Server

November 28, 2018

```
In [1]: import pandas as pd
        import numpy as np
        from collections import Counter
        data = pd.read_csv("kc_house_data.csv")
```

```
In [2]: data.head(10)
```

Out[2]:

	id	date	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	view	...	grade	sqft_above	sqft_basement	yr_built	yr_renovated	zipcode	lat	long
0	7129300520	20141013T000000	221900.0	3	1.00	1180	5650	1.0	0	0	...	7	1180.0	0	1955	0	98178	47.5112	-122.257
1	6414100192	20141209T000000	538000.0	3	2.25	2570	7242	2.0	0	0	...	7	2170.0	400	1951	1991	98125	47.7210	-122.319
2	5631500400	20150225T000000	180000.0	2	1.00	770	10000	1.0	0	0	...	6	770.0	0	1933	0	98028	47.7379	-122.233
3	2487200875	20141209T000000	604000.0	4	3.00	1960	5000	1.0	0	0	...	7	1050.0	910	1965	0	98136	47.5208	-122.393
4	1954400510	20150218T000000	510000.0	3	2.00	1680	8080	1.0	0	0	...	8	1680.0	0	1987	0	98074	47.6168	-122.045
5	7237550310	20140512T000000	1225000.0	4	4.50	5420	101930	1.0	0	0	...	11	3890.0	1530	2001	0	98053	47.6561	-122.005
6	1321400060	20140627T000000	257500.0	3	2.25	1715	6819	2.0	0	0	...	7	1715.0	0	1995	0	98003	47.3097	-122.327
7	2008000270	20150115T000000	291850.0	3	1.50	1060	9711	1.0	0	0	...	7	1060.0	0	1963	0	98198	47.4095	-122.315
8	2414600126	20150415T000000	229500.0	3	1.00	1780	7470	1.0	0	0	...	7	1050.0	730	1960	0	98146	47.5123	-122.337
9	3793500160	20150312T000000	323000.0	3	2.50	1890	6560	2.0	0	0	...	7	1890.0	0	2003	0	98038	47.3684	-122.031

```
6              0      1995             0    98003  47.3097 -122.327
7              0      1963             0    98198  47.4095 -122.315
8            730      1960             0    98146  47.5123 -122.337
9              0      2003             0    98038  47.3684 -122.031

   sqft_living15  sqft_lot15
0           1340        5650
1           1690        7639
2           2720        8062
3           1360        5000
4           1800        7503
5           4760      101930
6           2238        6819
7           1650        9711
8           1780        8113
9           2390        7570

[10 rows x 21 columns]
```

Data cleaning

```
In [3]: date = data['date'] # Only consider year of sale date
        for i in range(len(date)):
            year = date[i][0:4]
            data.iloc[i,1] = year

In [4]: yr_renovated = data['yr_renovated'] # If there is a renovation, consider it as time of
        for i in range(len(yr_renovated)):
            if(yr_renovated[i] != 0):
                data.loc[i,'yr_built'] = yr_renovated[i]

In [5]: data = data.dropna() # Drop all observations containing na

In [6]: dummy_data = pd.get_dummies(data, columns = ['date','bedrooms','waterfront','view','co

In [7]: price = dummy_data['price'] # Price is target
        newdata = dummy_data.drop(['id','yr_renovated','lat','long','price'],axis = 1) # id la
        # Non normalized dataframe

In [8]: from sklearn import preprocessing
        min_max_scaler = preprocessing.MinMaxScaler()
        d = min_max_scaler.fit_transform(newdata) #Normalized data matrix

C:\anaconda\envs\tensorflow\lib\site-packages\sklearn\preprocessing\data.py:323: DataConversio
  return self.partial_fit(X, y)


In [9]: from sklearn.model_selection import train_test_split
        X_train, X_test, y_train, y_test = train_test_split(d, price, test_size=0.2, random_sta
```

Linear regression

```
In [10]: from sklearn.linear_model import LinearRegression
         reg = LinearRegression().fit(X_train,y_train)
         reg.score(X_test,y_test)
```

