CS156 (Introduction to AI), Spring 2022

Homework 3 submission

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Any special notes or anything you would like to communicate to me about this homework submission goes in here.

References and sources

List all your references and sources here. This includes all sites/discussion boards/blogs/posts/etc. where you grabbed some code examples.

Solution

Load libraries and set random number generator seed

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as pyplot
from sklearn.datasets import load_boston
from sklearn import linear_model
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
```

In [2]:

```
np.random.seed(42)
```

Code the solution

In [3]:

```
data = pd.read_csv('homework3_input_data.csv')
```

In [13]:

```
X = data[['cement', 'slag',
       'flyash', 'water', 'superplasticizer',
       'coarseaggregate', 'fineaggregate','age']]
Y = data['csMPa']
data.head()
```

Out[13]:

	cement	slag	flyash	water	superplasticizer	coarseaggregate	fineaggregate	age	csMPa
0	540.0	0.0	0.0	162.0	2.5	1040.0	676.0	28	79.99
1	540.0	0.0	0.0	162.0	2.5	1055.0	676.0	28	61.89
2	332.5	142.5	0.0	228.0	0.0	932.0	594.0	270	40.27
3	332.5	142.5	0.0	228.0	0.0	932.0	594.0	365	41.05
4	198.6	132.4	0.0	192.0	0.0	978.4	825.5	360	44.30

In [5]:

```
data.describe()
```

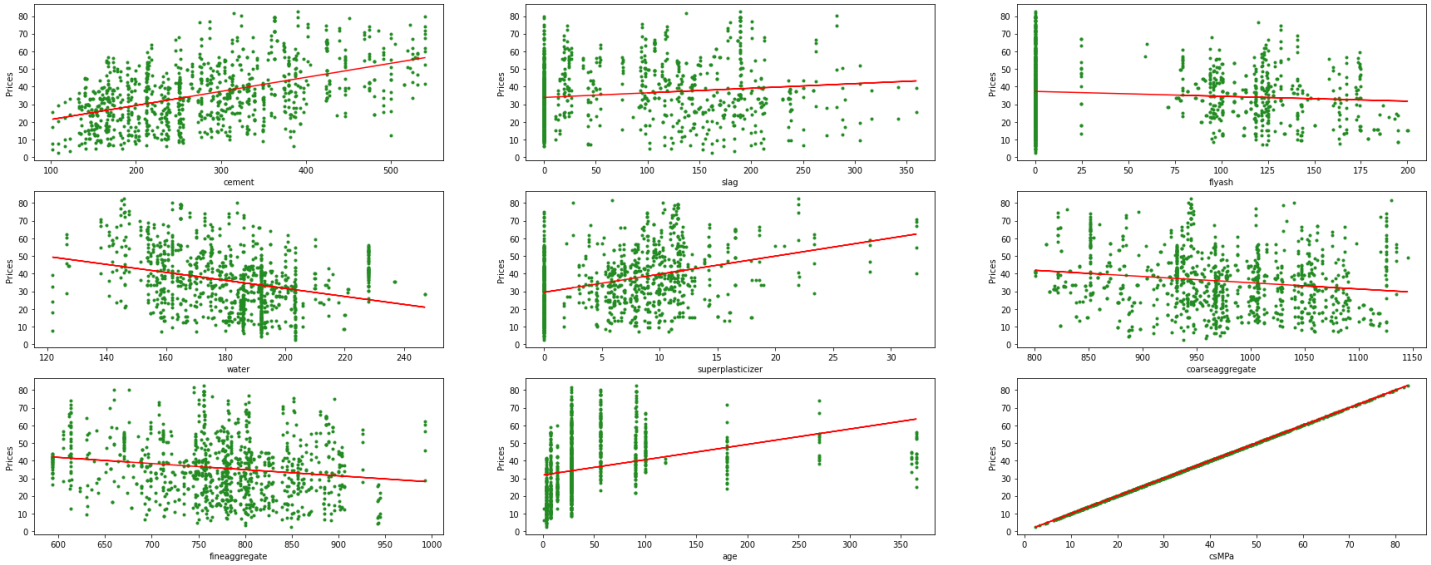
Out[5]:

	cement	slag	flyash	water	superplasticizer	coarseaggregate	fineaggregate	age
count	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000
mean	281.167864	73.895825	54.188350	181.567282	6.204660	972.918932	773.580485	45.662136
std	104.506364	86.279342	63.997004	21.354219	5.973841	77.753954	80.175980	63.169912
min	102.000000	0.000000	0.000000	121.800000	0.000000	801.000000	594.000000	1.000000
25%	192.375000	0.000000	0.000000	164.900000	0.000000	932.000000	730.950000	7.000000
50%	272.900000	22.000000	0.000000	185.000000	6.400000	968.000000	779.500000	28.000000
75%	350.000000	142.950000	118.300000	192.000000	10.200000	1029.400000	824.000000	56.000000
max	540.000000	359.400000	200.100000	247.000000	32.200000	1145.000000	992.600000	365.000000

In [6]:

