ai-assignment-1

October 25, 2023

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

[ ]:
```
# Load Data
data = pd.read_csv("/content/House Price India.csv")
data.shape
```

[ ]:
```
(14620, 23)
```

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

[ ]:

	id	Date	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	…	Built Year	Renovation Year	Postal Code	Lattitude	Longitude	living_area_renov	lot_area_renov
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4	5	…	1921	0	122003	52.8645	-114.557	2880	5400
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0	5	…	1909	0	122004	52.8878	-114.470	2470	4000
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0	3	…	1939	0	122004	52.8852	-114.468	2940	6600
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0	3	…	2001	0	122005				
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0	4	…	1929	0	122006				

```
3    52.9532   -114.321              3350           42847
4    52.9047   -114.485              2060            4500

   Number of schools nearby  Distance from the airport    Price
0                         2                         58  2380000
1                         2                         51  1400000
2                         1                         53  1200000
3                         3                         76   838000
4                         1                         51   805000

[5 rows x 23 columns]
```

```
<google.colab._quickchart_helpers.SectionTitle at 0x7931c16cbdc0>
```

```
import numpy as np
from google.colab import autoviz

def value_plot(df, y, figscale=1):
  from matplotlib import pyplot as plt
  df[y].plot(kind='line', figsize=(8 * figscale, 4 * figscale), title=y)
  plt.gca().spines[['top', 'right']].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = value_plot(_df_13, *['id'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def value_plot(df, y, figscale=1):
  from matplotlib import pyplot as plt
  df[y].plot(kind='line', figsize=(8 * figscale, 4 * figscale), title=y)
  plt.gca().spines[['top', 'right']].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = value_plot(_df_14, *['number of bedrooms'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def value_plot(df, y, figscale=1):
  from matplotlib import pyplot as plt
  df[y].plot(kind='line', figsize=(8 * figscale, 4 * figscale), title=y)
  plt.gca().spines[['top', 'right']].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()
```

```
chart = value_plot(_df_15, *['number of bathrooms'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def value_plot(df, y, figscale=1):
  from matplotlib import pyplot as plt
  df[y].plot(kind='line', figsize=(8 * figscale, 4 * figscale), title=y)
  plt.gca().spines[['top', 'right']].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = value_plot(_df_16, *['living area'], **{})
chart
```

```
<google.colab._quickchart_helpers.SectionTitle at 0x7931884477c0>
```

```
import numpy as np
from google.colab import autoviz

def histogram(df, colname, num_bins=20, figscale=1):
  from matplotlib import pyplot as plt
  df[colname].plot(kind='hist', bins=num_bins, title=colname,␣
 ↪figsize=(8*figscale, 4*figscale))
  plt.gca().spines[['top', 'right',]].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = histogram(_df_17, *['id'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def histogram(df, colname, num_bins=20, figscale=1):
  from matplotlib import pyplot as plt
  df[colname].plot(kind='hist', bins=num_bins, title=colname,␣
 ↪figsize=(8*figscale, 4*figscale))
  plt.gca().spines[['top', 'right',]].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = histogram(_df_18, *['number of bedrooms'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz
```

```
def histogram(df, colname, num_bins=20, figscale=1):
  from matplotlib import pyplot as plt
  df[colname].plot(kind='hist', bins=num_bins, title=colname,␣
 ↪figsize=(8*figscale, 4*figscale))
  plt.gca().spines[['top', 'right',]].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = histogram(_df_19, *['number of bathrooms'], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def histogram(df, colname, num_bins=20, figscale=1):
  from matplotlib import pyplot as plt
  df[colname].plot(kind='hist', bins=num_bins, title=colname,␣
 ↪figsize=(8*figscale, 4*figscale))
  plt.gca().spines[['top', 'right',]].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = histogram(_df_20, *['living area'], **{})
chart
```

```
<google.colab._quickchart_helpers.SectionTitle at 0x79318fef1390>
```

```
import numpy as np
from google.colab import autoviz

def scatter_plots(df, colname_pairs, figscale=1, alpha=.8):
  from matplotlib import pyplot as plt
  plt.figure(figsize=(len(colname_pairs) * 6 * figscale, 6 * figscale))
  for plot_i, (x_colname, y_colname) in enumerate(colname_pairs, start=1):
    ax = plt.subplot(1, len(colname_pairs), plot_i)
    df.plot(kind='scatter', x=x_colname, y=y_colname, s=(32 * figscale),␣
 ↪alpha=alpha, ax=ax)
    ax.spines[['top', 'right',]].set_visible(False)
  plt.tight_layout()
  return autoviz.MplChart.from_current_mpl_state()

chart = scatter_plots(_df_21, *[[['id', 'number of bedrooms'], ['number of␣
 ↪bedrooms', 'number of bathrooms'], ['number of bathrooms', 'living area'],␣
 ↪['living area', 'lot area']]], **{})
chart
```

```
<google.colab._quickchart_helpers.SectionTitle at 0x79318fef0790>
```

```
import numpy as np
from google.colab import autoviz
```

```
def time_series_multiline(df, timelike_colname, value_colname, series_colname,␣
 ↪figscale=1, mpl_palette_name='Dark2'):
  from matplotlib import pyplot as plt
  import seaborn as sns
  figsize = (10 * figscale, 5.2 * figscale)
  palette = list(sns.palettes.mpl_palette(mpl_palette_name))
  def _plot_series(series, series_name, series_index=0):
    if value_colname == 'count()':
      counted = (series[timelike_colname]
                 .value_counts()
                 .reset_index(name='counts')
                 .rename({'index': timelike_colname}, axis=1)
                 .sort_values(timelike_colname, ascending=True))
      xs = counted[timelike_colname]
      ys = counted['counts']
    else:
      xs = series[timelike_colname]
      ys = series[value_colname]
    plt.plot(xs, ys, label=series_name, color=palette[series_index %␣
 ↪len(palette)])

  fig, ax = plt.subplots(figsize=figsize, layout='constrained')
  df = df.sort_values(timelike_colname, ascending=True)
  if series_colname:
    for i, (series_name, series) in enumerate(df.groupby(series_colname)):
      _plot_series(series, series_name, i)
    fig.legend(title=series_colname, bbox_to_anchor=(1, 1), loc='upper left')
  else:
    _plot_series(df, '')
  sns.despine(fig=fig, ax=ax)
  plt.xlabel(timelike_colname)
  plt.ylabel(value_colname)
  return autoviz.MplChart.from_current_mpl_state()

chart = time_series_multiline(_df_22, *['id', 'number of bedrooms', None], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def time_series_multiline(df, timelike_colname, value_colname, series_colname,␣
 ↪figscale=1, mpl_palette_name='Dark2'):
  from matplotlib import pyplot as plt
  import seaborn as sns
  figsize = (10 * figscale, 5.2 * figscale)
  palette = list(sns.palettes.mpl_palette(mpl_palette_name))
  def _plot_series(series, series_name, series_index=0):
```

```
    if value_colname == 'count()':
      counted = (series[timelike_colname]
                 .value_counts()
                 .reset_index(name='counts')
                 .rename({'index': timelike_colname}, axis=1)
                 .sort_values(timelike_colname, ascending=True))
      xs = counted[timelike_colname]
      ys = counted['counts']
    else:
      xs = series[timelike_colname]
      ys = series[value_colname]
    plt.plot(xs, ys, label=series_name, color=palette[series_index %␣
  ↪len(palette)])

  fig, ax = plt.subplots(figsize=figsize, layout='constrained')
  df = df.sort_values(timelike_colname, ascending=True)
  if series_colname:
    for i, (series_name, series) in enumerate(df.groupby(series_colname)):
      _plot_series(series, series_name, i)
    fig.legend(title=series_colname, bbox_to_anchor=(1, 1), loc='upper left')
  else:
    _plot_series(df, '')
  sns.despine(fig=fig, ax=ax)
  plt.xlabel(timelike_colname)
  plt.ylabel(value_colname)
  return autoviz.MplChart.from_current_mpl_state()

chart = time_series_multiline(_df_23, *['id', 'number of bathrooms', None], **{})
chart
```

```
import numpy as np
from google.colab import autoviz

def time_series_multiline(df, timelike_colname, value_colname, series_colname,␣
  ↪figscale=1, mpl_palette_name='Dark2'):
  from matplotlib import pyplot as plt
  import seaborn as sns
  figsize = (10 * figscale, 5.2 * figscale)
  palette = list(sns.palettes.mpl_palette(mpl_palette_name))
  def _plot_series(series, series_name, series_index=0):
    if value_colname == 'count()':
      counted = (series[timelike_colname]
                 .value_counts()
                 .reset_index(name='counts')
                 .rename({'index': timelike_colname}, axis=1)
                 .sort_values(timelike_colname, ascending=True))
      xs = counted[timelike_colname]
      ys = counted['counts']
```

```
    else:
      xs = series[timelike_colname]
      ys = series[value_colname]
    plt.plot(xs, ys, label=series_name, color=palette[series_index %␣
 ↪len(palette)])

  fig, ax = plt.subplots(figsize=figsize, layout='constrained')
  df = df.sort_values(timelike_colname, ascending=True)
  if series_colname:
    for i, (series_name, series) in enumerate(df.groupby(series_colname)):
      _plot_series(series, series_name, i)
    fig.legend(title=series_colname, bbox_to_anchor=(1, 1), loc='upper left')
  else:
    _plot_series(df, '')
  sns.despine(fig=fig, ax=ax)
  plt.xlabel(timelike_colname)
  plt.ylabel(value_colname)
  return autoviz.MplChart.from_current_mpl_state()

chart = time_series_multiline(_df_24, *['id', 'living area', None], **{})
chart
```

