Housing

November 6, 2019

In [1]:
```
import pandas
from matplotlib import pyplot
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import BayesianRidge
from scipy import stats
import numpy
```

In [2]:
```
df = pandas.read_csv("datos/housing.csv")
df.head()
```

Out[2]:
```
   longitude  latitude  housing_median_age  total_rooms  total_bedrooms  \
0    -122.23     37.88                41.0        880.0           129.0
1    -122.22     37.86                21.0       7099.0          1106.0
2    -122.24     37.85                52.0       1467.0           190.0
3    -122.25     37.85                52.0       1274.0           235.0
4    -122.25     37.85                52.0       1627.0           280.0

   population  households  median_income  median_house_value ocean_proximity
0       322.0       126.0         8.3252            452600.0        NEAR BAY
1      2401.0      1138.0         8.3014            358500.0        NEAR BAY
2       496.0       177.0         7.2574            352100.0        NEAR BAY
3       558.0       219.0         5.6431            341300.0        NEAR BAY
4       565.0       259.0         3.8462            342200.0        NEAR BAY
```

In [3]:
```
df.shape
```

Out[3]:
```
(20640, 10)
```

In [4]:
```
df = df.dropna()
```

In [5]:
```
df.shape
```

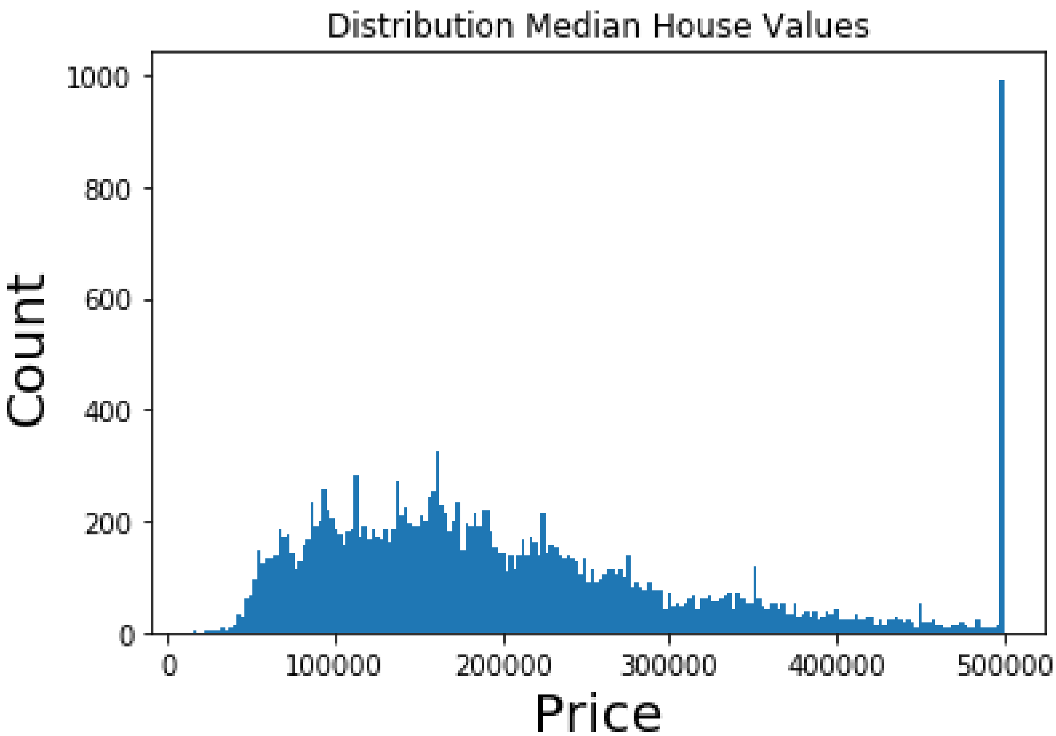
Out[5]:
```
(20433, 10)
```

In [6]:
```
df.columns
```

Out[6]: Index(['longitude', 'latitude', 'housing_median_age', 'total_rooms',
       'total_bedrooms', 'population', 'households', 'median_income',
       'median_house_value', 'ocean_proximity'],
      dtype='object')

In [7]:
```
pyplot.hist(df["median_house_value"], bins = 200)
pyplot.xlabel("Price", fontsize=20)
pyplot.ylabel("Count", fontsize=20)
pyplot.title("Distribution Median House Values")
```

Out[7]: Text(0.5, 1.0, 'Distribution Median House Values')



In [8]:
```
df.corr()["median_house_value"].sort_values()
```

Out[8]:
```
latitude             -0.144638
longitude            -0.045398
population           -0.025300
total_bedrooms        0.049686
households            0.064894
housing_median_age    0.106432
total_rooms           0.133294
median_income         0.688355
median_house_value    1.000000
Name: median_house_value, dtype: float64
```

