

Exploratory Data Analysis: Brazil House and Apartment Listings

Featuring Neural Network Regression

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<https://youtu.be/bfledEVtKQM>

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INTRODUCTION

Objectives

- Theme: Provide insights relevant to a potential customer
- Analyze the location of Brazil real-estates
- Showcase the trend of real-estate value
- Forecast new real-estate
- Provide recommendations for the stakeholders

ABOUT THE DATA

The BigQuery dataset Brazil Real Estate listings is from Properati a competitive marketplace for Latin America real estate. Listings from 2015 to 2018.



CLEANING THE BIGQUERY DATA



DATA: CRITERIA AND CONDITIONS

- Focus: Sell operation type
- Granularity: Monthly
- ID should not be nullable, assuming it as validation between the market and buyer
- Other non-nullable: Price, Property Type, Coordinates, Surface Area, Place, Floor, and Rooms.

DATA: CRITERIA AND CONDITIONS

- Check uniqueness of categorical values
- Uniformity and Usability all throughout the EDA and NN Regression
- Limitation: 16,000 records per export

DATA: CRITERIA AND CONDITIONS

```
SELECT id, operation, property_type, place_name, state_name,  
surface_covered_in_m2, floor, rooms, price  
  
FROM `properati-data-public.properties_br.properties_sell_201N`  
  
WHERE  
id IS NOT NULL AND  
property_type IS NOT NULL AND  
place_name IS NOT NULL AND  
state_name IS NOT NULL AND  
surface_covered_in_m2 IS NOT NULL AND  
floor IS NOT NULL AND  
rooms IS NOT NULL AND  
price IS NOT NULL
```

Additional Data Processing: Jupyter Files

MAIN DATA SELECTED

- Data: Brazil Listings of House and Apartment
- Time Frame: January 2015 to February 2018
- Records: 170,000+
- Features:
 - ID
 - Operation
 - Place and State name
 - Longitude and Latitude
 - Surface Area in Sq. Meters
 - Rooms and Floors
 - Price

LOCATION

Choosing from the Current Listings (Feb 2018)

RAW NUMBERS: VOLUME PER STATE

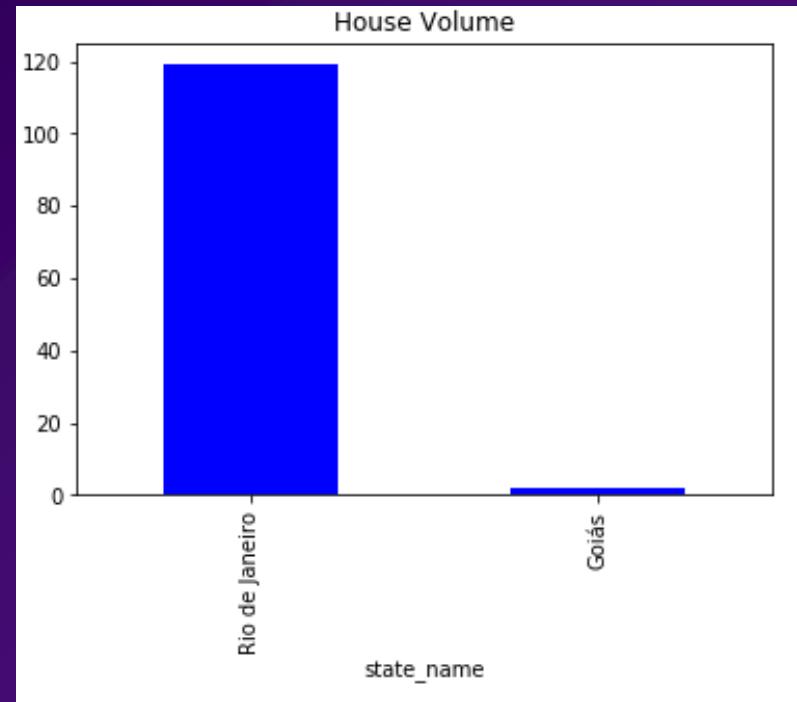
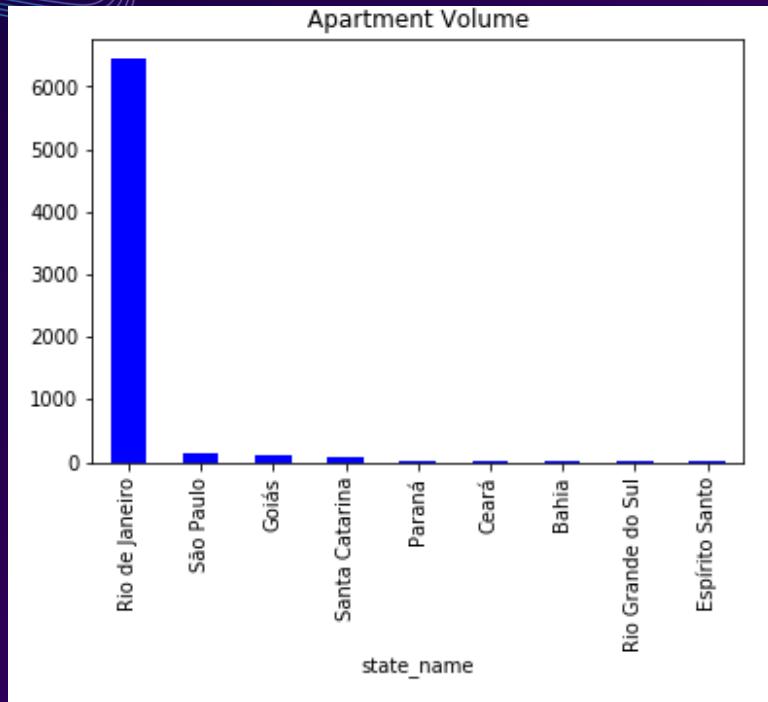
Apartment

state_name	
Rio de Janeiro	6436
São Paulo	125
Goiás	106
Santa Catarina	84
Paraná	10
Ceará	10
Bahia	9
Rio Grande do Sul	7
Espírito Santo	2

House

id	state_name
Rio de Janeiro	119
Goiás	2

RAW NUMBERS: VOLUME PER STATE



RAW NUMBERS: PRICE AVG PER STATE

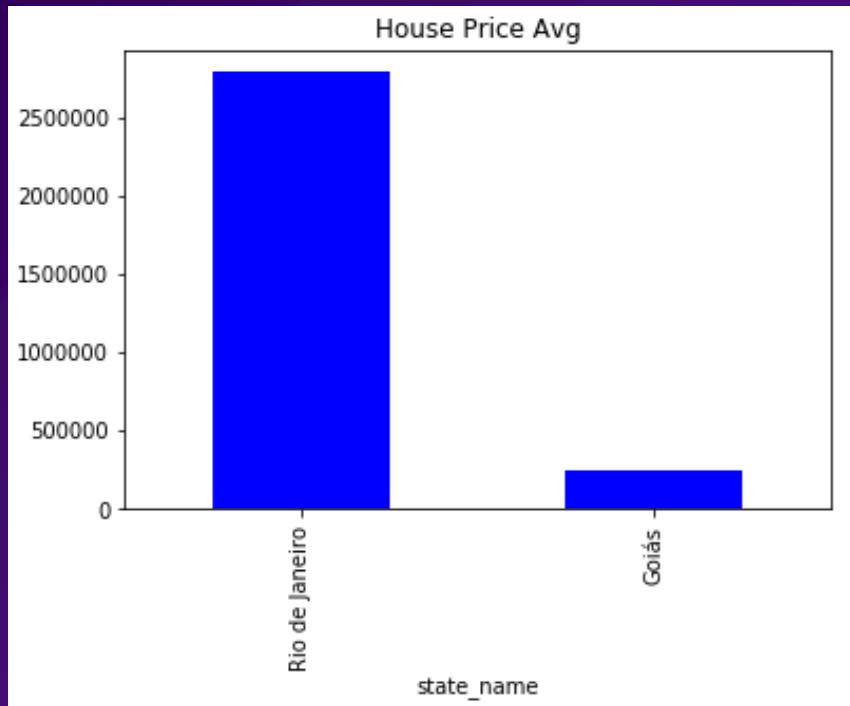
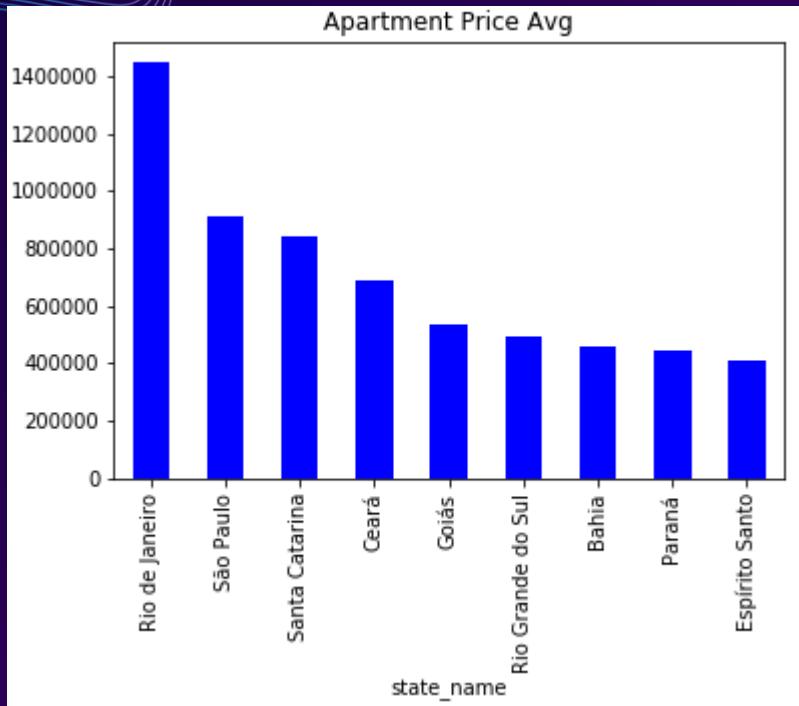
Apartment

state_name	
Rio de Janeiro	1445539.64
São Paulo	913592.00
Santa Catarina	839386.90
Ceará	684943.80
Goiás	534764.15
Rio Grande do Sul	494285.71
Bahia	460555.56
Paraná	442500.00
Espírito Santo	410000.00

