airbnb

November 21, 2024

0.0.1 Python Project EDA & Data Viz - AirBnB Listing 2024(New York)

steps

1. importing all dependenices (lib)
2. loading datasets
3. initial exploration
4. Data cleaning
5. Data Analysis

Task 1. Importing All Dependencies

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

%matplotlib inline
```

Task 2: Loading Datsets

[3]:
```
data = pd.read_csv('new_york_listings_2024.csv', encoding_errors='ignore')
```

Task 3: Initial Exploration

[6]:
```
data.head()
```

[6]:
```
             id                                            name    host_id  \
0  1.312228e+06         Rental unit in Brooklyn · 5.0 · 1 bedroom    7130382
1  4.527754e+07  Rental unit in New York · 4.67 · 2 bedrooms ·…   51501835
2  9.710000e+17  Rental unit in New York · 4.17 · 1 bedroom · …  528871354
3  3.857863e+06  Rental unit in New York · 4.64 · 1 bedroom · …   19902271
4  4.089661e+07  Condo in New York · 4.91 · Studio · 1 bed · 1…   61391963

           host_name neighbourhood_group       neighbourhood   latitude  \
0             Walter            Brooklyn        Clinton Hill  40.683710
```

```
1            Jeniffer           Manhattan       Hell's Kitchen  40.766610
2              Joshua           Manhattan              Chelsea  40.750764
3  John And Catherine           Manhattan   Washington Heights  40.835600
4      Stay With Vibe           Manhattan          Murray Hill  40.751120

   longitude        room_type  price  …  last_review  reviews_per_month  \
0 -73.964610     Private room   55.0  …     20/12/15               0.03
1 -73.988100  Entire home/apt  144.0  …     01/05/23               0.24
2 -73.994605  Entire home/apt  187.0  …     18/12/23               1.67
3 -73.942500     Private room  120.0  …     17/09/23               1.38
4 -73.978600  Entire home/apt   85.0  …     03/12/23               0.24

  calculated_host_listings_count  availability_365  number_of_reviews_ltm  \
0                             1.0               0.0                    0.0
1                           139.0             364.0                    2.0
2                             1.0             343.0                    6.0
3                             2.0             363.0                   12.0
4                           133.0             335.0                    3.0

      license  rating bedrooms beds          baths
0  No License       5        1    1  Not specified
1  No License    4.67        2    1              1
2      Exempt    4.17        1    2              1
3  No License    4.64        1    1              1
4  No License    4.91   Studio    1              1

[5 rows x 22 columns]
```

[7]:
```
data.tail()
```

[7]:
```
                 id                                               name  \
20765  2.473690e+07  Rental unit in New York · 4.75 · 1 bedroom · …
20766  2.835711e+06  Rental unit in New York · 4.46 · 1 bedroom · …
20767  5.182527e+07  Rental unit in New York · 4.93 · 1 bedroom · …
20768  7.830000e+17  Rental unit in New York · 5.0 · 1 bedroom · 1…
20769  5.660000e+17  Rental unit in Queens · 4.89 · 1 bedroom · 1 …

         host_id host_name neighbourhood_group      neighbourhood   latitude  \
20765  186680487   Henry D           Manhattan    Lower East Side  40.711380
20766    3237504     Aspen           Manhattan  Greenwich Village  40.730580
20767  304317395      Jeff           Manhattan     Hell's Kitchen  40.757350
20768  163083101   Marissa           Manhattan          Chinatown  40.713750
20769   93827372   Glenroy              Queens           Rosedale  40.658874

       longitude        room_type  price  …  last_review  reviews_per_month  \
20765 -73.991560     Private room   45.0  …     29/09/23               1.81
20766 -74.000700  Entire home/apt  105.0  …     01/07/23               0.48
```

```
20767 -73.993430  Entire home/apt  299.0  …     08/12/23               2.09
20768 -73.991470  Entire home/apt  115.0  …     17/09/23               0.91
20769 -73.728651     Private room  102.0  …     10/12/23               4.50

      calculated_host_listings_count  availability_365  number_of_reviews_ltm  \
20765                            1.0             157.0                   12.0
20766                            1.0               0.0                    1.0
20767                            1.0               0.0                   27.0
20768                            1.0             363.0                    7.0
20769                            1.0               0.0                   62.0

                 license  rating bedrooms beds baths
20765         No License    4.75        1    1     1
20766         No License    4.46        1    2     1
20767         No License    4.93        1    1     1
20768         No License       5        1    1     1
20769  OSE-STRREG-0000513    4.89        1    1     1

[5 rows x 22 columns]
```

[9]:
```
data.shape
```

[9]:
```
(20770, 22)
```

[11]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20770 entries, 0 to 20769
Data columns (total 22 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   id                              20770 non-null  float64
 1   name                            20770 non-null  object
 2   host_id                         20770 non-null  int64
 3   host_name                       20770 non-null  object
 4   neighbourhood_group             20770 non-null  object
 5   neighbourhood                   20763 non-null  object
 6   latitude                        20763 non-null  float64
 7   longitude                       20763 non-null  float64
 8   room_type                       20763 non-null  object
 9   price                           20736 non-null  float64
 10  minimum_nights                  20763 non-null  float64
 11  number_of_reviews               20763 non-null  float64
 12  last_review                     20763 non-null  object
 13  reviews_per_month               20763 non-null  float64
 14  calculated_host_listings_count  20763 non-null  float64
 15  availability_365                20763 non-null  float64
 16  number_of_reviews_ltm          20763 non-null  float64
 17  license                        20770 non-null  object
 18  rating                         20770 non-null  object
 19  bedrooms                       20770 non-null  object
 20  beds                           20770 non-null  int64
 21  baths                          20770 non-null  object
dtypes: float64(10), int64(2), object(10)
memory usage: 3.5+ MB
```

