Data_Preprocessing

July 13, 2021

[168]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import os

%matplotlib inline
```

[169]:
```
dataframe = pd.DataFrame({
        'max_force':[],
        'max_lenght':[],
        'max_time':[],
        'section_area':pd.Series([], dtype=np.dtype('int32')),
        'is_valid': pd.Series([], dtype=np.dtype('bool_')),
    })
```

[170]:
```
whitelist = ['3-2', '3-3', '3-5', '3-9', '3-10', '4-2', '5-6', '5-7', '5-10',␣
↪'6-1', '6-3', '6-8', '6-9', '7-1', '7-3', '7-7', '7-8', '7-9']
```

[171]:
```
for file in sorted(os.listdir('Data_samples/')):

    column_names = ['time', 'force', 'lenght']

    data = pd.read_csv(f'Data_samples/{file}', sep='\t', skiprows=17,␣
↪decimal=',', names = column_names)

    name = file.split('.')[0]
    section_area = int(file[0]) * 10
    max_force = data.force.max()
    max_lenght = data.loc[data.index[data.force.idxmax()], 'lenght']
    max_time = data.loc[data.index[data.force.idxmax()], 'time']

    if name in whitelist:
        is_valid = True
    else:
        is_valid = False
```

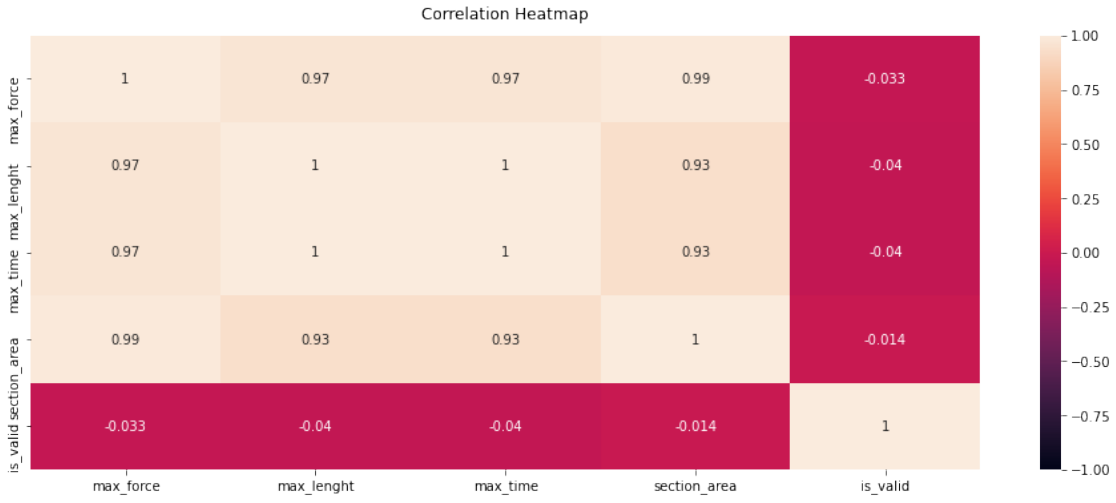
```
    new_value = {
        'max_force': max_force,
        'max_lenght':max_lenght,
        'max_time':max_time,
        'section_area':section_area,
        'is_valid':is_valid
    }

