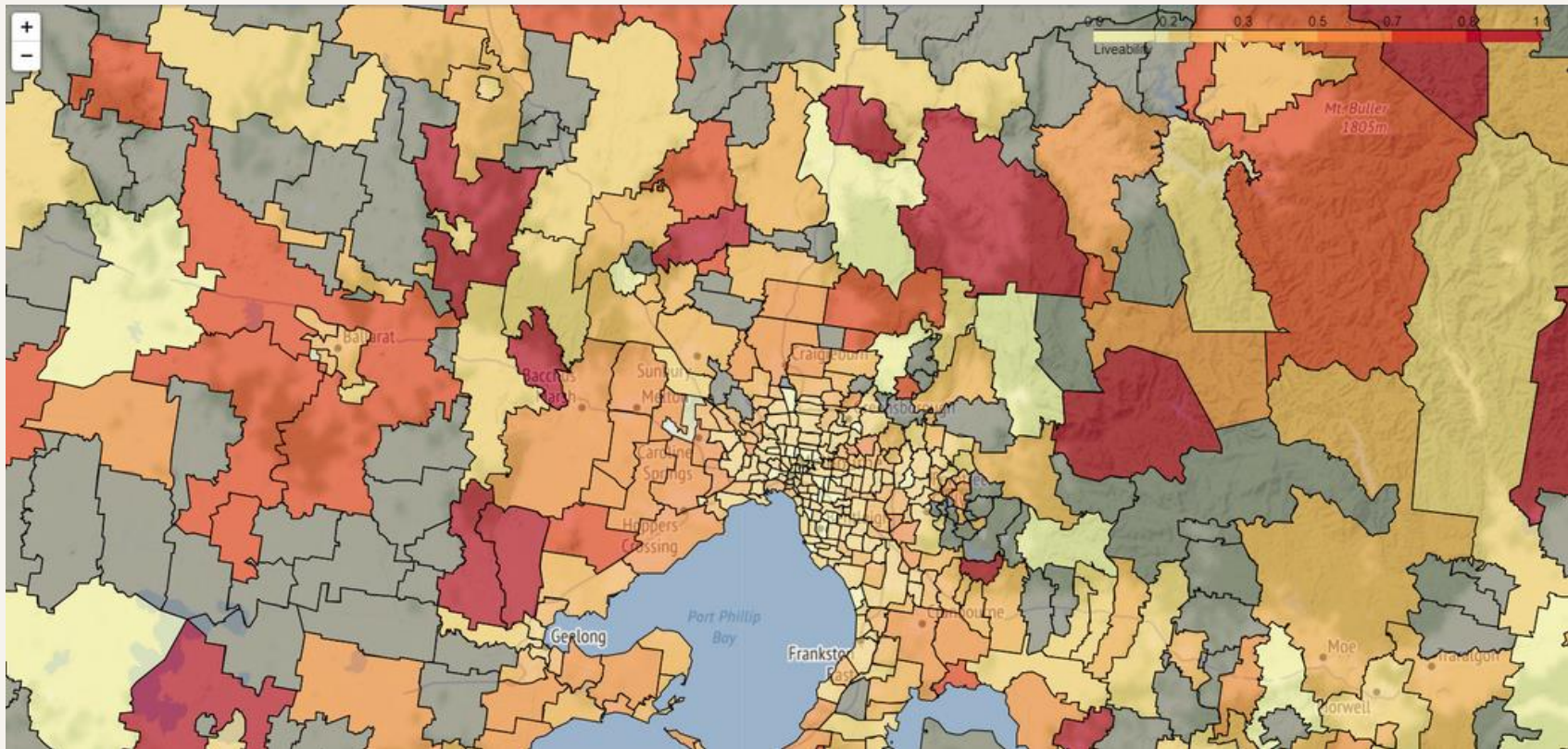


**Figure:** The features used for calculating the liveability metric



# LIVEABILITY

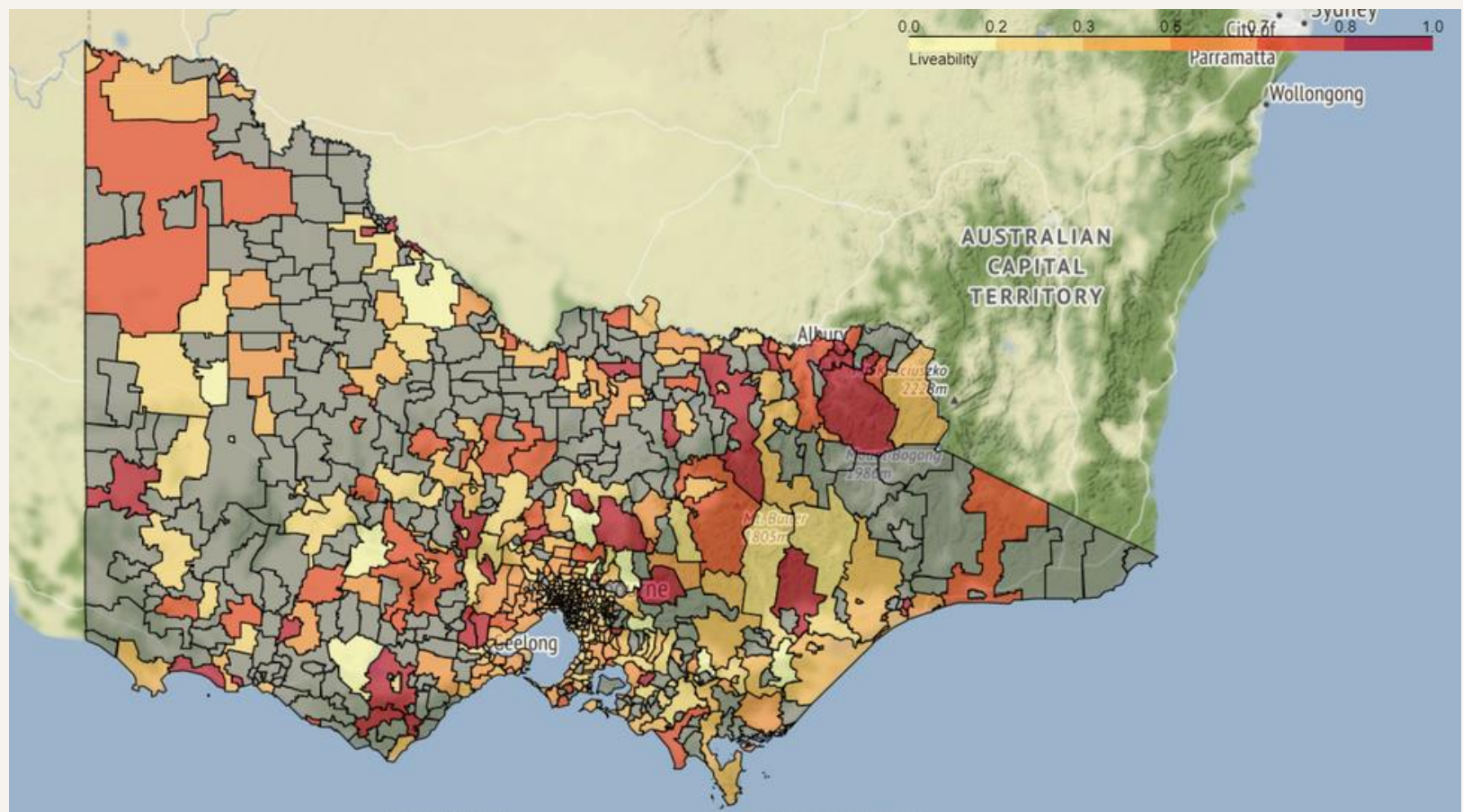
## LIVEABILITY IN METROPOLITAN AREAS



**Figure:** Heatmap of the liveability of Melbourne Metropolitan and outer Metropolitan areas

# LIVEABILITY

## LIVEABILITY ACROSS VICTORIA



**Figure:** Heatmap of the liveability of Victorian postal regions



# LIVEABILITY

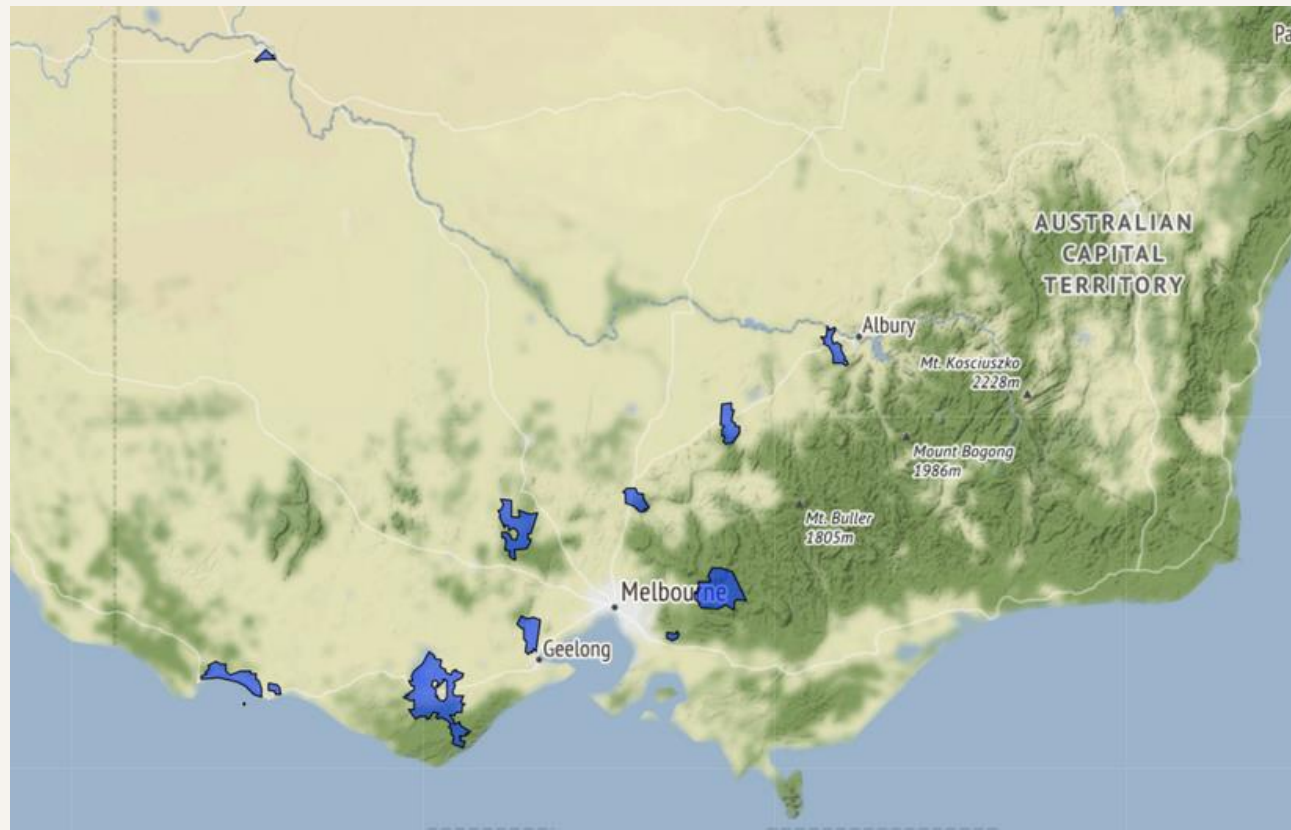
## TOP 10 MOST LIVEABLE VICTORIAN POSTCODES



**Figure:** Image displaying the top 10 most liveable postcodes across Victoria and their respective standardised liveability metric

# LIVEABILITY

## TOP 10 MOST LIVEABLE VICTORIAN POSTCODES



**Figure:** Visual representation of the top 10 most liveable postcodes across Victoria

# SECTION 4

## RECOMMENDATIONS



# LIMITATIONS

## **Volatile Market**

Potentially unable to accurately predict future trends from previous years data

## **Properties**

Single snapshot representative of entire property market (limited by number of available properties)

## **ORS**

Query time and functionality restrictions

# BUSINESS CONTEXT

## **Measuring Affordability & Liveability**

Provides a tool able to be utilised by individual consumers or provided as a client service

## **Forecasting Property Value**

Forecasting areas for promising investment/future development

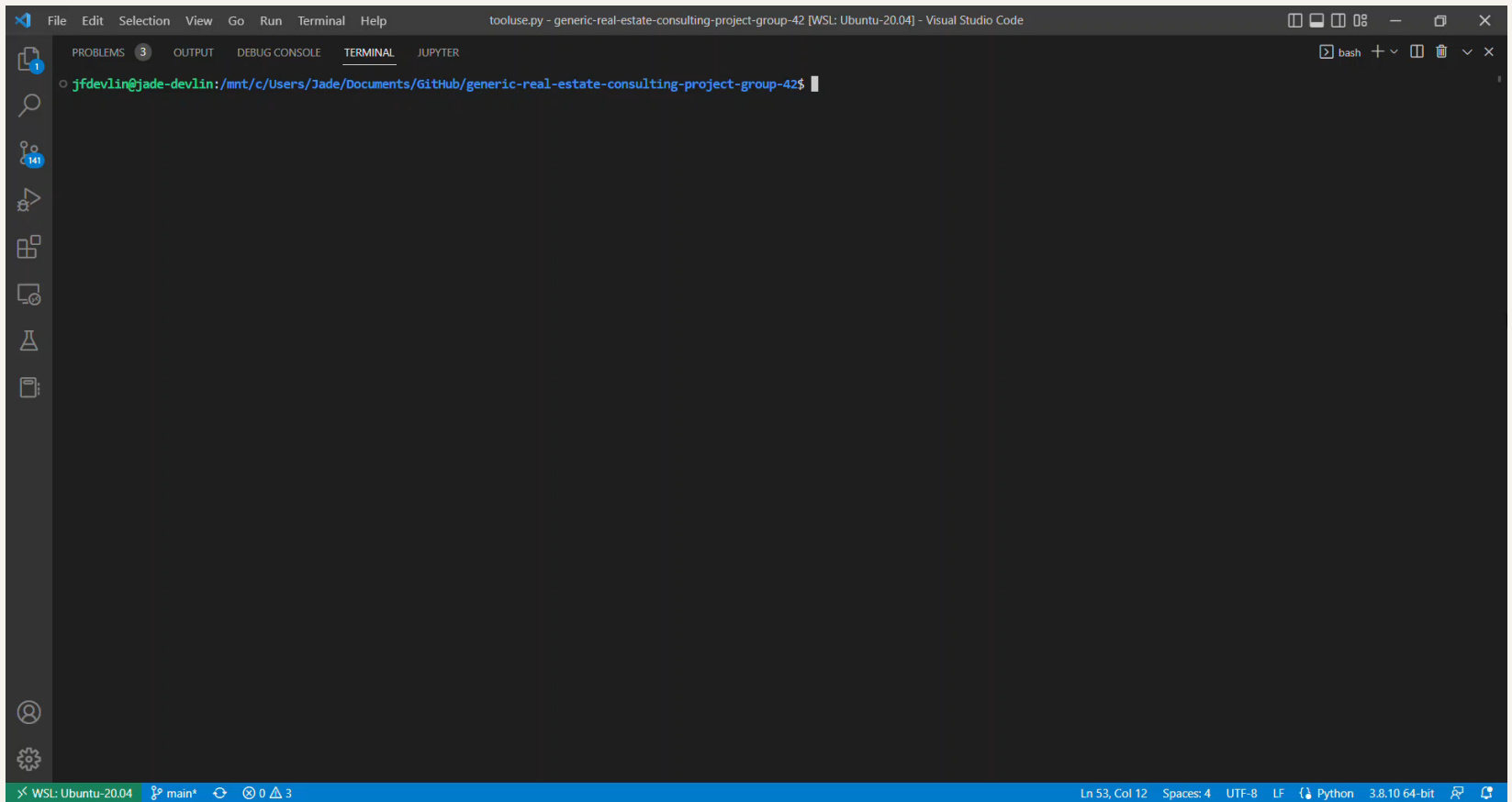
## **Correlated Features**

Enables businesses to accurately reflect property value in pricing



# BUSINESS CONTEXT

## PROTOTYPE FOR BUSINESS TOOL



# FUTURE RESEARCH

## AVENUES FOR DEVELOPMENT

- **Dividing Datasets**
  - Categorising the data based on location (Metropolitan or Region)
- **Expanding Feature Set**
  - Including other features for assessing correlation to rental price, affordability or liveability
- **Other Applications**
  - Expansion into sectors beyond private property market