[12]:

```
# Statistical Summary
data.describe()
```

[12]:

```
                 id       host_id      latitude     longitude          price  \
count  2.077000e+04  2.077000e+04  20763.000000  20763.000000   20736.000000
mean   3.033858e+17  1.749049e+08     40.726821    -73.939179     187.714940
std    3.901221e+17  1.725657e+08      0.060293      0.061403    1023.245124
min    2.595000e+03  1.678000e+03     40.500314    -74.249840      10.000000
25%    2.707260e+07  2.041184e+07     40.684159    -73.980755      80.000000
50%    4.992852e+07  1.086990e+08     40.722890    -73.949597     125.000000
75%    7.220000e+17  3.143997e+08     40.763106    -73.917475     199.000000
max    1.050000e+18  5.504035e+08     40.911147    -73.713650  100000.000000

       minimum_nights  number_of_reviews  reviews_per_month  \
count    20763.000000       20763.000000       20763.000000
mean        28.558493          42.610605           1.257589
std         33.532697          73.523401           1.904472
min          1.000000           1.000000           0.010000
25%         30.000000           4.000000           0.210000
50%         30.000000          14.000000           0.650000
75%         30.000000          49.000000           1.800000
max       1250.000000        1865.000000          75.490000

       calculated_host_listings_count  availability_365  \
count                    20763.000000      20763.000000
mean                        18.866686        206.067957
std                         70.921443        135.077259
min                          1.000000          0.000000
25%                          1.000000         87.000000
50%                          2.000000        215.000000
75%                          5.000000        353.000000
max                        713.000000        365.000000

       number_of_reviews_ltm          beds
count           20763.000000  20770.000000
mean               10.848962      1.723592
std                21.354876      1.211993
min                 0.000000      1.000000
```

```
25%                 1.000000      1.000000
50%                 3.000000      1.000000
75%                15.000000      2.000000
max              1075.000000     42.000000
```

Task 4: Data Cleaning

[14]:

```
data.isnull().sum()

# dropping all missing values rows
data.dropna(inplace=True)

# data.fillna()
data.isnull().sum()
```

[14]:

```
id                                0
name                              0
host_id                           0
host_name                         0
neighbourhood_group               0
neighbourhood                     0
latitude                          0
longitude                         0
room_type                         0
price                             0
minimum_nights                    0
number_of_reviews                 0
last_review                       0
reviews_per_month                 0
calculated_host_listings_count    0
availability_365                  0
number_of_reviews_ltm             0
license                           0
rating                            0
bedrooms                          0
beds                              0
baths                             0
dtype: int64
```

[20]:

```
# dealing with duplicates rows
data.duplicated().sum()

# deleting all duplicated rows
# data[data.duplicated()]

data.drop_duplicates(inplace=True)
data.duplicated().sum()
```

```
[20]: np.int64(0)
```

```
[26]: # type casting
      # changing data types

      data.dtypes

      data['id'] = data['id'].astype(object)
      data.dtypes

      data['host_id'] = data['host_id'].astype(object)
      data.dtypes
```

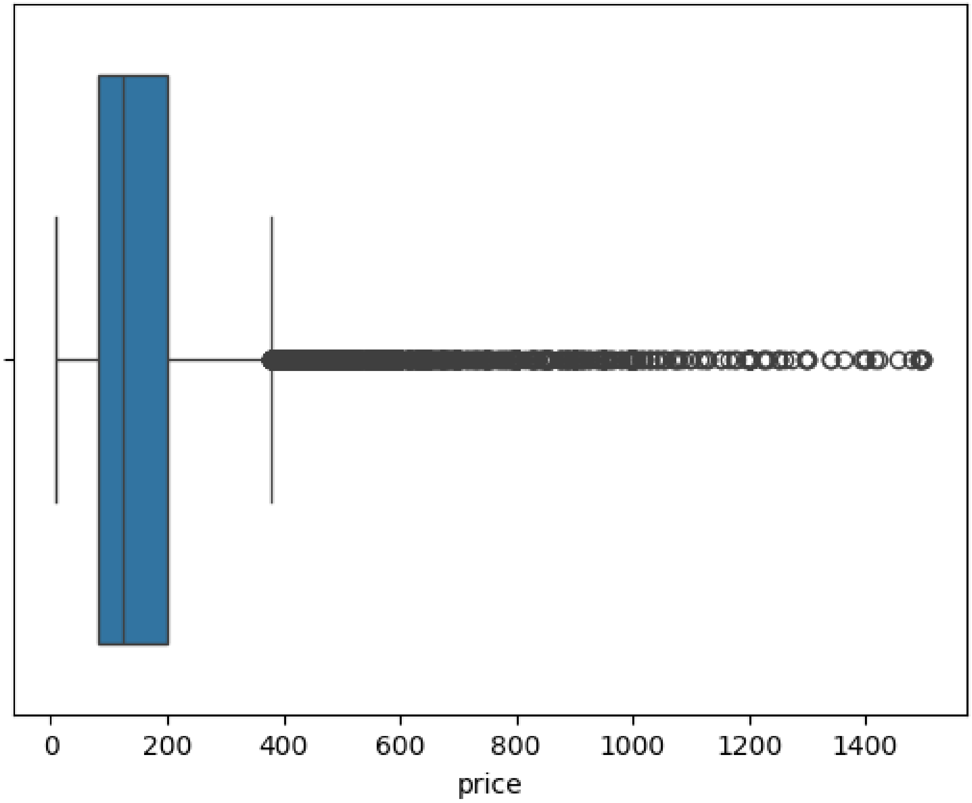
```
[26]: id                                 object
      name                               object
      host_id                            object
      host_name                          object
      neighbourhood_group                object
      neighbourhood                      object
      latitude                          float64
      longitude                         float64
      room_type                          object
      price                             float64
      minimum_nights                    float64
      number_of_reviews                 float64
      last_review                        object
      reviews_per_month                 float64
      calculated_host_listings_count    float64
      availability_365                  float64
      number_of_reviews_ltm             float64
      license                            object
      rating                             object
      bedrooms                           object
      beds                                int64
      baths                              object
      dtype: object
```

EDA   Task 5: Data Analysis

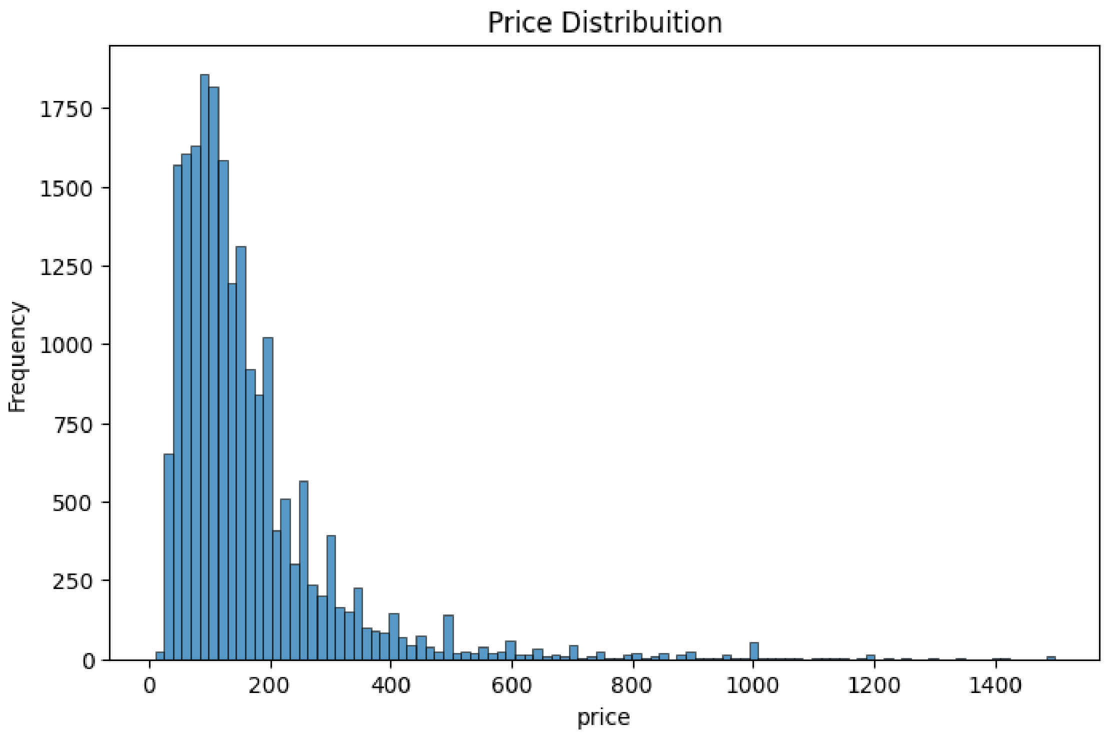
Univariate Analysis

```
[32]: # idenfying outliers in price

      df = data[data['price'] < 1500]

      sns.boxplot(data=df, x='price')
```

```
[32]: <Axes: xlabel='price'>
```



```
[41]: #Price distribuion

      plt.figure(figsize=(8, 5))
      sns.histplot(data=df, x='price', bins=100)
      plt.title('Price Distribuition')
      plt.ylabel("Frequency")
      plt.show()
```

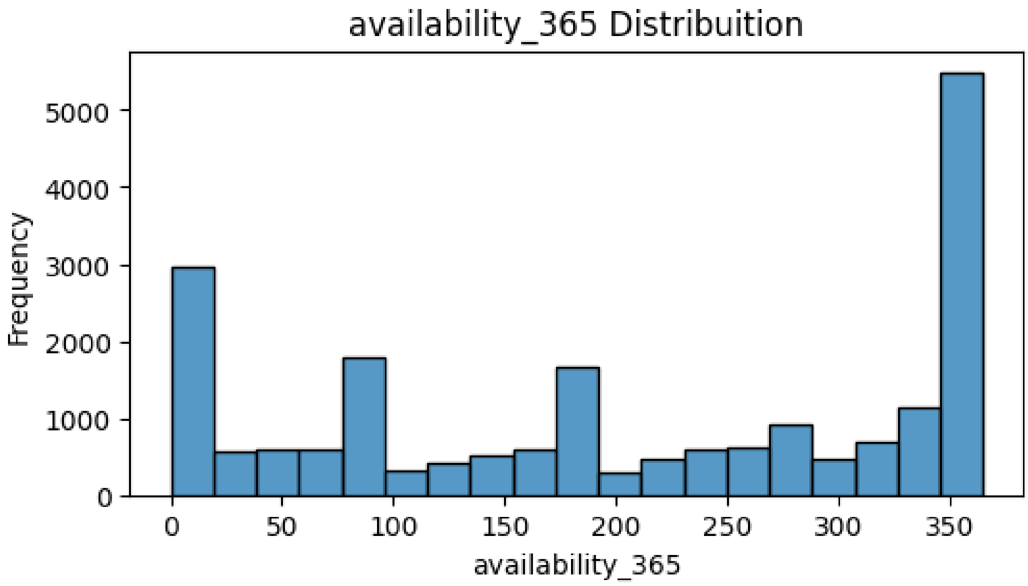


[39]:
```
df.dtypes
```

[39]:
```
id                                 object
name                               object
host_id                            object
host_name                          object
neighbourhood_group                object
neighbourhood                      object
latitude                          float64
longitude                         float64
room_type                          object
price                             float64
minimum_nights                    float64
number_of_reviews                 float64
last_review                        object
reviews_per_month                 float64
calculated_host_listings_count    float64
availability_365                  float64
number_of_reviews_ltm             float64
license                            object
rating                             object
bedrooms                           object
beds                                int64
```

```
baths                                 object
dtype: object
```

```
[44]: #Price distribuion
      plt.figure(figsize=(6, 3))
      sns.histplot(data=df, x='availability_365')
      plt.title('availability_365 Distribuition')
      plt.ylabel("Frequency")
      plt.show()
```



```
[53]: data.dtypes
```

```
[53]: id                                    object
      name                                  object
      host_id                               object
      host_name                             object
      neighbourhood_group                   object
      neighbourhood                         object
      latitude                             float64
      longitude                            float64
      room_type                             object
      price                                float64
      minimum_nights                       float64
      number_of_reviews                    float64
      last_review                           object
      reviews_per_month                    float64
      calculated_host_listings_count       float64
```

```
availability_365                   float64
number_of_reviews_ltm              float64
license                             object
rating                              object
bedrooms                            object
beds                                 int64
baths                               object
dtype: object
```

[54]:

```
df.groupby(by='neighbourhood_group')['price'].mean()
```

[54]:

```
neighbourhood_group
Bronx            107.990506
Brooklyn         155.138317
Manhattan        204.146014
Queens           121.681939
Staten Island    118.780069
Name: price, dtype: float64
```

Feature Engineering

[57]:

```
# average price per bed
df.groupby(by='neighbourhood_group')['price per bed'].mean()
```

[57]:

```
neighbourhood_group
Bronx             74.713639
Brooklyn          99.788493
Manhattan        138.708057
Queens            76.336210
Staten Island     67.728101
Name: price per bed, dtype: float64
```

[56]:

```
# ['price per bed']

df['price per bed']= df['price']/df['beds']
df.head()
```

```
/var/folders/r6/w18clwvn0bv96s8gbr9087c40000gn/T/ipykernel_67159/2324310957.py:3
: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['price per bed']= df['price']/df['beds']
```

[56]:

```
                     id                                               name  \
0             1312228.0         Rental unit in Brooklyn · 5.0 · 1 bedroom
1            45277537.0  Rental unit in New York · 4.67 · 2 bedrooms ·…
2  971000000000000000.0  Rental unit in New York · 4.17 · 1 bedroom · …
3             3857863.0  Rental unit in New York · 4.64 · 1 bedroom · …
4            40896611.0  Condo in New York · 4.91 · Studio · 1 bed · 1…

     host_id           host_name neighbourhood_group       neighbourhood  \
0    7130382              Walter            Brooklyn        Clinton Hill
1   51501835            Jeniffer           Manhattan      Hell's Kitchen
2  528871354              Joshua           Manhattan             Chelsea
3   19902271  John And Catherine           Manhattan  Washington Heights
4   61391963      Stay With Vibe           Manhattan         Murray Hill

    latitude  longitude        room_type  price  …  reviews_per_month  \
0  40.683710 -73.964610     Private room   55.0  …               0.03
1  40.766610 -73.988100  Entire home/apt  144.0  …               0.24
2  40.750764 -73.994605  Entire home/apt  187.0  …               1.67
3  40.835600 -73.942500     Private room  120.0  …               1.38
4  40.751120 -73.978600  Entire home/apt   85.0  …               0.24

   calculated_host_listings_count availability_365  number_of_reviews_ltm  \
0                             1.0              0.0                    0.0
1                           139.0            364.0                    2.0
2                             1.0            343.0                    6.0
3                             2.0            363.0                   12.0
4                           133.0            335.0                    3.0

      license  rating  bedrooms beds          baths price per bed
0  No License       5         1    1  Not specified          55.0
1  No License    4.67         2    1              1         144.0
2      Exempt    4.17         1    2              1          93.5
3  No License    4.64         1    1              1         120.0
4  No License    4.91    Studio    1              1          85.0

[5 rows x 23 columns]
```

[55]:

```
df.head()
```

[55]:

```
                     id                                               name  \
0             1312228.0         Rental unit in Brooklyn · 5.0 · 1 bedroom
1            45277537.0  Rental unit in New York · 4.67 · 2 bedrooms ·…
2  971000000000000000.0  Rental unit in New York · 4.17 · 1 bedroom · …
3             3857863.0  Rental unit in New York · 4.64 · 1 bedroom · …
4            40896611.0  Condo in New York · 4.91 · Studio · 1 bed · 1…

     host_id           host_name neighbourhood_group       neighbourhood  \
0    7130382              Walter            Brooklyn        Clinton Hill
1   51501835            Jeniffer           Manhattan      Hell's Kitchen
2  528871354              Joshua           Manhattan             Chelsea
3   19902271  John And Catherine           Manhattan  Washington Heights
4   61391963      Stay With Vibe           Manhattan         Murray Hill

    latitude  longitude        room_type  price  …  last_review  \
0  40.683710 -73.964610     Private room   55.0  …     20/12/15
1  40.766610 -73.988100  Entire home/apt  144.0  …     01/05/23
2  40.750764 -73.994605  Entire home/apt  187.0  …     18/12/23
3  40.835600 -73.942500     Private room  120.0  …     17/09/23
4  40.751120 -73.978600  Entire home/apt   85.0  …     03/12/23

   reviews_per_month calculated_host_listings_count  availability_365  \
0               0.03                            1.0               0.0
1               0.24                          139.0             364.0
2               1.67                            1.0             343.0
3               1.38                            2.0             363.0
4               0.24                          133.0             335.0

   number_of_reviews_ltm     license  rating bedrooms beds          baths
0                    0.0  No License       5        1    1  Not specified
1                    2.0  No License    4.67        2    1              1
2                    6.0      Exempt    4.17        1    2              1
3                   12.0  No License    4.64        1    1              1
4                    3.0  No License    4.91   Studio    1              1

[5 rows x 22 columns]
```

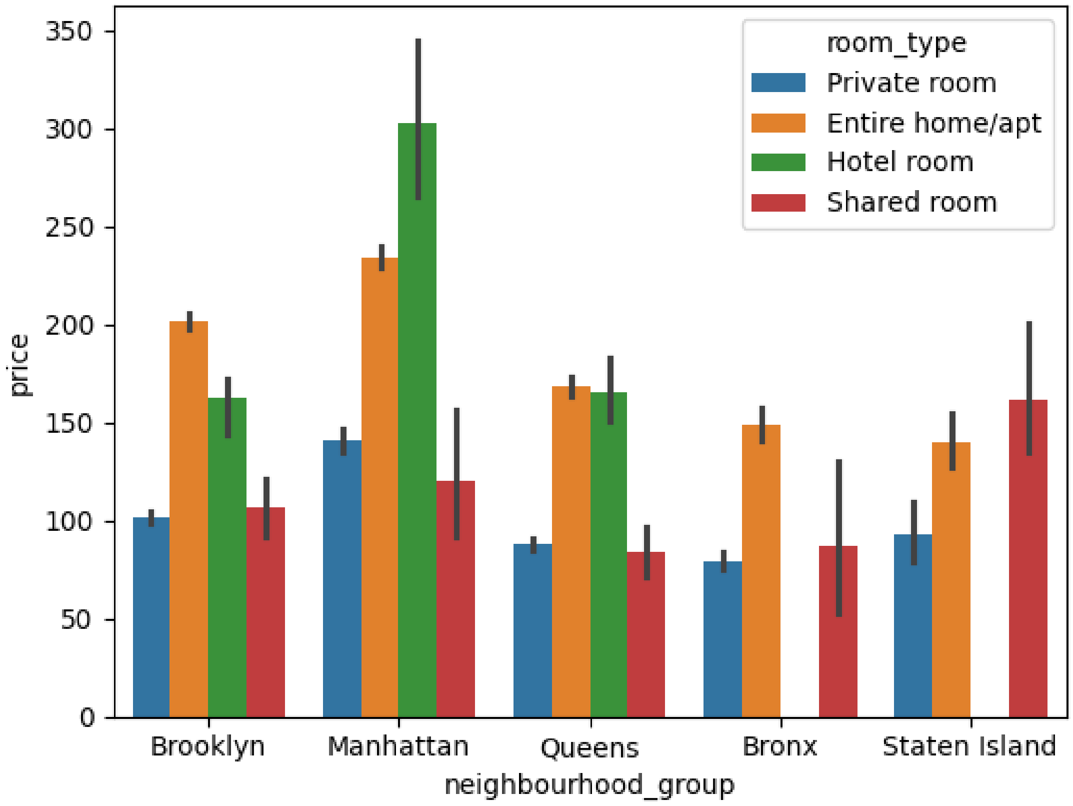
Bi Variable Analysis One variable depenency in another variable

[58]:
```
df.columns
```

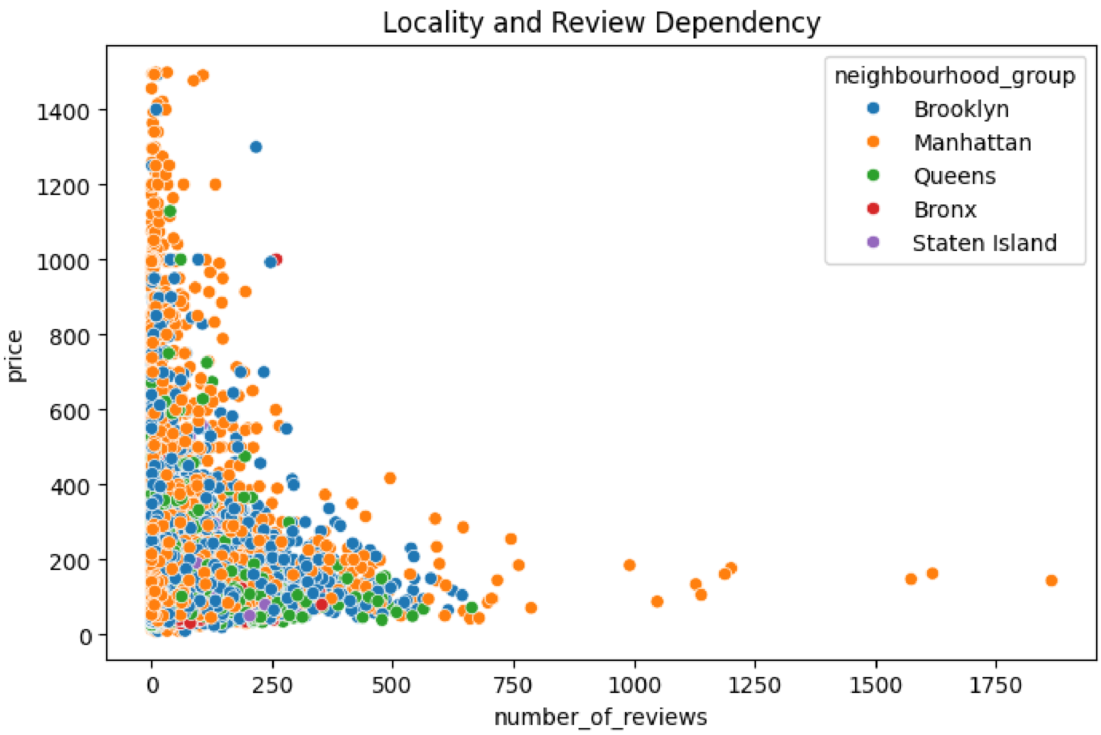
[58]:
```
Index(['id', 'name', 'host_id', 'host_name', 'neighbourhood_group',
       'neighbourhood', 'latitude', 'longitude', 'room_type', 'price',
       'minimum_nights', 'number_of_reviews', 'last_review',
       'reviews_per_month', 'calculated_host_listings_count',
       'availability_365', 'number_of_reviews_ltm', 'license', 'rating',
       'bedrooms', 'beds', 'baths', 'price per bed'],
      dtype='object')
```

[60]:
```
# price dependency on neighbourhood
sns.barplot(data=df, x='neighbourhood_group', y='price', hue='room_type')
```

[60]:
```
<Axes: xlabel='neighbourhood_group', ylabel='price'>
```



```
[66]: # number of reviews and price rel
plt.figure(figsize=(8, 5))
plt.title("Locality and Review Dependency")
sns.scatterplot(data=df, x='number_of_reviews', y='price',␣
 ↪hue='neighbourhood_group')
plt.show()
```



[68]:

```
df.dtypes
```

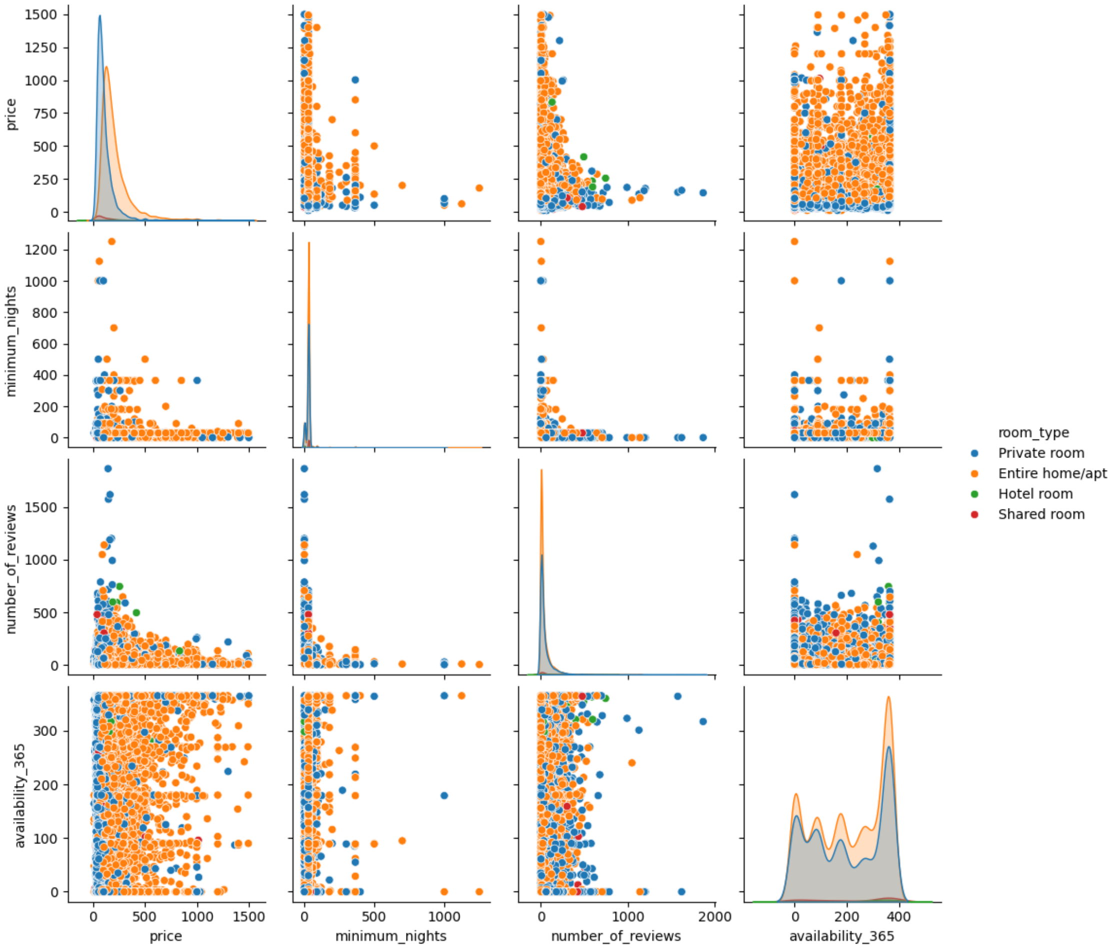
[68]:

```
id                                 object
name                               object
host_id                            object
host_name                          object
neighbourhood_group                object
neighbourhood                      object
latitude                          float64
longitude                         float64
room_type                          object
price                             float64
minimum_nights                    float64
number_of_reviews                 float64
last_review                        object
reviews_per_month                 float64
calculated_host_listings_count    float64
availability_365                  float64
number_of_reviews_ltm             float64
license                            object
rating                             object
bedrooms                           object
beds                                int64
```

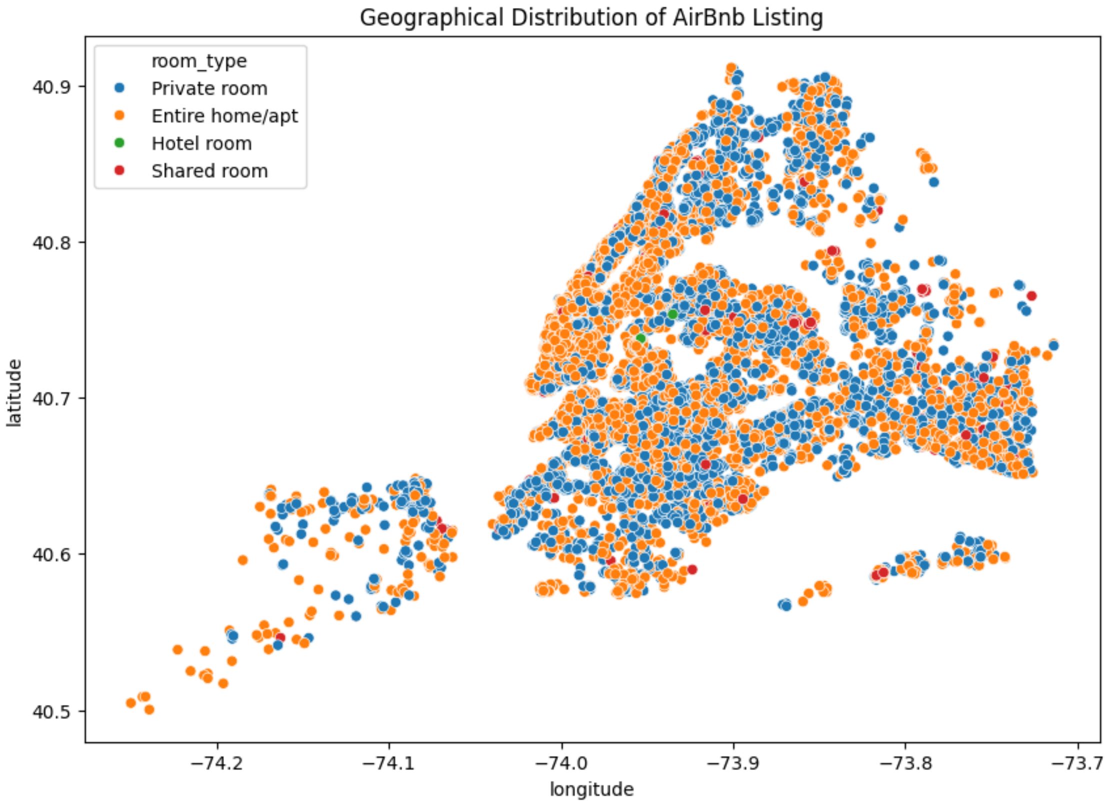
```
baths                                  object
price per bed                         float64
dtype: object
```

[70]:
```
sns.pairplot(data=df, vars=['price', 'minimum_nights', 'number_of_reviews',␣
↪'availability_365'], hue='room_type')
```

[70]:
```
<seaborn.axisgrid.PairGrid at 0x1495a4dd0>
```



[75]:
```
#Geographical Distribution of AirBnb Listing
plt.figure(figsize=(10, 7))
sns.scatterplot(data=df, x='longitude', y='latitude', hue='room_type')
plt.title("Geographical Distribution of AirBnb Listing")
plt.show()
```



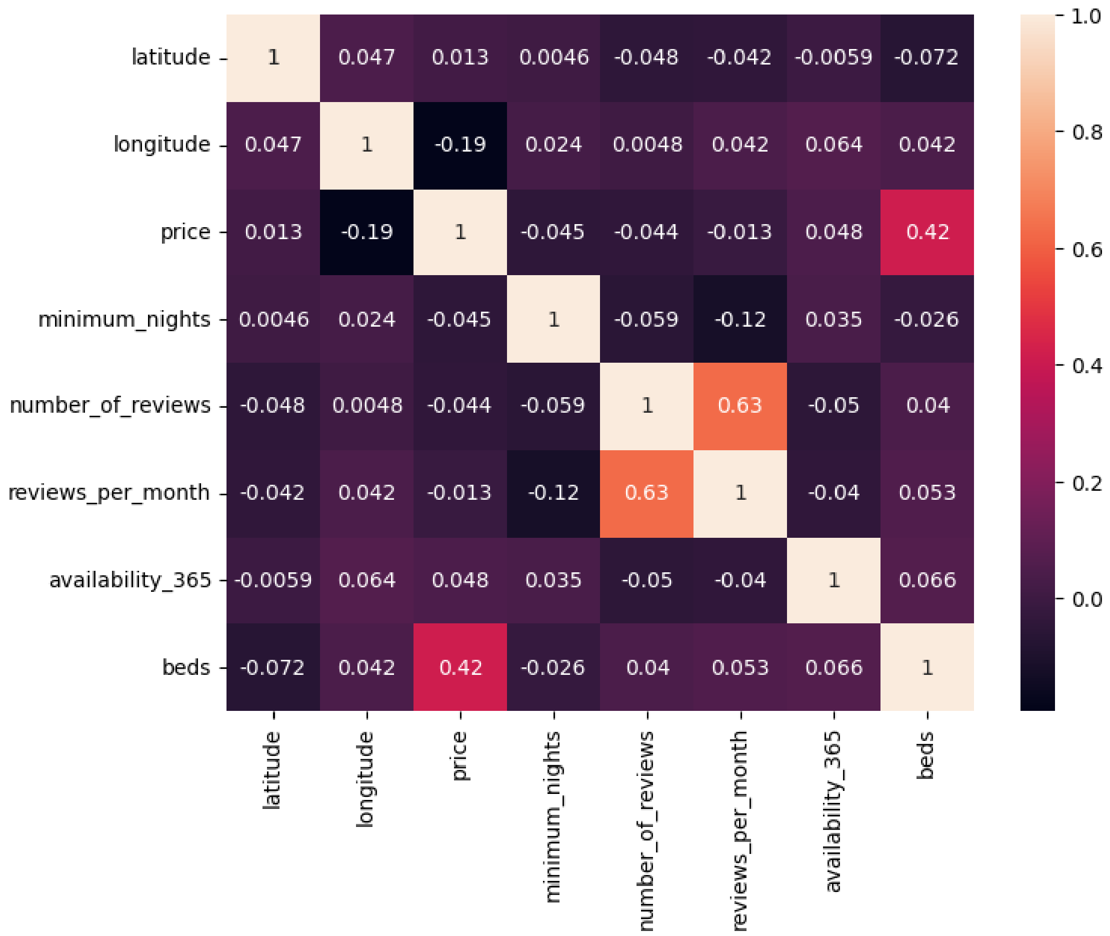
[76]:
```
df.dtypes
```

[76]:
```
id                                  object
name                                object
host_id                             object
host_name                           object
neighbourhood_group                 object
neighbourhood                       object
latitude                           float64
longitude                          float64
room_type                           object
price                              float64
minimum_nights                     float64
number_of_reviews                  float64
last_review                         object
reviews_per_month                  float64
calculated_host_listings_count     float64
availability_365                   float64
number_of_reviews_ltm              float64
license                             object
rating                              object
```

```
bedrooms                                   object
beds                                        int64
baths                                      object
price per bed                             float64
dtype: object
```

[80]:
```
# heat map - correlation of one variable with others for numerical column

corr = df[['latitude', 'longitude', 'price', 'minimum_nights',␣
 ↪'number_of_reviews', 'reviews_per_month', 'availability_365', 'beds']].corr()
corr

plt.figure(figsize=(8, 6))
sns.heatmap(data=corr, annot=True)
```

[80]:
```
<Axes: >
```


latitude 1 0.047 0.013 0.0046 -0.048 -0.042 -0.0059 -0.072
longitude 0.047 1 -0.19 0.024 0.0048 0.042 0.064 0.042
price 0.013 -0.19 1 -0.045 -0.044 -0.013 0.048 0.42
minimum_nights 0.0046 0.024 -0.045 1 -0.059 -0.12 0.035 -0.026
number_of_reviews -0.048 0.0048 -0.044 -0.059 1 0.63 -0.05 0.04
reviews_per_month -0.042 0.042 -0.013 -0.12 0.63 1 -0.04 0.053
availability_365 -0.0059 0.064 0.048 0.035 -0.05 -0.04 1 0.066
beds -0.072 0.042 0.42 -0.026 0.04 0.053 0.066 1
latitude
longitude
price
minimum_nights
number_of_reviews
reviews_per_month
availability_365
beds