    dataframe.loc[f'{name}'] = new_value

dataframe.to_csv('a.csv')
```

[172]:
```
dataframe.tail()
```

[172]:

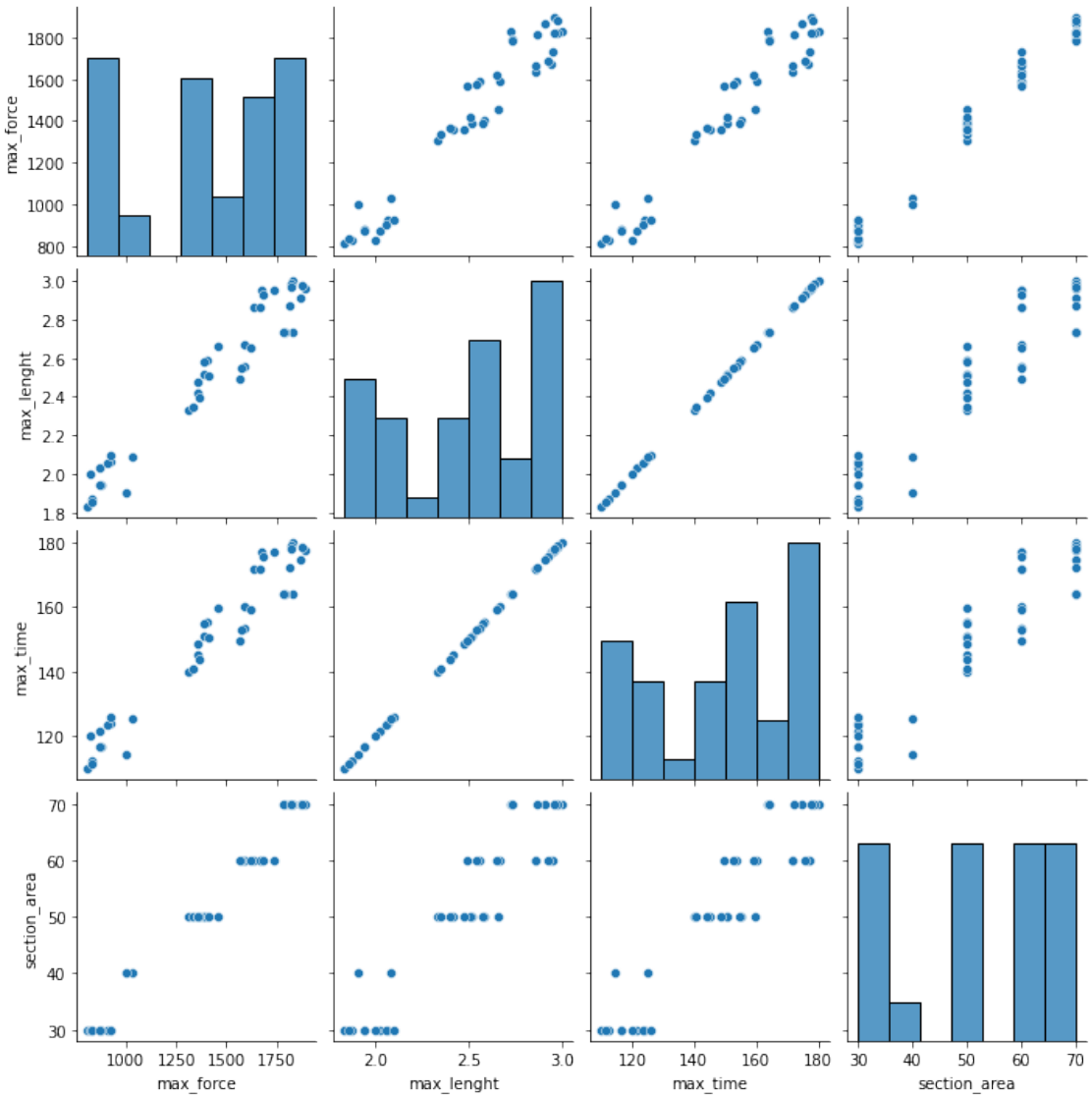
	max_force	max_lenght	max_time	section_area	is_valid
7-5	1792.026	2.732233	163.93	70	False
7-6	1877.844	2.973667	178.42	70	False
7-7	1821.631	2.978700	178.72	70	True
7-8	1783.597	2.732367	163.94	70	True
7-9	1818.671	2.963700	177.82	70	True

[173]:
```
plt.figure(figsize=(16, 6))
heatmap = sns.heatmap(dataframe.corr(), vmin=-1, vmax=1, annot=True, )
heatmap.set_title('Correlation Heatmap', fontdict={'fontsize':12}, pad=12);
```



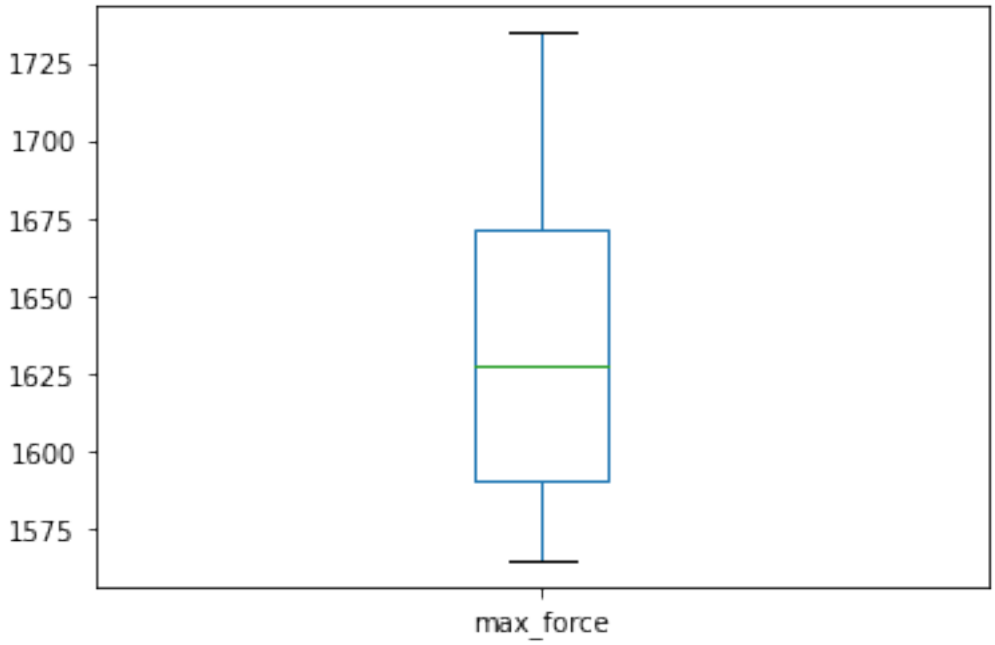
[174]:
```
sns.pairplot(dataframe.drop('is_valid', axis=1))
```

[174]:
```
<seaborn.axisgrid.PairGrid at 0x7f75df0717c0>
```



[175]:
```
dataframe[dataframe.section_area == 60].max_force.plot.box()
```

[175]: <AxesSubplot:>



[176]:
```
import statsmodels.api as sm
```

[177]:
```
X = dataframe.section_area
X = sm.add_constant(X) # adding a constant
y = dataframe.max_force
```

[178]:
```
model = sm.OLS(y, X).fit()
```

[179]:
```
model.summary()
```

[179]:
```
<class 'statsmodels.iolib.summary.Summary'>
"""
                            OLS Regression Results
==============================================================================
Dep. Variable:              max_force   R-squared:                       0.981
Model:                            OLS   Adj. R-squared:                  0.981
Method:                 Least Squares   F-statistic:                     2099.
Date:                Thu, 01 Jul 2021   Prob (F-statistic):           3.46e-36
Time:                        23:59:08   Log-Likelihood:                -223.88
No. Observations:                  42   AIC:                             451.8
Df Residuals:                      40   BIC:                             455.2
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
```

```
------------------------------------------------------------------------------
const          128.3474     29.043      4.419      0.000      69.649     187.046
section_area    24.6678      0.538     45.814      0.000      23.580      25.756
==============================================================================
Omnibus:                        0.421   Durbin-Watson:                   1.334
Prob(Omnibus):                  0.810   Jarque-Bera (JB):                0.360
Skew:                           0.210   Prob(JB):                        0.835
Kurtosis:                       2.830   Cond. No.                         198.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly
specified.
"""
```

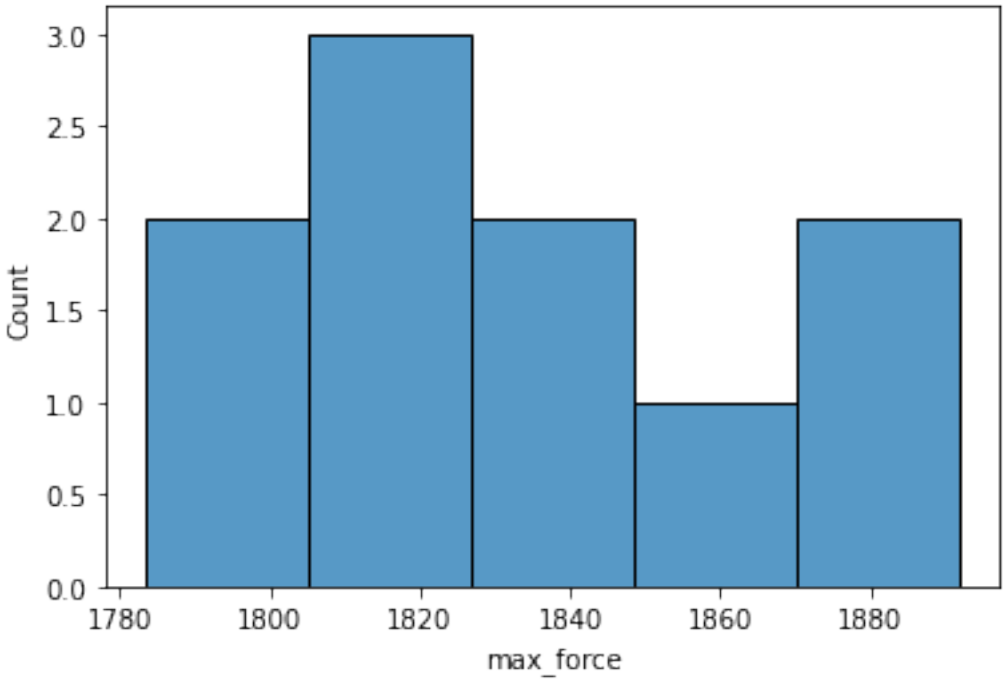
[180]:
```
model.predict(X)
```

[180]:
```
3-1      868.381155
3-10     868.381155
3-2      868.381155
3-3      868.381155
3-4      868.381155
3-5      868.381155
3-6      868.381155
3-7      868.381155
3-8      868.381155
3-9      868.381155
4-1     1115.059058
4-2     1115.059058
5-1     1361.736961
5-10    1361.736961
5-2     1361.736961
5-3     1361.736961
5-4     1361.736961
5-5     1361.736961
5-6     1361.736961
5-7     1361.736961
5-8     1361.736961
5-9     1361.736961
6-1     1608.414865
6-10    1608.414865
6-2     1608.414865
6-3     1608.414865
6-4     1608.414865
6-5     1608.414865
6-6     1608.414865
6-7     1608.414865
```

```
6-8     1608.414865
6-9     1608.414865
7-1     1855.092768
7-10    1855.092768
7-2     1855.092768
7-3     1855.092768
7-4     1855.092768
7-5     1855.092768
7-6     1855.092768
7-7     1855.092768
7-8     1855.092768
7-9     1855.092768
dtype: float64
```

[181]:
```
sns.histplot(dataframe[dataframe.section_area == 70].max_force)
```

[181]:
```
<AxesSubplot:xlabel='max_force', ylabel='Count'>
```



[182]:
```
np.ptp(dataframe[(dataframe.section_area == 70) & (dataframe.is_valid == True)].
↪max_force)
```

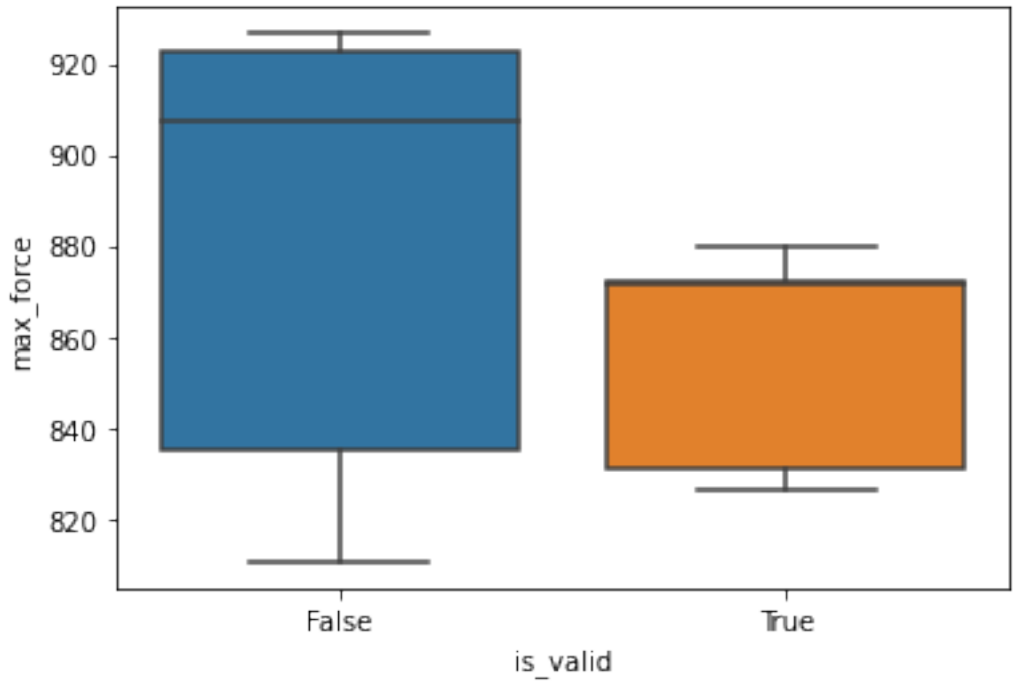
[182]:
```
108.23700000000008
```

[183]:
```
np.ptp(dataframe[(dataframe.section_area == 70) & (dataframe.is_valid ==␣
↪False)].max_force)
```

[183]:
```
85.81799999999998
```

[186]:
```
sns.boxplot(x="is_valid", y="max_force", data=dataframe[dataframe.section_area
↪== 30])
```

[186]:
```
<AxesSubplot:xlabel='is_valid', ylabel='max_force'>
```



[188]:
```
dataframe[(dataframe.section_area == 30) & (dataframe.is_valid == True)].
↪median()
```

[188]:
```
max_force       871.825200
max_lenght        1.945533
max_time        116.730000
section_area     30.000000
is_valid          1.000000
dtype: float64
```

[190]:
```
dataframe[(dataframe.section_area == 30) & (dataframe.is_valid == True)]
```

[190]:

	max_force	max_lenght	max_time	section_area	is_valid
3-10	871.8252	2.029167	121.75	30	True
3-2	879.5913	1.945533	116.73	30	True
3-3	831.2734	1.874533	112.47	30	True
3-5	826.3668	1.999033	119.94	30	True
3-9	871.9587	1.943533	116.61	30	True

[191]:
```
dataframe.groupby('section_area').is_valid.value_counts()
```

[191]:
```
section_area  is_valid
30            False       5
              True        5
40            False       1
              True        1
50            False       7
              True        3
60            False       6
              True        4
70            False       5
              True        5
Name: is_valid, dtype: int64
```

[165]:
```
import statsmodels.formula.api as sf
```

[166]:
```
logit_res = sf.glm('is_valid ~ section_area + max_force', dataframe, family =␣
↪sm.families.Binomial()).fit()
```

[167]:
```
logit_res.summary()
```

[167]:
```
<class 'statsmodels.iolib.summary.Summary'>
"""
                           Generalized Linear Model Regression Results
==============================================================================
=================
Dep. Variable:     ['is_valid[False]', 'is_valid[True]']   No. Observations:
32
Model:                                               GLM   Df Residuals:
29
Model Family:                                  Binomial   Df Model:
2
Link Function:                                    logit   Scale:
1.0000
Method:                                            IRLS   Log-Likelihood:
-21.050
Date:                                  Thu, 01 Jul 2021   Deviance:
42.101
Time:                                          23:58:58   Pearson chi2:
31.8
No. Iterations:                                       4
Covariance Type:                              nonrobust
==============================================================================
                  coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      -1.0131      1.564     -0.648      0.517      -4.079       2.052
```

```
section_area    -0.1431      0.193     -0.740      0.459      -0.522       0.236
max_force        0.0063      0.007      0.844      0.399      -0.008       0.021
==============================================================================
"""
```

[ ]:

[ ]: