# Leveraging nearby places and businesses' public data as predictors of housing prices. The case of Barcelona neighborhoods with the use of Foursquare Places API.

# Improving investment seeking and valuation models is desirable for Real Estate investment firms. Leveraging social media platforms data can be the next step.

- Information Technology is a fast developing field and advancement and innovation needs to be made in order to stay competitive.
- Companies are already making such improvements, as Real Estate investment platform Cadre did in the beginning of 2020, when they became the first Real Estate investment firm to license Foursquare location data to power their investment seeking end evaluation machinery [1].

**[1]** Gourarie, Chava (2020, February 27). *Cadre to Use Foursquare's Data to Evaluate Investments*. Commercial Observer. Retrieved from https://commercialobserver.com/2020/02/cadre-to-use-foursquares-data-to-evaluate-investments/

# Data collection and cleaning.

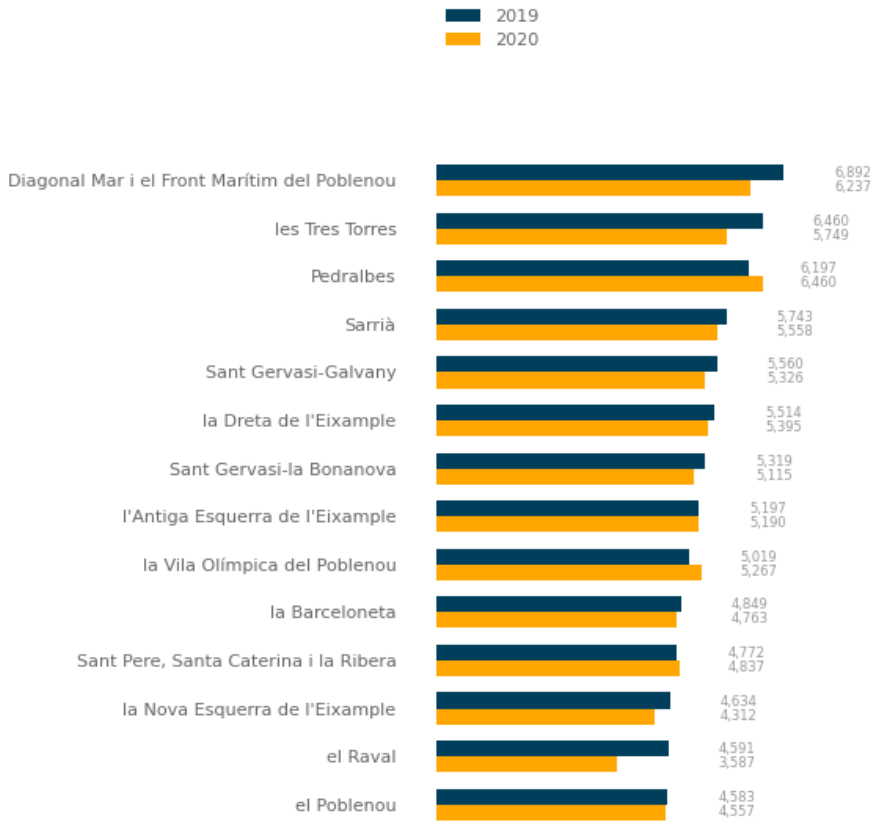
Datasets:

- Barcelona City Council statistics publications datasets:
  - **Asking price of second-hand housing - Year 2019**:
    - District
    - Neighborhood
    - Asking price (€/m2)
  - **Asking price of second-hand housing - Year 2020:**
    - District
    - Neighborhood
    - Asking price (€/m2)
- Foursquare Places API:
  - **Venue Category data**:
    - Venues within a specified radius from the center of the neighborhood
    - Category of the venue

Resulting dataset after cleaning:

| | Neighborhood | Neighborhood Latitude | Neighborhood Longitude | Venue | Venue Latitude | Venue Longitude | Venue Category |
|---|---|---|---|---|---|---|---|
| 0 | el Raval | 41.379518 | 2.168368 | A Tu Bola | 41.380096 | 2.169054 | Tapas Restaurant |
| 1 | el Raval | 41.379518 | 2.168368 | La Robadora | 41.379500 | 2.170463 | Gastropub |

# Average price for 2019 and 2020 as a target measure.




**Objective:** Show how a set of places and businesses describe the neighborhoods' variation in its second-hand housing price per square meter (€/m2).