House

state_name	
Rio de Janeiro	2787798.24
Goiás	247500.00

RAW NUMBERS: PRICE AVG PER STATE



CORRELATION OF NUMERICAL FEATURES

Apartment

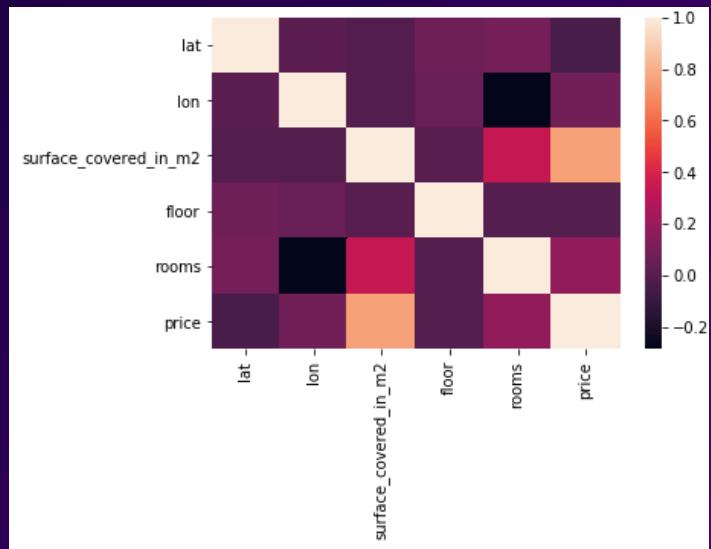
	lat	lon	surface_covered_in_m2	floor	rooms	price
lat	1.000000	0.022591	-0.009909	0.073397	0.096309	-0.038786
lon	0.022591	1.000000	-0.010605	0.057375	-0.287277	0.084386
surface_covered_in_m2	-0.009909	-0.010605	1.000000	0.006778	0.338234	0.756377
floor	0.073397	0.057375	0.006778	1.000000	-0.002624	-0.000925
rooms	0.096309	-0.287277	0.338234	-0.002624	1.000000	0.182658
price	-0.038786	0.084386	0.756377	-0.000925	0.182658	1.000000

House

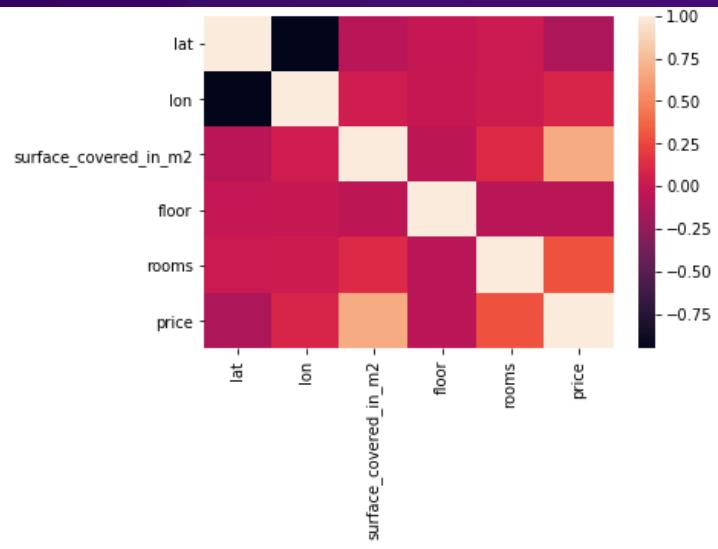
	lat	lon	surface_covered_in_m2	floor	rooms	price
lat	1.000000	-0.954284	-0.068422	-0.011678	0.016420	-0.117335
lon	-0.954284	1.000000	0.045528	-0.000447	0.030223	0.099063
surface_covered_in_m2	-0.068422	0.045528	1.000000	-0.038567	0.120627	0.673911
floor	-0.011678	-0.000447	-0.038567	1.000000	-0.062161	-0.059607
rooms	0.016420	0.030223	0.120627	-0.062161	1.000000	0.291653
price	-0.117335	0.099063	0.673911	-0.059607	0.291653	1.000000

CORRELATION OF NUMERICAL FEATURES

Apartment



House



Foundational Idea: Consider Surface Covered in SqM as a good Price indicator

INTERACTIVE FOLIUM GEO: APARTMENTS

LEGEND

Data: Listing of Apartments in Brazil (February 2018)

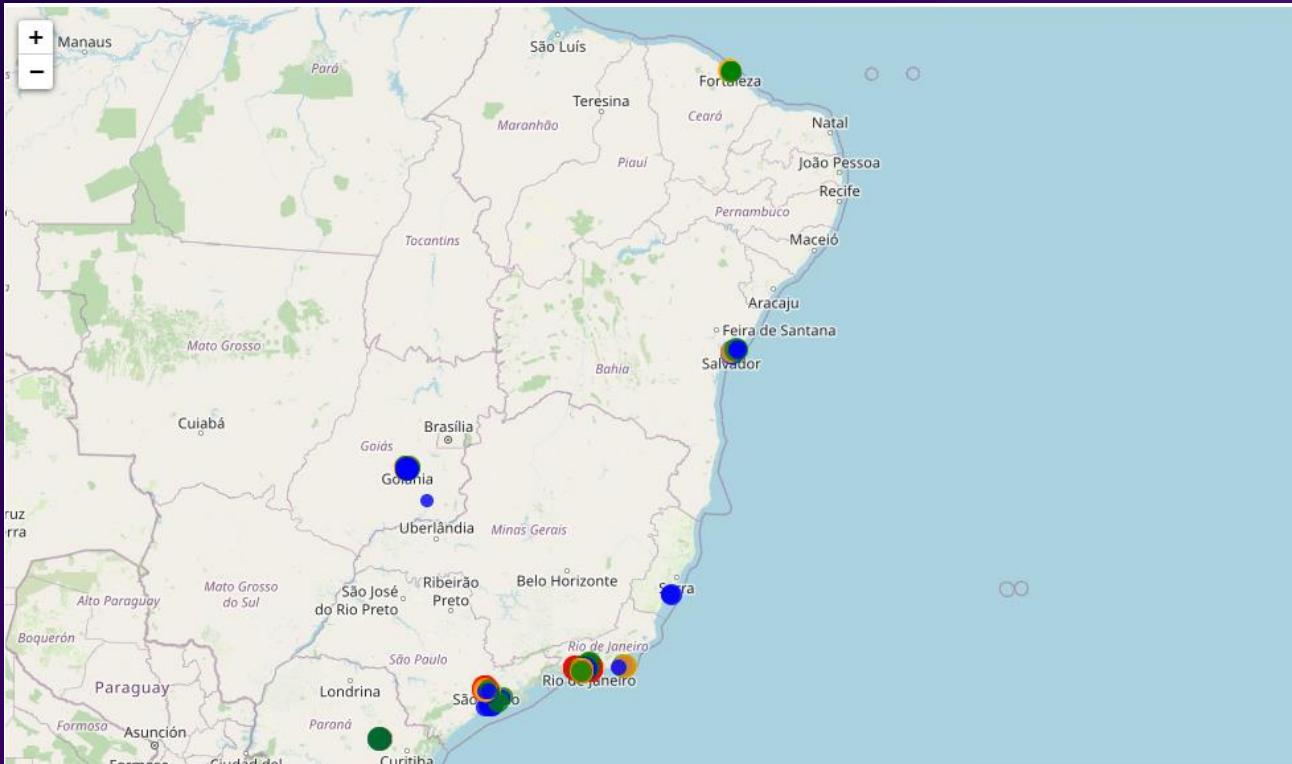
Color: Price Based (Ascending)

- 1st Quartile
- 2nd Quartile
- 3rd Quartile
- 4th Quartile

Size of Markers: Corresponds to Area in Sq. Meters

INTERACTIVE FOLIUM GEO: APARTMENTS

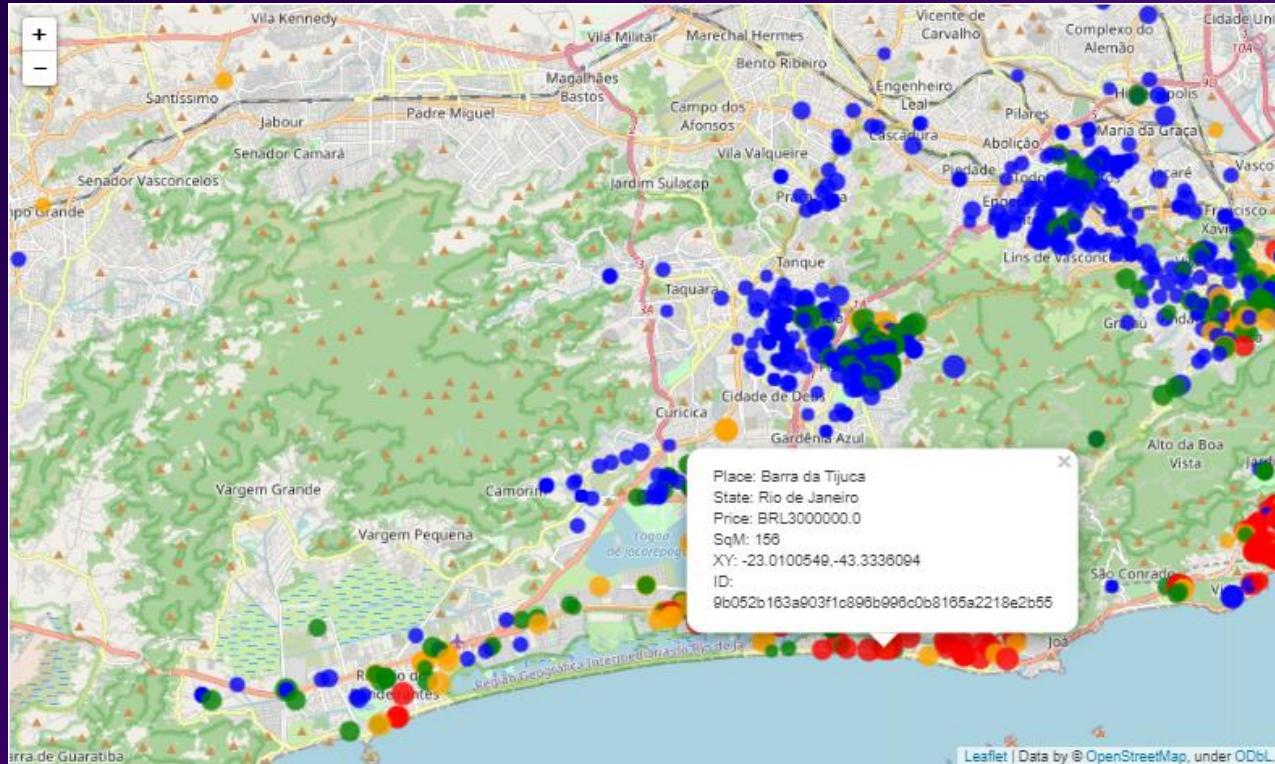
Brazil



OPERATION TYPE: SELL

INTERACTIVE FOLIUM GEO: APARTMENTS

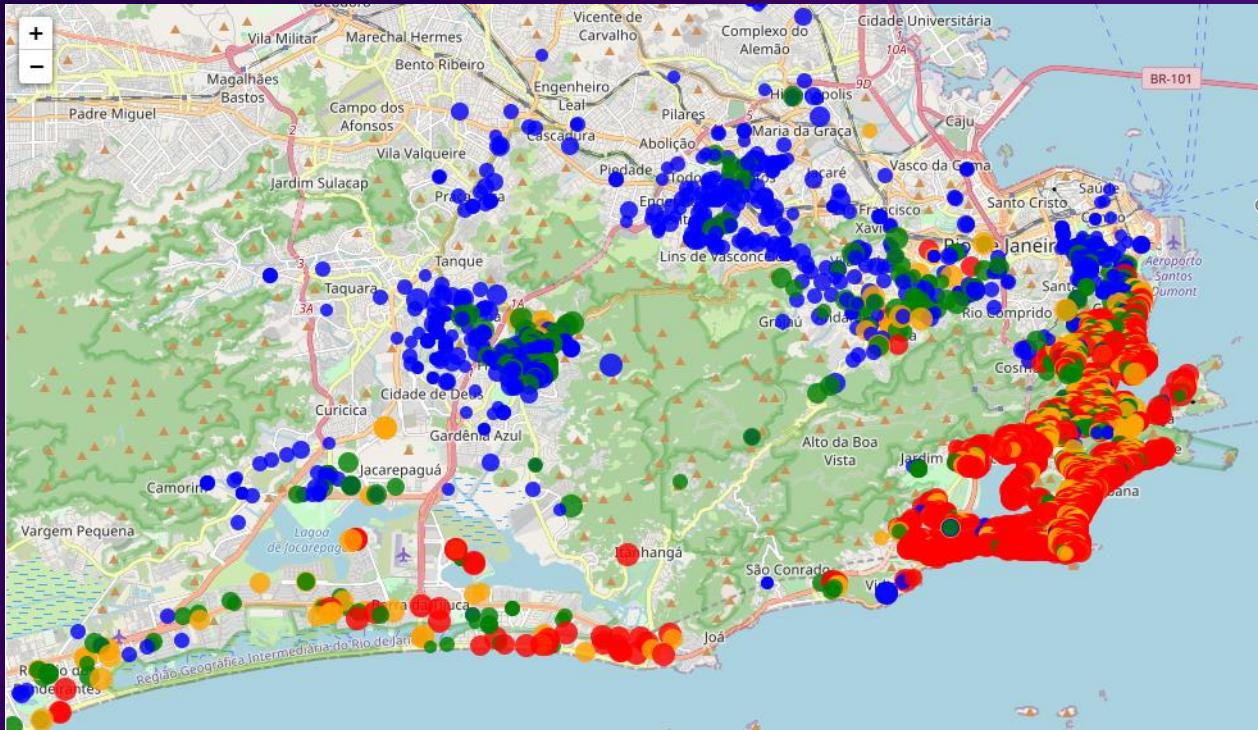
Brazil



OPERATION TYPE: SELL

INTERACTIVE FOLIUM GEO: APARTMENTS

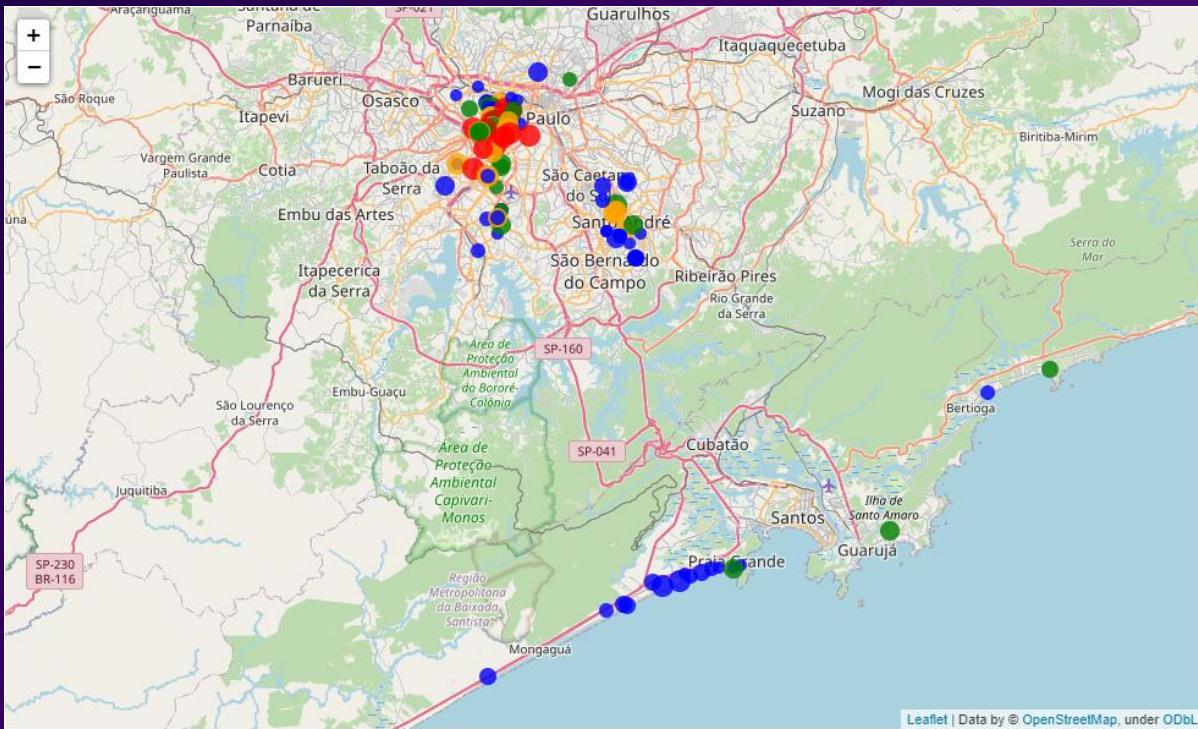
Rio de Janeiro



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

