```python
import numpy as np
import pandas as pd
from collections import Counter
import matplotlib.pyplot as plt
plt.style.use('seaborn')
import seaborn as sns

#listings_csv descrito e fazendo uma amostragem.

listings_file = 'F:\FIAPdes4\dados\listings.csv'

# Colunas que teoricamente vamos utilizar
columns = ['price',
           'summary',
           'neighbourhood_group_cleansed',
           'property_type',
           'room_type',
           'price',
           'number_of_reviews',
           'instant_bookable',
           'review_scores_rating',
           'beds',
           'bedrooms',
           'bathrooms',
           'accommodates',
           'amenities',
           'cancellation_policy',
           'reviews_per_month',
           'latitude',
           'longitude',
           'cleaning_fee',
           'security_deposit',
          'minimum_nights',
          'host_listings_count']

df = pd.read_csv(listings_file, usecols=columns)

df.head()
```

```
                                             summary
host_listings_count  \
0  Pls note that special rates apply for Carnival...
2.0
1  Our apartment is a little gem, everyone loves ...
3.0
2  This nice and clean 1 bedroom apartment is loc...
1.0
3  This cosy apartment  is just a few steps away ...
1.0
4  Our newly renovated studio is located in the b...
```

```
1.0

   neighbourhood_group_cleansed  latitude  longitude property_type  \
0                           NaN -22.96592  -43.17896   Condominium
1                           NaN -22.97712  -43.19045     Apartment
2                           NaN -22.98302  -43.21427     Apartment
3                           NaN -22.98816  -43.19359     Apartment
4                           NaN -22.98127  -43.19046          Loft

         room_type  accommodates  bathrooms  bedrooms  ...  \
0  Entire home/apt             5        1.0       2.0  ...
1  Entire home/apt             2        1.0       1.0  ...
2  Entire home/apt             3        1.0       1.0  ...
3  Entire home/apt             3        1.5       1.0  ...
4  Entire home/apt             2        1.0       1.0  ...

                                           amenities    price  \
0  {TV,"Cable TV",Internet,Wifi,"Air conditioning...  $332.00
1  {TV,"Cable TV",Internet,Wifi,"Air conditioning...  $160.00
2  {TV,"Cable TV",Internet,Wifi,"Air conditioning...  $273.00
3  {TV,"Cable TV",Internet,Wifi,"Air conditioning...  $378.00
4  {TV,"Cable TV",Wifi,"Air conditioning",Kitchen...  $130.00

  security_deposit cleaning_fee minimum_nights  number_of_reviews  \
0            $0.00      $378.00              4                243
1        $1,000.00      $250.00              7                235
2            $0.00       $84.00              2                271
3        $1,050.00      $172.00              2                169
4          $400.00      $140.00              3                316

   review_scores_rating  instant_bookable          cancellation_policy
\
0                  93.0                 t  strict_14_with_grace_period

1                  94.0                 f  strict_14_with_grace_period

2                  96.0                 t  strict_14_with_grace_period

3                  94.0                 f  strict_14_with_grace_period

4                  98.0                 f  strict_14_with_grace_period


  reviews_per_month
0              2.13
1              2.04
2              2.38
3              2.28
4              2.84
```

```
[5 rows x 21 columns]

#todos os campos que são nulos no dataset
df.isna().sum()
#estatísticas básicas do dataset airbnb
df.describe()
#tipos de colunas
df.info()

       host_listings_count  neighbourhood_group_cleansed      latitude
\
count         33695.000000                           0.0  33715.000000

mean              7.347559                           NaN    -22.965208

std              32.194777                           NaN      0.035244

min               0.000000                           NaN    -23.073400

25%               1.000000                           NaN    -22.984710

50%               1.000000                           NaN    -22.970850

75%               3.000000                           NaN    -22.946725

max            1259.000000                           NaN    -22.750380


          longitude  accommodates     bathrooms      bedrooms
beds  \
count  33715.000000  33715.000000  33661.000000  33673.000000
33667.000000
mean     -43.254228      4.199941      1.694765      1.646126
2.574242
std        0.097488      2.625252      1.508228      1.075649
2.121490
min      -43.737090      1.000000      0.000000      0.000000
0.000000
25%      -43.323360      2.000000      1.000000      1.000000
1.000000
50%      -43.200220      4.000000      1.000000      1.000000
2.000000
75%      -43.187085      6.000000      2.000000      2.000000
3.000000
max      -43.104060    160.000000    200.000000     20.000000