Data is processed for year 2020 and 2019 (Covid-19 is taken with caution) and an estimation will be performed for 2019 as well as 2020.

# Top venues in high income neighborhoods are related to leisure.

| | Neighborhood | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Can Baró | Spanish Restaurant | Chinese Restaurant | Grocery Store | Tapas Restaurant | Scenic Lookout | Historic Site | Breakfast Spot | Park | Plaza |
| 1 | Can Peguera | Park | Hostel | Tapas Restaurant | Escape Room | Café | Sports Club | Supermarket | Food & Drink Shop | Grocery Store |
| 2 | Canyelles | Soccer Field | Mediterranean Restaurant | Plaza | Grocery Store | Tapas Restaurant | Food & Drink Shop | Market | Café | Metro Station |
| 3 | Ciutat Meridiana | Metro Station | Plaza | Park | Train Station | Grocery Store | Supermarket | Wine Shop | Diner | Escape Room |
| 4 | Diagonal Mar i el Front Marítim del Poblenou | Restaurant | Mediterranean Restaurant | Hotel | Italian Restaurant | Breakfast Spot | Pizza Place | Plaza | Fast Food Restaurant | Café |

On the opposite side, low income neighborhoods display venues such as Park, Soccer Field or Metro Station as top venues, therefore conveying a lack of leisure related businesses such as restaurants, cafés, and hotels.

# Regression models' performances: Multiple Linear regression and Random Forest regression

Multiple Linear regression:

| 2019 prices model | | |
|---|---|---|
| | R2 | MSE |
| In-sample | 0.6687 | 403281 |
| Out-of-sample | 0.5491 | 737239 |

| 2020 prices model | | |
|---|---|---|
| | R2 | MSE |
| In-sample | 0.6241 | 437365 |
| Out-of-sample | 0.5558 | 666305 |

Random Forest regression:

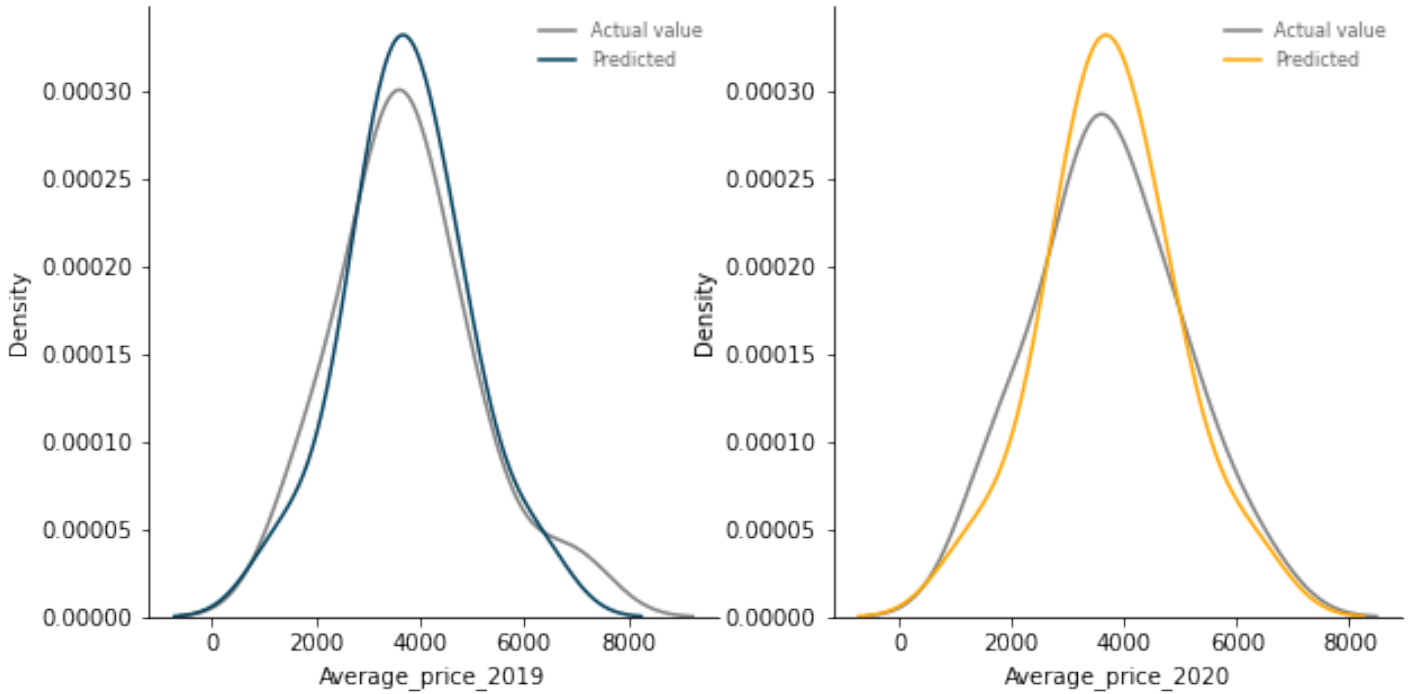
| 2019 prices model | | |
|---|---|---|
| | R2 | MSE |
| Out-of-sample | 0.4987 | 819685 |