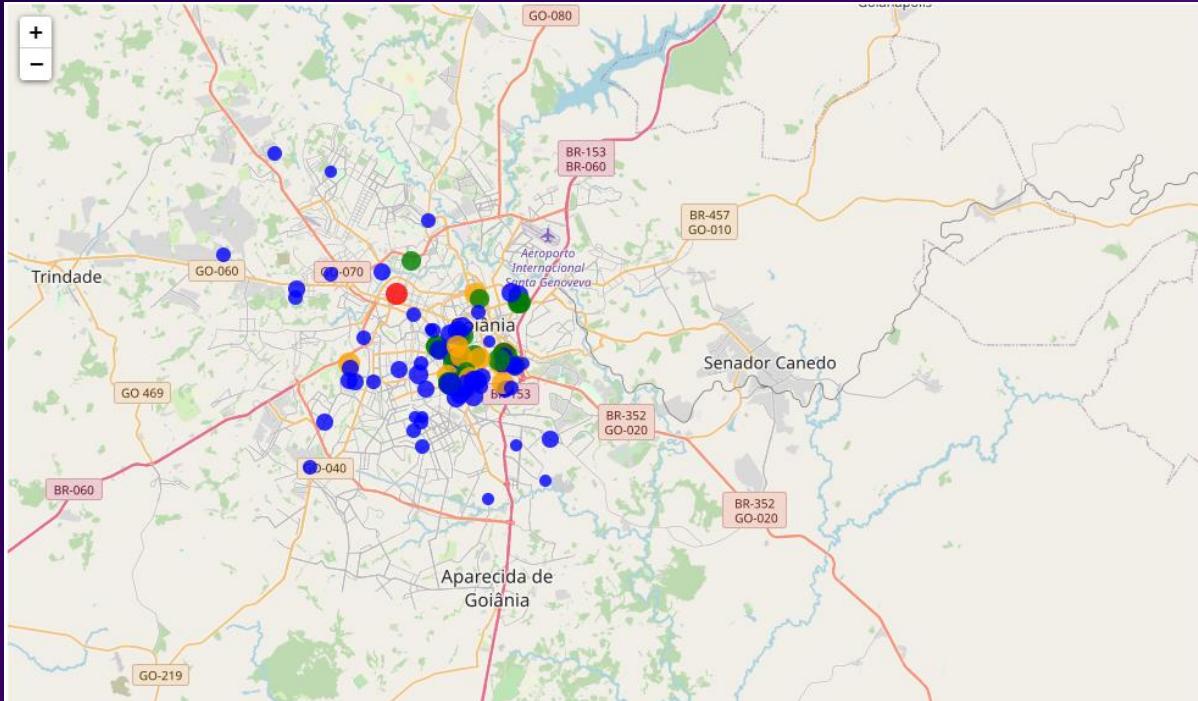
São Paulo



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

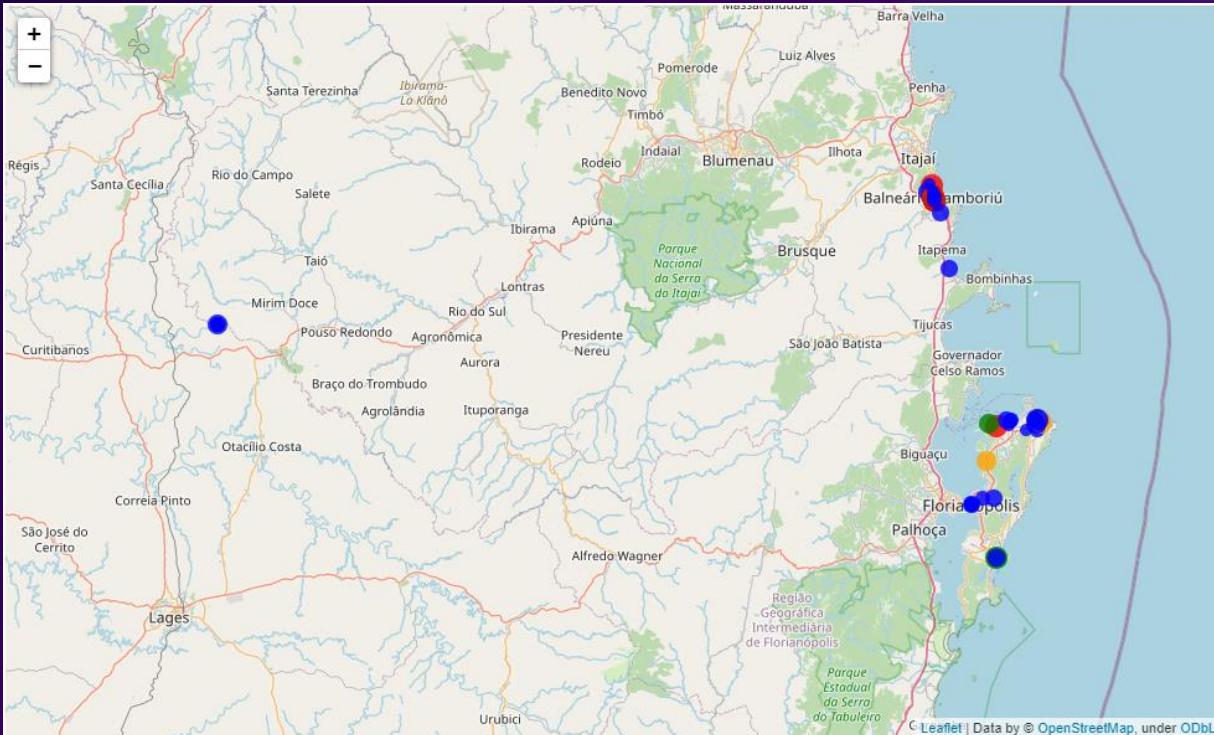
Goiás



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

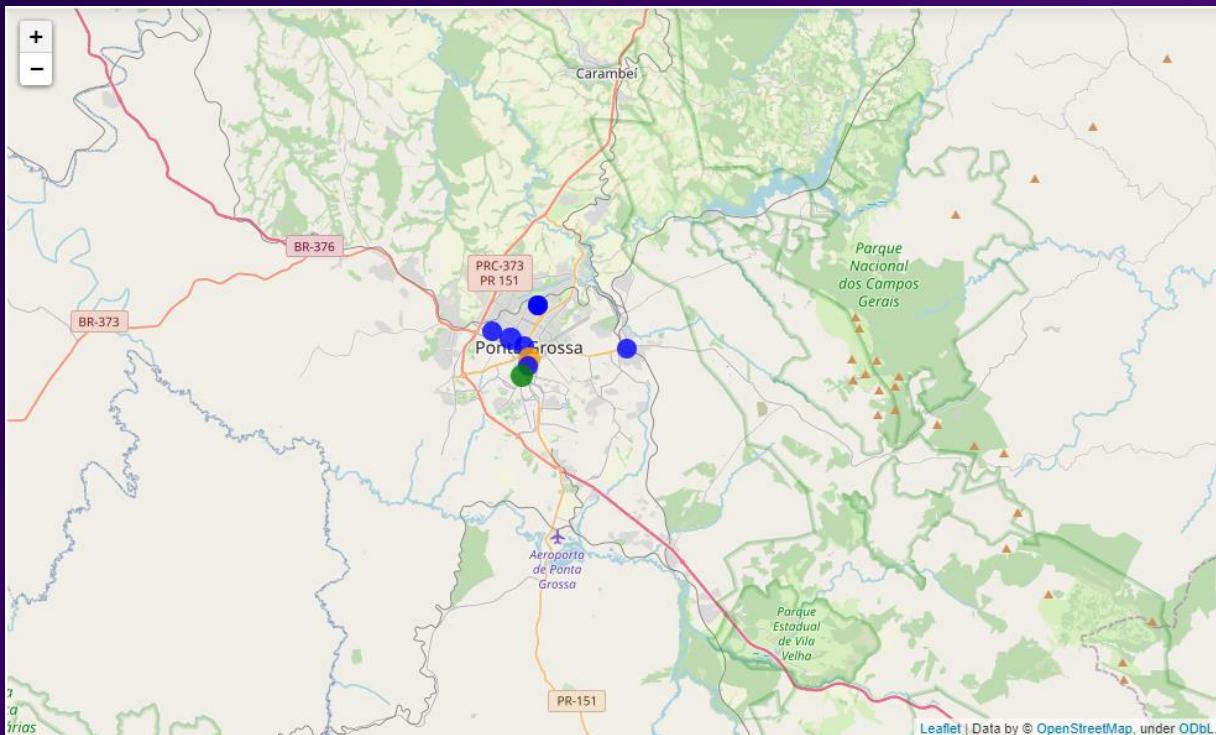
Santa Catarina



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

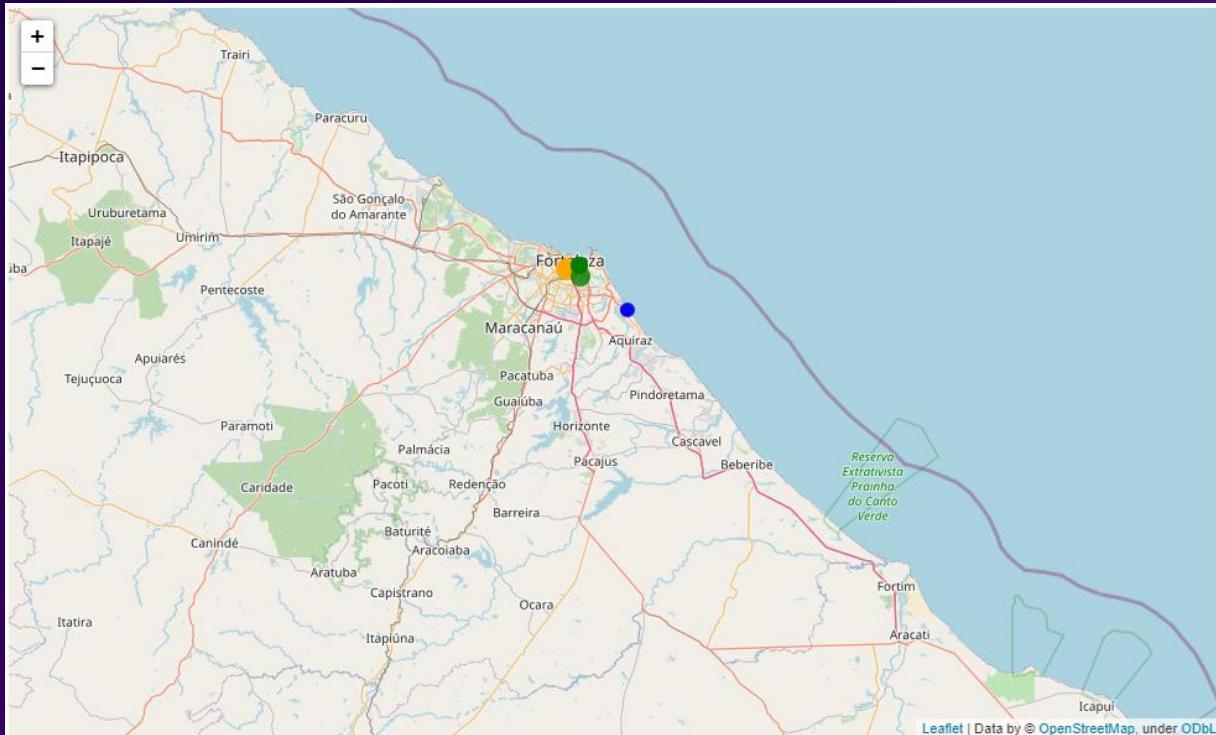
Paraná



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

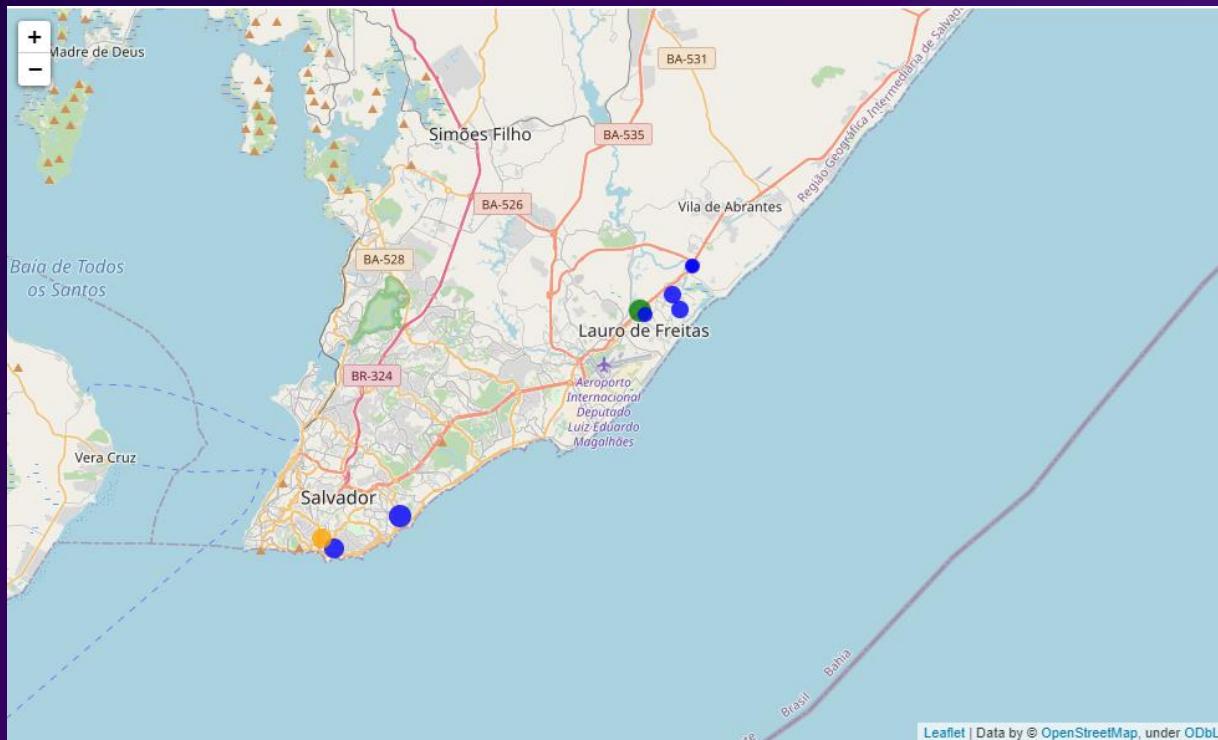
Ceará



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

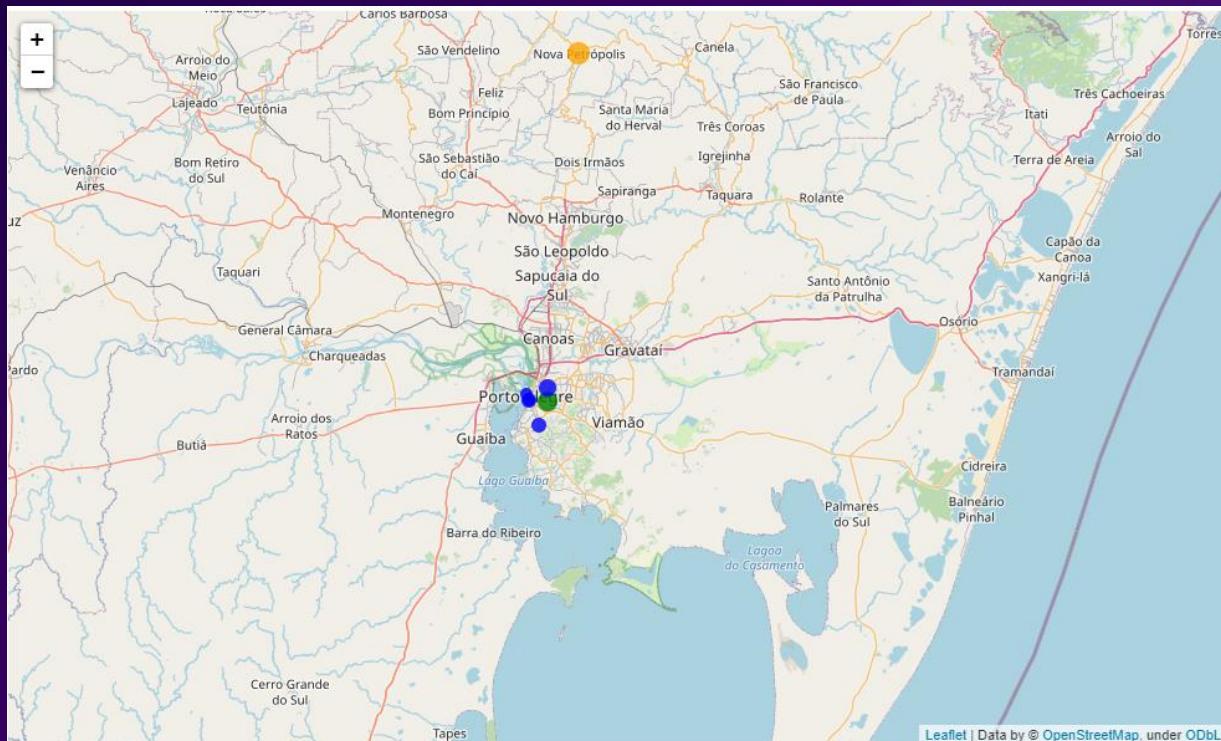
Bahia



OPERATION TYPE: SELL

INTERACTIVE FOLIUM MAP: APARTMENTS

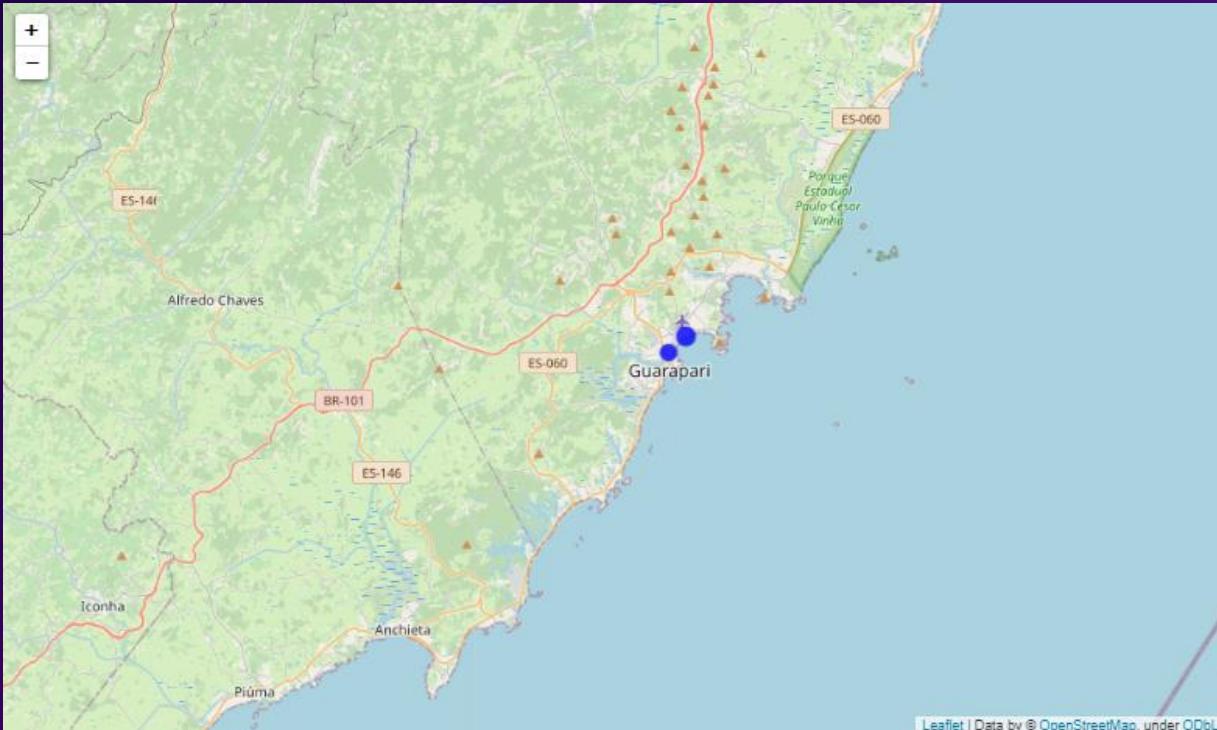
Rio Grande do Sul



OPERATION TYPE: SELL

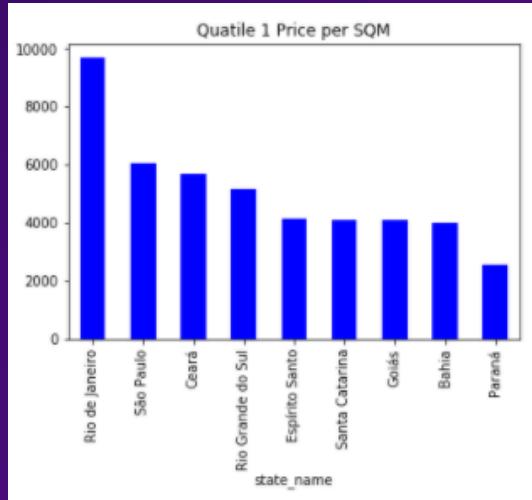
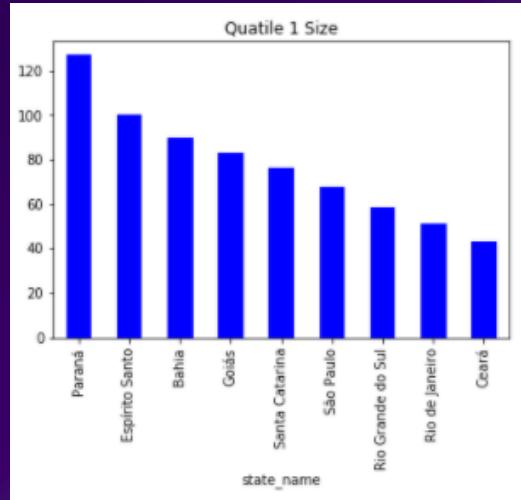
INTERACTIVE FOLIUM MAP: APARTMENTS

Espírito Santo

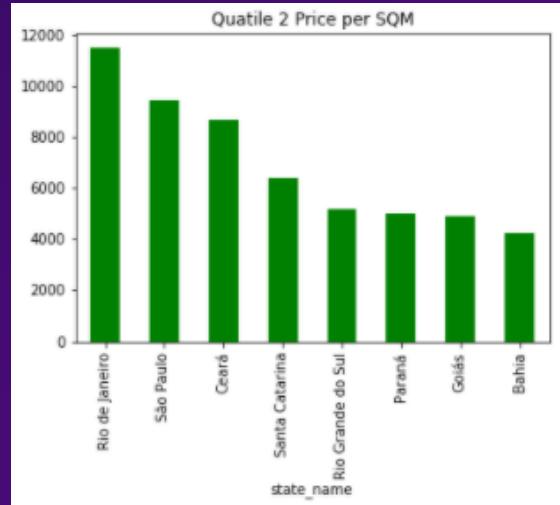
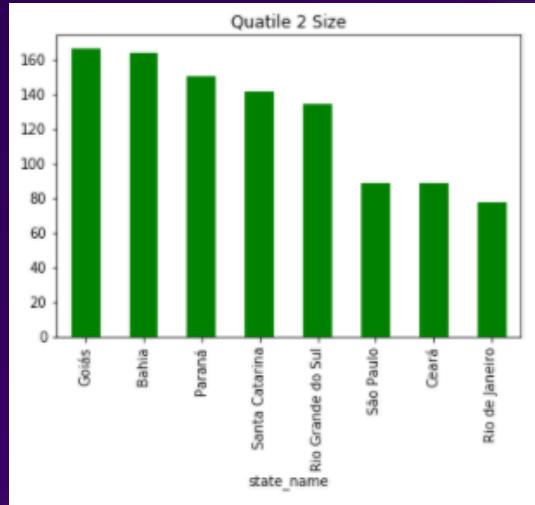


OPERATION TYPE: SELL

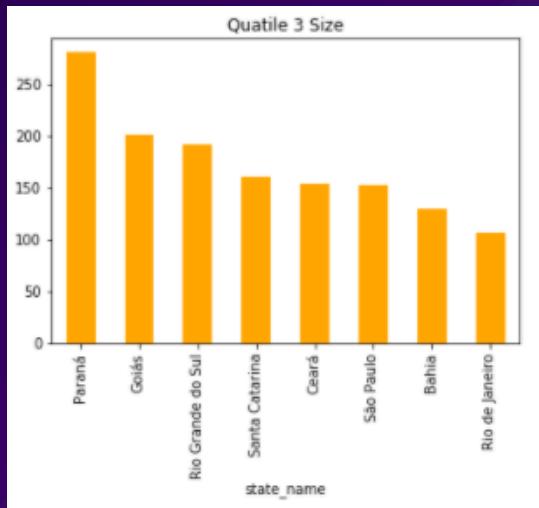
SUPPORTING TABLES: QUARTILE 1



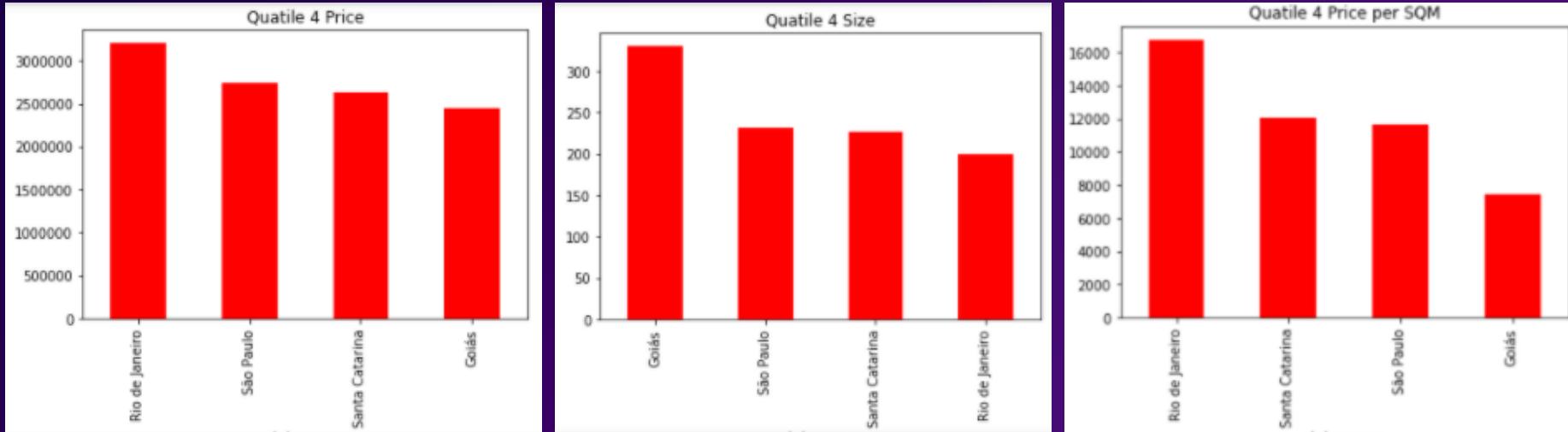
SUPPORTING TABLES: QUARTILE 2



SUPPORTING TABLES: QUARTILE 3



SUPPORTING TABLES: QUARTILE 3

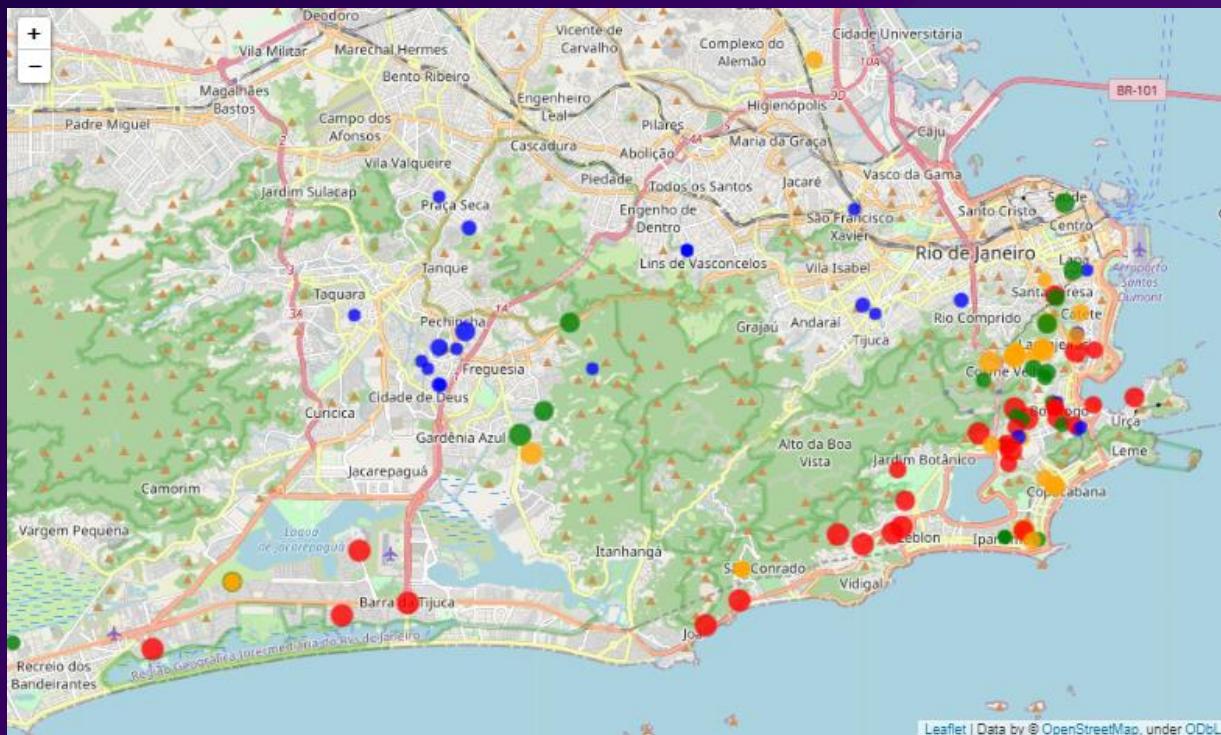


Apartment Insights

- Paraná is the best state for buying apartments in terms of getting the most spacious with the least amount of money. Consistently in first three price quartiles, Paraná is among the lowest price per sq. meter and among the most spacious. In fact, Paraná ranked last in price per sq. meter and first in surface per sq. meter. However the state lacks variety.
- Rio de Janeiro is an intriguing state of seeking investments, dominates the market in terms of volume especially the south-eastern coastline that is primarily populated by Q4 apartments. Observing the folium map, the price and volume of apartments are increasing as it approaches the south-eastern coastline of Rio de Janeiro.

INTERACTIVE FOLIUM MAP: HOUSES

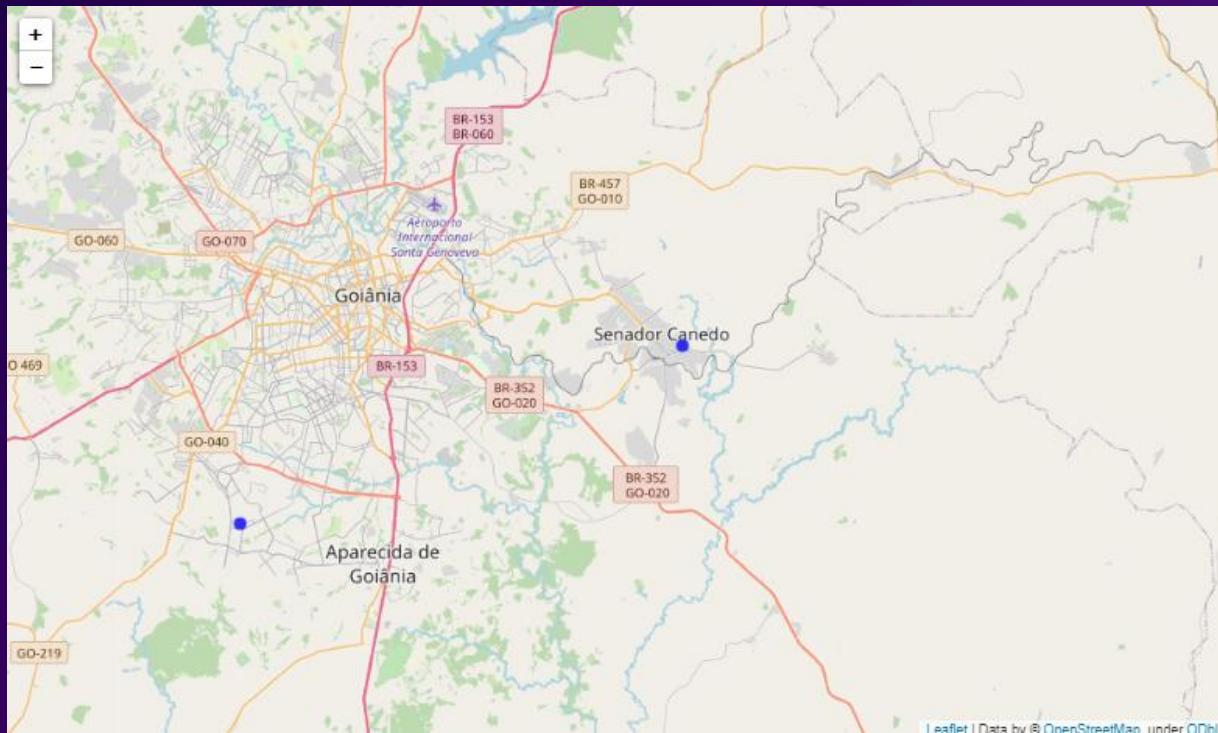
Rio de Janeiro



OPERATION TYPE: SELL

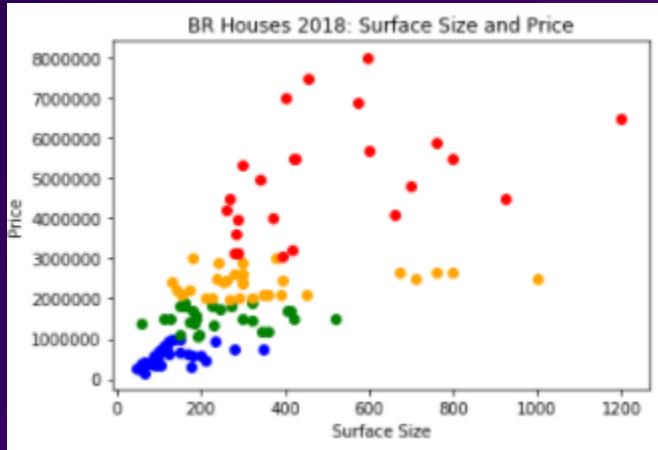
INTERACTIVE FOLIUM MAP: HOUSES

Goiás

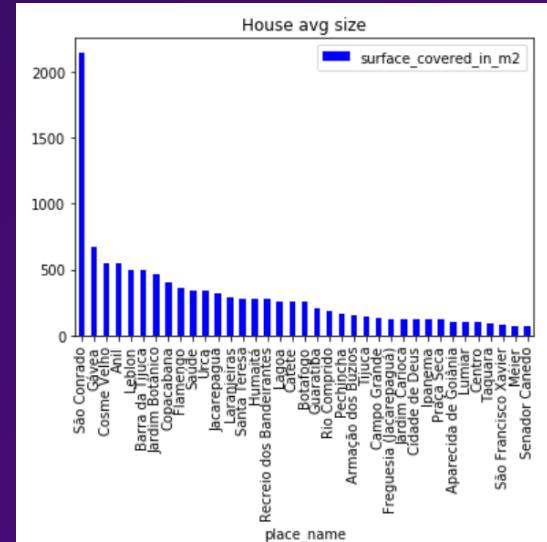
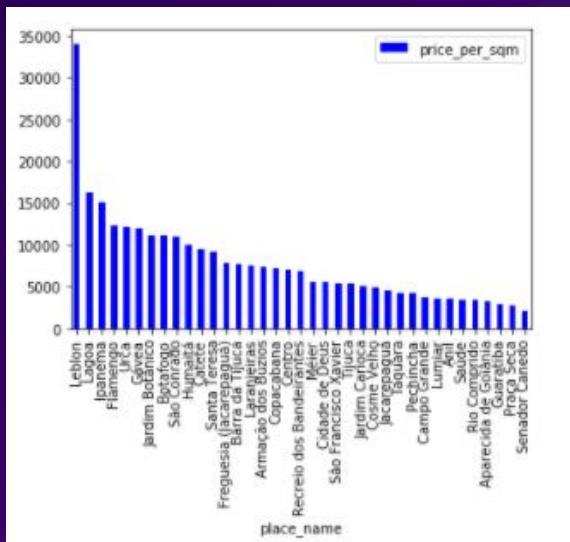
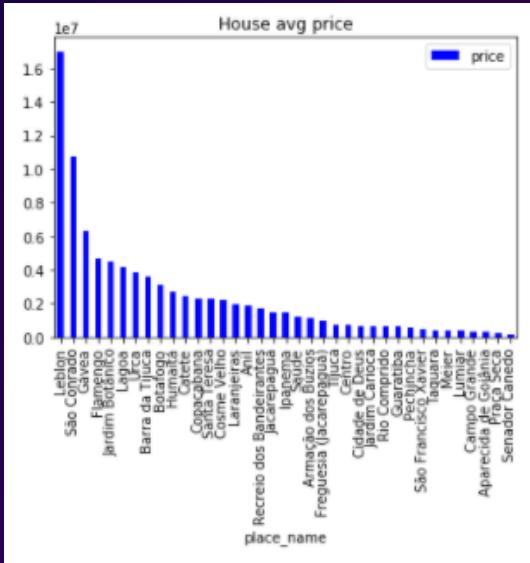


OPERATION TYPE: SELL

SUPPORTING SCATTER PLOT



SUPPORTING HISTOGRAMS



Housing Insights

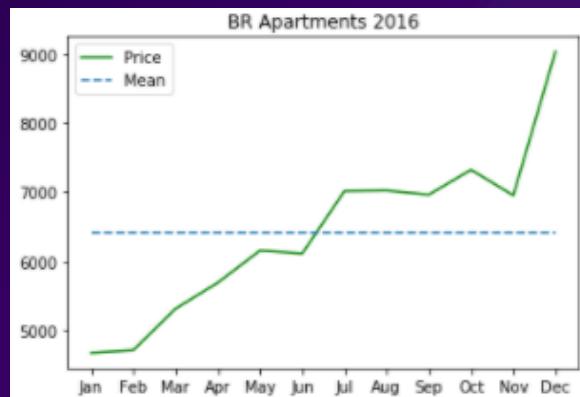
- Generally, an apartment is the more expensive form of investment due to its volume indicating a strong demand and a better average price per sq. meters.
- Housing listings is identical to the Apartment listings' price relationship on other features. In fact, the housing market follows the trend south-eastern coastline trend of Rio de Janeiro rather than utilizing for a larger space in less urban areas. This is based on the geospatial maps and supporting histograms.

TIME

Finding the best time to purchase

MARKET SEASONALITY TREND

Apartments

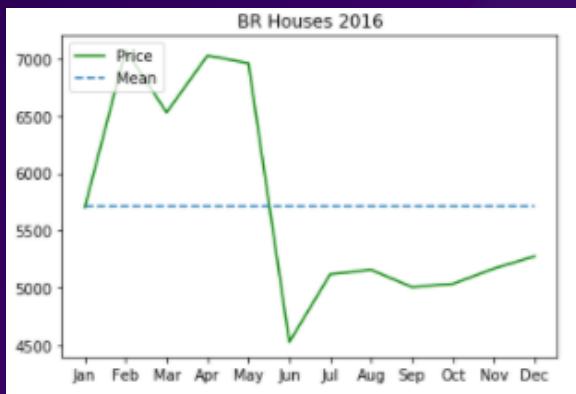
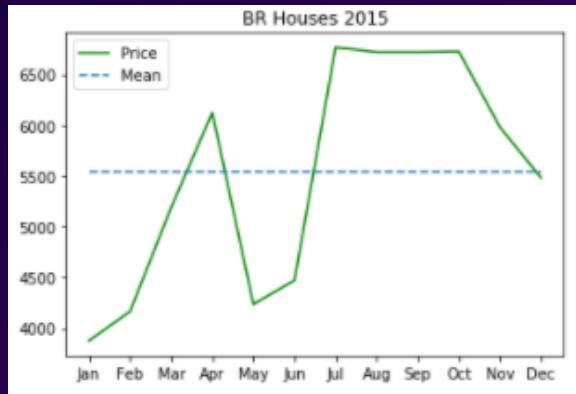


Price: Average Price per Sq. Meters Covered by the Real Estate

OPERATION TYPE: SELL

MARKET SEASONALITY TREND

Houses

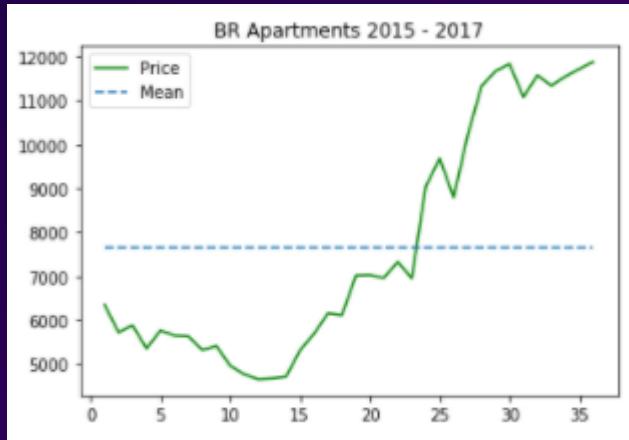


Price: Average Price per Sq. Meters Covered by the Real Estate

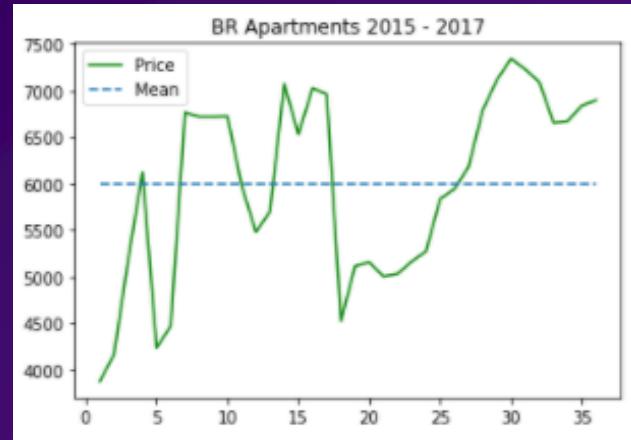
OPERATION TYPE: SELL

3 YEAR GROWTH OF THE MARKET

Apartments



Houses



Price: Price per Sq. Meters Covered by the Real Estate

OPERATION TYPE: SELL

23.26%

Apartments Market CAGR

Compound Annual Growth Rate of the apartment market from 2015 to 2017 in terms of Average Market Price per Sq. Meter

21.16%

Housing Market CAGR

Compound Annual Growth Rate of the housing market from 2015 to 2017 in terms of Average Market Price per Sq. Meter

Time Insights

- There is a seasonality trend of the average price per sq. meter in both markets. This is something to consider when purchasing on a tight budget, hence a short-term perspective.
- In the long-term perspective, the seasonality trend of the average price per sq. meter is nothing to be worried about because of a good compound annual growth rate of the apartment and the housing market throughout 2015 and 2017. Yielding a 23.26% CAGR and 21.16% CAGR respectively.

Neural Network Regression

Materializing the Ideal Real Estate

IDEALIZING THE RIGHT PLACE



AT THE HEART OF RIO
DE JANEIRO

Somewhere near the
south-eastern coastline

IDEALIZING THE RIGHT PLACE

ABOVE THE GROUND

But not near the clouds,
placed between the
15th or 12th floor



IDEALIZING THE RIGHT PLACE



SPACIOUS

Around 300 Sq. Meters
of an apartment is
enough





IDEALIZING THE RIGHT PLACE

What could be the Price?

IDEALIZING THE RIGHT PLACE

-22.930501, -
43.188083

13th Floor

293 Sq. Meters

Apartment



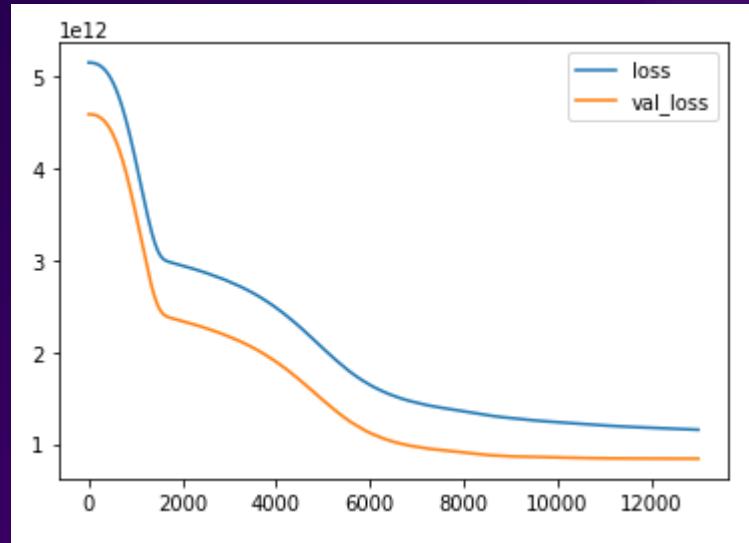
Tensorflow Neural
Network



Predicted Price: BRL 3083962.8

Actual Price: BRL 2900000.0

IDEALIZING THE RIGHT PLACE



MSE Evaluation of the Model

TRAINING AND LIMITATION

- Dataset from the latest listings, February 2018
- Removing Outliers: Narrowed to Apartments and the state of Rio de Janeiro
- Fine-tuned to showcase the south-eastern coastline trend
- Trained to 6000+ Apartment listings
- Forecasted possible new real-estate with promising results

SCALING UP AND POTENTIAL

- Adding a time dimension for a time series analysis
- Using a more powerful platform unlocks the data extraction limitation
- More training time for using of larger amounts of data
- Result: Improving the overall customer experience with accurate forecasts

CLOSING

SUMMARY OF INSIGHTS

- The south-eastern coastline trend of Rio de Janeiro. Increasing both apartment and housing volume, size, and price as it approaches the area.
- Apartment: Paraná is the best state for buying apartments in terms of getting the most spacious with the least amount of money.
- The existing seasonality trend of both apartment and housing markets, an inconvenience for short-term perspective and tight budgets.
- The promising CAGR of Apartment market of 23.26% and the housing market of 21.16%. Negates the seasonal trend in the long run.

RECOMMENDATIONS

- Scaling-up the Neural Network Regression will be a promising improvement of customer experience in all forms investments. Idealizing the right place and forecasting the the future value of the real estates.
- An apartment in Rio de Janeiro along its south-eastern coastline is the best long-term investment. Partnered with a good CAGR Apartment Market average price per sq. meter, makes the decision more compelling to buy and hold. The only bottleneck of this plan is the purchase to begin with.



THANK YOU!