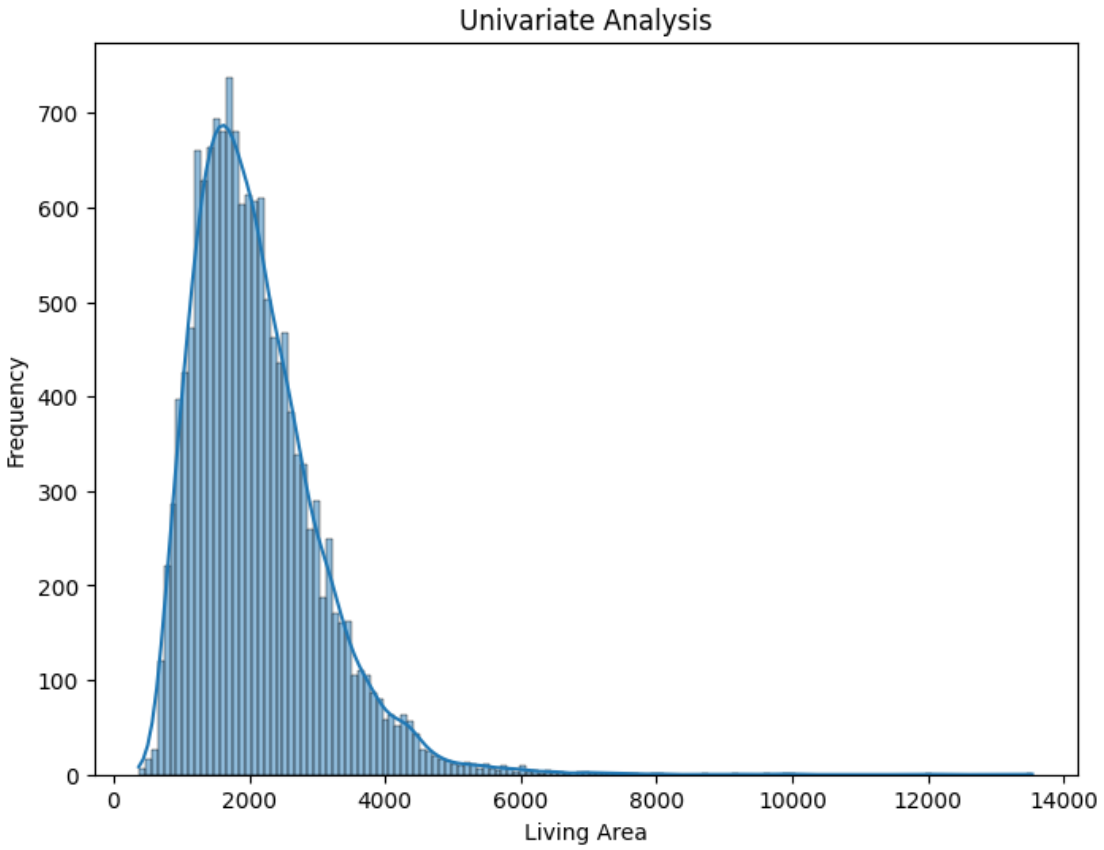
```
import numpy as np
from google.colab import autoviz

def time_series_multiline(df, timelike_colname, value_colname, series_colname,␣
 ↪figscale=1, mpl_palette_name='Dark2'):
  from matplotlib import pyplot as plt
  import seaborn as sns
  figsize = (10 * figscale, 5.2 * figscale)
  palette = list(sns.palettes.mpl_palette(mpl_palette_name))
  def _plot_series(series, series_name, series_index=0):
    if value_colname == 'count()':
      counted = (series[timelike_colname]
                 .value_counts()
                 .reset_index(name='counts')
                 .rename({'index': timelike_colname}, axis=1)
                 .sort_values(timelike_colname, ascending=True))
      xs = counted[timelike_colname]
      ys = counted['counts']
    else:
      xs = series[timelike_colname]
      ys = series[value_colname]
    plt.plot(xs, ys, label=series_name, color=palette[series_index %␣
 ↪len(palette)])

  fig, ax = plt.subplots(figsize=figsize, layout='constrained')
  df = df.sort_values(timelike_colname, ascending=True)
```

```
  if series_colname:
    for i, (series_name, series) in enumerate(df.groupby(series_colname)):
      _plot_series(series, series_name, i)
    fig.legend(title=series_colname, bbox_to_anchor=(1, 1), loc='upper left')
  else:
    _plot_series(df, '')
  sns.despine(fig=fig, ax=ax)
  plt.xlabel(timelike_colname)
  plt.ylabel(value_colname)
  return autoviz.MplChart.from_current_mpl_state()

chart = time_series_multiline(_df_25, *['id', 'lot area', None], **{})
chart
```

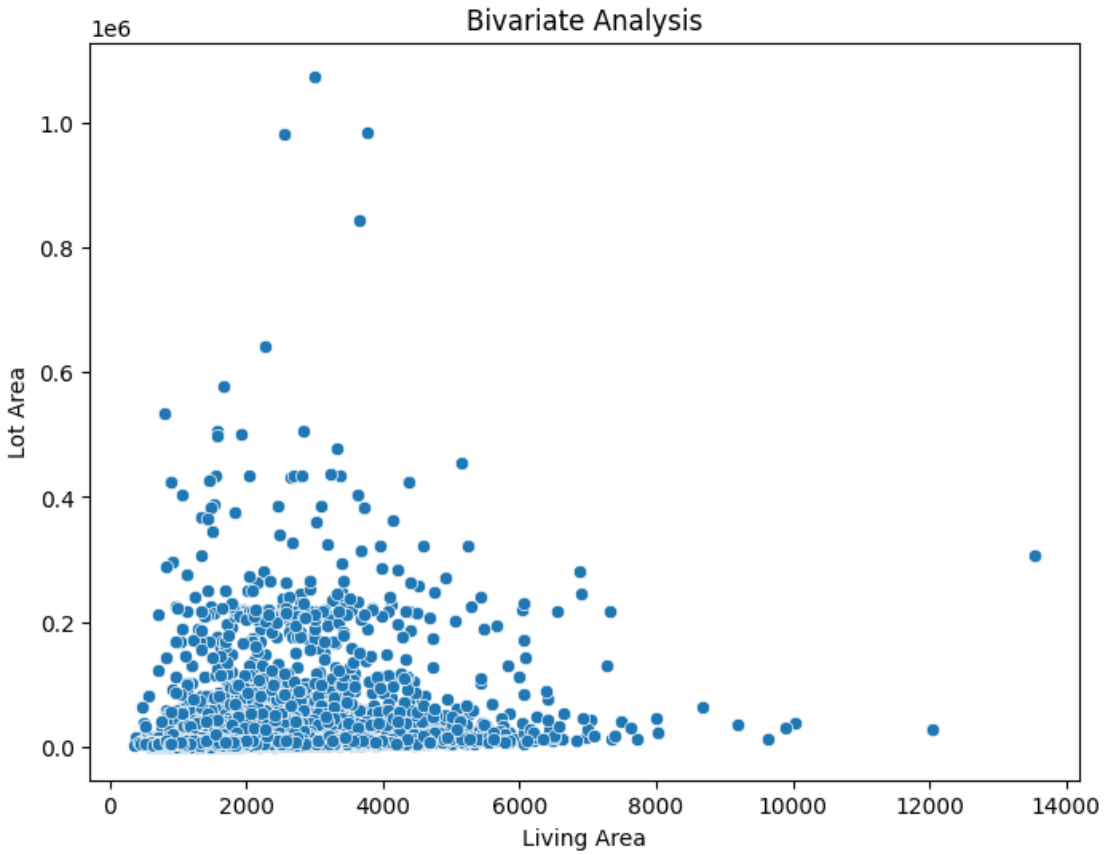
[ ]:
```
summary_stats = data['id'].describe()
summary_stats
```

[ ]:
```
count    1.462000e+04
mean     6.762821e+09
std      6.237575e+03
min      6.762810e+09
25%      6.762815e+09
50%      6.762821e+09
75%      6.762826e+09
max      6.762832e+09
Name: id, dtype: float64
```

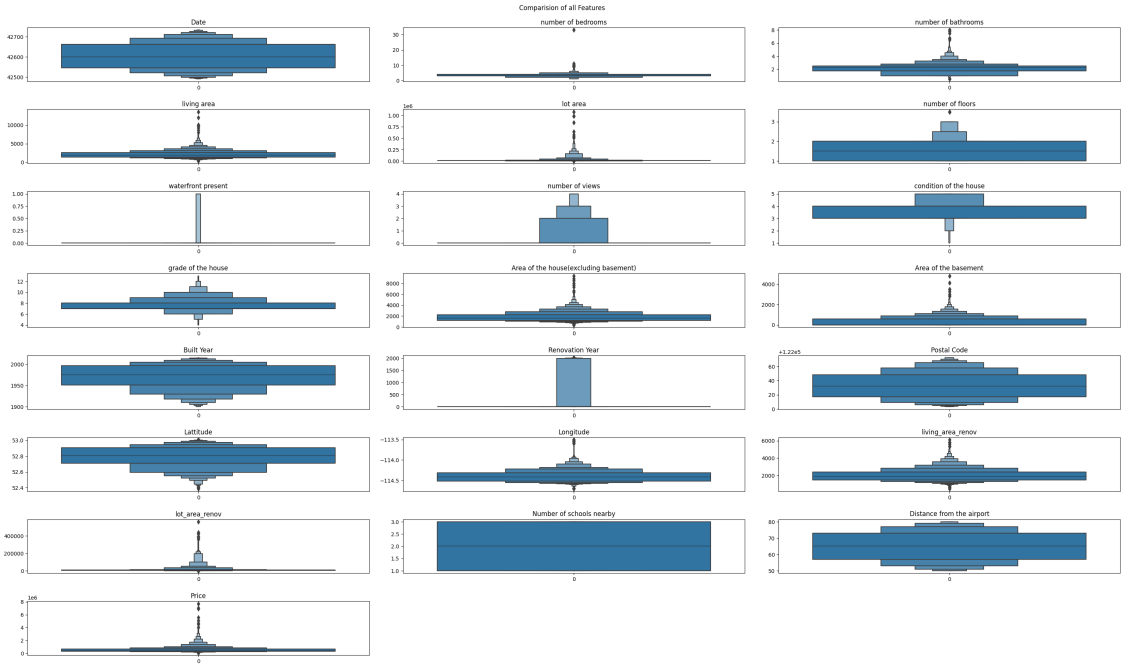
[ ]:
```
# Univariate Analysis
plt.figure(figsize=(8, 6))
sns.histplot(data['living area'], kde=True)
plt.xlabel('Living Area')
plt.ylabel('Frequency')
plt.title('Univariate Analysis')
plt.show()
```



[ ]:
```
# Bivariate Analysis
plt.figure(figsize=(8, 6))
sns.scatterplot(data=data, x='living area', y='lot area')
plt.xlabel('Living Area')
plt.ylabel('Lot Area')
plt.title('Bivariate Analysis')
plt.show()
```



[ ]:
```
# Multivariate Analysis
fig = plt.figure(figsize = [30, 18])

for i in range(1, len(list(data.columns))):
    plt.subplot(8, 3, i)

    fig.tight_layout(pad=2)
    df_new = data.iloc[:,i]

    plt.suptitle('Comparision of all Features')
    plt.title(list(data.columns)[i])

    sns.boxenplot(df_new)

plt.show()
```