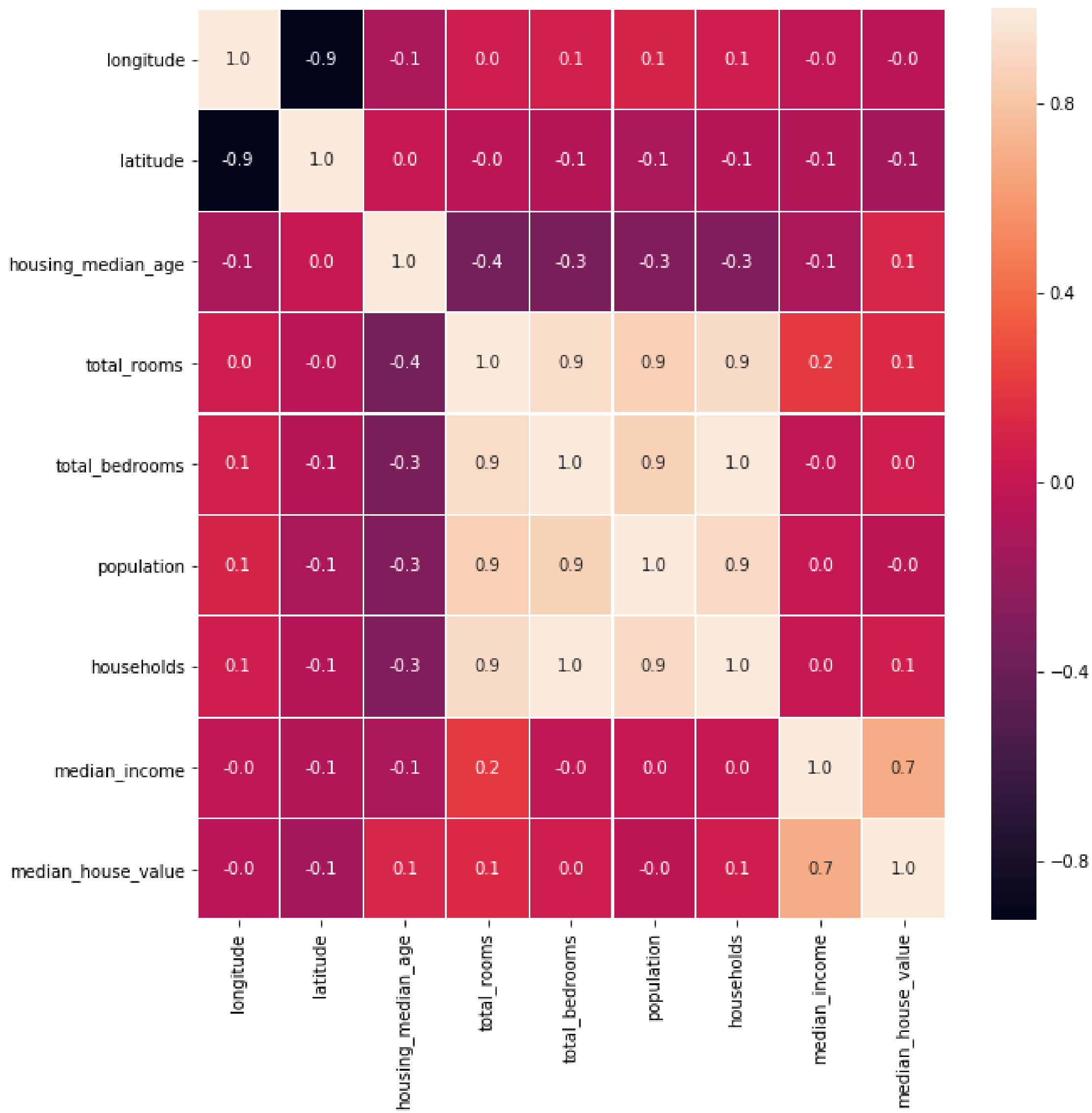
```
In [9]: # One hot encode the variables
        dummy_df = pandas.get_dummies(df["ocean_proximity"])

        # Put the grade back in the dataframe
        dummy_df['median_house_value'] = df['median_house_value']

        # Find correlations with grade
        dummy_df.corr()['median_house_value'].sort_values()
```

```
Out[9]: INLAND               -0.484787
        ISLAND                0.023525
        NEAR OCEAN            0.140378
        NEAR BAY              0.160526
        <1H OCEAN             0.257614
        median_house_value    1.000000
        Name: median_house_value, dtype: float64
```

```
In [10]: f, ax = pyplot.subplots(figsize = (10, 10))
         sns.heatmap(df.corr(), annot = True, linewidth = 0.3, fmt = ".1f", ax = ax)
         pyplot.show()
```




```
In [11]: def format_data(df):
             # Targets are final grade of student
             labels = df['median_house_value']

             # One-Hot Encoding of Categorical Variables
             df = pandas.get_dummies(df)

             # Find correlations with the Grade
             most_correlated = df.corr().abs()['median_house_value'].sort_values(ascending=False

             # Maintain the top 6 most correlation features with Grade
             most_correlated = most_correlated[:]
```

```
    df = df.loc[:, most_correlated.index]

    # Split into training/testing sets with 25% split
    X_train, X_test, y_train, y_test = train_test_split(df, labels,
                                                        test_size = 0.25,
                                                        random_state=42)

    return X_train, X_test, y_train, y_test
```

In [12]:
```
X_train, X_test, y_train, y_test = format_data(df)
X_train.head()
```

Out[12]:
```
       median_house_value  median_income  ocean_proximity_INLAND  \
2830              44600.0         1.7109                       1
14951            155000.0         2.4567                       0
8314             450000.0         2.1579                       0
14271             65700.0         1.0531                       0
305               91200.0         1.8913                       0

       ocean_proximity_<1H OCEAN  ocean_proximity_NEAR BAY  latitude  \
2830                           0                         0     35.40
14951                          1                         0     32.71
8314                           0                         0     33.35
14271                          0                         0     32.70
305                            0                         1     37.76

       ocean_proximity_NEAR OCEAN  total_rooms  housing_median_age  \
2830                            0       8739.0                11.0
14951                           0       2413.0                18.0
8314                            0       1675.0                27.0
14271                           1        818.0                38.0
305                             0       2018.0                43.0

       households  total_bedrooms  longitude  population  \
2830       1919.0          2190.0    -119.01      4781.0
14951       551.0           533.0    -116.96      1129.0
8314        331.0           521.0    -118.32       744.0
14271       231.0           217.0    -117.12       953.0
305         367.0           408.0    -122.18      1111.0

       ocean_proximity_ISLAND
2830                        0
14951                       0
8314                        1
14271                       0
305                         0
```

In [13]:
```
print(X_train.shape)
```

```
        print(X_test.shape)
```

```
(15324, 14)
(5109, 14)
```

```
In [14]: def evaluate(X_train, X_test, y_train, y_test):
             # Names of models
             model_name_list = ['Linear Regression', "Bayesian Ridge"]

             X_train = X_train.drop(columns='median_house_value')
             X_test = X_test.drop(columns='median_house_value')

             # Instantiate the models
             model1 = LinearRegression()
             model2 = BayesianRidge(compute_score=True)

             # Dataframe for results
             results = pandas.DataFrame(columns=['mae', 'rmse'], index = model_name_list)

             # Train and predict with each model
             for i, model in enumerate([model1, model2]):
                 model.fit(X_train, y_train)
                 predictions = model.predict(X_test)
                 coeff = model.coef_
                 score = model.score(X_test, y_test)

                 print("{} Coefficients: ".format(model_name_list[i]), coeff)
                 print("\n")
                 print("{} Score: ".format(model_name_list[i]), score)
                 print("\n")
                 # Metrics
                 mae = numpy.mean(abs(predictions - y_test))
                 rmse = numpy.sqrt(numpy.mean((predictions - y_test) ** 2))

                 # Insert results into the dataframe
                 model_name = model_name_list[i]
                 results.loc[model_name, :] = [mae, rmse]

             # Median Value Baseline Metrics
             baseline = numpy.mean(y_train)
             baseline_mae = numpy.mean(abs(baseline - y_test))
             baseline_rmse = numpy.sqrt(numpy.mean((baseline - y_test) ** 2))

             results.loc['Baseline', :] = [baseline_mae, baseline_rmse]

             return results
```

```
In [15]: results = evaluate(X_train, X_test, y_train, y_test)
```

```
Linear Regression Coefficients:  [ 3.92330777e+04 -7.36819088e+04 -3.40321348e+04 -4.02817945e+0
 -2.55205753e+04 -3.12916376e+04 -6.36691750e+00  1.08813173e+03
  4.35107705e+01  1.02597469e+02 -2.68384898e+04 -3.62122333e+01
  1.79287476e+05]


Linear Regression Score:  0.6547516410329023


Bayesian Ridge Coefficients:  [ 3.92244863e+04 -5.00655360e+04 -1.05743626e+04 -1.67689497e+04
 -2.56126711e+04 -7.85132337e+03 -6.36482591e+00  1.09028421e+03
  4.30517739e+01  1.03031260e+02 -2.69134708e+04 -3.62257024e+01
  8.52601716e+04]


Bayesian Ridge Score:  0.6553914482946943
```

In [16]:
```python
print(results)
```

```
                       mae     rmse
Linear Regression  49958.5  68343.3
Bayesian Ridge     49921.4  68279.9
Baseline           92461.7   116314
```

In [17]:
```python
X_test.iloc[50]
```

Out[17]:
```
median_house_value            177500.0000
median_income                      2.4827
ocean_proximity_INLAND             0.0000
ocean_proximity_<1H OCEAN          1.0000
ocean_proximity_NEAR BAY           0.0000
latitude                          38.3600
ocean_proximity_NEAR OCEAN         0.0000
total_rooms                     5496.0000
housing_median_age                 6.0000
households                      1189.0000
total_bedrooms                  1374.0000
longitude                       -122.6900
population                      2502.0000
ocean_proximity_ISLAND             0.0000
Name: 19157, dtype: float64
```

In [18]:
```python
model1 = LinearRegression()
model2 = BayesianRidge(compute_score=True)
```

```python
# Train and predict with each model
for i, model in enumerate([model1, model2]):
    model.fit(X_train, y_train)
    predictions = model.predict(X_test)
    print(predictions[50])
```

```
177499.99999999997
177500.00000951337
```

In [ ]:

In [ ]: