

# Machine Learning: Rental Housing Data

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# Project Overview

## Objective

Explore and predict the rental prices in the private property market using machine learning algorithms on web scraped Craigslist housing data

## Presentation Sections

Data Acquisition

Data Exploration & Preliminary Analysis

Machine Learning

# What I Used

## Language



## Libraries



## Tools



## Algorithms

- Linear Regression
- Random Forest

# Data Acquisition

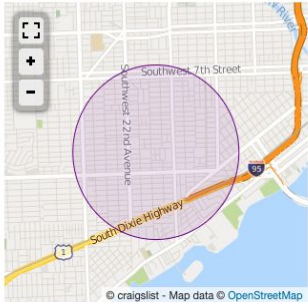

# Web Scraped Datasets

- Web Scraping code includes a **splinter** that opens each listing (3000) and pulls out the specific details within the post
- Code took about 1.5 hours to webscrape 3000 listings
- I web scraped Miami and San Francisco and used the different data sets on my ML models

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**\$1,450 / 2br - 884ft<sup>2</sup> - Nice 2 Bed 1 Bath condo in a small Building (Miami)**

image 1 of 5



2BR / 1Ba 884ft<sup>2</sup>

cats are OK - purrr  
dogs are OK - woof  
condo  
w/d in unit  
off-street parking

Nice 2 Bed 1 Bath condo in a small Building, near the Golf Course ,Normandy Park and the Beach. Security entrance to the Building!

# Web Scrapped DataFrame

	datetimes	hoods	prices	bedrooms	bathrooms	sqft	housing_type	laundry	parking	cats	dogs	furnished
0	2021-05-30 14:02	(Dadeland 2/2)	\$1,900	2BR	2Ba	none	apartment	w/d in unit	carport	none	none	none
1	2021-05-30 14:02	(Doral)	\$2,557	2BR	2Ba	none	apartment	w/d in unit	attached garage	none	none	none
2	2021-05-30 14:02	(Miami)	\$2,241	2BR	2Ba	1106	apartment	w/d in unit	off-street parking	yes	yes	none
3	2021-05-30 14:02	(Doral)	\$3,399	3BR	2Ba	none	apartment	w/d in unit	attached garage	none	none	none
4	2021-05-30 14:01	(doral)	\$1,978	1BR	1Ba	none	apartment	w/d in unit	attached garage	none	none	none

# Data Exploration

# Data Exploration - ETL Process

## Extract

Extract datasets using web scrape method ensuring it has all necessary information and limited null values.

Null values in sq. ft. presents a challenge

## Transform

Transform data by removing duplicate listings, converting data types, replacing string values, creating separate data frames

Convert null values to 0 instead of dropping

## Load

Load the data into PostgreSQL



# Dataset 1: Miami Rental Listings

neighborhood	br	ba	sqft	housingType	laundry	parking	cats	dogs	furnished	rent
Dadeland	2	2.0	0.0	apartment	w/d in unit	carport	no	no	no	1900
Doral	2	2.0	0.0	apartment	w/d in unit	attached garage	no	no	no	2557
Miami	2	2.0	1106.0	apartment	w/d in unit	off-street parking	yes	yes	no	2241
Doral	3	2.0	0.0	apartment	w/d in unit	attached garage	no	no	no	3399
Doral	1	1.0	0.0	apartment	w/d in unit	attached garage	no	no	no	1978

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1836 entries, 0 to 1835
Data columns (total 11 columns):
 #   Column          Non-Null Count  Dtype  
---  -
 0   neighborhood    1836 non-null  object  
 1   br              1836 non-null  int64   
 2   ba              1836 non-null  float64  
 3   sqft            1836 non-null  float64  
 4   housingType     1836 non-null  object  
 5   laundry         1836 non-null  object  
 6   parking         1836 non-null  object  
 7   cats            1836 non-null  object  
 8   dogs            1836 non-null  object  
 9   furnished       1836 non-null  object  
10  rent            1836 non-null  int64   
dtypes: float64(2), int64(2), object(7)
memory usage: 157.9+ KB
```

	br	ba	sqft	rent
count	1836.000000	1836.00000	1836.000000	1836.000000
mean	1.735294	1.69390	342.716231	2016.338235
std	0.774721	0.55118	538.560115	799.370174
min	0.000000	1.00000	0.000000	500.000000
25%	1.000000	1.00000	0.000000	1500.000000
50%	2.000000	2.00000	0.000000	1800.000000
75%	2.000000	2.00000	750.000000	2250.000000
max	5.000000	4.50000	2921.000000	4950.000000

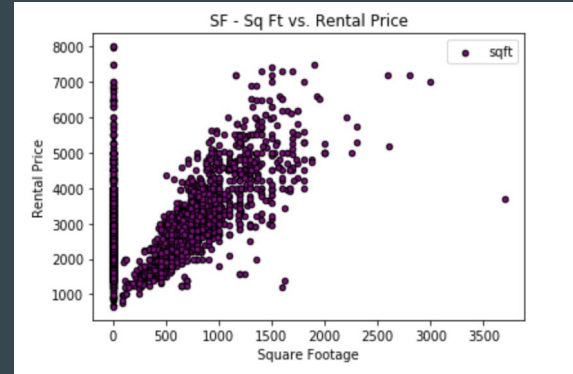
# Dataset 2: San Francisco Rental Listings

neighborhood	br	ba	sqft	housingType	laundry	parking	cats	dogs	furnished	rent
Sunset / Parkside	4	2.0	1600.0	apartment	laundry on site	street parking	no	no	no	4200
Lower Pac Hts	0	1.0	0.0	apartment	laundry in bldg	attached garage	no	no	no	2850
SOMA / South Beach	1	1.0	598.0	apartment	w/d in unit	detached garage	yes	yes	no	3431
Lower Pac Hts	1	1.0	915.0	apartment	w/d in unit	attached garage	no	no	no	3795
Ingleside / SFSU / CCSF	1	1.0	0.0	apartment	no laundry on site	street parking	no	no	no	2000

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2596 entries, 0 to 2595
Data columns (total 11 columns):
#   Column              Non-Null Count  Dtype
---  -
0   neighborhood        2596 non-null   object
1   br                  2596 non-null   int64
2   ba                  2596 non-null   float64
3   sqft                2596 non-null   float64
4   housingType         2596 non-null   object
5   laundry             2596 non-null   object
6   parking             2596 non-null   object
7   cats                2596 non-null   object
8   dogs                2596 non-null   object
9   furnished           2596 non-null   object
10  rent                2596 non-null   int64
dtypes: float64(2), int64(2), object(7)
memory usage: 223.2+ KB
```

	br	ba	sqft	rent
count	2596.000000	2596.000000	2596.000000	2596.000000
mean	1.417951	1.211287	402.965331	3007.330123
std	1.095361	0.444560	508.831219	1187.119637
min	0.000000	1.000000	0.000000	650.000000
25%	1.000000	1.000000	0.000000	2190.000000
50%	1.000000	1.000000	0.000000	2795.000000
75%	2.000000	1.000000	750.000000	3688.500000
max	8.000000	4.000000	3700.000000	7995.000000

# Preliminary Analysis



Correlation Matrix and Scatter Plots to see if there's any obvious relationship between variables and Rent Price



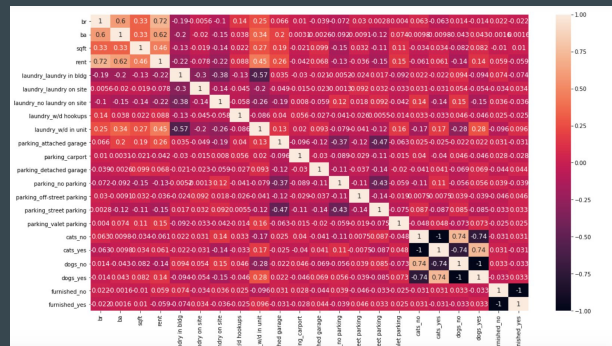
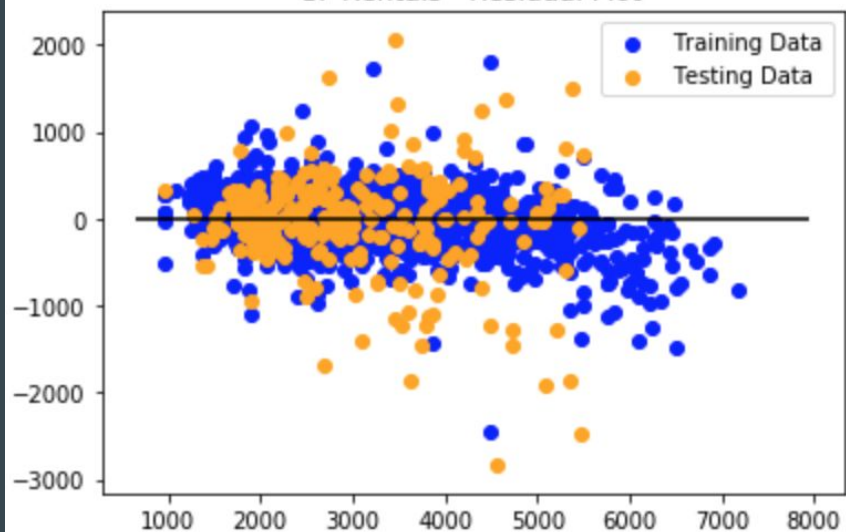
# Machine Learning

# Model Testing

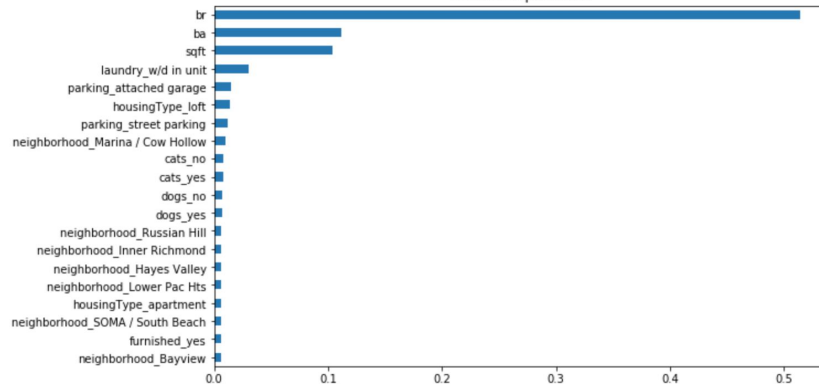
Model Name	Data Processing	Model Parameters	Independent Variable(s) Used	RMSE	R2
LinearRegression()	80/20 train test split		sqft	\$3,286.06	0.22
LinearRegression() - Multiple	80/20 train test split		br, ba, sqft, housingType, laundry, parking, cats, dogs, furnished	\$3,285.83	0.72
RandomForestRegressor()	K-fold cross validation with cv = 10 (10 90/10 splits)	(n_estimators = 1000, random_state = 42, criterion = 'mse', bootstrap=True)	neighborhood, br, ba, sqft, housingType, laundry, parking, cats, dogs, furnished	\$579.54	0.7597
RandomForestRegressor()	RandomizedSearch CV param_distributions = {'bootstrap': [True, False], 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None], 'max_features': ['auto', 'sqrt'], 'min_samples_leaf': [1, 2, 4], 'min_samples_split': [2, 5, 10], 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}	best_params = 'n_estimators': 600, 'min_samples_split': 5, 'min_samples_leaf': 1, 'max_features': 'sqrt', 'max_depth': 60, 'bootstrap': False	neighborhood, br, ba, sqft, housingType, laundry, parking, cats, dogs, furnished	\$567.28	0.7703

# Findings

SF Rentals - Residual Plot



Feature Importances



**Thank You**