[ ]:
```
# Perform descriptive statistics on the dataset.
data.describe()
```

[ ]:

	id	Date	number of bedrooms	number of bathrooms	\
count	1.462000e+04	14620.000000	14620.000000	14620.000000	
mean	6.762821e+09	42604.538646	3.379343	2.129583	
std	6.237575e+03	67.347991	0.938719	0.769934	
min	6.762810e+09	42491.000000	1.000000	0.500000	
25%	6.762815e+09	42546.000000	3.000000	1.750000	
50%	6.762821e+09	42600.000000	3.000000	2.250000	
75%	6.762826e+09	42662.000000	4.000000	2.500000	
max	6.762832e+09	42734.000000	33.000000	8.000000	

	living area	lot area	number of floors	waterfront present	\
count	14620.000000	1.462000e+04	14620.000000	14620.000000	
mean	2098.262996	1.509328e+04	1.502360	0.007661	
std	928.275721	3.791962e+04	0.540239	0.087193	
min	370.000000	5.200000e+02	1.000000	0.000000	
25%	1440.000000	5.010750e+03	1.000000	0.000000	
50%	1930.000000	7.620000e+03	1.500000	0.000000	
75%	2570.000000	1.080000e+04	2.000000	0.000000	
max	13540.000000	1.074218e+06	3.500000	1.000000	

	number of views	condition of the house	…	Built Year	\
count	14620.000000	14620.000000	…	14620.000000	

```
mean          0.233105               3.430506  …   1970.926402
std           0.766259               0.664151  …     29.493625
min           0.000000               1.000000  …   1900.000000
25%           0.000000               3.000000  …   1951.000000
50%           0.000000               3.000000  …   1975.000000
75%           0.000000               4.000000  …   1997.000000
max           4.000000               5.000000  …   2015.000000

       Renovation Year    Postal Code     Lattitude     Longitude  \
count     14620.000000   14620.000000  14620.000000  14620.000000
mean         90.924008  122033.062244     52.792848   -114.404007
std         416.216661      19.082418      0.137522      0.141326
min           0.000000  122003.000000     52.385900   -114.709000
25%           0.000000  122017.000000     52.707600   -114.519000
50%           0.000000  122032.000000     52.806400   -114.421000
75%           0.000000  122048.000000     52.908900   -114.315000
max        2015.000000  122072.000000     53.007600   -113.505000

       living_area_renov  lot_area_renov  Number of schools nearby  \
count       14620.000000    14620.000000              14620.000000
mean         1996.702257    12753.500068                  2.012244
std           691.093366    26058.414467                  0.817284
min           460.000000      651.000000                  1.000000
25%          1490.000000     5097.750000                  1.000000
50%          1850.000000     7620.000000                  2.000000
75%          2380.000000    10125.000000                  3.000000
max          6110.000000   560617.000000                  3.000000

       Distance from the airport         Price
count                14620.000000  1.462000e+04
mean                    64.950958  5.389322e+05
std                      8.936008  3.675324e+05
min                     50.000000  7.800000e+04
25%                     57.000000  3.200000e+05
50%                     65.000000  4.500000e+05
75%                     73.000000  6.450000e+05
max                     80.000000  7.700000e+06

[8 rows x 23 columns]
```

[ ]:
```python
# Handle the Missing values.
# (1) Dropping Missing Values

# Drop rows with any missing values
data.dropna(inplace=True)

# Drop columns with any missing values
```

```
data.dropna(axis=1, inplace=True)
data
```

[ ]:

	id	Date	number of bedrooms	number of bathrooms	\
0	6762810145	42491	5	2.50	
1	6762810635	42491	4	2.50	
2	6762810998	42491	5	2.75	
3	6762812605	42491	4	2.50	
4	6762812919	42491	3	2.00	
…	…	…	…	…	
14615	6762830250	42734	2	1.50	
14616	6762830339	42734	3	2.00	
14617	6762830618	42734	2	1.00	
14618	6762830709	42734	4	1.00	
14619	6762831463	42734	3	1.00	

	living area	lot area	number of floors	waterfront present	\
0	3650	9050	2.0	0	
1	2920	4000	1.5	0	
2	2910	9480	1.5	0	
3	3310	42998	2.0	0	
4	2710	4500	1.5	0	
…	…	…	…	…	
14615	1556	20000	1.0	0	
14616	1680	7000	1.5	0	
14617	1070	6120	1.0	0	
14618	1030	6621	1.0	0	
14619	900	4770	1.0	0	

	number of views	condition of the house	…	Built Year	\
0	4	5	…	1921	
1	0	5	…	1909	
2	0	3	…	1939	
3	0	3	…	2001	
4	0	4	…	1929	
…	…	…	…	…	
14615	0	4	…	1957	
14616	0	4	…	1968	
14617	0	3	…	1962	
14618	0	4	…	1955	
14619	0	3	…	1969	

	Renovation Year	Postal Code	Lattitude	Longitude	living_area_renov	\
0	0	122003	52.8645	-114.557	2880	
1	0	122004	52.8878	-114.470	2470	
2	0	122004	52.8852	-114.468	2940	
3	0	122005	52.9532	-114.321	3350	

```
4                    0       122006    52.9047   -114.485                2060
…                  …          …         …         …                    …
14615                0       122066    52.6191   -114.472                2250
14616                0       122072    52.5075   -114.393                1540
14617                0       122056    52.7289   -114.507                1130
14618                0       122042    52.7157   -114.411                1420
14619             2009       122018    52.5338   -114.552                 900

       lot_area_renov  Number of schools nearby  Distance from the airport  \
0                5400                         2                         58
1                4000                         2                         51
2                6600                         1                         53
3               42847                         3                         76
4                4500                         1                         51
…                …                          …                          …
14615           17286                         3                         76
14616            7480                         3                         59
14617            6120                         2                         64
14618            6631                         3                         54
14619            3480                         2                         55

         Price
0      2380000
1      1400000
2      1200000
3       838000
4       805000
…         …
14615   221700
14616   219200
14617   209000
14618   205000
14619   146000

[14620 rows x 23 columns]
```

[ ]:
```python
# (2) Imputation
# Filling with the mean, median, or mode of the column

mean = data['living area'].mean()
data['living area'].fillna(mean, inplace=True)
```

[ ]:
```python
#  (3) Forward or backward filling
data.fillna(method='ffill', inplace=True)
data.fillna(method='bfill', inplace=True)
```

[ ]:
```python
data
```

[ ]:

	id	Date	number of bedrooms	number of bathrooms	\
0	6762810145	42491	5	2.50	
1	6762810635	42491	4	2.50	
2	6762810998	42491	5	2.75	
3	6762812605	42491	4	2.50	
4	6762812919	42491	3	2.00	
…	…	…	…	…	
14615	6762830250	42734	2	1.50	
14616	6762830339	42734	3	2.00	
14617	6762830618	42734	2	1.00	
14618	6762830709	42734	4	1.00	
14619	6762831463	42734	3	1.00	

	living area	lot area	number of floors	waterfront present	\
0	3650	9050	2.0	0	
1	2920	4000	1.5	0	
2	2910	9480	1.5	0	
3	3310	42998	2.0	0	
4	2710	4500	1.5	0	
…	…	…	…	…	
14615	1556	20000	1.0	0	
14616	1680	7000	1.5	0	
14617	1070	6120	1.0	0	
14618	1030	6621	1.0	0	
14619	900	4770	1.0	0	

	number of views	condition of the house	…	Built Year	\
0	4	5	…	1921	
1	0	5	…	1909	
2	0	3	…	1939	
3	0	3	…	2001	
4	0	4	…	1929	
…	…	…	…	…	
14615	0	4	…	1957	
14616	0	4	…	1968	
14617	0	3	…	1962	
14618	0	4	…	1955	
14619	0	3	…	1969	

	Renovation Year	Postal Code	Lattitude	Longitude	living_area_renov	\
0	0	122003	52.8645	-114.557	2880	
1	0	122004	52.8878	-114.470	2470	
2	0	122004	52.8852	-114.468	2940	
3	0	122005	52.9532	-114.321	3350	
4	0	122006	52.9047	-114.485	2060	
…	…	…	…	…	…	
14615	0	122066	52.6191	-114.472	2250	

```
14616               0       122072    52.5075   -114.393               1540
14617               0       122056    52.7289   -114.507               1130
14618               0       122042    52.7157   -114.411               1420
14619            2009       122018    52.5338   -114.552                900

       lot_area_renov  Number of schools nearby  Distance from the airport  \
0                5400                         2                         58
1                4000                         2                         51
2                6600                         1                         53
3               42847                         3                         76
4                4500                         1                         51
…                …                          …                          …
14615           17286                         3                         76
14616            7480                         3                         59
14617            6120                         2                         64
14618            6631                         3                         54
14619            3480                         2                         55

         Price
0      2380000
1      1400000
2      1200000
3       838000
4       805000
…         …
14615   221700
14616   219200
14617   209000
14618   205000
14619   146000

[14620 rows x 23 columns]
```