| 2020 prices model | | |
|---|---|---|
| | R2 | MSE |
| Out-of-sample | 0.5195 | 720842 |

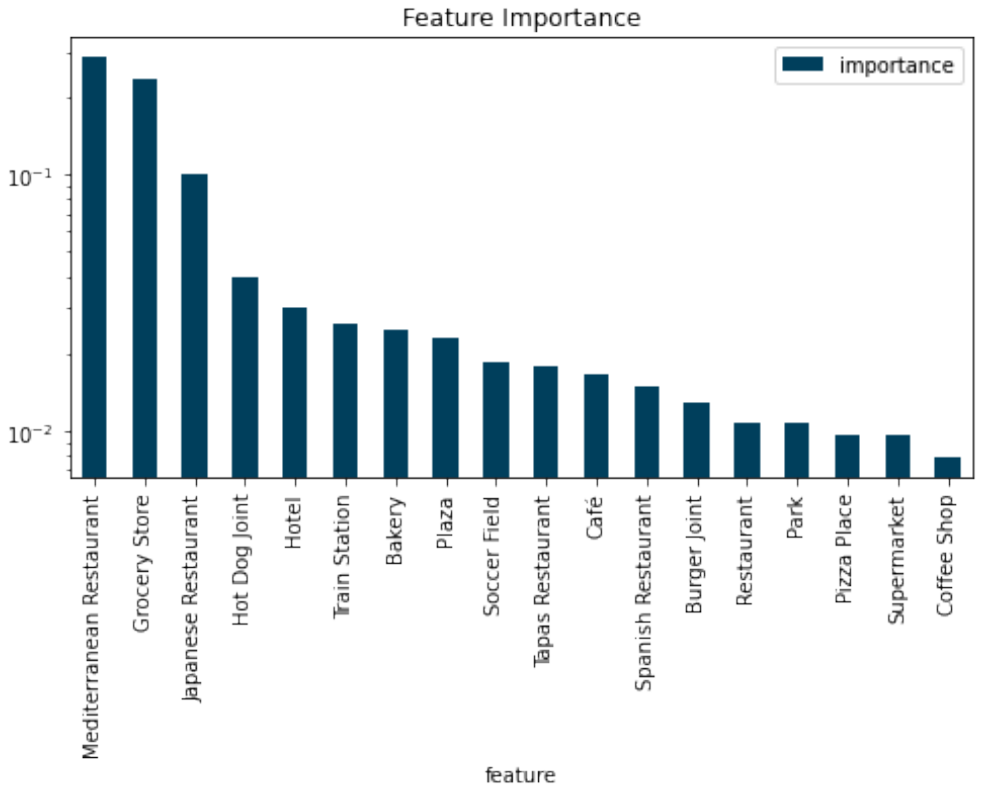
Both Linear Regression and Random Forest models performed very similarly in terms of **r-squared** and **MSE**. The Random Forest, with a larger set of predictor variables (76 in the Random Forest compared to 12 in the Linear Regression) did not display higher out-of-sample accuracy.