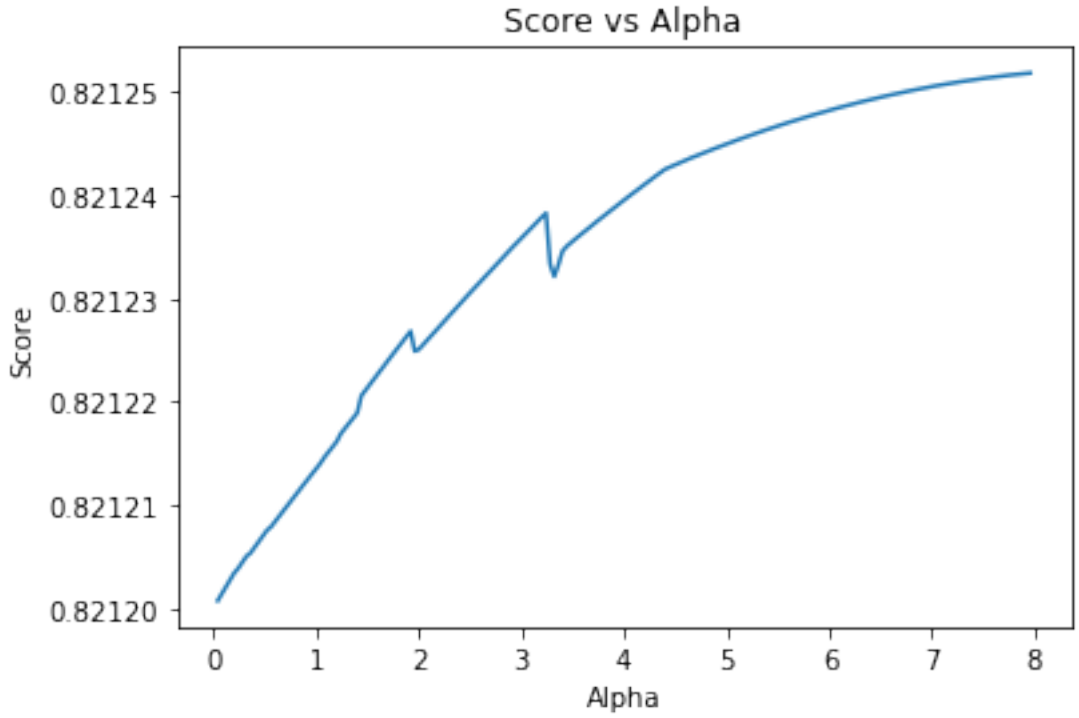
```
Out[10]: -1.4150968018545946e+20
```

