si-assignment02

February 2, 2024

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[ ]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
```

[ ]:
```
df = pd.read_csv("manufacturing.csv")
df.head()
```

[ ]:
```
   Temperature (°C)  Pressure (kPa)  Temperature x Pressure  \
0        209.762701        8.050855             1688.769167
1        243.037873       15.812068             3842.931469
2        220.552675        7.843130             1729.823314
3        208.976637       23.786089             4970.736918
4        184.730960       15.797812             2918.345014

   Material Fusion Metric  Material Transformation Metric  Quality Rating
0            44522.217074                    9.229576e+06       99.999971
1            63020.764997                    1.435537e+07       99.985703
2            49125.950249                    1.072839e+07       99.999758
3            57128.881547                    9.125702e+06       99.999975
4            38068.201283                    6.303792e+06      100.000000
```

[ ]:
```
df.isnull().sum()
```

[ ]:
```
Temperature (°C)                0
Pressure (kPa)                  0
Temperature x Pressure          0
Material Fusion Metric          0
Material Transformation Metric  0
Quality Rating                  0
dtype: int64
```

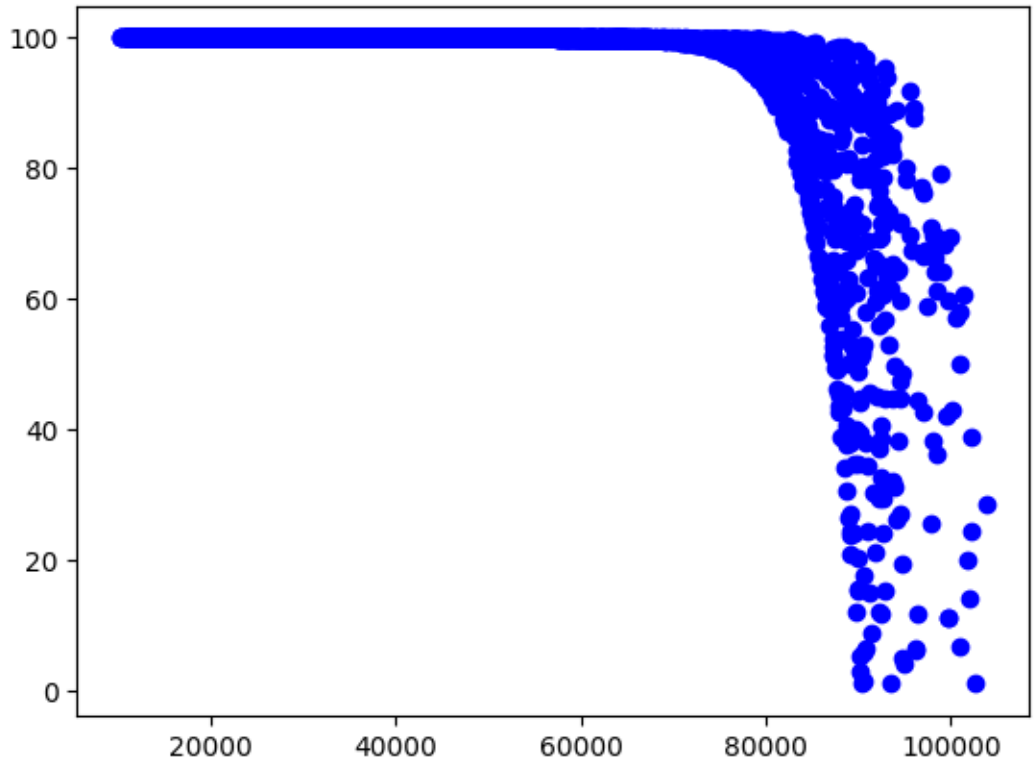
[ ]:
```
df.corr()
```

[ ]:
```
                                Temperature (°C)  Pressure (kPa)  \
Temperature (°C)                        1.000000       -0.024754
```

```
Pressure (kPa)                          -0.024754        1.000000
Temperature x Pressure                   0.571743        0.773572
Material Fusion Metric                   0.974901        0.151095
Material Transformation Metric           0.971210       -0.022862
Quality Rating                          -0.461279        0.013129

                                Temperature x Pressure  \
Temperature (°C)                              0.571743
Pressure (kPa)                                0.773572
Temperature x Pressure                        1.000000
Material Fusion Metric                        0.694733
Material Transformation Metric                0.555579
Quality Rating                               -0.258474

                                Material Fusion Metric  \
Temperature (°C)                              0.974901
Pressure (kPa)                                0.151095
Temperature x Pressure                        0.694733
Material Fusion Metric                        1.000000
Material Transformation Metric                0.976708
Quality Rating                               -0.511972

                                Material Transformation Metric  Quality Rating
Temperature (°C)                                      0.971210       -0.461279
Pressure (kPa)                                       -0.022862        0.013129
Temperature x Pressure                                0.555579       -0.258474
Material Fusion Metric                                0.976708       -0.511972
Material Transformation Metric                        1.000000       -0.575756
Quality Rating                                       -0.575756        1.000000
```

[ ]:
```
plt.scatter(df['Material Fusion Metric'],df['Quality Rating'],  color='blue')
```

[ ]:
```
<matplotlib.collections.PathCollection at 0x78eb41587ca0>
```



[ ]:
```
X = np.array(df['Material Fusion Metric'])
y = np.array(df['Quality Rating'])
```

[ ]:
```
X = X.reshape(-1, 1)
```

[ ]:
```
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import mean_squared_error
```

[ ]:
```
Lmodel = LinearRegression()
Lmodel.fit(X,y)
```

[ ]:
```
LinearRegression()
```

[ ]:
```
Lpreds = Lmodel.predict(X)
```

[ ]:
```
mean_squared_error(y,Lpreds) **0.5
```

[ ]:
```
11.158974684716515
```

##Polynomial

[ ]:
```
poly = PolynomialFeatures(degree=2)
X_poly = poly.fit_transform(X)
print(X_poly)
lin2 = LinearRegression()
lin2.fit(X_poly,y)
```

```
[[1.00000000e+00 4.45222171e+04 1.98222781e+09]
 [1.00000000e+00 6.30207650e+04 3.97161682e+09]
 [1.00000000e+00 4.91259502e+04 2.41335899e+09]
 …
 [1.00000000e+00 6.26576910e+04 3.92598624e+09]
 [1.00000000e+00 5.71959855e+04 3.27138076e+09]
 [1.00000000e+00 4.10923929e+04 1.68858475e+09]]
```

[ ]:
```
LinearRegression()
```

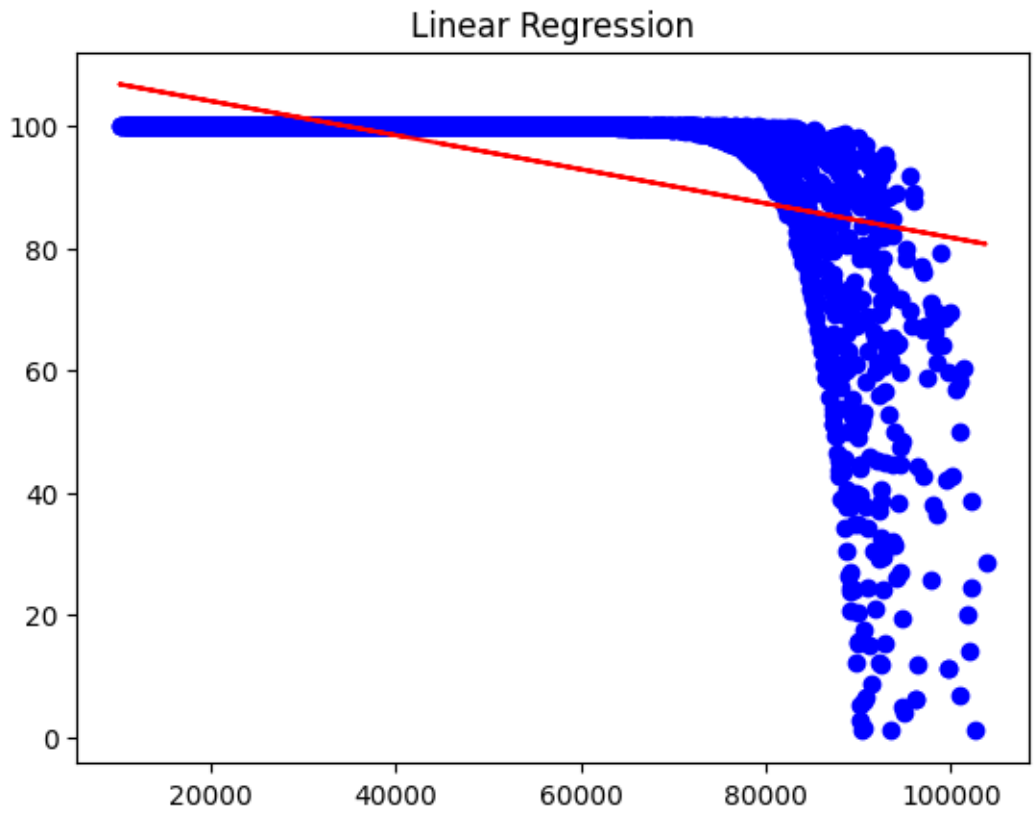
[ ]:
```
Ppreds = lin2.predict(X_poly)
```

[ ]:
```
mean_squared_error(y,Ppreds)**0.5
```

[ ]:
```
9.032703968165075
```

[ ]:
```
plt.scatter(X,y,color='blue')
plt.plot(X, Lpreds, color = 'red')
plt.title('Linear Regression')
```

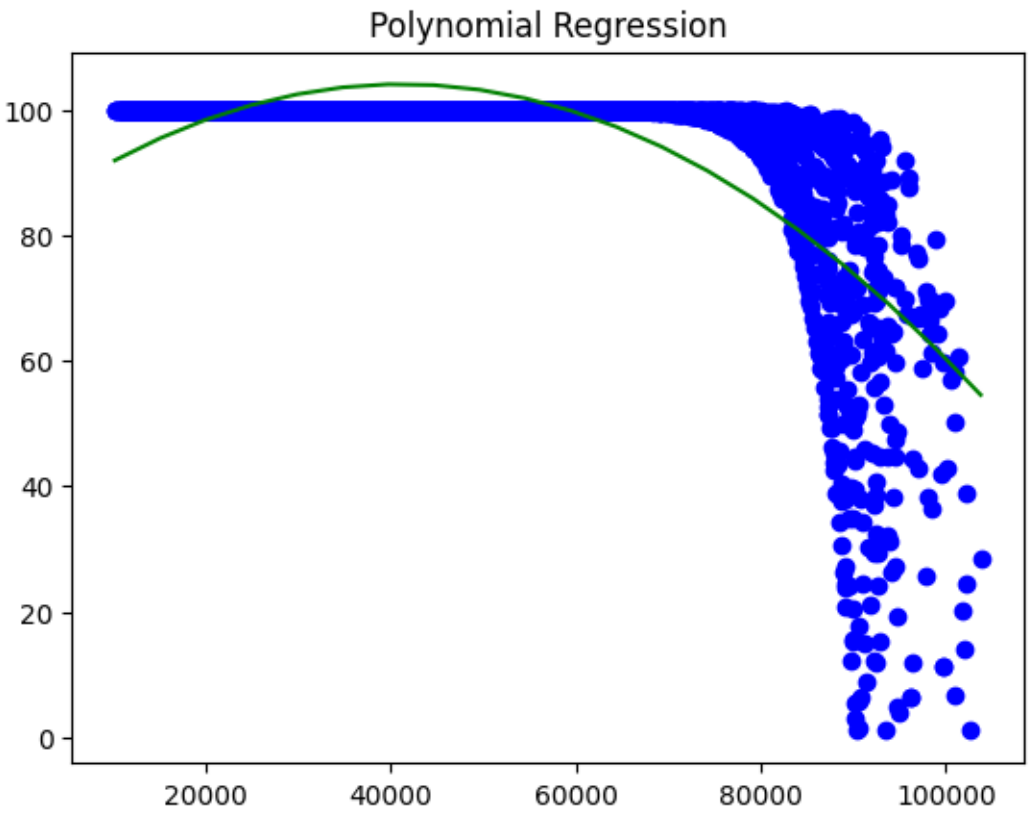
[ ]:
```
Text(0.5, 1.0, 'Linear Regression')
```



[ ]:
```
X.shape
```

[ ]: (3957, 1)

[ ]:
```
plt.scatter(X,y,color='blue')
plt.title('Polynomial Regression')
# Plot the regression curve
X_range = np.linspace(X.min(), X.max(), 20).reshape(-1, 1)
X_range_poly = poly.transform(X_range)
y_range_pred = lin2.predict(X_range_poly)
plt.plot(X_range, y_range_pred, color='green', label='Polynomial Regression')
plt.show()
```


Polynomial Regression
100
80
60
40
20
0
20000
40000
60000
80000
100000