To

IITD-AIA Foundation of Smart Manufacturing

Date:25-06-2023

Subject: ***Weekly Progress Report for Week-4.***

Dear Sir,

Following is the required progress report of this week dated from 26-06-2023 to 02-07-2023.

Weekly Progress:

June 26 & June 27 :

Topics covered:

- Have done Data analysis.
- Applying Linear regression and Mean squared error on the model.
- Two separate linear regression models are trained for surface roughness and tool wear prediction.
- The models are fitted on the training data using the fit method. Predictions are made on the testing set using the predict method, and the mean squared error (MSE) is calculated to evaluate the model's performance.
- Abstract included basis, machine learning model to be used on the dataset, data analysis and EDA (exploratory data analysis) on the data.

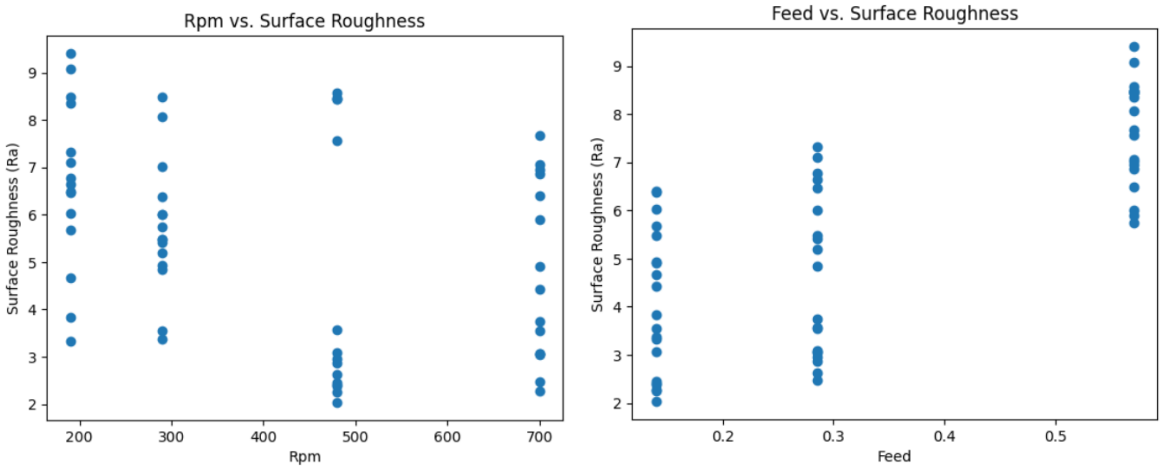
```
Descriptive Statistics:
       Experiment          Rpm        Feed     Depth          Ra
count   60.000000   60.000000  60.000000  60.00000  60.000000
mean    30.500000  415.000000   0.331667   0.60000   5.418967
std     17.464249  196.386854   0.180129   0.28523   2.148913
min      1.000000  190.000000   0.140000   0.20000   2.037000
25%     15.750000  265.000000   0.140000   0.40000   3.365250
50%     30.500000  385.000000   0.285000   0.60000   5.580000
75%     45.250000  535.000000   0.570000   0.80000   7.029000
max     60.000000  700.000000   0.570000   1.00000   9.411000
```

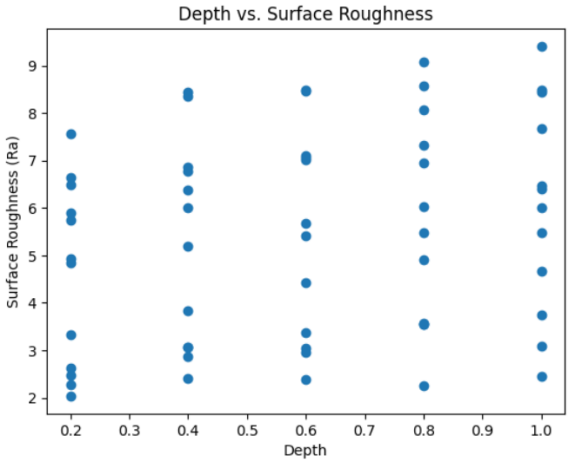
```
Experiment    0
Rpm           0
Feed          0
Depth         0
Ra            0
dtype: int64
```

June 28 & June 29:

Topics covered:

- I have applied Data visualization on the dataset.
- I have done it in Python using the Matplotlib library to visualize the relationships between the machining parameters (RPM, feed rate, depth of cut) and the surface roughness (Ra) in the lathe machine.
- We load the dataset and create scatter plots to visualize the relationships between each machining parameter (RPM, feed rate, depth of cut) and the surface roughness (Ra).
- Each scatter plot displays the values of the respective parameter on the x-axis and the surface roughness values on the y-axis. The plt.xlabel(), plt.ylabel(), and plt.title() functions are used to label the axes and provide a title for each plot.
- Each machining parameter helps observe the trends and patterns between the variables.





June 30 & July 01:

Topics covered:

- I have performed feature engineering on the dataset using the pandas library.
- It involves creating new features or deriving additional variables from the existing ones to capture important relationships or interactions.

•Feed_RPM_Ratio: This feature represents the ratio of the feed rate to the RPM. It can capture the relationship between the rate of material feed and the rotational speed of the lathe machine.
•Depth_RPM_Ratio: This feature represents the ratio of the depth of cut to the RPM. It can capture the relationship between the depth of cut and the rotational speed of the lathe machine.

- By calculating these ratios, you can potentially capture meaningful information that might be useful in predicting tool wear and surface roughness.

	Experiment	Rpm	Feed	Depth	Ra	Feed_RPM_Ratio	Depth_RPM_Ratio
0	1	190	0.14	0.2	3.324	0.000737	0.001053
1	2	190	0.14	0.4	3.843	0.000737	0.002105
2	3	190	0.14	0.6	5.671	0.000737	0.003158
3	4	190	0.14	0.8	6.025	0.000737	0.004211
4	5	190	0.14	1.0	4.664	0.000737	0.005263

July 02:

Topics covered:

- I have started training the machine learning model.
- I have modeled and fitted the dataset into a Linear Regression model.
- I have also found the MSE (Mean square Error) and R2 Score of the model.
- Mean Squared Error (MSE): 1.3886596104682267
- Coefficient of Determination (R2 Score): 0.7033756090297395
- I have split the dataset into training and testing sets using the train_test_split() function from scikit-learn. We allocate 80% of the data for training and 20% for testing.
- The predictions are stored in y_pred whose output is [4.00713465 3.62812479 3.6926767 7.40379233 3.94391245 8.06488213 5.21710267 8.43969874 3.59861032 6.54045616 7.74909447 6.68367359].

```
[4.00713465 3.62812479 3.6926767  7.40379233 3.94391245 8.06488213
 5.21710267 8.43969874 3.59861032 6.54045616 7.74909447 6.68367359]
Mean Squared Error (MSE): 1.3886596104682267
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