Filterbasedpredictors

March 13, 2023

[2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
from sklearn.model_selection import train_test_split
from sklearn.feature_selection import mutual_info_regression,␣
↪mutual_info_classif
```

[134]:
```
#read dataset
#data = pd.read_csv("/content/drive/MyDrive/CIND 820 Capstone Project/
↪categoricaltonumericdata.csv")
data = pd.read_csv("/content/drive/MyDrive/CIND 820 Capstone Project/
↪merged_completedata.csv")
data.shape
```

[134]:
```
(78032, 28)
```

[135]:
```
data.head()
```

[135]:

	RecordID	X	Y	FID	BusinessID	\
0	1	-79.689829	43.644181	1	1055	
1	2	-79.689419	43.644988	2	1057	
2	3	-79.689419	43.644988	3	1058	
3	4	-79.689419	43.644988	4	1060	
4	5	-79.690664	43.645493	5	1061	

	Name	Address	StreetNo	\
0	Golf Trends Inc.	300 Ambassador Dr	300	
1	Apex Graphics Inc.	320 Ambassador Dr	320	
2	Sands, John & Associates Limited	320 Ambassador Dr	320	
3	Printmedia-Tackaberry Times	320 Ambassador Dr	320	
4	S W R Industries Ltd.	321 Ambassador Dr	321	

	StreetName	BldgNo	…	Fax	TollFree	EMail	WebAddress	\
0	Ambassador Dr	No	…	905-795-8988	Yes	Yes	Yes	
1	Ambassador Dr	No	…	905-795-8775	No	Yes	Yes	

```
2  Ambassador Dr     No  …  905-795-8775       No    No          No
3  Ambassador Dr     No  …  905-564-7395       No   Yes         Yes
4  Ambassador Dr     No  …  905-564-5003       No   Yes         Yes

   EmplRange       CENT_X        CENT_Y  Year isnew Closed
0          3  605668.2538  4.833187e+06  2016    No     No
1          4  605699.9370  4.833277e+06  2016    No     No
2          5  605699.9370  4.833277e+06  2016    No     No
3          1  605699.9370  4.833277e+06  2016    No     No
4          2  605598.6442  4.833332e+06  2016    No     No

[5 rows x 28 columns]
```

[136]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 78032 entries, 0 to 78031
Data columns (total 28 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   RecordID    78032 non-null  int64
 1   X           78032 non-null  float64
 2   Y           78032 non-null  float64
 3   FID         78032 non-null  int64
 4   BusinessID  78032 non-null  int64
 5   Name        78032 non-null  object
 6   Address     78032 non-null  object
 7   StreetNo    78032 non-null  int64
 8   StreetName  78032 non-null  object
 9   BldgNo      78032 non-null  object
 10  UnitNo      78032 non-null  object
 11  PostalCode  78032 non-null  object
 12  Location    78032 non-null  object
 13  Ward        78032 non-null  int64
 14  NAICSCode   78032 non-null  int64
 15  NAICSCat    78032 non-null  object
 16  NAICSDescr  78032 non-null  object
 17  Phone       78032 non-null  object
 18  Fax         78032 non-null  object
 19  TollFree    78032 non-null  object
 20  EMail       78032 non-null  object
 21  WebAddress  78032 non-null  object
 22  EmplRange   78032 non-null  int64
 23  CENT_X      78032 non-null  float64
 24  CENT_Y      78032 non-null  float64
 25  Year        78032 non-null  int64
 26  isnew       78032 non-null  object
```

```
 27  Closed      78032 non-null  object
dtypes: float64(4), int64(8), object(16)
memory usage: 16.7+ MB
```

[137]:
```
#NAICSCode back to object as it is nominal not ordinal
data['NAICSCode'] = data['NAICSCode'].astype(str)
```

[138]:
```
#drop unique fields
#data.drop(['FID','BusinessID','Name','Address',␣
 ↪'StreetNo','StreetName','Location','Phone','Fax','NAICSDescr','EMail','NAICSCode','BldgNo',
 ↪axis=1, inplace=True)
data.drop(['RecordID','FID','BusinessID','Name','Address',␣
 ↪'StreetNo','StreetName','NAICSDescr'], axis=1, inplace=True)
```

[139]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 78032 entries, 0 to 78031
Data columns (total 20 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   X           78032 non-null  float64
 1   Y           78032 non-null  float64
 2   BldgNo      78032 non-null  object
 3   UnitNo      78032 non-null  object
 4   PostalCode  78032 non-null  object
 5   Location    78032 non-null  object
 6   Ward        78032 non-null  int64
 7   NAICSCode   78032 non-null  object
 8   NAICSCat    78032 non-null  object
 9   Phone       78032 non-null  object
 10  Fax         78032 non-null  object
 11  TollFree    78032 non-null  object
 12  EMail       78032 non-null  object
 13  WebAddress  78032 non-null  object
 14  EmplRange   78032 non-null  int64
 15  CENT_X      78032 non-null  float64
 16  CENT_Y      78032 non-null  float64
 17  Year        78032 non-null  int64
 18  isnew       78032 non-null  object
 19  Closed      78032 non-null  object
dtypes: float64(4), int64(3), object(13)
memory usage: 11.9+ MB
```

[140]:
```
#decribe categorical data
data.describe(include='O')
#There is none if I get an error
```

[140]:
```
        BldgNo UnitNo PostalCode             Location NAICSCode      NAICSCat  \
count    78032  78032      78032                78032     78032         78032
unique       2      2         37                   56        24            19
top         No    Yes        L4W  Northeast EA (West)        81  Retail Trade
freq     73798  53665      12410                21104      9052         11071

         Phone    Fax TollFree  EMail WebAddress  isnew Closed
count    78032  78032    78032  78032      78032  78032  78032
unique   25064  15752        2      2          2      2      2
top                        No    Yes        Yes     No     No
freq      1457  29473    66596  47406      56765  71148  71617
```

[141]:
```
#if there is categorical data then factorize it
data['WebAddress'] = pd.factorize(data['WebAddress'])[0]
data['BldgNo'] = pd.factorize(data['BldgNo'])[0]
data['Fax'] = pd.factorize(data['Fax'])[0]
data['TollFree'] = pd.factorize(data['TollFree'])[0]
data['UnitNo'] = pd.factorize(data['UnitNo'])[0]
data['isnew'] = pd.factorize(data['isnew'])[0]
data['Closed'] = pd.factorize(data['Closed'])[0]
data['NAICSCode'] = pd.factorize(data['NAICSCode'])[0]
data['NAICSCat'] = pd.factorize(data['NAICSCat'])[0]
data['Location'] = pd.factorize(data['Location'])[0]
data['Phone'] = pd.factorize(data['Phone'])[0]
data['EMail'] = pd.factorize(data['EMail'])[0]
data['PostalCode'] = pd.factorize(data['PostalCode'])[0]
```

[142]:
```
data.head()
```

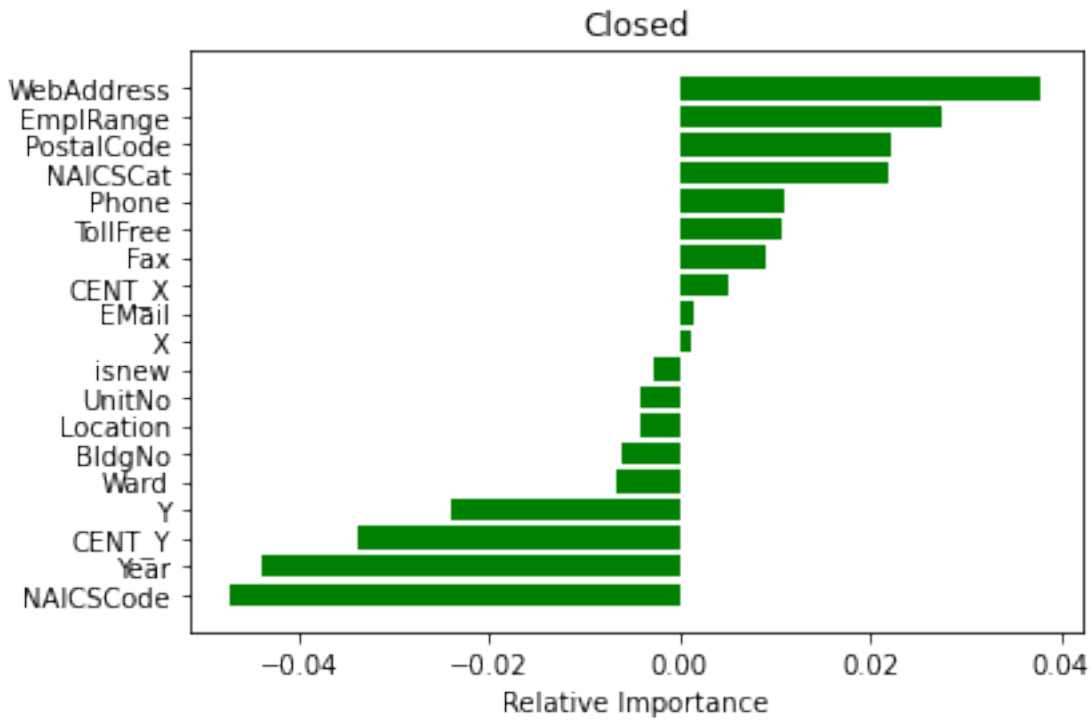
[142]:
```
           X          Y  BldgNo  UnitNo  PostalCode  Location  Ward  \
0 -79.689829  43.644181       0       0           0         0     5
1 -79.689419  43.644988       0       0           0         0     5
2 -79.689419  43.644988       0       0           0         0     5
3 -79.689419  43.644988       0       0           0         0     5
4 -79.690664  43.645493       0       0           0         0     5

   NAICSCode  NAICSCat  Phone  Fax  TollFree  EMail  WebAddress  EmplRange  \
0          0         0      0    0         0      0           0          3
1          1         1      1    1         1      0           0          4
2          1         1      2    1         1      1           1          5
3          1         1      3    2         1      0           0          1
4          0         0      4    3         1      0           0          2

        CENT_X        CENT_Y  Year  isnew  Closed
0  605668.2538  4.833187e+06  2016      0       0
1  605699.9370  4.833277e+06  2016      0       0
2  605699.9370  4.833277e+06  2016      0       0
```

```
3  605699.9370  4.833277e+06  2016      0       0
4  605598.6442  4.833332e+06  2016      0       0
```

[143]:
```
importances = data.drop('Closed', axis=1).apply(lambda x: x.corr(data.Closed))
indices = np.argsort(importances)
print(importances[indices])
```

```
EmplRange    -0.047171
Year         -0.043896
CENT_Y       -0.033631
Fax          -0.023913
NAICSCode    -0.006639
NAICSCat     -0.006051
PostalCode   -0.004191
X            -0.004051
Y            -0.002768
TollFree      0.001339
BldgNo        0.001632
Ward          0.005117
CENT_X        0.008961
Phone         0.010661
Location      0.011091
WebAddress    0.021861
EMail         0.022285
isnew         0.027482
UnitNo        0.037975
dtype: float64
```

[148]:
```
#names=['UnitNo','isnew','EMail','WebAddress','Location','Phone','CENT_X',␣
 ↪'Ward',␣
 ↪'BldgNo','TollFree','Y','X','PostalCode','NAICSCat','NAICSCode','Fax','CENT_Y','Year','Empl
plt.title('Closed')
plt.barh(range(len(indices)), importances[indices], color='g', align='center')
plt.yticks(range(len(indices)), [names[i] for i in indices])
plt.xlabel('Relative Importance')
plt.show()
```



[145]:
```
for i in range(0, len(indices)):
    if np.abs(importances[i])>0.2:
        print(names[i])
#only WebAddress is close to 0.4!
```

[146]:
```
X= data[ ['Fax','UnitNo', 'CENT_X', 'Phone',␣
 ↪'NAICSCat','TollFree','WebAddress','PostalCode','CENT_Y', 'Ward']]
```

[147]:
```
for i in range(0,len(X.columns)):
    for j in  range(0,len(X.columns)):
        if i!=j:
            corr_1=np.abs(X[X.columns[i]].corr(X[X.columns[j]]))
            if corr_1 <0.3:
                print( X.columns[i] , " is not correlated  with ", X.columns[j])
            elif corr_1>0.75:
                print( X.columns[i] , " is highly  correlated  with ", X.
 ↪columns[j])
```

```
Fax  is not correlated  with  UnitNo
Fax  is not correlated  with  CENT_X
Fax  is not correlated  with  NAICSCat
Fax  is not correlated  with  TollFree
Fax  is not correlated  with  WebAddress
Fax  is not correlated  with  PostalCode
```

```
Fax  is not correlated  with  CENT_Y
Fax  is not correlated  with  Ward
UnitNo  is not correlated  with  Fax
UnitNo  is not correlated  with  CENT_X
UnitNo  is not correlated  with  Phone
UnitNo  is not correlated  with  NAICSCat
UnitNo  is not correlated  with  TollFree
UnitNo  is not correlated  with  WebAddress
UnitNo  is not correlated  with  PostalCode
UnitNo  is not correlated  with  CENT_Y
UnitNo  is not correlated  with  Ward
CENT_X  is not correlated  with  Fax
CENT_X  is not correlated  with  UnitNo
CENT_X  is not correlated  with  Phone
CENT_X  is not correlated  with  NAICSCat
CENT_X  is not correlated  with  TollFree
CENT_X  is not correlated  with  WebAddress
CENT_X  is not correlated  with  PostalCode
CENT_X  is not correlated  with  CENT_Y
CENT_X  is highly  correlated  with  Ward
Phone  is not correlated  with  UnitNo
Phone  is not correlated  with  CENT_X
Phone  is not correlated  with  NAICSCat
Phone  is not correlated  with  TollFree
Phone  is not correlated  with  WebAddress
Phone  is not correlated  with  PostalCode
Phone  is not correlated  with  CENT_Y
Phone  is not correlated  with  Ward
NAICSCat  is not correlated  with  Fax
NAICSCat  is not correlated  with  UnitNo
NAICSCat  is not correlated  with  CENT_X
NAICSCat  is not correlated  with  Phone
NAICSCat  is not correlated  with  TollFree
NAICSCat  is not correlated  with  WebAddress
NAICSCat  is not correlated  with  PostalCode
NAICSCat  is not correlated  with  CENT_Y
NAICSCat  is not correlated  with  Ward
TollFree  is not correlated  with  Fax
TollFree  is not correlated  with  UnitNo
TollFree  is not correlated  with  CENT_X
TollFree  is not correlated  with  Phone
TollFree  is not correlated  with  NAICSCat
TollFree  is not correlated  with  WebAddress
TollFree  is not correlated  with  PostalCode
TollFree  is not correlated  with  CENT_Y
TollFree  is not correlated  with  Ward
WebAddress  is not correlated  with  Fax
WebAddress  is not correlated  with  UnitNo
```

```
WebAddress  is not correlated  with  CENT_X
WebAddress  is not correlated  with  Phone
WebAddress  is not correlated  with  NAICSCat
WebAddress  is not correlated  with  TollFree
WebAddress  is not correlated  with  PostalCode
WebAddress  is not correlated  with  CENT_Y
WebAddress  is not correlated  with  Ward
PostalCode  is not correlated  with  Fax
PostalCode  is not correlated  with  UnitNo
PostalCode  is not correlated  with  CENT_X
PostalCode  is not correlated  with  Phone
PostalCode  is not correlated  with  NAICSCat
PostalCode  is not correlated  with  TollFree
PostalCode  is not correlated  with  WebAddress
PostalCode  is not correlated  with  Ward
CENT_Y  is not correlated  with  Fax
CENT_Y  is not correlated  with  UnitNo
CENT_Y  is not correlated  with  CENT_X
CENT_Y  is not correlated  with  Phone
CENT_Y  is not correlated  with  NAICSCat
CENT_Y  is not correlated  with  TollFree
CENT_Y  is not correlated  with  WebAddress
CENT_Y  is not correlated  with  Ward
Ward  is not correlated  with  Fax
Ward  is not correlated  with  UnitNo
Ward  is highly  correlated  with  CENT_X
Ward  is not correlated  with  Phone
Ward  is not correlated  with  NAICSCat
Ward  is not correlated  with  TollFree
Ward  is not correlated  with  WebAddress
Ward  is not correlated  with  PostalCode
Ward  is not correlated  with  CENT_Y
```

[ ]:
```
X= dataset[ ['NAICSCat', 'acceleration', 'model year']]
```