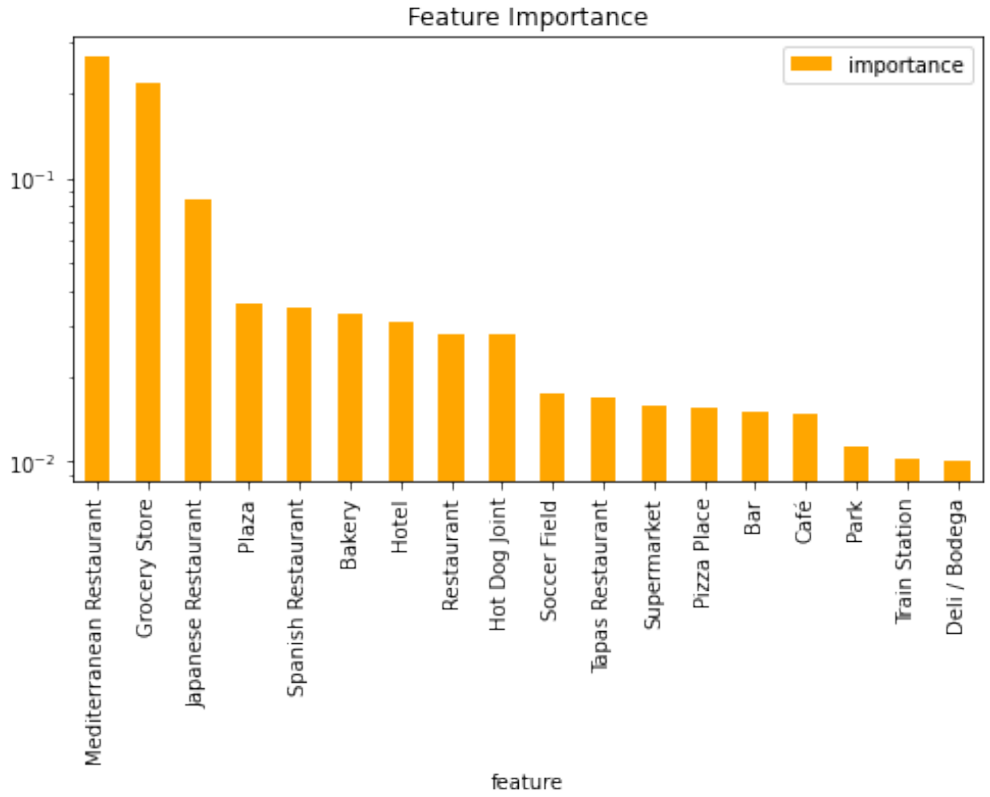
Regarding the comparison between 2019 and 2020(Covid-19) price data, no significant differences were found either in terms of predictor variables or in model accuracy.

# Linear regression's distribution plots display a decent out-of-sample performance considering that only venue category data were used as model predictors.



# Random Forest regressor's feature importances display a rather high cardinality that suggests that for prediction of average prices at neighborhood scale, grouping of categories might be advised.



# Conclusion and future directions.

The results of the study suggest that, although an R2 score of around 0.5 is not to be considered enough in prediction of prices, achieving this rate with the sole use of Foursquare's Venue Category variable to explain housing price variation among neighborhoods proves that data available on social media platforms can improve predictive power of traditional housing valuation models.

In future studies, data available in the pay-per-use version of the Foursquare API as well as other social media platforms such as Google Places API, Facebook Graph API and Yelp Fusion API could be used to improve prediction power and find ways to better complement traditional housing valuation models. In such case, higher granularity data regarding housing prices should be considered.