69.000000

       minimum_nights  number_of_reviews  review_scores_rating  \
```

```
count    33715.000000       33715.000000          18293.000000
mean         4.789826           9.374344             94.777565
std         22.640328          24.815311              9.141386
min          1.000000           0.000000             20.000000
25%          1.000000           0.000000             93.000000
50%          2.000000           1.000000             98.000000
75%          4.000000           6.000000            100.000000
max       1123.000000         372.000000            100.000000

       reviews_per_month
count       19149.000000
mean            0.707232
std             0.927453
min             0.010000
25%             0.110000
50%             0.340000
75%             0.980000
max            10.080000
```

```python
# Nos campos numéricos, substituir os valores nulos por 0
df.review_scores_rating.fillna(0, inplace=True)

# remover o $
df.price = df.price.str.replace('$', '').str.replace(',',
'').astype(float)

# Remover registros que estão com valores nulos em bathrooms, bedrooms
e beds
df.dropna(subset=['bathrooms', 'bedrooms', 'beds'], inplace=True)
```

```
C:\Users\edu\AppData\Local\Temp\ipykernel_88584\677663314.py:5:
FutureWarning: The default value of regex will change from True to
False in a future version. In addition, single character regular
expressions will *not* be treated as literal strings when regex=True.
  df.price = df.price.str.replace('$', '').str.replace(',',
'').astype(float)
```

```python
#nesse, vimos que a maioria do campo property_value é apartamento,
quase 80% do total:
tipo_ac_df = df.property_type.value_counts(normalize = True)

print(tipo_ac_df)
```

```
Apartment                 0.764499
House                     0.103854
Condominium               0.055022
Serviced apartment        0.021455
Loft                      0.018450
Guest suite               0.006011
Bed and breakfast         0.004166
Guesthouse                0.003988
```

```
Villa                        0.003273
Hostel                       0.003035
Other                        0.002797
Hotel                        0.002678
Townhouse                    0.001904
Aparthotel                   0.001756
Cottage                      0.000952
Chalet                       0.000922
Earth house                  0.000863
Boutique hotel               0.000863
Tiny house                   0.000803
Boat                         0.000684
Bungalow                     0.000298
Cabin                        0.000298
Nature lodge                 0.000298
Casa particular (Cuba)       0.000298
Island                       0.000149
Treehouse                    0.000119
Hut                          0.000089
Castle                       0.000089
Farm stay                    0.000060
Camper/RV                    0.000060
Houseboat                    0.000060
Dorm                         0.000060
Tent                         0.000030
Yurt                         0.000030
Campsite                     0.000030
Barn                         0.000030
Igloo                        0.000030
Name: property_type, dtype: float64
```

```python
#retirando os campos que não serão utilizados

data = df[['price',
           'room_type',
           'review_scores_rating',
           'beds',
           'bedrooms',
           'bathrooms',
           'accommodates'
          ]]
```

```python
# get_dummies function para transformar os valores em colunas, e os
valores das colunas em 1 ou 0
room_type = pd.get_dummies(data.room_type).astype(int)

# alterar a coluna original para transformar em colunas
data = data.drop(['room_type'], axis = 1)
data = pd.concat((data, room_type), axis = 1)
```

```python
data.head()
```

```
   price  review_scores_rating  beds  bedrooms  bathrooms
accommodates  \
0  332.0                  93.0   2.0       2.0        1.0
5
1  160.0                  94.0   2.0       1.0        1.0
2
2  273.0                  96.0   2.0       1.0        1.0
3
3  378.0                  94.0   2.0       1.0        1.5
3
4  130.0                  98.0   1.0       1.0        1.0
2

   Entire home/apt  Hotel room  Private room  Shared room
0                1           0             0            0
1                1           0             0            0
2                1           0             0            0
3                1           0             0            0
4                1           0             0            0
```

```
#https://www.sharpsightlabs.com/blog/scikit-train_test_split/
# import train_test_split , para separar os dados de treino e teste.
from sklearn.model_selection import train_test_split
# import metrics
from sklearn.metrics import mean_squared_error, r2_score

# create target and features. No treino, colocamos todas as colunas, 
menos o preço, pois vamos verificar a importância a partir do preço. 
Essa coluna é a característica.
a = data.drop(['price'], axis = 1)
#No teste, utilizaremos o preço, que é o que temos que descobrir, ou 
seja, a variação desse campo em relação aos demais. Esse é o alvo
b = data.price
#A tabela (dataframe) é a melhor forma de utilizarmos x e y, pois 
nesse caso, as duas tem que ter a mesma quantidade de linhas.

# Separar os dados de treino e teste. O tamanho é de 20% dos dados. 
Random_state é o modo em que ele ordena para fazer os testes.
X_train, X_test, y_train, y_test = train_test_split(a, b, 
test_size=0.2, random_state=2)

# Normalizar as características ( a )
from sklearn.preprocessing import StandardScaler
from sklearn.dummy import DummyRegressor

#criamos um objeto dummy regressor, para fazer regressão.
dummy_regressor = DummyRegressor()
dummy_regressor.fit(X_train, y_train)

#criamos um objeto do sklearn, um standardscaler
```

```
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test  = sc.transform(X_test)



#Preços preditos pelo dummyRegressor, que é a média de preços
encontrada.
dummy_regressor.predict(X_test)
```

```
array([654.43107424, 654.43107424, 654.43107424, ..., 654.43107424,
       654.43107424, 654.43107424])
```

```
#Linear Regression
from sklearn import linear_model
from sklearn import metrics

# linear regression testing
reg = linear_model.LinearRegression()
reg.fit(X_train, y_train)
linear = metrics.r2_score(y_test, reg.predict(X_test))

y_test_pred = reg.predict(X_test)
y_train_pred = reg.predict(X_train)

print (f"Linear Regression: {round(linear, 5)}")
```

```
Linear Regression: 0.14433
```

```
# Modelo rigde
ridge = linear_model.Ridge()
ridge.fit(X_train, y_train)
ridge_result = metrics.r2_score(y_test, ridge.predict(X_test))

y_test_pred = ridge.predict(X_test)
y_train_pred = ridge.predict(X_train)

print (f"Linear Ridge: {round(ridge_result, 5)}")
```

```
Linear Ridge: 0.14436
```

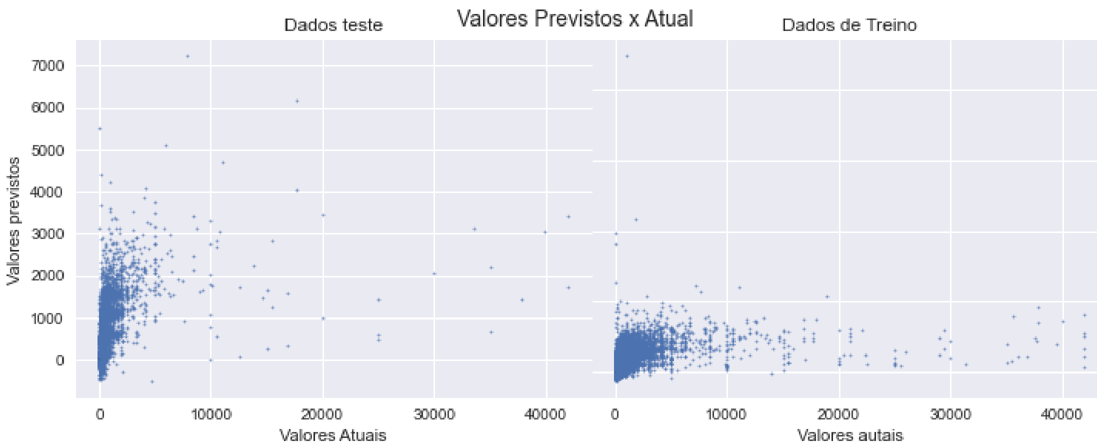
```
#mostrar os valores dos dados autais e os dados que serão usados para
treino.
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(12, 4))
fig.suptitle('Valores Previstos x Atual', fontsize=14, y=1)
plt.subplots_adjust(top=0.93, wspace=0)

ax1.scatter(y_test, y_test_pred, s=2, alpha=0.7)
ax1.plot(list(range(2,8)), list(range(2,8)), color='black',
linestyle='--')
ax1.set_title('Dados teste')
```

```
ax1.set_xlabel('Valores Atuais')
ax1.set_ylabel('Valores previstos')

ax2.scatter(y_train, y_train_pred, s=2, alpha=0.7)
ax2.plot(list(range(2,8)), list(range(2,8)), color='black',
linestyle='--')
ax2.set_title('Dados de Treino')
ax2.set_xlabel('Valores autais')
ax2.set_ylabel('')
ax2.set_yticklabels(labels='')

plt.show()
```




```
#https://github.com/carlosfab/sigmoidal_ai/blob/master/XGBoost%20-
%20aprenda%20este%20algoritmo%20de%20Machine%20Learning%20em
%20Python.ipynb
import xgboost as xgb
# cria o modelo de predição do xgb regressor
modelo = xgb.XGBRegressor()

#https://www.projectpro.io/recipes/find-optimal-parameters-using-
gridsearchcv-for-regression
#https://www.kaggle.com/code/stuarthallows/using-xgboost-with-scikit-
learn

from sklearn.model_selection import GridSearchCV

# criar grid de parâmetros, para aprender e selecionar o melhor
parâmetro
param_grid = {'n_estimators': [100, 150, 200, 300], #modelos ou
funções que vamos passar
              'learning_rate': [0.01, 0.05, 0.1],  #taxa de
aprendizado
              'max_depth': [4,6,8,10],
              'colsample_bytree': [0.6, 0.7, 1],
              'gamma': [0.0, 0.1, 0.2]}
```

```python
# instantiate the tuned random forest
modelo_grid = GridSearchCV(modelo, param_grid, cv=2, n_jobs=-1)
#njobs=-1 quer dizer que pode utilizar toda a cpu. cv é o número de
divisões que ele faz para a validação cruzada.

# treinar o grid do modelo
modelo_grid.fit(X_train, y_train)

# Imprimir os melhores estimos
print(modelo_grid.best_estimator_)
# Imprimir os melhores parâmetros
print(modelo_grid.best_params_)
# Imprimir os melhores scores
print(modelo_grid.best_score_)
```

```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=0.6, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None,
feature_types=None,
             gamma=0.0, gpu_id=None, grow_policy=None,
importance_type=None,
             interaction_constraints=None, learning_rate=0.01,
max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=4, max_leaves=None,
             min_child_weight=None, missing=nan,
monotone_constraints=None,
             n_estimators=300, n_jobs=None, num_parallel_tree=None,
             predictor=None, random_state=None, ...)
{'colsample_bytree': 0.6, 'gamma': 0.0, 'learning_rate': 0.01,
'max_depth': 4, 'n_estimators': 300}
0.22502950590493975
```

```python
# Iniciar o xgboost com os parâmetros obtidos na célula anterior
modelo = xgb.XGBRegressor(colsample_bytree=0.6, gamma=0.0,
learning_rate=0.01,
                           max_depth=4, n_estimators=300,
random_state=4)

# Treinar o modelo
modelo.fit(X_train, y_train)

# Predizer os valores usando o predict
y_pred_train = modelo.predict(X_train)
y_pred_test = modelo.predict(X_test)
```

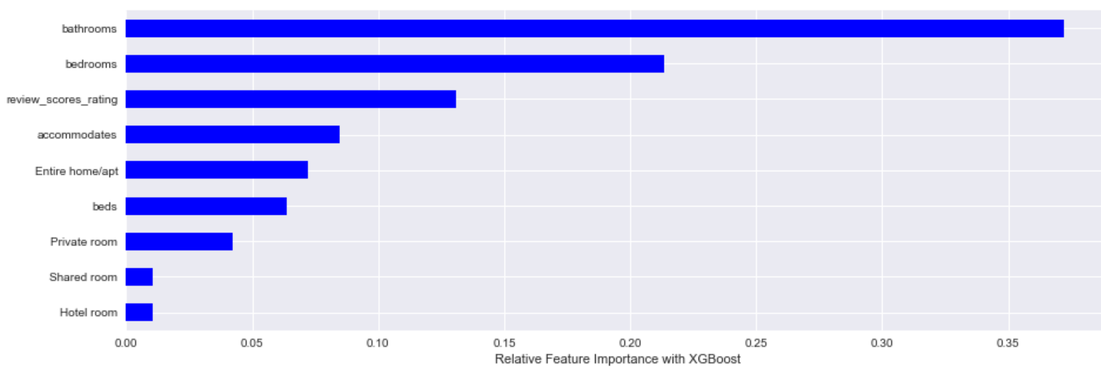
```
# Erro médio absoluto do modelo
RMSE = np.sqrt(mean_squared_error(y_test, y_pred_test))
print(f"RMSE: {round(RMSE, 5)}")
```

```
RMSE: 1159.54724
```

```
print(X_train.size)
print(X_test.size)
print(y_train.size)
print(y_test.size)
```

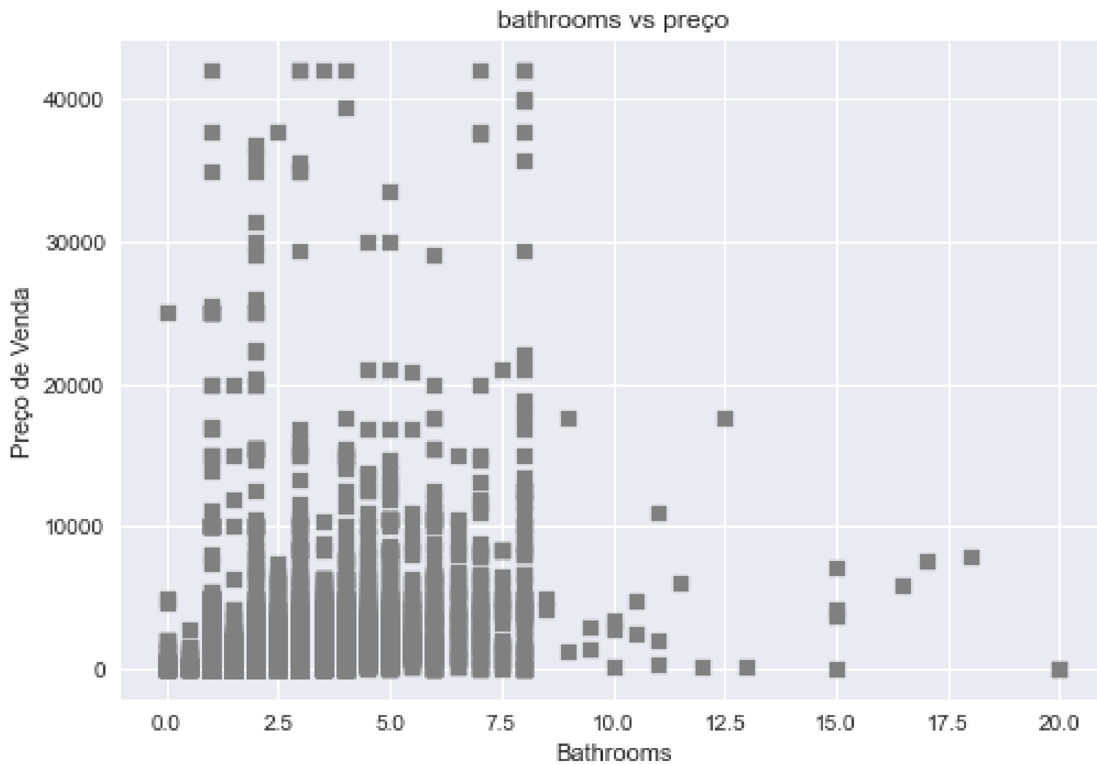
```
241956
60489
26884
6721
```

```
# características mais importantes nos dados, de acordo com o preço
features_importance = pd.Series(modelo.feature_importances_,
index=a.columns)
features_importance.nlargest(15).sort_values().plot(kind='barh',
color='blue', figsize=(15,5))
plt.xlabel('Relative Feature Importance with XGBoost');
```

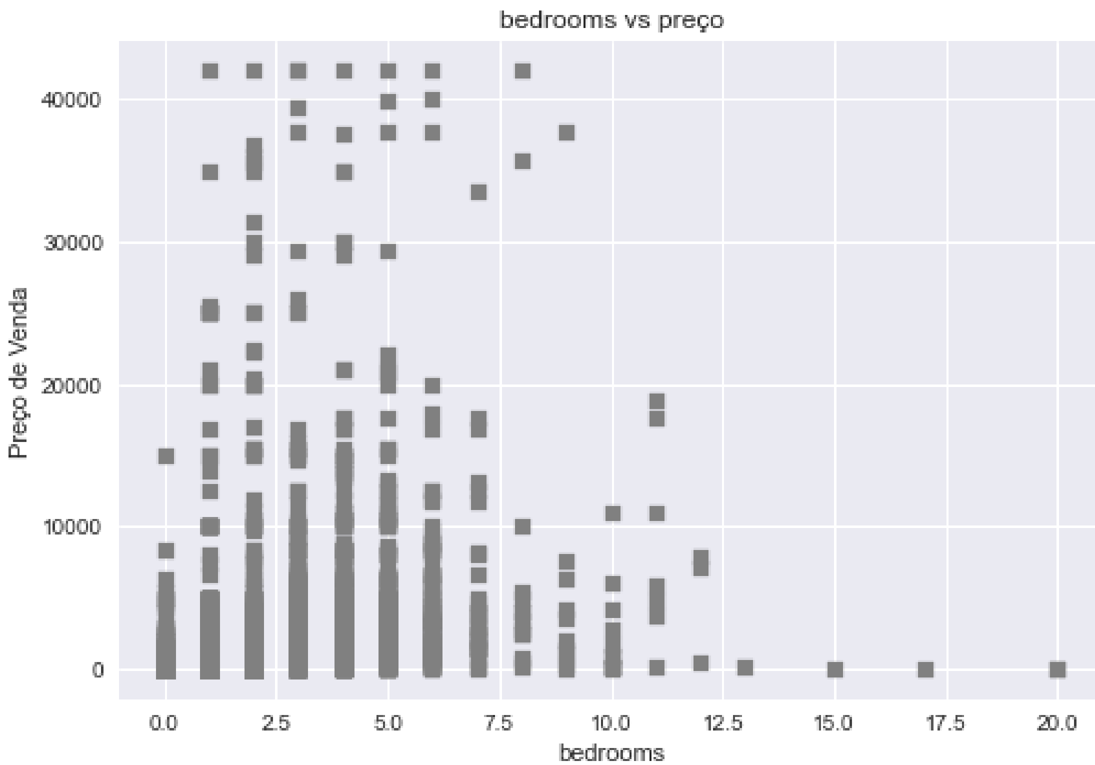



```
#retirando o valor de 200 banheiros, que podem estar errados.
df2 = df[data.bathrooms != 200]
```

```
#Analisando os fatores mais importantes, conforme gráfico anterior, o
número de banheiros:
plt.scatter(df2.bathrooms, df2.price, c = "gray", marker = "s")
plt.title("bathrooms vs preço")
plt.xlabel("Bathrooms")
plt.ylabel("Preço de Venda")
plt.show()
```




```
#Analisando os fatores mais importantes, conforme gráfico anterior, o número de quartos:
plt.scatter(df2.bedrooms, df2.price, c = "gray", marker = "s")
plt.title("bedrooms vs preço")
plt.xlabel("bedrooms")
plt.ylabel("Preço de Venda")
plt.show()
```


bedrooms vs preço
Preço de Venda
40000
30000
20000
10000
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
bedrooms