lasso regression

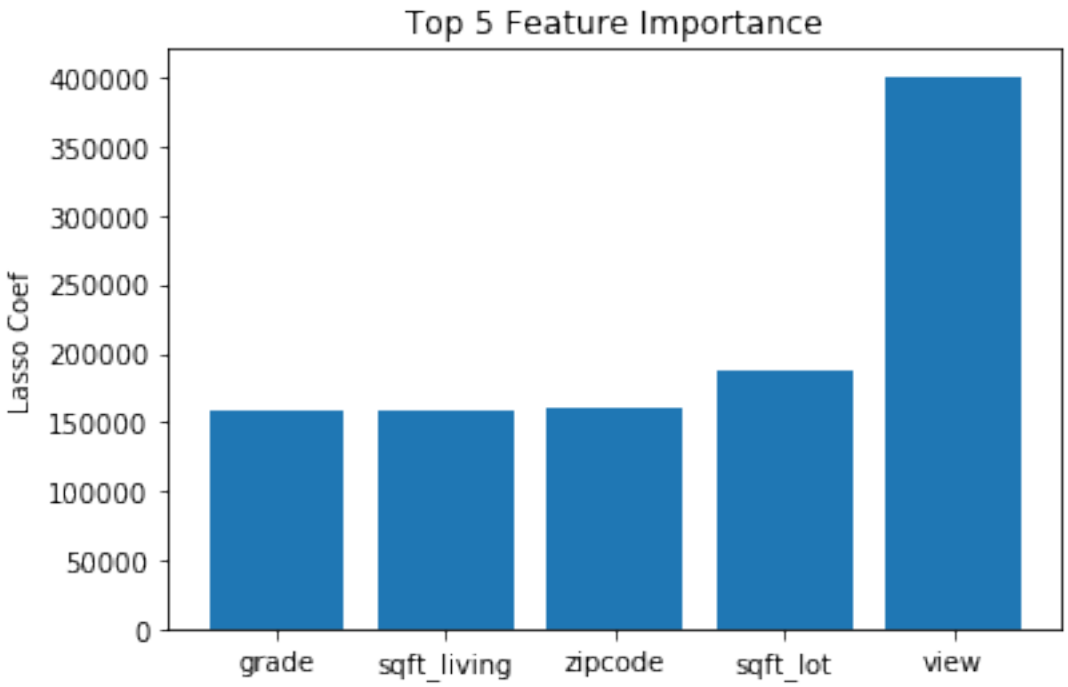
```
In [11]: from sklearn import linear_model
         import matplotlib.pyplot as plt
```

```
In [12]: import warnings
         warnings.filterwarnings("ignore")
         score_list = []
         x = []
         for i in range(1,200):
             alpha = i/25
             x.append(alpha)
             clf = linear_model.Lasso(alpha=alpha)
             clf.fit(X_train,y_train)
             score_list.append(clf.score(X_test,y_test))
```

```
In [15]: plt.plot(x,score_list)
         plt.title('Score vs Alpha')
         plt.xlabel('Alpha')
         plt.ylabel('Score')
         plt.show()
```



```
In [16]: clf = linear_model.Lasso(alpha=0.1) #There is no big difference so we choose alpha=0.
         clf.fit(X_train,y_train)
         clf.score(X_test,y_test)

Out[16]: 0.82120176281296309

In [17]: feature_importance = clf.coef_
         a = np.argsort(feature_importance)[-20:]
         newdata.columns[a]

Out[17]: Index(['sqft_above', 'zipcode_98107', 'zipcode_98033', 'zipcode_98122',
                'bathrooms', 'zipcode_98199', 'view_4', 'zipcode_98105', 'grade_11',
                'zipcode_98119', 'zipcode_98102', 'zipcode_98040', 'zipcode_98109',
                'sqft_lot', 'zipcode_98112', 'zipcode_98004', 'grade_12',
                'zipcode_98039', 'sqft_living', 'grade_13'],
               dtype='object')

In [18]: Feature_5 = ['grade','sqft_living','zipcode','sqft_lot','view']
         Importance_5 = [feature_importance[a[0]],feature_importance[a[1]],feature_importance[a

In [19]: x = np.arange(5)
         plt.bar(x, Importance_5)
         plt.xticks(x, (Feature_5))
         plt.title('Top 5 Feature Importance')
         plt.ylabel('Lasso Coef')
         plt.show()
```

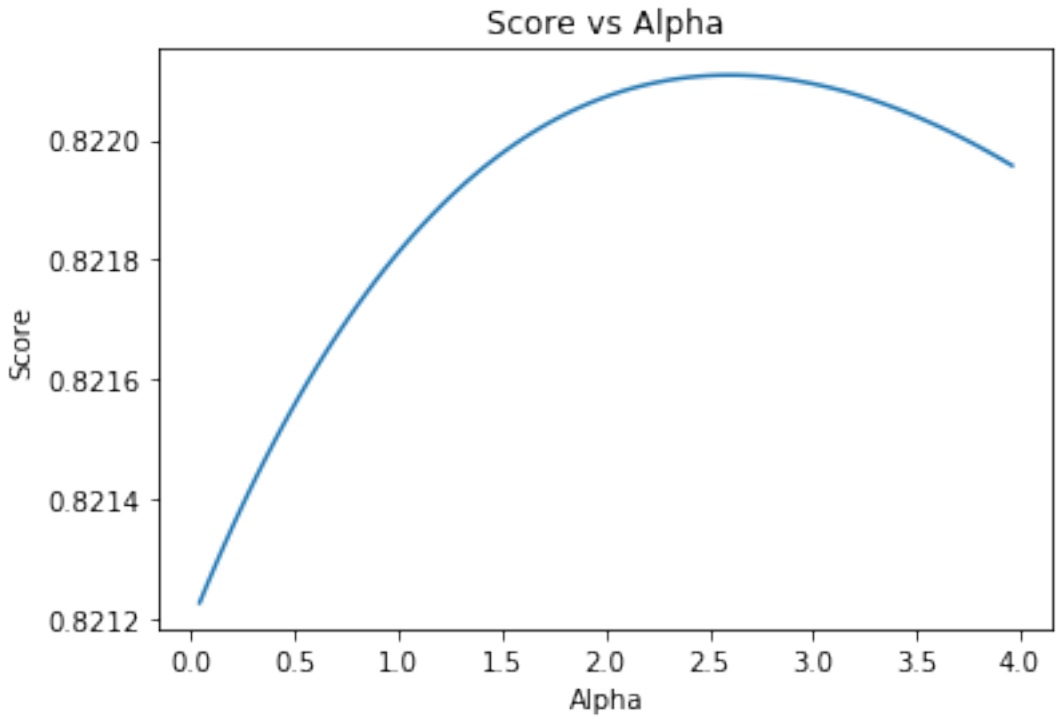


Ridge

In [20]:
```
from sklearn.linear_model import Ridge
```

In [21]:
```
score_list = []
x = []
for i in range(1,100):
    alpha = i/25
    x.append(alpha)
    clf = Ridge(alpha=alpha)
    clf.fit(X_train,y_train)
    score_list.append(clf.score(X_test,y_test))
```

In [22]:
```
plt.plot(x,score_list)
plt.title('Score vs Alpha')
plt.xlabel('Alpha')
plt.ylabel('Score')
plt.show()
```



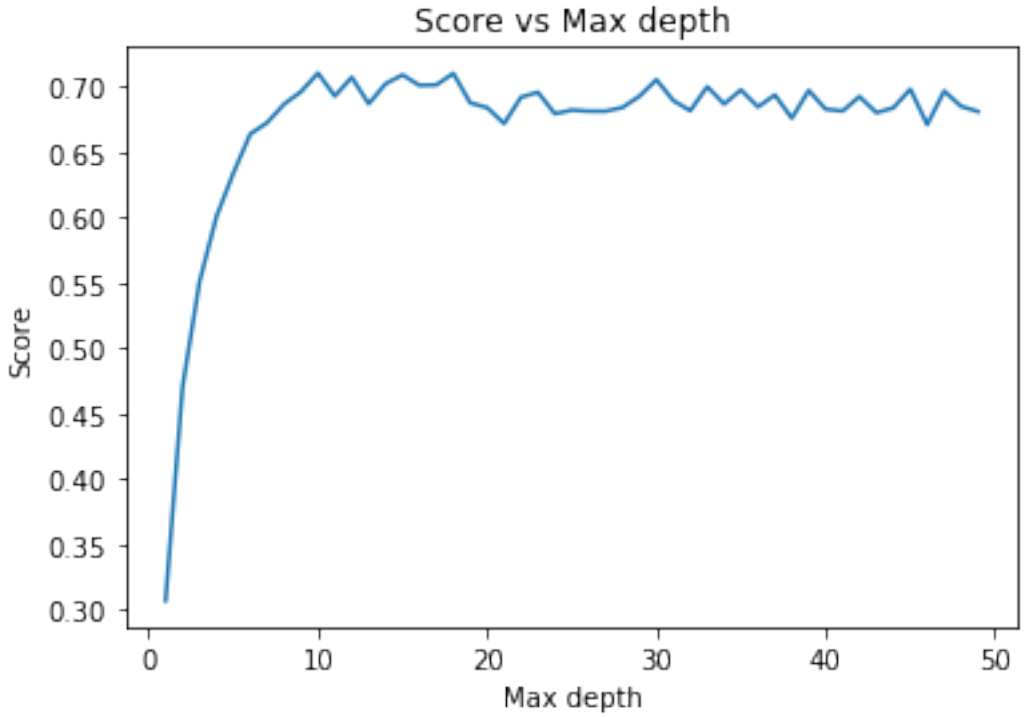
In [23]:
```
best_alpha = x[score_list.index(max(score_list))]
print(best_alpha)
clf = Ridge(alpha=best_alpha)
clf.fit(X_train,y_train)
clf.score(X_test,y_test)
```

2.6

Out[23]: 0.8221088316932128

Decision Tree Regressor

```
In [24]: from sklearn.tree import DecisionTreeRegressor

In [25]: score_list = []
         x = []
         for i in range(1,50):
             x.append(i)
             clf = DecisionTreeRegressor(max_depth=i)
             clf.fit(X_train,y_train)
             score_list.append(clf.score(X_test,y_test))

In [26]: plt.plot(x,score_list)
         plt.title('Score vs Max depth')
         plt.xlabel('Max depth')
         plt.ylabel('Score')
         plt.show()
```




```
In [27]: clf = DecisionTreeRegressor(max_depth=12)
         clf.fit(X_train,y_train)
         clf.score(X_test,y_test)
```

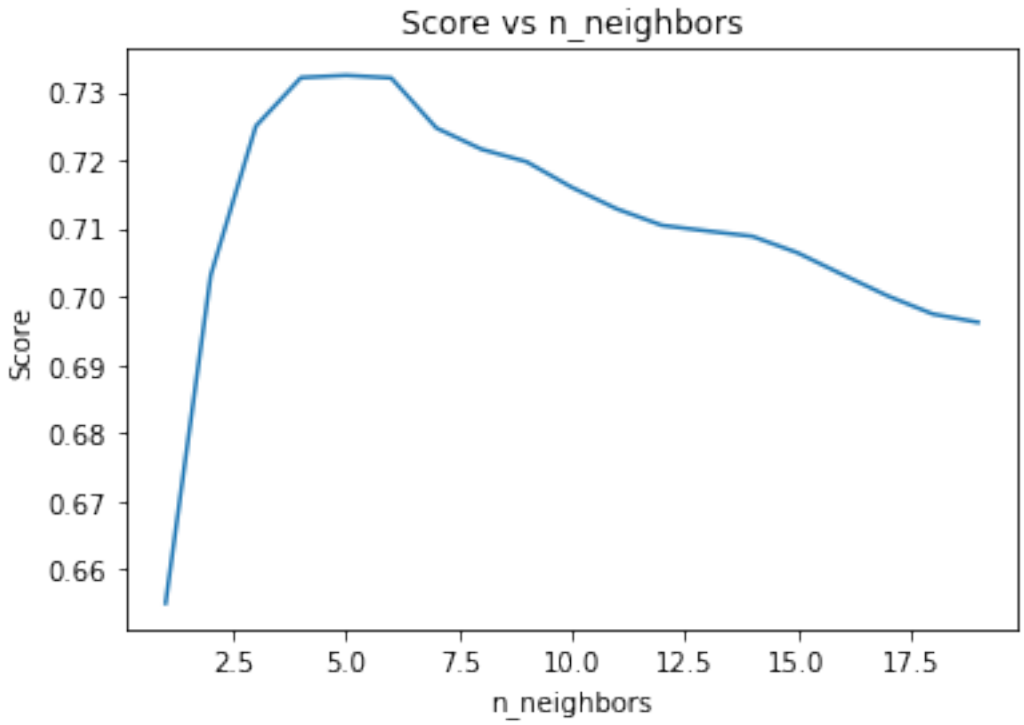
```
Out[27]: 0.69959298556335991
```

KNN

```
In [28]: from sklearn.neighbors import KNeighborsRegressor
```

```
In [32]: score_list = []
         x = []
         for i in range(1,20):
             x.append(i)
             neigh = KNeighborsRegressor(n_neighbors=i)
             neigh.fit(X_train,y_train)
             score_list.append(neigh.score(X_test,y_test))
```

```
In [33]: plt.plot(x,score_list)
         plt.title('Score vs n_neighbors')
         plt.xlabel('n_neighbors')
         plt.ylabel('Score')
         plt.show()
```




```
In [34]: best_i = x[score_list.index(max(score_list))]
         print(best_i)
         neigh = KNeighborsRegressor(n_neighbors=best_i)
         neigh.fit(X_train,y_train)
         neigh.score(X_test,y_test)
```

5

Out[34]: 0.73246137628722385

Conclusion: The best model is lasso regression or ridge regression with score above 0.8, so we decide to choose lasso regression with alpha = 0.1 for our final prediction

In [35]:
```
from flask import Flask,jsonify
import json
from flask_cors import CORS
```

In [36]:
```
from scipy.spatial import distance
```

In [95]:
```
def KNN(data, sqft, zipcode, year, bedroom, bathroom): #input sqft, zipcode, year, be
    ob = pd.DataFrame(np.matrix([sqft, year, bedroom, bathroom]), columns=['sqft_livi
    df_zipcode = data[['sqft_living','zipcode','yr_built','bedrooms','bathrooms']] #f
    df_zipcode = df_zipcode[df_zipcode['zipcode'] == zipcode][['sqft_living','yr_buil
    df_zipcode = df_zipcode.append(ob)
    df_norm = min_max_scaler.fit_transform(df_zipcode)
    dist = []
    observation = df_norm[len(df_norm)-1,:]
    for i in range(len(df_norm)-1):
        dist.append(distance.euclidean(df_norm[i,:],observation)) #find the observati
    index = np.argsort(dist)[:10]
    df_10 = df_zipcode.iloc[index,:]
    return df_10 #return index of dataframe
```

In [97]:
```
def predict(clf,data,newdata,sqft,zipcode, year, bedroom, bathroom): #data:original d
    temp = KNN(data, sqft, zipcode, year, bedroom, bathroom)
    index = temp.index
    df = newdata[newdata.index.isin(index)]
    min_max_scaler.fit(newdata) #normalize
    df_norm = min_max_scaler.transform(df)
    top_prediction = clf.predict(df_norm) #do predition
    return np.median(top_prediction)
```

In [101]:
```
a
```

Out[101]:

	sqft_living	yr_built	bedrooms	bathrooms
2098	1870	1926	3	2.00
8440	2190	1927	3	2.25
15270	2060	1940	2	1.75
18833	1640	1939	2	1.75
3863	1400	1924	3	2.00
15623	1430	1928	3	1.75
7521	1430	1934	2	1.50
3945	1740	1939	3	1.75
7335	1880	1941	3	1.75
2914	1720	1940	3	1.75

```
In [100]: a = KNN(data,2000,98125,1920,2,2)
          dict_3 = []
          for i in range(len(a)):
              dict_3.append({})

In [91]: clf = linear_model.Lasso(alpha=0.1)
         clf.fit(X_train,y_train)

Out[91]: Lasso(alpha=0.1, copy_X=True, fit_intercept=True, max_iter=1000,
            normalize=False, positive=False, precompute=False, random_state=None,
            selection='cyclic', tol=0.0001, warm_start=False)

In [92]: app = Flask(__name__)
         CORS(app)
         @app.route('/project/status=<status>&sqft=<sqft>&zipcode=<zipcode>&year=<year>&bedroo
         def server(status,sqft,zipcode,year,bedroom,bathroom):
             status = int(status)
             sqft = float(sqft)
             zipcode = int(zipcode)
             year = int(year)
             bedroom = float(bedroom)
             bathroom = float(bathroom)
             if(status == 1): # st = 1 means we want to do a prediction
                 price_pred = predict(clf,data,newdata,sqft,zipcode,year,bedroom,bathroom)
                 return json.dumps(price_pred)
             if(status == 2): # return the dataset with columns of zipcode and price
                 dict_2 = []
                 for i in range(len(data)):
                     dict_2.append({"zipcode":float(data.iloc[i,16]),"price":data.iloc[i,2]})
                 return json.dumps(dict_2)
             if(status == 3):
                 df_10 = KNN()
                 return 1


In [93]: if __name__ == '__main__':
             app.run() #The port will be 5000

 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [27/Nov/2018 02:12:28] "GET /project/status=1&sqft=2000&zipcode=98125&year=1920&
127.0.0.1 - - [27/Nov/2018 02:13:07] "GET /project/status=2&sqft=2000&zipcode=98125&year=1920&


----------------------------------------
Exception happened during processing of request from ('127.0.0.1', 53931)
```