DecissionTreeClassifier

July 31, 2022

[64]:
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn import tree
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeRegressor
from sklearn.tree import DecisionTreeClassifier

import seaborn as sns
```

[3]:
```
df = pd.read_csv("reviews.csv")
df.head()
```

[3]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d…
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut…
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe…
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200	Cough Medicine	If you are looking for the secret ingredient i…
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600	Great taffy	Great taffy at a great price. There was a wid…

[32]:
```
print("length",len(df))
print("unique summary",len(df['Summary'].unique()))
#df['ProductId'].describe()
df['Summary'] = df['Summary'].astype('category')
df['UserId'] = df['UserId'].astype('category')
```

```
df['ProductId'] = df['ProductId'].astype('category')
df.dtypes
```

```
length 568454
unique summary 295743
```

[32]:
```
Id                          int64
ProductId                category
UserId                   category
ProfileName                object
HelpfulnessNumerator        int64
HelpfulnessDenominator      int64
Score                       int64
Time                        int64
Summary                  category
Text                       object
dtype: object
```

[37]:
```
cat_columns = df.select_dtypes(['category']).columns
cat_columns
df[cat_columns] = df[cat_columns].apply(lambda x: x.cat.codes)
df.head()
```

[37]:

	Id	ProductId	UserId	ProfileName	\
0	1	27619	188646	delmartian	
1	2	72383	25105	dll pa	
2	3	15267	210482	Natalia Corres "Natalia Corres"	
3	4	19718	152635	Karl	
4	5	69007	57804	Michael D. Bigham "M. Wassir"	

	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	\
0	1	1	5	1303862400	83434	
1	0	0	1	1346976000	167649	
2	1	1	4	1219017600	126	
3	3	3	2	1307923200	47071	
4	0	0	5	1350777600	107323	

	Text
0	I have bought several of the Vitality canned d…
1	Product arrived labeled as Jumbo Salted Peanut…
2	This is a confection that has been around a fe…
3	If you are looking for the secret ingredient i…
4	Great taffy at a great price. There was a wid…

[47]:
```
features = ['HelpfulnessNumerator', 'HelpfulnessDenominator', 'Time','Summary',␣
↪'UserId','ProductId']
cols = ['HelpfulnessNumerator', 'HelpfulnessDenominator', 'Time','Summary',␣
↪'UserId','ProductId','Score']
```

```
df=df[cols]
X = df.loc[:, features]
y= df.loc[:,'Score']
```

[48]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0,␣
↪train_size = .7)
```

[49]:
```
X_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 397917 entries, 333546 to 305711
Data columns (total 6 columns):
 #   Column                  Non-Null Count   Dtype
---  ------                  --------------   -----
 0   HelpfulnessNumerator    397917 non-null  int64
 1   HelpfulnessDenominator  397917 non-null  int64
 2   Time                    397917 non-null  int64
 3   Summary                 397917 non-null  int32
 4   UserId                  397917 non-null  int32
 5   ProductId               397917 non-null  int32
dtypes: int32(3), int64(3)
memory usage: 16.7 MB
```

[50]:
```
X_train.isnull().sum()
```

[50]:
```
HelpfulnessNumerator      0
HelpfulnessDenominator    0
Time                      0
Summary                   0
UserId                    0
ProductId                 0
dtype: int64
```

[51]:
```
## Show Xtrain Describe
X_train.describe()
```

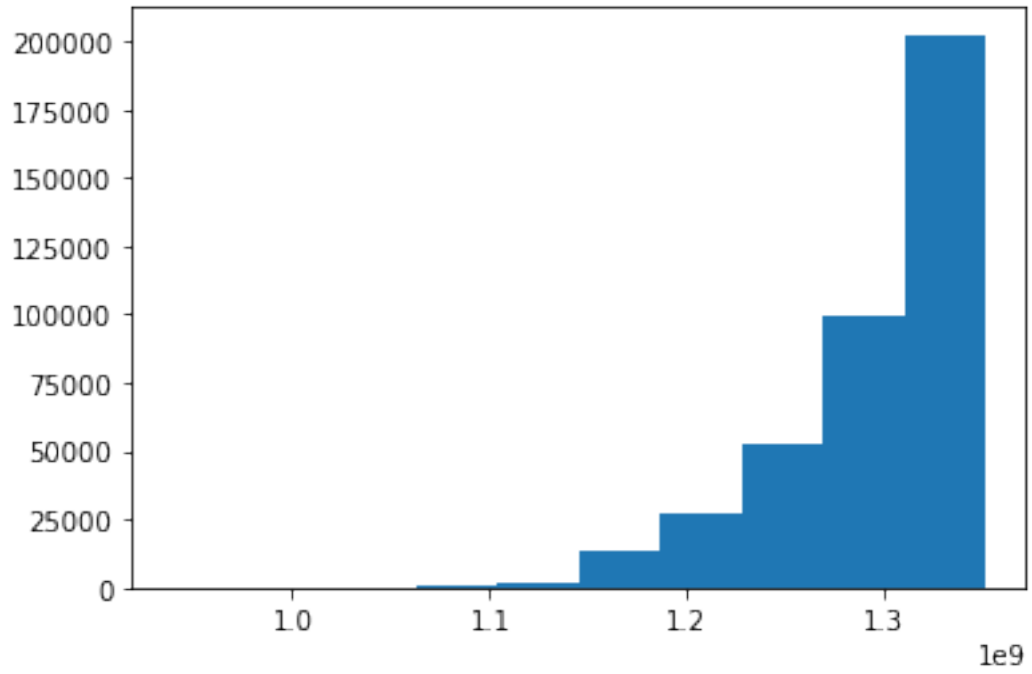
[51]:
```
       HelpfulnessNumerator  HelpfulnessDenominator          Time  \
count         397917.000000           397917.000000  3.979170e+05
mean               1.749078                2.231827  1.296217e+09
std                7.743817                8.387483  4.809582e+07
min                0.000000                0.000000  9.393408e+08
25%                0.000000                0.000000  1.271290e+09
50%                0.000000                1.000000  1.311120e+09
75%                2.000000                2.000000  1.332720e+09
max              866.000000              923.000000  1.351210e+09

             Summary         UserId      ProductId
count  397917.000000  397917.000000  397917.000000
```

```
mean    148312.345916  128555.180357   34785.412126
std      85100.280409   73636.071812   21229.398155
min         -1.000000       2.000000       0.000000
25%      75314.000000   65145.000000   15989.000000
50%     145076.000000  128547.000000   32923.000000
75%     223306.000000  192151.000000   51391.000000
max     295740.000000  256058.000000   74256.000000
```

[52]:
```
plt.hist(X_train['Time'])
```

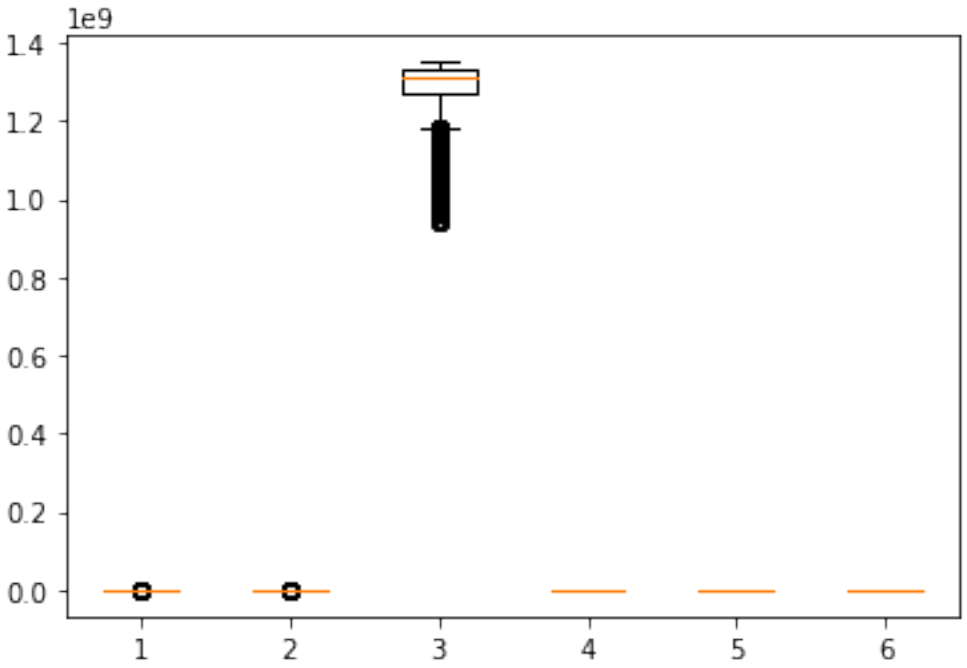
[52]:
```
(array([2.7000e+01, 2.6000e+01, 4.8000e+01, 4.7600e+02, 1.6390e+03,
        1.3131e+04, 2.7437e+04, 5.2910e+04, 9.9863e+04, 2.0236e+05]),
 array([9.39340800e+08, 9.80527680e+08, 1.02171456e+09, 1.06290144e+09,
        1.10408832e+09, 1.14527520e+09, 1.18646208e+09, 1.22764896e+09,
        1.26883584e+09, 1.31002272e+09, 1.35120960e+09]),
 <BarContainer object of 10 artists>)
```



[53]:
```
### Show boxplot of features
plt.boxplot(X_train)
```

[53]:
```
{'whiskers': [<matplotlib.lines.Line2D at 0x20921aefa60>,
  <matplotlib.lines.Line2D at 0x20921aefdf0>,
  <matplotlib.lines.Line2D at 0x20921b0b3d0>,
  <matplotlib.lines.Line2D at 0x20921b0b760>,
  <matplotlib.lines.Line2D at 0x20921b16d00>,
```

```
 <matplotlib.lines.Line2D at 0x20921b210d0>,
 <matplotlib.lines.Line2D at 0x20921b2d670>,
 <matplotlib.lines.Line2D at 0x20921b2da00>,
 <matplotlib.lines.Line2D at 0x20921b3cfa0>,
 <matplotlib.lines.Line2D at 0x20921b45370>,
 <matplotlib.lines.Line2D at 0x20921b50910>,
 <matplotlib.lines.Line2D at 0x20921b50ca0>],
'caps': [<matplotlib.lines.Line2D at 0x20921aff1c0>,
 <matplotlib.lines.Line2D at 0x20921aff550>,
 <matplotlib.lines.Line2D at 0x20921b0baf0>,
 <matplotlib.lines.Line2D at 0x20921b0be80>,
 <matplotlib.lines.Line2D at 0x20921b21460>,
 <matplotlib.lines.Line2D at 0x20921b217f0>,
 <matplotlib.lines.Line2D at 0x20921b2dd90>,
 <matplotlib.lines.Line2D at 0x20921b3c160>,
 <matplotlib.lines.Line2D at 0x20921b45700>,
 <matplotlib.lines.Line2D at 0x20921b45a90>,
 <matplotlib.lines.Line2D at 0x20921b5d070>,
 <matplotlib.lines.Line2D at 0x20921b5d400>],
'boxes': [<matplotlib.lines.Line2D at 0x20921aef6d0>,
 <matplotlib.lines.Line2D at 0x20921b0b040>,
 <matplotlib.lines.Line2D at 0x20921b16970>,
 <matplotlib.lines.Line2D at 0x20921b2d2e0>,
 <matplotlib.lines.Line2D at 0x20921b3cc10>,
 <matplotlib.lines.Line2D at 0x20921b50580>],
'medians': [<matplotlib.lines.Line2D at 0x20921aff8e0>,
 <matplotlib.lines.Line2D at 0x20921b16250>,
 <matplotlib.lines.Line2D at 0x20921b21b80>,
 <matplotlib.lines.Line2D at 0x20921b3c4f0>,
 <matplotlib.lines.Line2D at 0x20921b45e20>,
 <matplotlib.lines.Line2D at 0x20921b5d790>],
'fliers': [<matplotlib.lines.Line2D at 0x20921affc70>,
 <matplotlib.lines.Line2D at 0x20921b165e0>,
 <matplotlib.lines.Line2D at 0x20921b21f10>,
 <matplotlib.lines.Line2D at 0x20921b3c880>,
 <matplotlib.lines.Line2D at 0x20921b501f0>,
 <matplotlib.lines.Line2D at 0x20921b5db20>],
'means': []}
```



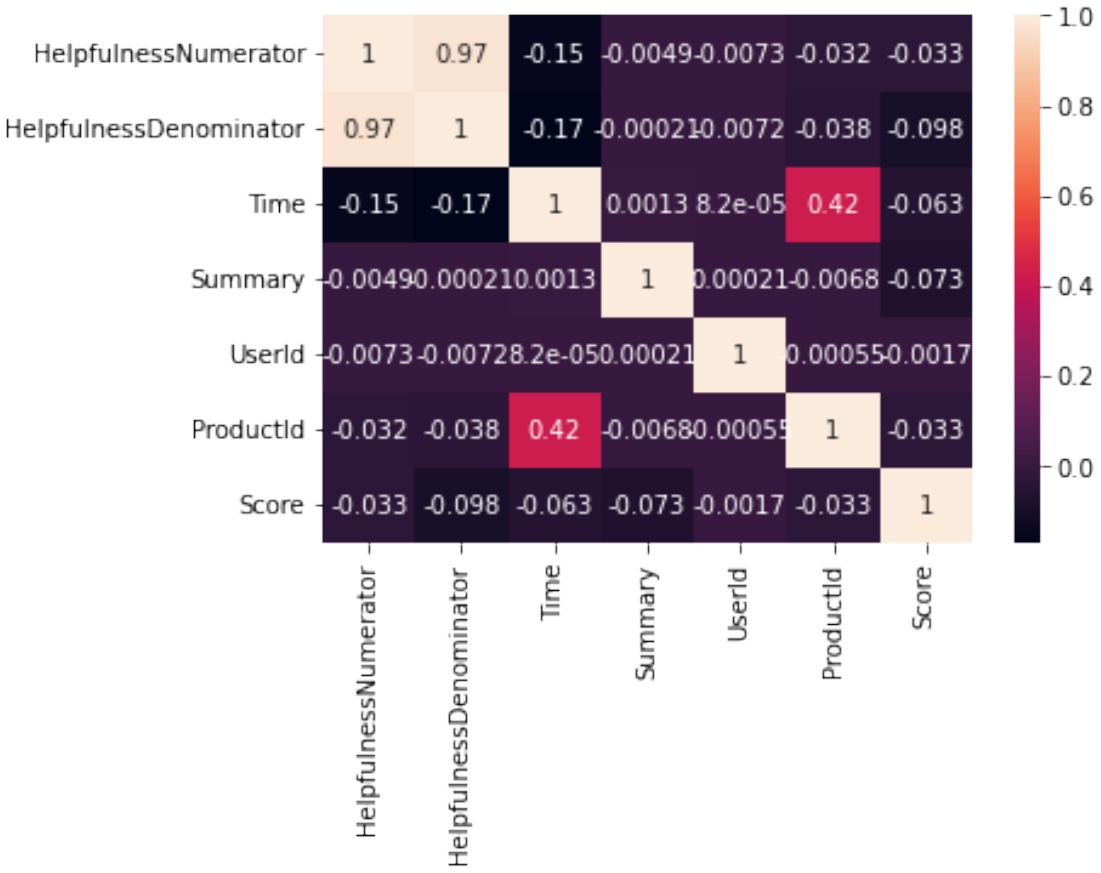
[45]:
```
### Show correlation
X_train.corr()
```

[45]:

	HelpfulnessNumerator	HelpfulnessDenominator	Time	Summary	UserId	ProductId
HelpfulnessNumerator	1.000000	0.976223	-0.153102	-0.005489	-0.005428	-0.032285
HelpfulnessDenominator	0.976223	1.000000	-0.171041	-0.000938	-0.004843	-0.037050
Time	-0.153102	-0.171041	1.000000	0.001376	0.000062	0.417867
Summary	-0.005489	-0.000938	0.001376	1.000000	0.000256	-0.006606
UserId	-0.005428	-0.004843	0.000062	0.000256	1.000000	-0.000182
ProductId	-0.032285	-0.037050	0.417867	-0.006606	-0.000182	1.000000

[69]:
```
sns.heatmap(df.corr(), annot=True)
```

[69]: <AxesSubplot:>



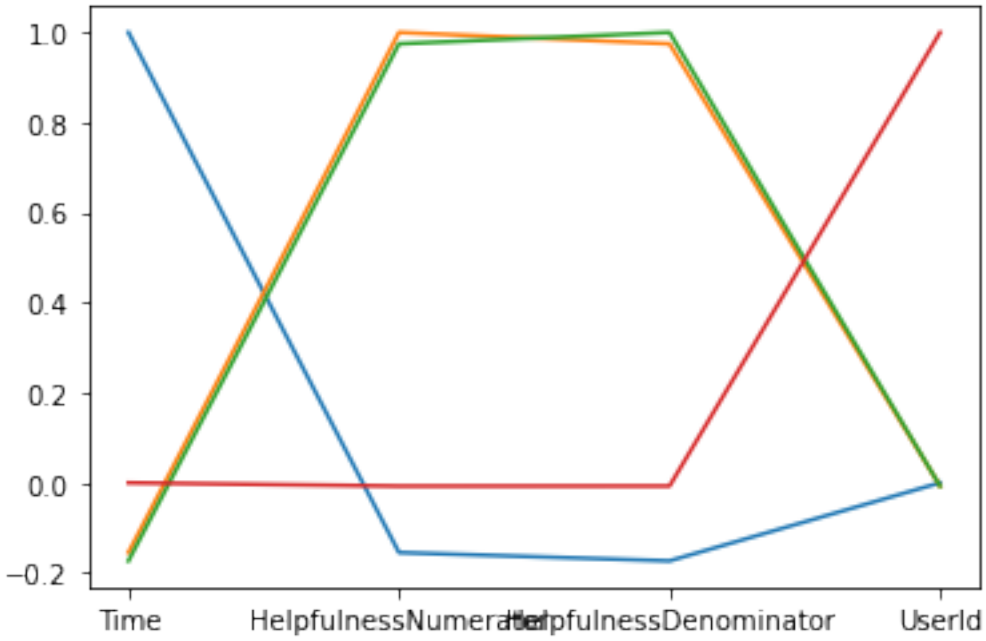
0.1 Select most influential variables

I select time, helpfulness and Userid

0.2 Plot a correlation of most influential features with the target variable

[63]:
```
cols = ['Time', 'HelpfulnessNumerator','HelpfulnessDenominator','UserId']
plt.plot(df[cols].corr())
```

[63]:
```
[<matplotlib.lines.Line2D at 0x2093aa9aeb0>,
 <matplotlib.lines.Line2D at 0x2093aa9adf0>,
 <matplotlib.lines.Line2D at 0x2093aa9afa0>,
 <matplotlib.lines.Line2D at 0x2093aaa7100>]
```



0.3 Create model

[66]:
```
dtree = DecisionTreeClassifier()
dtree.fit(X.values,y.values)
```

[66]:
```
DecisionTreeClassifier()
```

[67]:
```
dtree.predict(X_test[0:10])
```

```
D:\Programs\anaconda3\lib\site-packages\sklearn\base.py:443: UserWarning: X has
feature names, but DecisionTreeClassifier was fitted without feature names
  warnings.warn(
```

[67]:
```
array([5, 5, 5, 5, 2, 5, 4, 4, 5, 3], dtype=int64)
```

[68]:
```
# get the score
score = dtree.score(X_test, y_test)
score
```

```
D:\Programs\anaconda3\lib\site-packages\sklearn\base.py:443: UserWarning: X has
feature names, but DecisionTreeClassifier was fitted without feature names
  warnings.warn(
```

[68]:
```
0.9999941361698634
```

[ ]: