```python
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import pandas as pd
from sklearn.preprocessing import MinMaxScaler
import numpy as np
import scipy.stats as stats
import matplotlib.pyplot as plt

def load_data(): # Load data from csv file.
    data = pd.read_csv(r'C:\\Users\\dimit\\Desktop\\
Anagnwrish_Protypwn_2022-2023\\housing.csv') # absolute path
    #data = pd.read_csv(r'housing.csv') # relative path
    return data

def normalize_data(data): # normalize data to range [0, 1000].
    return MinMaxScaler((0,1000)).fit_transform(data)

def plot_pdf_histograms(data_for_pdf_plot, data_columns_names): # Plot
pdf histograms.
    for i in range(data_for_pdf_plot.shape[1]):
        column = data_for_pdf_plot[:, i]
        x = np.linspace(column.min(), column.max(), 100)
        y = stats.norm.pdf(x, np.mean(column), np.std(column))
        plt.hist(column, bins=20, density=True)
        plt.plot(x, y, '-r', label='pdf')
        plt.legend()
        plt.title(data_columns_names[i])
        plt.show()

def _2d_scatter_plot_with_2_attributes(data_columns_names,
data_columns_values): # Plot 2d scatter plot with 2 attributes.
    x = data_columns_values[0] # attribute 1
    y = data_columns_values[1] # attribute 2
    plt.scatter(x, y, c='blue')
    plt.xlabel(data_columns_names[0])
    plt.ylabel(data_columns_names[1])
    title = 'Scatter plot of {} - {}'.format(data_columns_names[0],
data_columns_names[1])
    plt.title(title)
    plt.show()

def _2d_scatter_plot_with_3_attributes(data_columns_names,
data_columns_values): # Plot 2d scatter plot with 3 attributes.
    x = data_columns_values[0] # attribute 1
    y = data_columns_values[1] # attribute 2
    color = data_columns_values[2] # attribute 3
    color_label = data_columns_names[2]
    cmap_value = 'viridis'
    plt.scatter(x, y, c=color, cmap=cmap_value)
    plt.xlabel(data_columns_names[0])
    plt.ylabel(data_columns_names[1])
    plt.colorbar(label=color_label)
    title = 'Scatter plot of {} - {} -
{}'.format(data_columns_names[0], data_columns_names[1], color_label)
    plt.title(title)
    plt.show()

def _2d_scatter_plot_with_4_attributes(data_columns_names,
data_columns_values): # Plot 2d scatter plot with 4 attributes.
    x = data_columns_values[0] # attribute 1
    y = data_columns_values[1] # attribute 2
    color = data_columns_values[2] # attribute 3
    size = data_columns_values[3] # attribute 4
    color_label = data_columns_names[2]
    cmap_value = 'viridis'
    plt.scatter(x, y, c=color, cmap=cmap_value, s=size)
    plt.xlabel(data_columns_names[0])
    plt.ylabel(data_columns_names[1])
    plt.colorbar(label=color_label)
    title = 'Scatter plot of {} - {} - {} -
{}'.format(data_columns_names[0], data_columns_names[1], color_label,
data_columns_names[3])
    plt.title(title)
    plt.show()

if __name__ == '__main__':
    data = load_data()
    data_columns_names = list(data.columns)
    numerical_data = data.drop("ocean_proximity", axis=1)
    categorical_data = data["ocean_proximity"]

    # Replace categorical values with numerical values.
    categorical_data_encoded = data['ocean_proximity'].replace({'<1H
OCEAN': 0, 'INLAND': 0.25, 'ISLAND': 0.5,'NEAR BAY': 0.75, 'NEAR
OCEAN':1 })

    numerical_data = numerical_data.fillna(numerical_data.median()) #
Fill missing values with median.
    normalized_numerical_data =
normalize_data(np.array(numerical_data)) # Normalize numerical data.

    data_for_pdf_plot = []
    for x in list(normalized_numerical_data): # Add numerical data to
the data_for_pdf_plot list.
        data_for_pdf_plot.append(x.tolist())

    temp_categorical_data_encoded = list(categorical_data_encoded)
    for x in data_for_pdf_plot: # Add categorical data to the
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data_for_pdf_plot list.
        x.append(temp_categorical_data_encoded.pop(0))

    data_for_pdf_plot = np.array(data_for_pdf_plot) # Convert
data_for_pdf_plot list to numpy array.
    plot_pdf_histograms(data_for_pdf_plot, data_columns_names) # Plot
pdf histograms.

    # Convert normalized_numerical_data[i] to list and add them to
data_columns_values list.
    data_columns_values = [x.tolist() for x in
normalized_numerical_data]

    # Convert categorical_data_encoded to list and add them to
temp_categorical_data_encoded list.
    temp_categorical_data_encoded = [x for x in
categorical_data_encoded.tolist()]
    for values in data_columns_values: # Add categorical data to
data_columns_values list.
        values.append(temp_categorical_data_encoded.pop(0))

    # Plot 2d scatter plot with 2 attributes, 3 attributes and 4
attributes.
    _2d_scatter_plot_with_2_attributes(data_columns_names,
data_columns_values)
    _2d_scatter_plot_with_3_attributes(data_columns_names,
data_columns_values)
    _2d_scatter_plot_with_4_attributes(data_columns_names,
data_columns_values)
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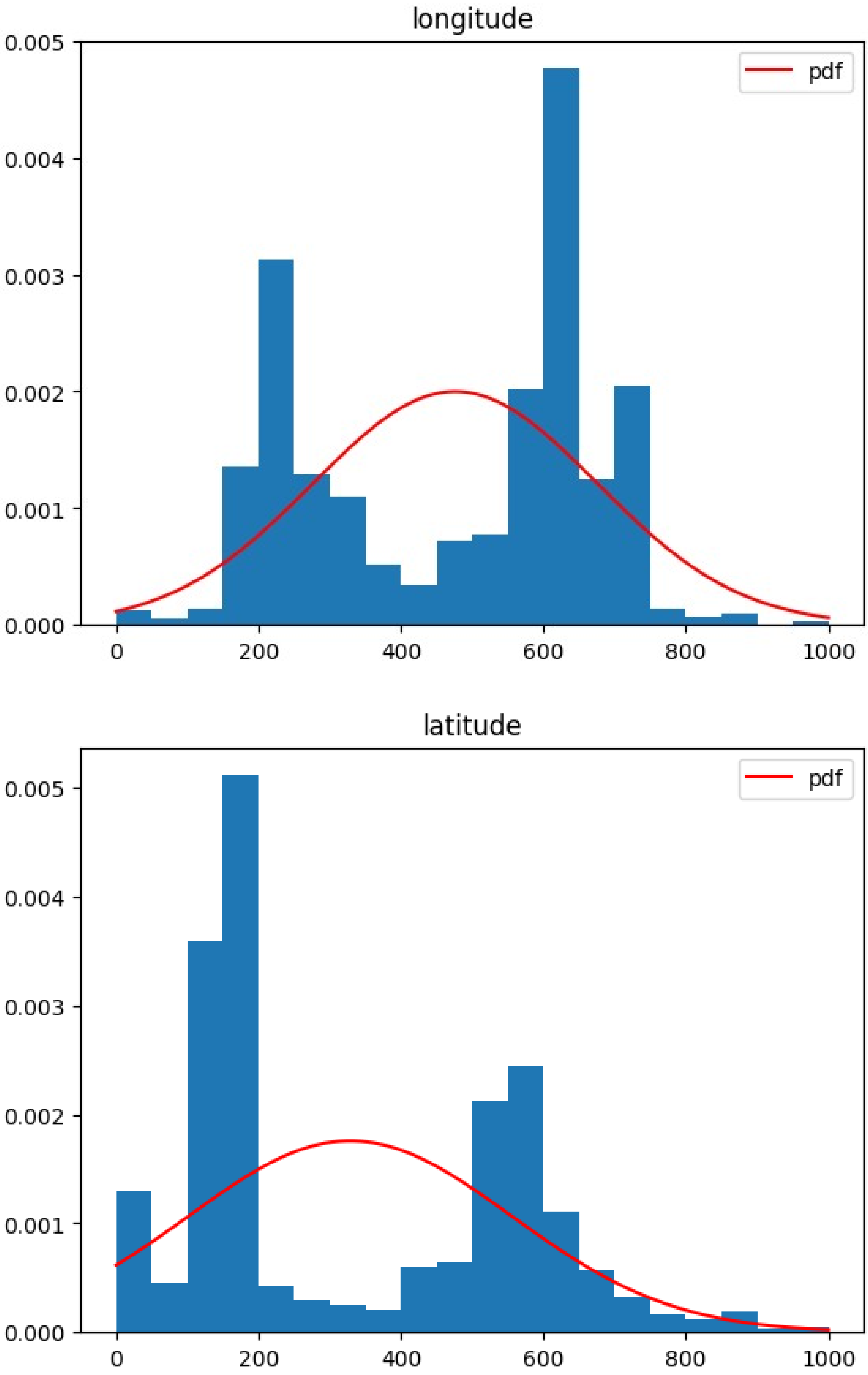
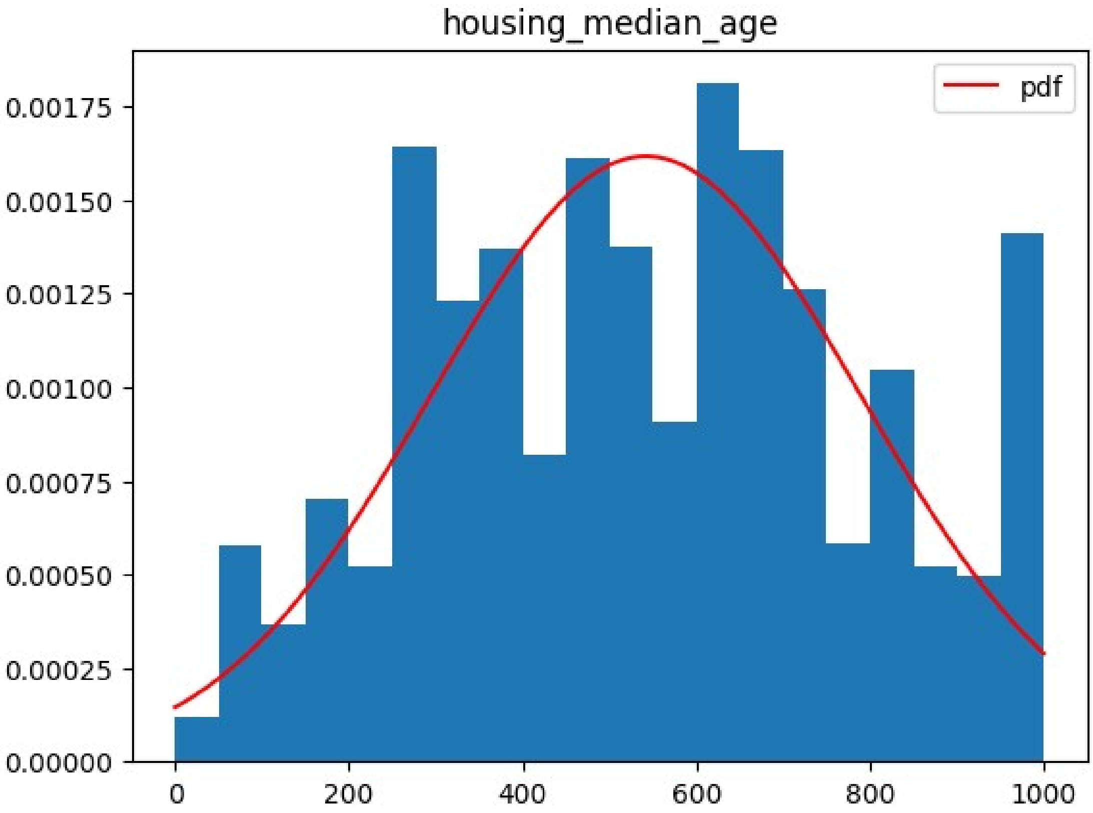
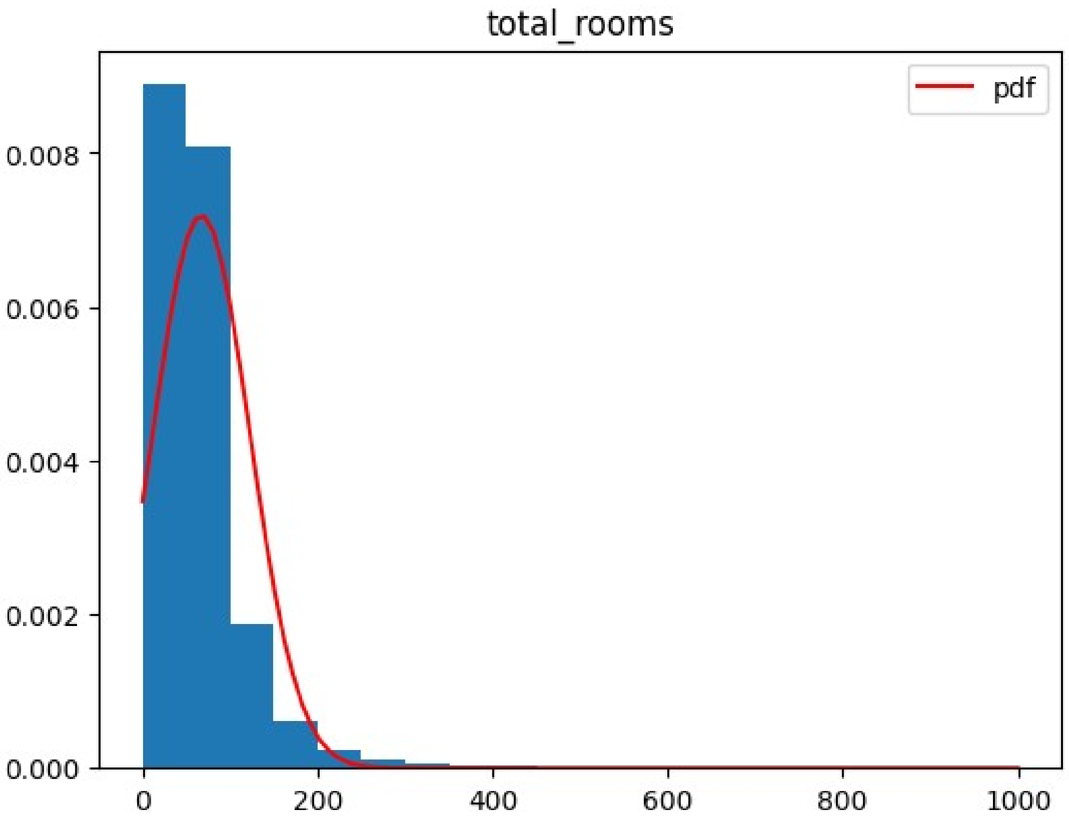
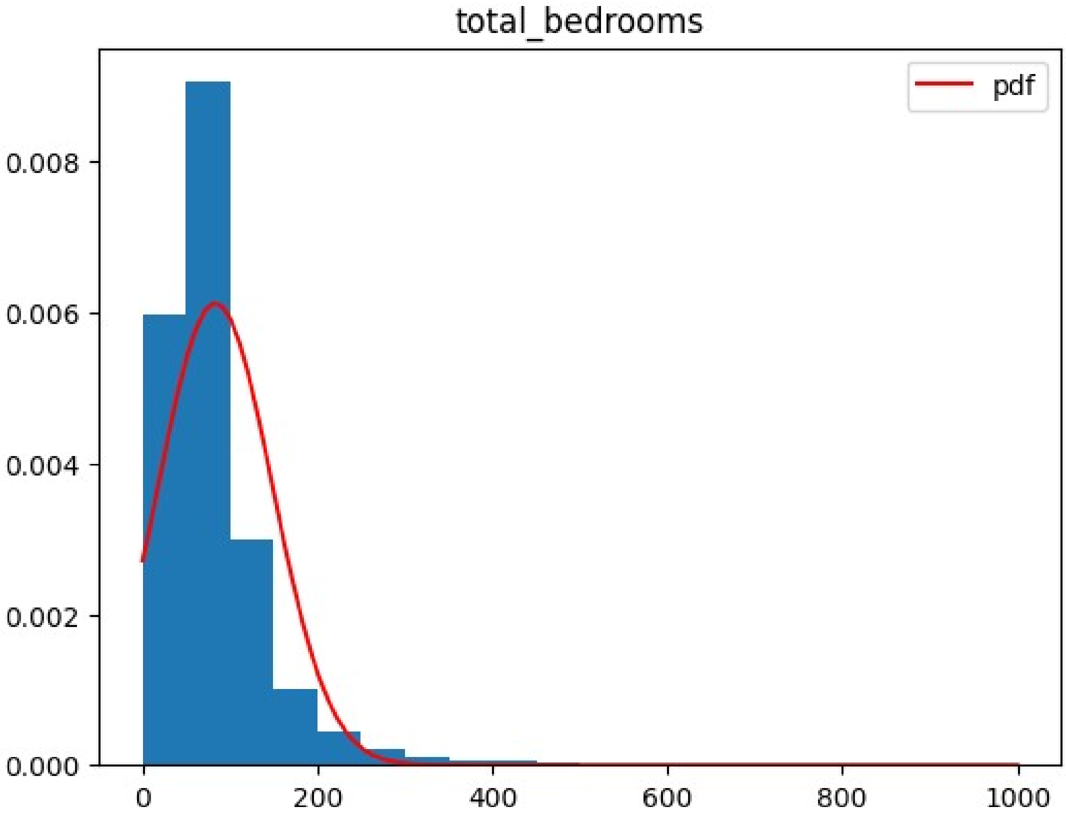
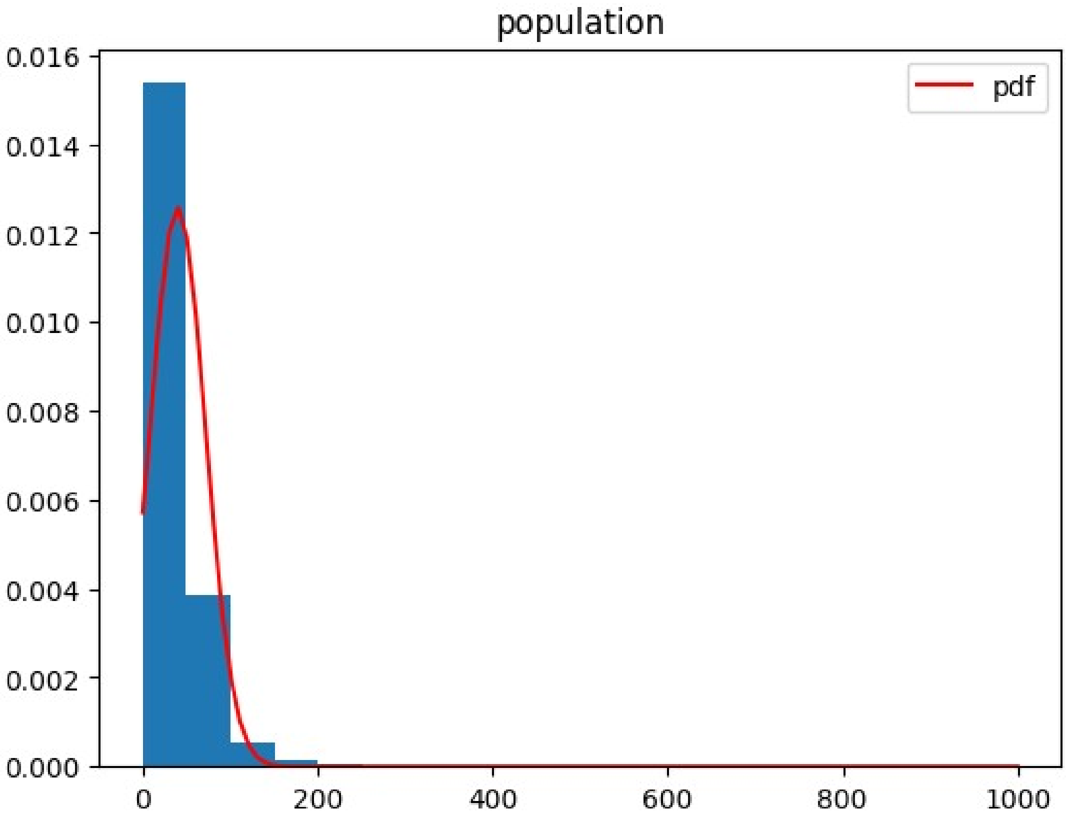
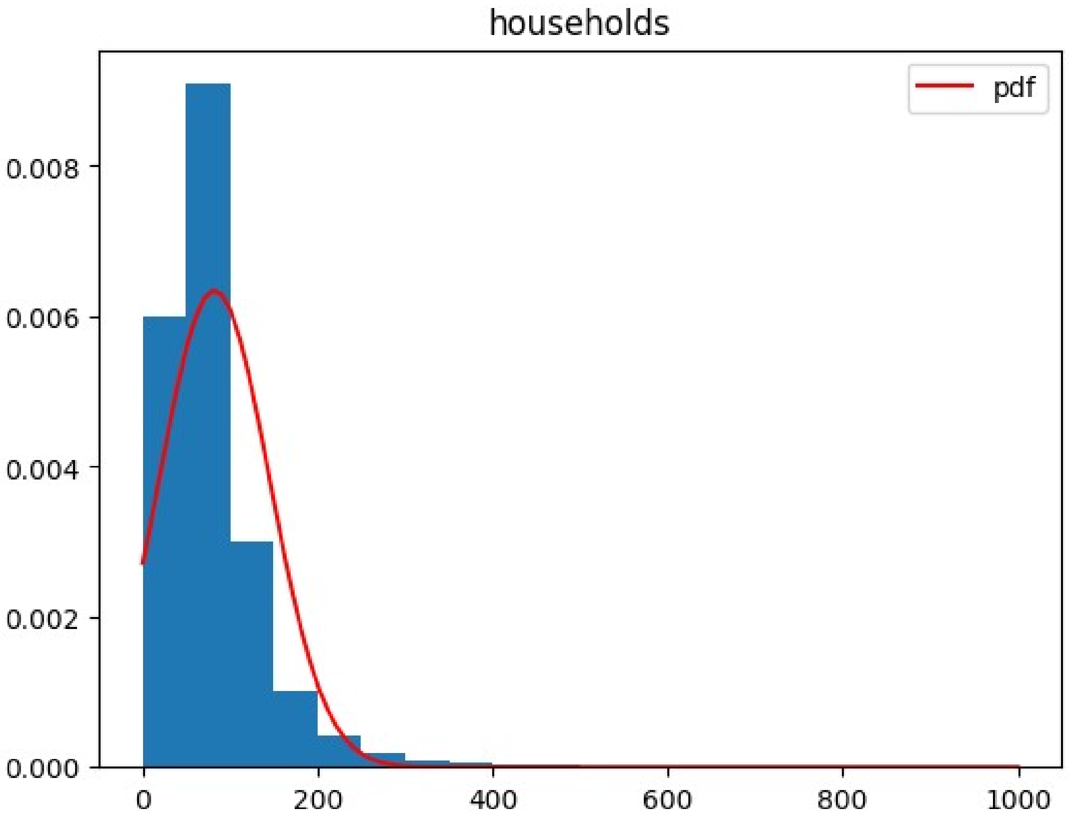

longitude
pdf
0.005
0.004
0.003
0.002
0.001
0.000
0
200
400
600
800
1000
latitude
pdf
0.005
0.004
0.003
0.002
0.001
0.000
0
200
400
600
800
1000

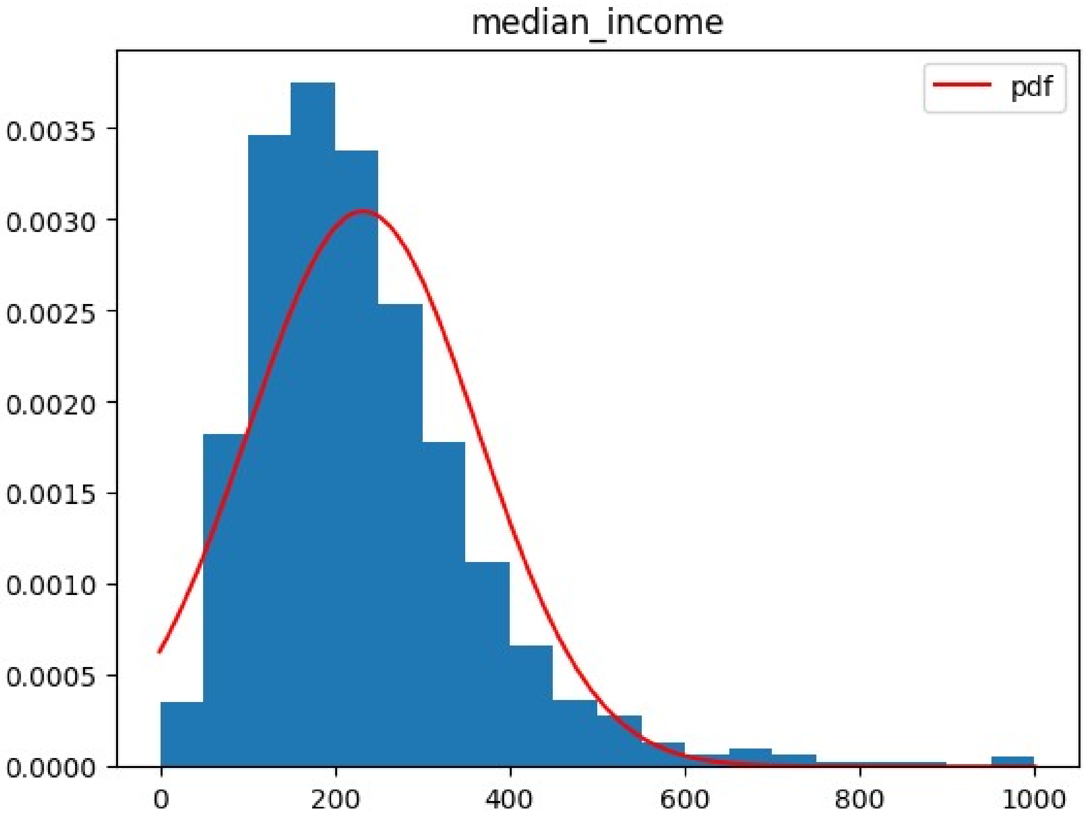

housing_median_age
pdf
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
0
200
400
600
800
1000

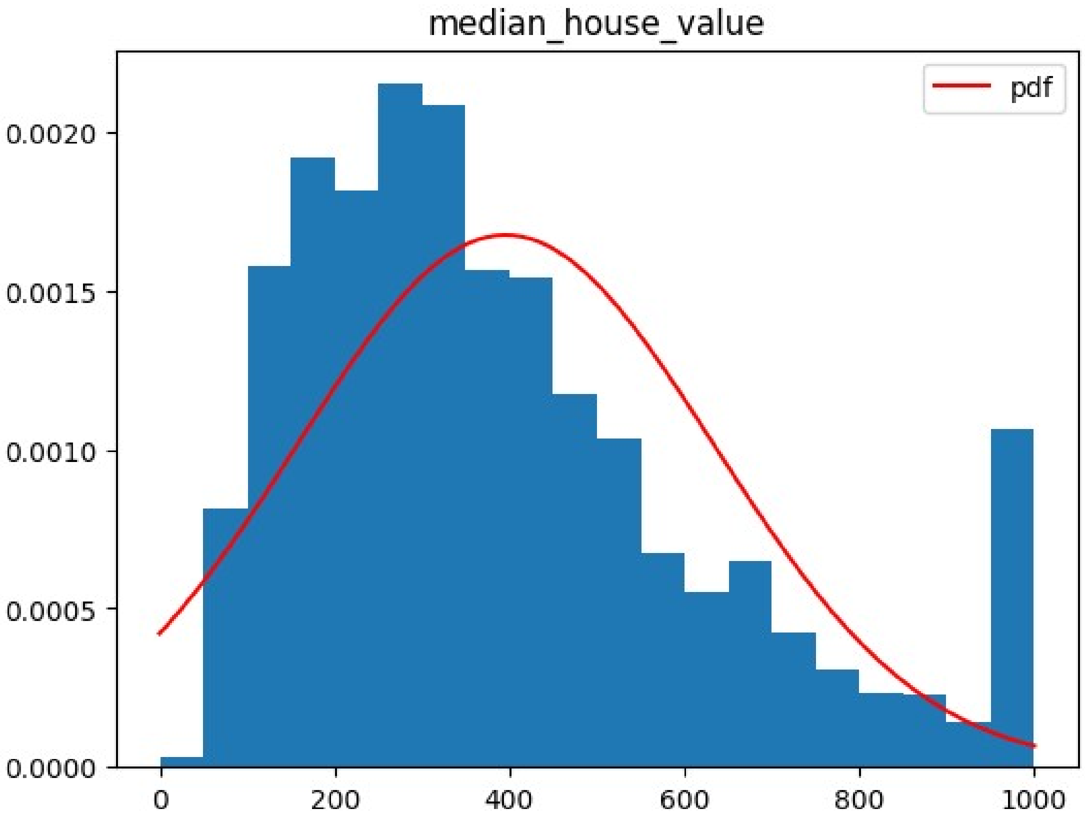

total_rooms
pdf
0.008
0.006
0.004
0.002
0.000
0
200
400
600
800
1000


total_bedrooms
pdf
0.000
0.002
0.004
0.006
0.008
0
200
400
600
800
1000

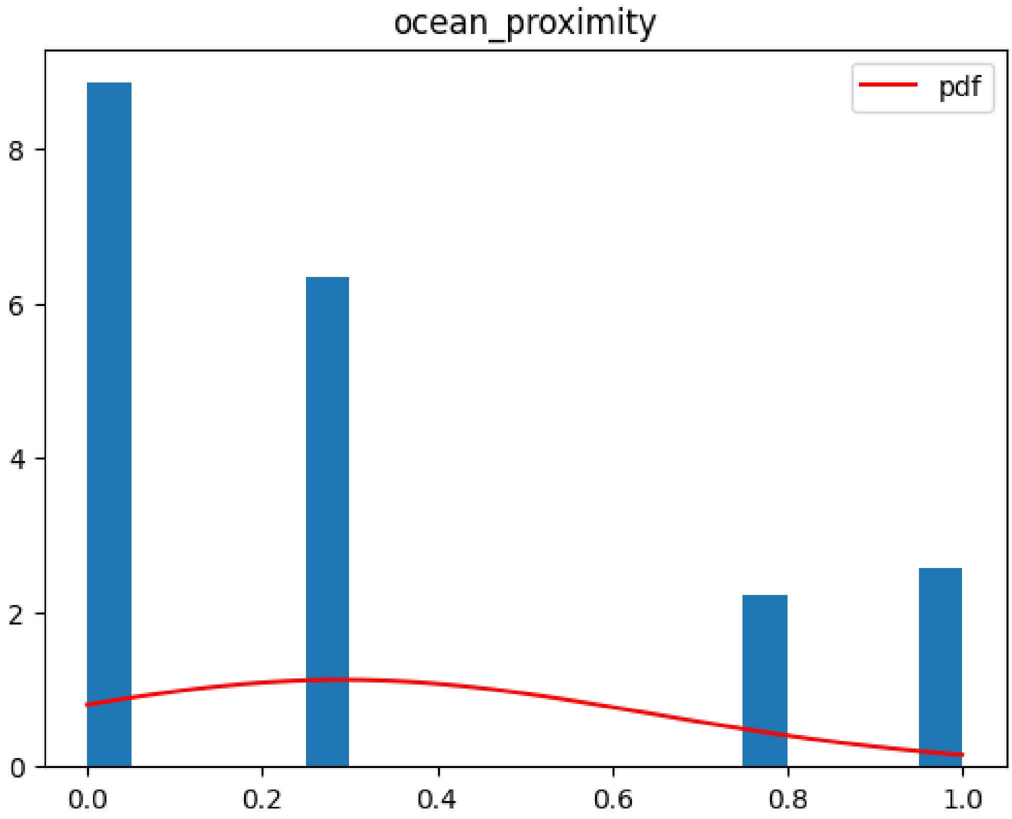

population
pdf
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0
200
400
600
800
1000


households
pdf
0.000
0.002
0.004
0.006
0.008
0
200
400
600
800
1000

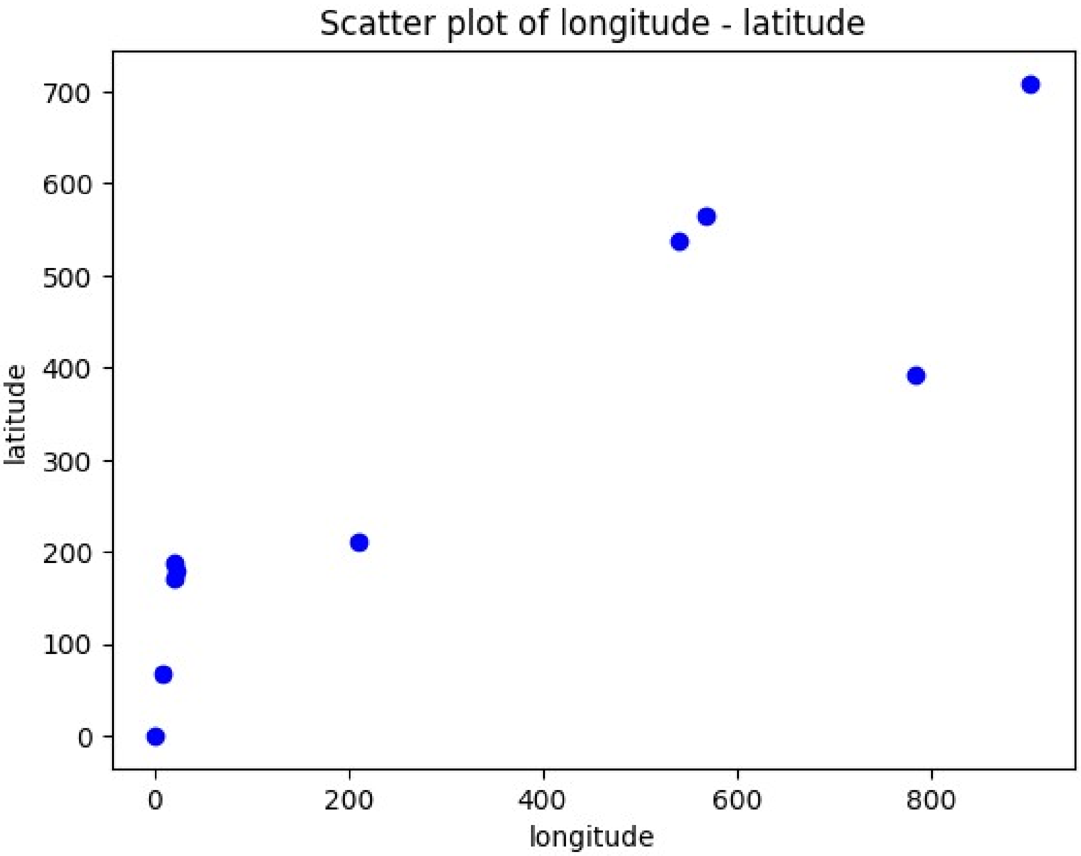

median_income
pdf
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0.0030
0.0035
0
200
400
600
800
1000

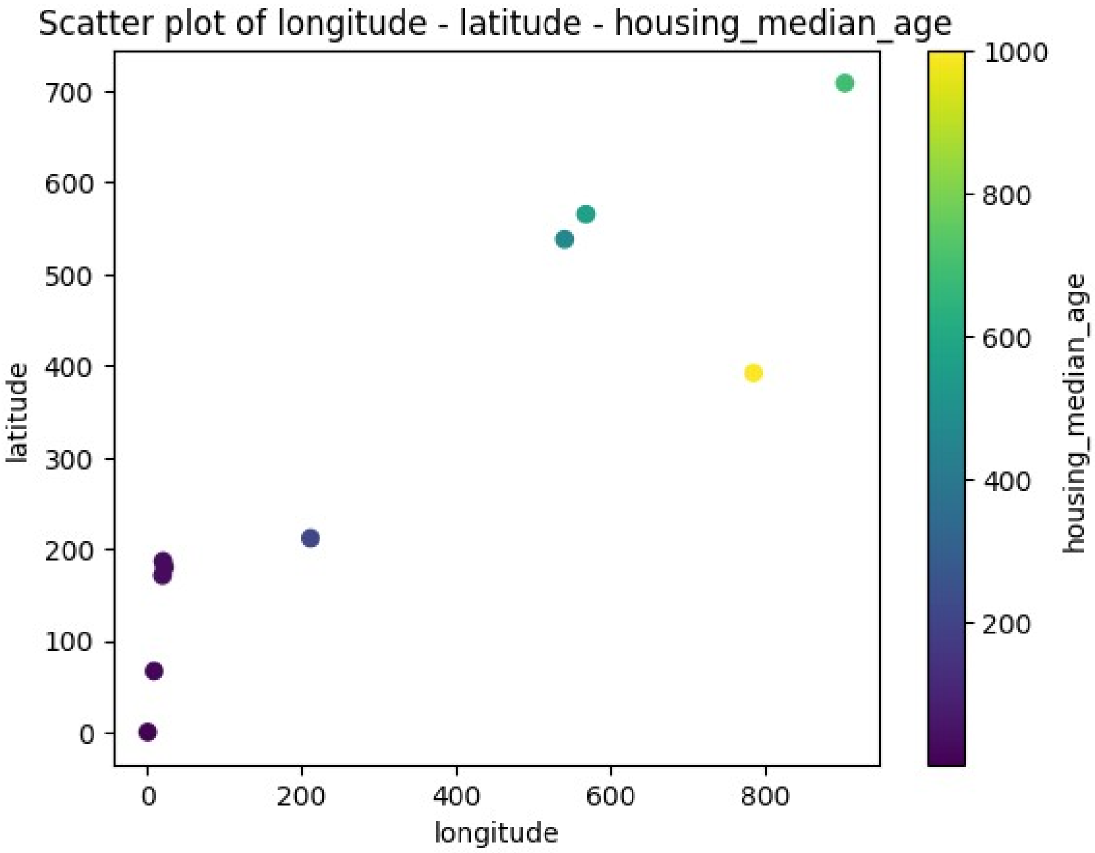


median_house_value

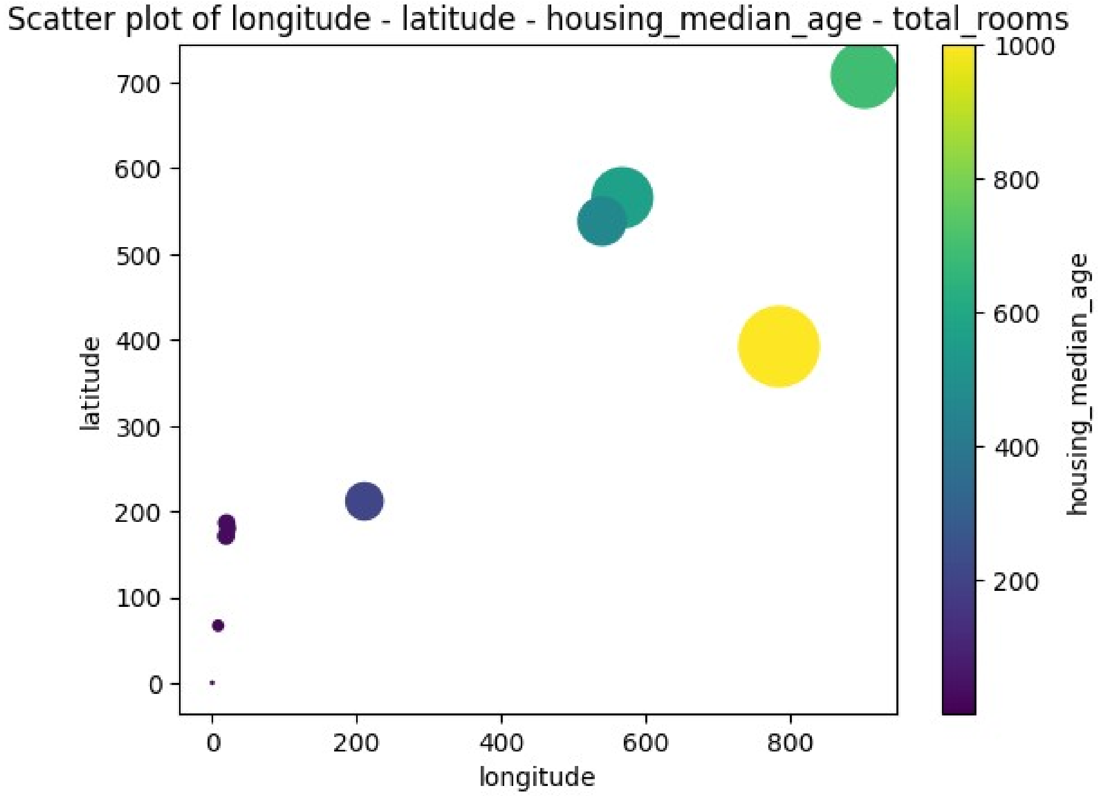


ocean_proximity


Scatter plot of longitude - latitude
latitude
700
600
500
400
300
200
100
0
0
200
400
600
800
longitude



Scatter plot of longitude - latitude - housing_median_age



Scatter plot of longitude - latitude - housing_median_age - total_rooms