```
pyplot.figure(figsize=(30,20))
for i, col in enumerate(data.columns[0:13]):
    pyplot.subplot(5, 3, i+1)
    x = data[col]
    y = data['csMPa']
    pyplot.plot(x, y, '.', color="forestgreen")

    # linear regression and plotting points
    m, b = np.polyfit(x, y, 1)
    pyplot.plot(x, m*x + b, color="red")
    pyplot.xlabel(col)
    pyplot.ylabel('Prices')
```



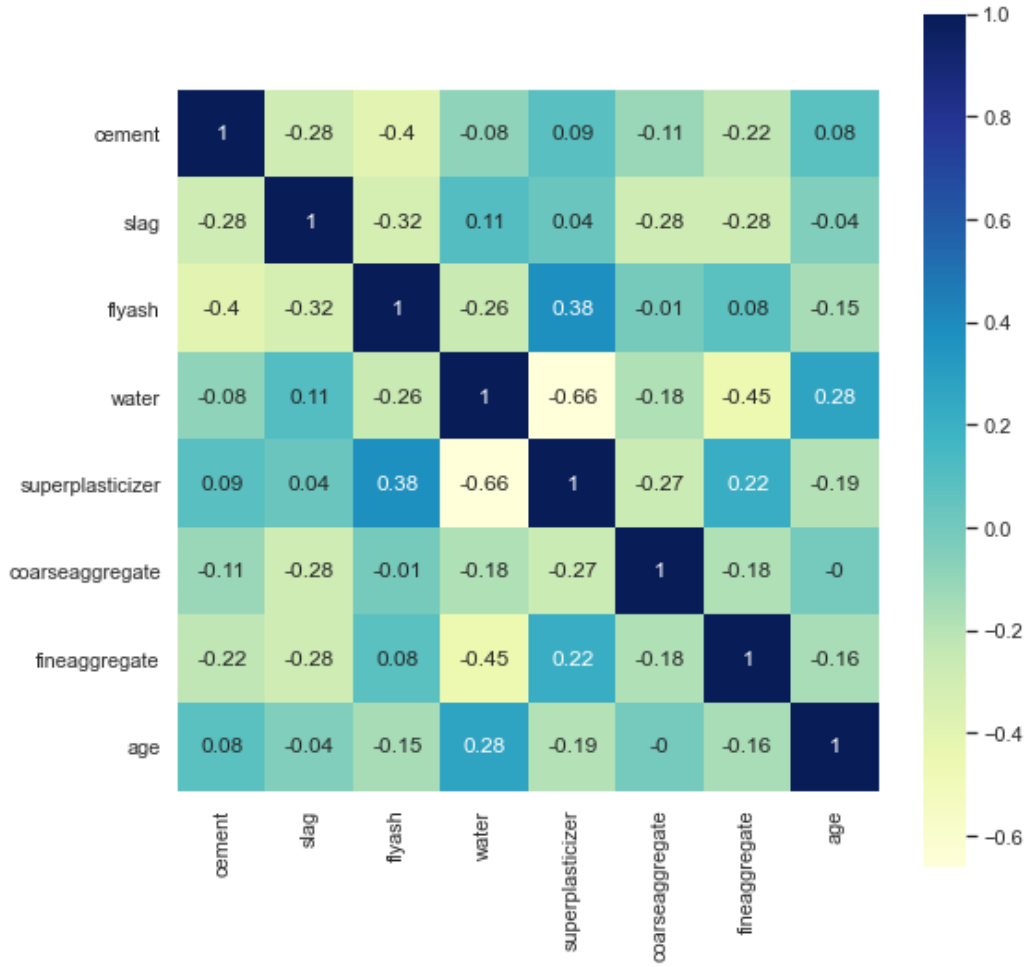
In [7]:

```
features = X
sns.set(rc={'figure.figsize': (8.5, 8.5)})
```

```
sns.heatmap(features.corr().round(2), square=True, cmap='YlGnBu', annot=True)
```

Out[7]:

```
<AxesSubplot:>
```



In [8]:

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y,test_size=0.2, random_state=0)
X_train.shape, Y_train.shape, X_test.shape, Y_test.shape
```

Out[8]:

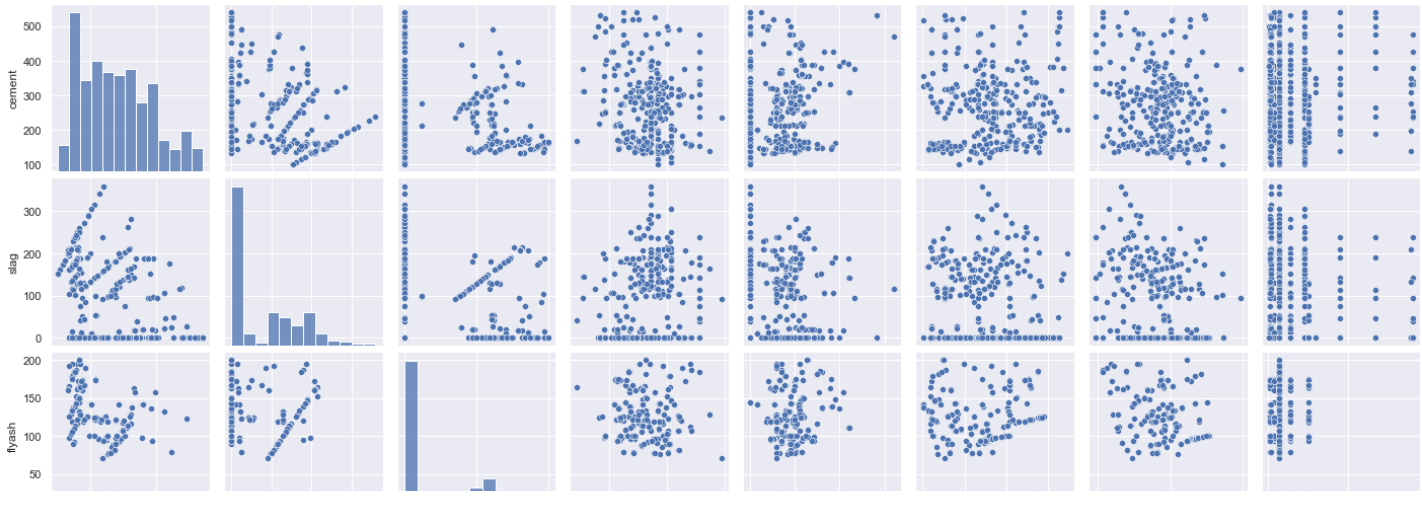
```
((824, 8), (824,), (206, 8), (206,))
```

In [9]:

```
train_data = pd.DataFrame(X_train, columns=data.columns.values)
train_data['Happiness Score'] = Y_train
sns.pairplot(train_data, vars = features)
```

Out[9]:

```
<seaborn.axisgrid.PairGrid at 0x2ade69bbee0>
```



In [10]:

```
model = linear_model.LinearRegression().fit(X_train, Y_train)
```

In [11]:

```
print('Coefficients: \n', model.coef_)

Y_test_pred = model.predict(X_test)

# Printing mean squared error
print('Mean squared error: %.2f' % mean_squared_error(Y_test, Y_test_pred))

# Printing coefficient of determination
print('Coefficient of determination: %.2f' % r2_score(Y_test, Y_test_pred))
```

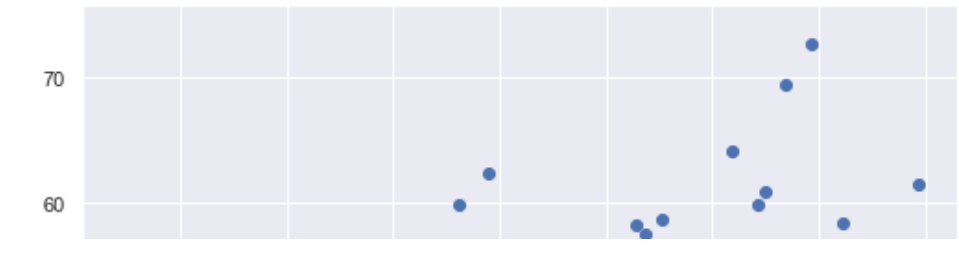
```
Coefficients:
 [ 0.11923772  0.10881555  0.0911555  -0.14527714  0.31551104  0.02225423
  0.02248514  0.11520355]
Mean squared error: 95.62
Coefficient of determination: 0.64
```

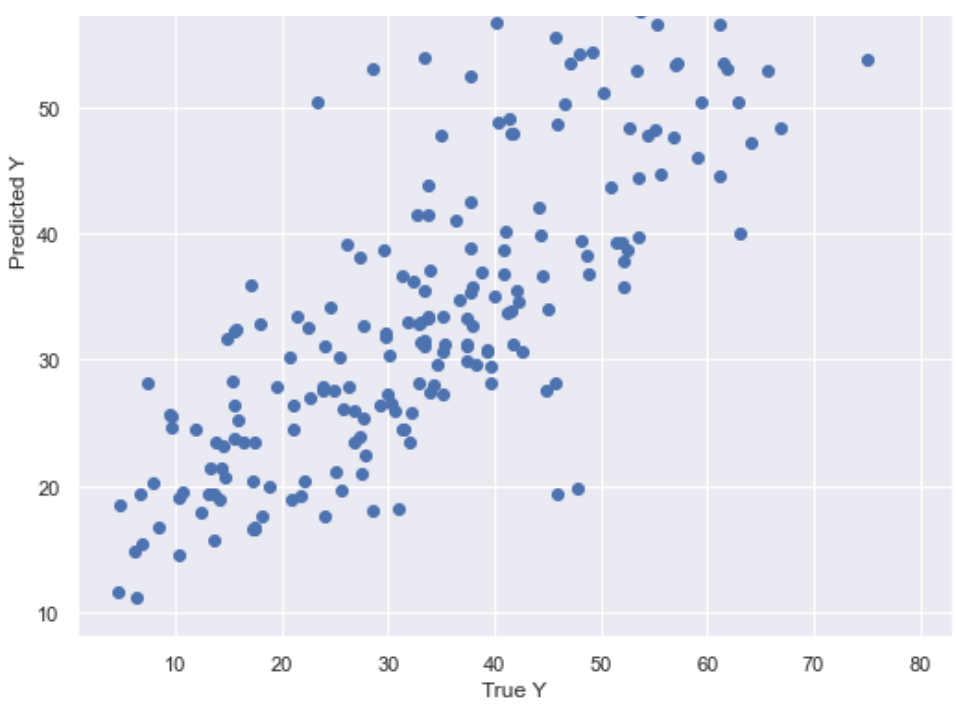
In [12]:

```
# scatter diagram
pyplot.scatter(Y_test,Y_test_pred)
pyplot.xlabel('True Y')
pyplot.ylabel('Predicted Y')
```

Out[12]:

```
Text(0, 0.5, 'Predicted Y')
```





In [ ]:

In [ ]: