MP2 Term Paper

In [1]:

```
import numpy as np
import pandas as pd
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
#MODEL
```

In [3]:

```
df2=pd.read_excel()
df2.head()
```

Out[3]:

	Pressure	AFR	Orifice	Focsuing tube dia	STD	MRR
0	3400	0.55	0.33	0.99	3	897.80
1	3600	0.55	0.33	0.99	1	1000.03
2	3600	0.55	0.30	1.05	2	961.93
3	3600	0.55	0.33	0.90	3	918.21
4	3800	0.55	0.33	0.90	2	1043.96

In [4]:

```
X=df2.drop(columns=['MRR'])
y=df2['MRR']
```

In [5]:

```
X.head()
```

Out[5]:

	Pressure	AFR	Orifice	Focsuing tube dia	STD
0	3400	0.55	0.33	0.99	3
1	3600	0.55	0.33	0.99	1
2	3600	0.55	0.30	1.05	2
3	3600	0.55	0.33	0.90	3
4	3800	0.55	0.33	0.90	2

In [6]:

```
#Linear Regression
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import KFold
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import train_test_split
from sklearn import metrics

X_train, X_test, y_train, y_test= train_test_split(X,y, train_size = 0.7, test_size = 0.3)

reg=LinearRegression()
reg.fit(X_train,y_train)

y_pred_linear = reg.predict(X_test)
mape = np.mean((np.array(abs(y_test - y_pred_linear))/np.array(y_test)))*100
rmse = np.sqrt(metrics.mean_squared_error(y_test,y_pred_linear))
rmse,mape
```

Out[6]:

```
(28.814218188668423, 2.498081915815343)
```

In [7]:

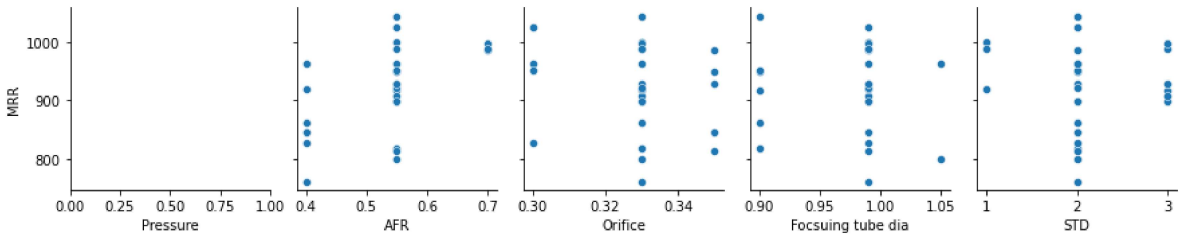
```
reg.predict([[3600,0.55,0.33,0.9,3]])
```

Out[7]:

```
array([924.91280808])
```

In [8]:

```
import seaborn as sns
pp = sns.pairplot(data=df2,y_vars=['MRR'],x_vars=['Pressure','AFR','Orifice','Focsuing tube
```



In [9]:

```
#fitting Mulivariate Polynomial
from sklearn.preprocessing import PolynomialFeatures
from sklearn import metrics
from sklearn import linear_model
deg=[2,3,4,5,6,7]
rmse_poly=np.zeros(len(deg))
mape_poly=np.zeros(len(deg))
for i in range(len(deg)):
    poly = PolynomialFeatures(degree=deg[i])
    poly_variables = poly.fit_transform(X)
    poly_var_train, poly_var_test, res_train, res_test = train_test_split(poly_variables,y,
    regression = linear_model.LinearRegression()
    model = regression.fit(poly_var_train, res_train)
    y_pred = regression.predict(poly_var_test)

    mape_poly[i] = np.mean((np.array(abs(res_test - y_pred))/np.array(res_test)))*100
    rmse_poly[i] = np.sqrt(metrics.mean_squared_error(res_test,y_pred))
mape_poly=list(mape_poly)
rmse_poly=list(rmse_poly)
mape_poly,rmse_poly
```

Out[9]:

```
([4.262884906239675,
  7.6912015519880725,
  12.47354019707104,
  10.84689558278936,
  13.466305701511303,
  10.758045454600438],
 [47.46563301132759,
  100.3851334702627,
  201.82635537726787,
  116.80802759771298,
  168.45252248365315,
  119.73173433441525])
```

In [10]:

```
#Best model
poly_best = PolynomialFeatures(degree=deg[mape_poly.index(min(mape_poly))])
poly_variables = poly_best.fit_transform(X)
poly_var_train, poly_var_test, res_train, res_test = train_test_split(poly_variables,y, tes
regression = linear_model.LinearRegression()
model = regression.fit(poly_var_train, res_train)
deg[mape_poly.index(min(mape_poly))]
```

Out[10]:

```
2
```

In [11]:

```
model.predict(poly_best.fit_transform([[3600,0.55,0.33,0.9,3]]))
```

Out[11]:

```
array([918.21000001])
```

In [12]:

```
model.coef_
```

Out[12]:

```
array([ 8.62320220e-04,  7.20039166e+00,  5.64201282e+03,  2.91227912e+03,
       -5.86858142e+03, -5.75970575e+02, -3.68053199e-04, -1.65573627e+00,
       -3.11129964e+00, -1.20944934e+00, -4.79610199e-01,  3.59029275e+02,
       -5.48767691e+03,  2.35787290e+03, -1.42675197e+01,  6.08978675e+03,
       -4.40612819e+03,  5.63448794e+03,  5.04288553e+03,  2.44690311e+02,
        4.06800000e+01])
```

In [ ]:

```

```

In [13]:

```
#ANN
import keras
model= keras.Sequential()
model.add(keras.layers.Dense(5,activation='relu',input_shape=(5,)))
model.add(keras.layers.Dense(6,activation='relu'))
model.add(keras.layers.Dense(1))

model.compile(optimizer='adam',loss='mean_squared_error',metrics=['accuracy'])
```

```
Using TensorFlow backend.
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:516: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:517: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:518: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:519: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:520: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
D:\Anaconda\lib\site-packages\tensorflow\python\framework\dtypes.py:525: F
utureWarning: Passing (type, 1) or '1type' as a synonym of type is depreca
ted; in a future version of numpy, it will be understood as (type, (1,)) /
'(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:541: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:542: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:543: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:544: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
```

```
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:545: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
D:\Anaconda\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.p
y:550: FutureWarning: Passing (type, 1) or '1type' as a synonym of type is
deprecated; in a future version of numpy, it will be understood as (type,
(1,)) / '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
```

In [14]:

```
history=model.fit(X,y,epochs=500,validation_split=0.33,callbacks=[keras.callbacks.EarlyStop
```

```
Epoch 30/500
17/17 [==============================] - 0s 176us/step - loss: 3198755.750
0 - accuracy: 0.0000e+00 - val_loss: 3077292.5000 - val_accuracy: 0.0000e+
00
Epoch 31/500
17/17 [==============================] - 0s 173us/step - loss: 3160570.250
0 - accuracy: 0.0000e+00 - val_loss: 3040045.7500 - val_accuracy: 0.0000e+
00
Epoch 32/500
17/17 [==============================] - 0s 235us/step - loss: 3122928.250
0 - accuracy: 0.0000e+00 - val_loss: 3003334.7500 - val_accuracy: 0.0000e+
00
Epoch 33/500
17/17 [==============================] - 0s 291us/step - loss: 3085822.750
0 - accuracy: 0.0000e+00 - val_loss: 2967152.0000 - val_accuracy: 0.0000e+
00
Epoch 34/500
17/17 [==============================] - 0s 294us/step - loss: 3049249.000
0 - accuracy: 0.0000e+00 - val_loss: 2931492.5000 - val_accuracy: 0.0000e+
00
```

In [15]:

```
test_data=np.array([3600,0.55,0.33,0.9,3])
model.predict(test_data.reshape(1,5),batch_size=1)
```

Out[15]:

```
array([[905.8831]], dtype=float32)
```

In [16]:

```
test_data=np.array([3800,0.4,0.33,0.9,3])
model.predict(test_data.reshape(1,5),batch_size=1)
```

Out[16]:

```
array([[956.1766]], dtype=float32)
```

In [17]:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_1 (Dense)              (None, 5)                 30
_________________________________________________________________
dense_2 (Dense)              (None, 6)                 36
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 7
=================================================================
Total params: 73
Trainable params: 73
Non-trainable params: 0
_________________________________________________________________
```

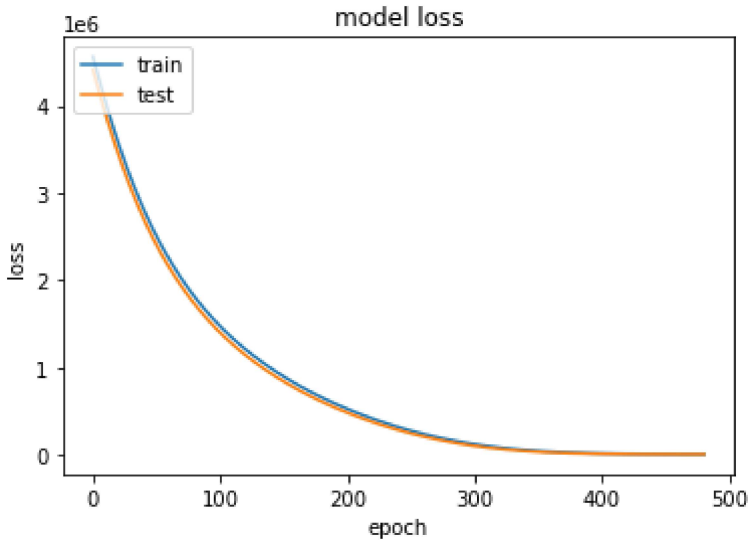
In [18]:

```
model.save("model.h5")
print("Saved model to disk")
```

```
Saved model to disk
```

In [21]:

```
from keras.callbacks import History
# summarize history for loss
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()
```



In [20]:

```
print(history.history.keys())
```

```
dict_keys(['val_loss', 'val_accuracy', 'loss', 'accuracy'])
```

In [ ]:

```

```