ercedes-benze-sangini-phansekar

January 30, 2024

[1]:
```
#Importing Libraries
```

[22]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
from sklearn.feature_selection import VarianceThreshold
variance = VarianceThreshold(threshold=0)
from sklearn.preprocessing import StandardScaler, LabelEncoder
label = LabelEncoder
```

[23]:
```
#Reading Dataset
```

[24]:
```
train = pd.read_csv('train.csv')
train.head()
```

[24]:
```
   ID       y  X0 X1  X2 X3 X4 X5 X6 X8  …  X375  X376  X377  X378  X379  \
0   0  130.81   k  v  at  a  d  u  j  o  …     0     0     1     0     0
1   6   88.53   k  t  av  e  d  y  l  o  …     1     0     0     0     0
2   7   76.26  az  w   n  c  d  x  j  x  …     0     0     0     0     0
3   9   80.62  az  t   n  f  d  x  l  e  …     0     0     0     0     0
4  13   78.02  az  v   n  f  d  h  d  n  …     0     0     0     0     0

   X380  X382  X383  X384  X385
0     0     0     0     0     0
1     0     0     0     0     0
2     0     1     0     0     0
3     0     0     0     0     0
4     0     0     0     0     0

[5 rows x 378 columns]
```

[25]:
```
test = pd.read_csv('test.csv')
test.head()
```

```
[25]:    ID  X0 X1  X2 X3 X4 X5 X6 X8  X10  …  X375  X376  X377  X378  X379  X380  \
      0   1  az  v   n  f  d  t  a  w    0  …     0     0     0     1     0     0
      1   2   t  b  ai  a  d  b  g  y    0  …     0     0     1     0     0     0
      2   3  az  v  as  f  d  a  j  j    0  …     0     0     0     1     0     0
      3   4  az  l   n  f  d  z  l  n    0  …     0     0     0     1     0     0
      4   5   w  s  as  c  d  y  i  m    0  …     1     0     0     0     0     0

         X382  X383  X384  X385
      0     0     0     0     0
      1     0     0     0     0
      2     0     0     0     0
      3     0     0     0     0
      4     0     0     0     0

      [5 rows x 377 columns]
```

```
[26]: train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4209 entries, 0 to 4208
Columns: 378 entries, ID to X385
dtypes: float64(1), int64(369), object(8)
memory usage: 12.1+ MB
```

```
[27]: test.describe()
```

```
[27]:                 ID          X10          X11          X12          X13  \
      count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
      mean   4211.039202     0.019007     0.000238     0.074364     0.061060
      std    2423.078926     0.136565     0.015414     0.262394     0.239468
      min       1.000000     0.000000     0.000000     0.000000     0.000000
      25%    2115.000000     0.000000     0.000000     0.000000     0.000000
      50%    4202.000000     0.000000     0.000000     0.000000     0.000000
      75%    6310.000000     0.000000     0.000000     0.000000     0.000000
      max    8416.000000     1.000000     1.000000     1.000000     1.000000

                     X14          X15          X16          X17          X18  …  \
      count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000  …
      mean      0.427893     0.000713     0.002613     0.008791     0.010216  …
      std       0.494832     0.026691     0.051061     0.093357     0.100570  …
      min       0.000000     0.000000     0.000000     0.000000     0.000000  …
      25%       0.000000     0.000000     0.000000     0.000000     0.000000  …
      50%       0.000000     0.000000     0.000000     0.000000     0.000000  …
      75%       1.000000     0.000000     0.000000     0.000000     0.000000  …
      max       1.000000     1.000000     1.000000     1.000000     1.000000  …

                    X375         X376         X377         X378         X379  \
      count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
      mean      0.325968     0.049656     0.311951     0.019244     0.011879
      std       0.468791     0.217258     0.463345     0.137399     0.108356
      min       0.000000     0.000000     0.000000     0.000000     0.000000
      25%       0.000000     0.000000     0.000000     0.000000     0.000000
      50%       0.000000     0.000000     0.000000     0.000000     0.000000
      75%       1.000000     0.000000     1.000000     0.000000     0.000000
      max       1.000000     1.000000     1.000000     1.000000     1.000000

                    X380         X382         X383         X384         X385
      count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
      mean      0.008078     0.008791     0.000475     0.000713     0.001663
      std       0.089524     0.093357     0.021796     0.026691     0.040752
      min       0.000000     0.000000     0.000000     0.000000     0.000000
      25%       0.000000     0.000000     0.000000     0.000000     0.000000
      50%       0.000000     0.000000     0.000000     0.000000     0.000000
      75%       0.000000     0.000000     0.000000     0.000000     0.000000
      max       1.000000     1.000000     1.000000     1.000000     1.000000

      [8 rows x 369 columns]
```

[28]:
```
train.isnull().sum()
```

[28]:
```
ID       0
y        0
X0       0
X1       0
X2       0
        ..
X380     0
X382     0
X383     0
X384     0
X385     0
Length: 378, dtype: int64
```

[29]:
```
train_target = train["y"]
train_data = train.drop(["y","ID"] ,axis=1)
```

[30]:
```
train_data.head()
```

[30]:
```
   X0 X1  X2 X3 X4 X5 X6 X8  X10  X11  …  X375  X376  X377  X378  X379  \
0   k  v  at  a  d  u  j  o    0    0  …     0     0     1     0     0
1   k  t  av  e  d  y  l  o    0    0  …     1     0     0     0     0
2  az  w   n  c  d  x  j  x    0    0  …     0     0     0     0     0
3  az  t   n  f  d  x  l  e    0    0  …     0     0     0     0     0
4  az  v   n  f  d  h  d  n    0    0  …     0     0     0     0     0
```

```
   X380  X382  X383  X384  X385
0     0     0     0     0     0
1     0     0     0     0     0
2     0     1     0     0     0
3     0     0     0     0     0
4     0     0     0     0     0

[5 rows x 376 columns]
```

[31]:
```
#To check Variance
#If for any columns, the variance is equal to zero, then you need to remove␣
↪those variables
```

[32]:
```
train_data.var().sort_values().head(15)
```

```
/tmp/ipykernel_162/2491115096.py:1: FutureWarning: The default value of
numeric_only in DataFrame.var is deprecated. In a future version, it will
default to False. In addition, specifying 'numeric_only=None' is deprecated.
Select only valid columns or specify the value of numeric_only to silence this
warning.
  train_data.var().sort_values().head(15)
```

[32]:
```
X233    0.000000
X11     0.000000
X107    0.000000
X293    0.000000
X290    0.000000
X330    0.000000
X93     0.000000
X268    0.000000
X297    0.000000
X235    0.000000
X347    0.000000
X289    0.000000
X207    0.000238
X257    0.000238
X39     0.000238
dtype: float64
```

[33]:
```
test = pd.read_csv('test.csv')
test.head()
```

[33]:
```
   ID  X0 X1  X2 X3 X4 X5 X6 X8  X10  …  X375  X376  X377  X378  X379  X380  \
0   1  az  v   n  f  d  t  a  w    0  …     0     0     0     1     0     0
1   2   t  b  ai  a  d  b  g  y    0  …     0     0     1     0     0     0
2   3  az  v  as  f  d  a  j  j    0  …     0     0     0     1     0     0
```

```
3    4  az  l   n  f  d  z  l  n    0  …     0     0     0     1     0     0
4    5   w  s  as  c  d  y  i  m    0  …     1     0     0     0     0     0

   X382  X383  X384  X385
0     0     0     0     0
1     0     0     0     0
2     0     0     0     0
3     0     0     0     0
4     0     0     0     0

[5 rows x 377 columns]
```

[34]:
```
test.describe()
```

[34]:
```
                ID          X10          X11          X12          X13  \
count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
mean   4211.039202     0.019007     0.000238     0.074364     0.061060
std    2423.078926     0.136565     0.015414     0.262394     0.239468
min       1.000000     0.000000     0.000000     0.000000     0.000000
25%    2115.000000     0.000000     0.000000     0.000000     0.000000
50%    4202.000000     0.000000     0.000000     0.000000     0.000000
75%    6310.000000     0.000000     0.000000     0.000000     0.000000
max    8416.000000     1.000000     1.000000     1.000000     1.000000

               X14          X15          X16          X17          X18  …  \
count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000  …
mean      0.427893     0.000713     0.002613     0.008791     0.010216  …
std       0.494832     0.026691     0.051061     0.093357     0.100570  …
min       0.000000     0.000000     0.000000     0.000000     0.000000  …
25%       0.000000     0.000000     0.000000     0.000000     0.000000  …
50%       0.000000     0.000000     0.000000     0.000000     0.000000  …
75%       1.000000     0.000000     0.000000     0.000000     0.000000  …
max       1.000000     1.000000     1.000000     1.000000     1.000000  …

              X375         X376         X377         X378         X379  \
count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
mean      0.325968     0.049656     0.311951     0.019244     0.011879
std       0.468791     0.217258     0.463345     0.137399     0.108356
min       0.000000     0.000000     0.000000     0.000000     0.000000
25%       0.000000     0.000000     0.000000     0.000000     0.000000
50%       0.000000     0.000000     0.000000     0.000000     0.000000
75%       1.000000     0.000000     1.000000     0.000000     0.000000
max       1.000000     1.000000     1.000000     1.000000     1.000000

              X380         X382         X383         X384         X385
count  4209.000000  4209.000000  4209.000000  4209.000000  4209.000000
mean      0.008078     0.008791     0.000475     0.000713     0.001663
```

```
std       0.089524     0.093357     0.021796     0.026691     0.040752
min       0.000000     0.000000     0.000000     0.000000     0.000000
25%       0.000000     0.000000     0.000000     0.000000     0.000000
50%       0.000000     0.000000     0.000000     0.000000     0.000000
75%       0.000000     0.000000     0.000000     0.000000     0.000000
max       1.000000     1.000000     1.000000     1.000000     1.000000

[8 rows x 369 columns]
```

[35]:
```
train.isnull().sum()
```

[35]:
```
ID       0
y        0
X0       0
X1       0
X2       0
        ..
X380     0
X382     0
X383     0
X384     0
X385     0
Length: 378, dtype: int64
```

[36]:
```
train_data_without_zero_var = variance.fit_transform(train_data.iloc[:,9:])
train_data_without_zero_var
```

[36]:
```
array([[0, 1, 0, …, 0, 0, 0],
       [0, 0, 0, …, 0, 0, 0],
       [0, 0, 0, …, 0, 0, 0],
       …,
       [1, 1, 0, …, 0, 0, 0],
       [0, 0, 1, …, 0, 0, 0],
       [0, 0, 0, …, 0, 0, 0]])
```

[37]:
```
labeled_data = train_data.iloc[:,0:8]
labeled_data.head()
```

[37]:
```
   X0 X1  X2 X3 X4 X5 X6 X8
0   k  v  at  a  d  u  j  o
1   k  t  av  e  d  y  l  o
2  az  w   n  c  d  x  j  x
3  az  t   n  f  d  x  l  e
4  az  v   n  f  d  h  d  n
```

[38]:
```
# Checking Null and Unique values for train
```

[39]:
```
labeled_data.nunique()
```

[39]:
```
X0    47
X1    27
X2    44
X3     7
X4     4
X5    29
X6    12
X8    25
dtype: int64
```

[40]:
```
labeled_data1 = labeled_data.apply(label().fit_transform)
labeled_data1.head()
```

[40]:
```
   X0  X1  X2  X3  X4  X5  X6  X8
0  32  23  17   0   3  24   9  14
1  32  21  19   4   3  28  11  14
2  20  24  34   2   3  27   9  23
3  20  21  34   5   3  27  11   4
4  20  23  34   5   3  12   3  13
```

[41]:
```
labeled_data1.var()
```

[41]:
```
X0    188.741938
X1     72.777974
X2    118.808135
X3      3.027295
X4      0.005461
X5     68.076236
X6      8.508730
X8     49.531868
dtype: float64
```

[42]:
```
train_data_Zero_var_final = pd.DataFrame(train_data_without_zero_var)
train_data_Zero_var_final.head()
```

[42]:
```
   0    1    2    3    4    5    6    7    8    9   …  345  346  347  348  \
0    0    1    0    0    0    0    1    0    0    1  …    0    0    1    0
1    0    0    0    0    0    0    1    0    0    0  …    1    0    0    0
2    0    0    0    0    0    1    0    0    0    0  …    0    0    0    0
3    0    0    0    0    0    0    0    0    0    0  …    0    0    0    0
4    0    0    0    0    0    0    0    0    0    0  …    0    0    0    0

   349  350  351  352  353  354
0    0    0    0    0    0    0
1    0    0    0    0    0    0
```

```
2    0    0    1    0    0    0
3    0    0    0    0    0    0
4    0    0    0    0    0    0

[5 rows x 355 columns]
```

[43]:
```
final_train_data= pd.concat([labeled_data1,train_data_Zero_var_final],axis=1)
final_train_data.head()
```

[43]:
```
   X0  X1  X2  X3  X4  X5  X6  X8  0  1  …  345  346  347  348  349  350  \
0  32  23  17   0   3  24   9  14  0  1  …    0    0    1    0    0    0
1  32  21  19   4   3  28  11  14  0  0  …    1    0    0    0    0    0
2  20  24  34   2   3  27   9  23  0  0  …    0    0    0    0    0    0
3  20  21  34   5   3  27  11   4  0  0  …    0    0    0    0    0    0
4  20  23  34   5   3  12   3  13  0  0  …    0    0    0    0    0    0

   351  352  353  354
0    0    0    0    0
1    0    0    0    0
2    1    0    0    0
3    0    0    0    0
4    0    0    0    0

[5 rows x 363 columns]
```

[44]:
```
final_train_data.isnull().any()
```

[44]:
```
X0      False
X1      False
X2      False
X3      False
X4      False
        …
350     False
351     False
352     False
353     False
354     False
Length: 363, dtype: bool
```

[45]:
```
test = test.drop(['ID'] ,axis=1)
test.head()
```

[45]:
```
   X0 X1  X2 X3 X4 X5 X6 X8  X10  X11  …  X375  X376  X377  X378  X379  \
0  az  v   n  f  d  t  a  w    0    0  …     0     0     0     1     0
1   t  b  ai  a  d  b  g  y    0    0  …     0     0     1     0     0
2  az  v  as  f  d  a  j  j    0    0  …     0     0     0     1     0
```

```
3  az  l   n  f  d  z  l  n    0    0  …     0     0     0     1     0
4   w  s  as  c  d  y  i  m    0    0  …     1     0     0     0     0

   X380  X382  X383  X384  X385
0     0     0     0     0     0
1     0     0     0     0     0
2     0     0     0     0     0
3     0     0     0     0     0
4     0     0     0     0     0

[5 rows x 376 columns]
```

[46]:
```
#check for null and unique values for test
```

[47]:
```
test.nunique()
```

[47]:
```
X0      49
X1      27
X2      45
X3       7
X4       4
        ..
X380     2
X382     2
X383     2
X384     2
X385     2
Length: 376, dtype: int64
```

[48]:
```
test.isnull().any()
```

[48]:
```
X0      False
X1      False
X2      False
X3      False
X4      False
        …
X380    False
X382    False
X383    False
X384    False
X385    False
Length: 376, dtype: bool
```

[49]:
```
test.var().sort_values().head(15)
```

```
/tmp/ipykernel_162/1038450595.py:1: FutureWarning: The default value of
```

```
numeric_only in DataFrame.var is deprecated. In a future version, it will
default to False. In addition, specifying 'numeric_only=None' is deprecated.
Select only valid columns or specify the value of numeric_only to silence this
warning.
  test.var().sort_values().head(15)
```

[49]:
```
X369    0.000000
X257    0.000000
X258    0.000000
X296    0.000000
X295    0.000000
X288    0.000238
X330    0.000238
X210    0.000238
X290    0.000238
X293    0.000238
X259    0.000238
X11     0.000238
X105    0.000238
X278    0.000238
X233    0.000238
dtype: float64
```

[50]:
```
test_without_zero_var=variance.transform(test.iloc[:,9:])
test_without_zero_var
```

[50]:
```
array([[0, 0, 0, …, 0, 0, 0],
       [0, 0, 0, …, 0, 0, 0],
       [0, 0, 1, …, 0, 0, 0],
       …,
       [0, 0, 1, …, 0, 0, 0],
       [0, 1, 1, …, 0, 0, 0],
       [0, 0, 0, …, 0, 0, 0]])
```

[51]:
```
test_without_zero_var_final = pd.DataFrame(test_without_zero_var)
test_without_zero_var_final
```

[51]:
```
      0  1  2  3  4  5  6  7  8  9  …  345  346  347  \
0     0  0  0  0  0  0  0  0  0  0  …    0    0    0
1     0  0  0  0  0  0  0  1  0  0  …    0    0    1
2     0  0  1  0  0  0  0  0  0  0  …    0    0    0
3     0  0  0  0  0  0  0  0  0  0  …    0    0    0
4     0  0  1  0  0  0  0  0  0  0  …    1    0    0
…    …  …  …  …  …  …  …  …  …  …  …  …    …    …
4204  0  0  1  0  0  0  0  0  0  0  …    0    0    0
4205  0  0  0  0  0  0  0  1  0  0  …    0    1    0
4206  0  0  1  0  0  0  0  0  0  0  …    0    0    0
```

```
4207    0    1    1    0    0    0    0    0    0    0  …    0    0    1
4208    0    0    0    0    0    0    0    1    0    0  …    1    0    0

      348  349  350  351  352  353  354
0       1    0    0    0    0    0    0
1       0    0    0    0    0    0    0
2       1    0    0    0    0    0    0
3       1    0    0    0    0    0    0
4       0    0    0    0    0    0    0
…    …   …   …   …   …   …   …
4204    0    0    0    0    0    0    0
4205    0    0    0    0    0    0    0
4206    0    0    0    0    0    0    0
4207    0    0    0    0    0    0    0
4208    0    0    0    0    0    0    0

[4209 rows x 355 columns]
```

[52]:
```
labeled_data1=test.iloc[:,0:8]
labeled_data1.head()
```

[52]:
```
   X0 X1  X2 X3 X4 X5 X6 X8
0  az  v   n  f  d  t  a  w
1   t  b  ai  a  d  b  g  y
2  az  v  as  f  d  a  j  j
3  az  l   n  f  d  z  l  n
4   w  s  as  c  d  y  i  m
```

[53]:
```
test_label = labeled_data1.apply(label().fit_transform)
test_label.head()
```

[53]:
```
   X0  X1  X2  X3  X4  X5  X6  X8
0  21  23  34   5   3  26   0  22
1  42   3   8   0   3   9   6  24
2  21  23  17   5   3   0   9   9
3  21  13  34   5   3  31  11  13
4  45  20  17   2   3  30   8  12
```

[54]:
```
test_data_final = pd.concat([test_label,test_without_zero_var_final],axis=1)
test_data_final.head()
```

[54]:
```
   X0  X1  X2  X3  X4  X5  X6  X8  0  1  …  345  346  347  348  349  350  \
0  21  23  34   5   3  26   0  22  0  0  …    0    0    0    1    0    0
1  42   3   8   0   3   9   6  24  0  0  …    0    0    1    0    0    0
2  21  23  17   5   3   0   9   9  0  0  …    0    0    0    1    0    0
3  21  13  34   5   3  31  11  13  0  0  …    0    0    0    1    0    0
4  45  20  17   2   3  30   8  12  0  0  …    1    0    0    0    0    0
```

```
   351  352  353  354
0    0    0    0    0
1    0    0    0    0
2    0    0    0    0
3    0    0    0    0
4    0    0    0    0

[5 rows x 363 columns]
```

[55]:
```
#Perform Dimensionality Reduction
```

[56]:
```
test_data_final.keys()
```

[56]:
```
Index(['X0', 'X1', 'X2', 'X3', 'X4', 'X5', 'X6', 'X8',    0,    1,
       …
        345,  346,  347,  348,  349,  350,  351,  352,  353,  354],
      dtype='object', length=363)
```

[57]:
```
test_data_final.columns=test_data_final.columns.astype(str)
```

[58]:
```
scaler = StandardScaler()
scaler.fit(test_data_final)
```

[58]:
```
StandardScaler()
```

[59]:
```
scaled_data = scaler.transform(test_data_final)
```

[60]:
```
scaled_data
```

[60]:
```
array([[-0.62521149,  1.39576032,  1.58606761, …, -0.02180363,
        -0.02670705, -0.04081511],
       [ 0.75460919, -0.94519929, -0.95644521, …, -0.02180363,
        -0.02670705, -0.04081511],
       [-0.62521149,  1.39576032, -0.07634462, …, -0.02180363,
        -0.02670705, -0.04081511],
       …,
       [ 1.08313793,  1.39576032, -0.07634462, …, -0.02180363,
        -0.02670705, -0.04081511],
       [-1.54509194,  1.39576032, -0.07634462, …, -0.02180363,
        -0.02670705, -0.04081511],
       [ 0.75460919, -1.17929525, -0.95644521, …, -0.02180363,
        -0.02670705, -0.04081511]])
```

[61]:
```
#from sklearn.decomposition import PCA
```

[62]:
```
from sklearn.model_selection import train_test_split
```

```
[63]: x_train,x_test, y_train, y_test = train_test_split(scaled_data, train_target,␣
       ↪random_state = 42, test_size = 0.3)
```

```
[64]: x_train.shape, x_test.shape, y_train.shape, y_test.shape
```

```
[64]: ((2946, 363), (1263, 363), (2946,), (1263,))
```

```
[65]: from sklearn.decomposition import PCA
      pca = PCA(n_components=2)
```

```
[66]: pca=PCA(n_components=2)
      pca.fit(scaled_data)
      x_pca = pca.transform(scaled_data)
      scaled_data.shape
      x_pca.shape
```

```
[66]: (4209, 2)
```

```
[67]: scaled_data.shape
```

```
[67]: (4209, 363)
```

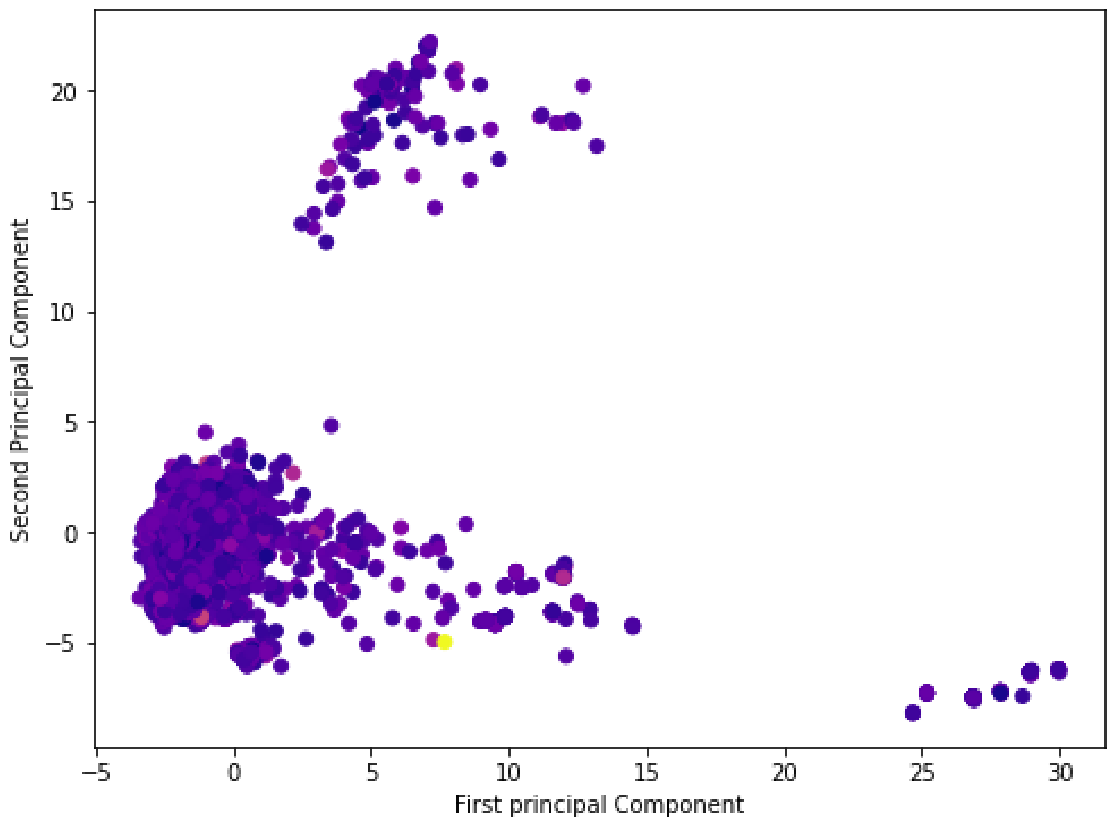
```
[68]: x_pca.shape
```

```
[68]: (4209, 2)
```

```
[69]: # plot figure
```

```
[70]: plt.figure(figsize=(8,6))
      plt.scatter(x_pca[:,0],x_pca[:,1],c=train['y'],cmap='plasma')
      plt.xlabel('First principal Component')
      plt.ylabel('Second Principal Component')
```

```
[70]: Text(0, 0.5, 'Second Principal Component')
```



```
[71]: #XGBoost
```

```
[72]: from sklearn import svm
      from sklearn.metrics import r2_score, mean_squared_error
      from xgboost import XGBRegressor
      xgbr = XGBRegressor(random_state=42)
```

```
[73]: model = xgbr.fit(x_train, y_train)
```

```
[74]: ypred_test = model.predict(x_test)
      ypred_test
```

```
[74]: array([107.663704, 102.37494 , 102.57482 , …,  89.09564 , 102.00936 ,
              99.39917 ], dtype=float32)
```

```
[75]: ypred_train = model.predict(x_train)
      ypred_train
```

```
[75]: array([ 99.53446 , 102.702675,  96.319984, …,  98.61626 ,  96.17458 ,
             101.20219 ], dtype=float32)
```

```
[76]: print(r2_score(ypred_train, y_train))
```

```
0.24660149892560312
```

```
[77]: print(mean_squared_error(ypred_train, y_train))
```

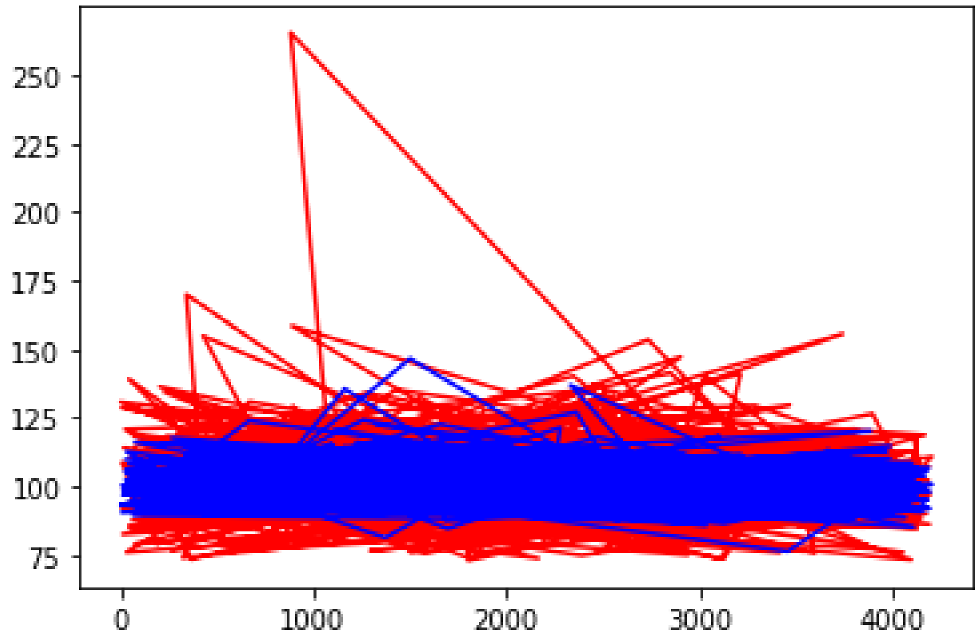
```
47.12593276125439
```

```
[78]: test_data_final_prediction = model.predict(test_data_final)
      test_data_final_prediction
```

```
[78]: array([ 82.54247 ,  79.10698 , 105.050095, …, 102.59405 ,  98.634445,
             109.8387  ], dtype=float32)
```

```
[79]: prediction = pd.DataFrame({'ytest':y_test,'ypred':ypred_test})
```

```
[80]: #sns.lmplot(x=ytest, y=ypred, data=prediction)
      plt.plot(prediction['ytest'],color='red')
      plt.plot(prediction['ypred'],color='Blue')
      plt.show()
```



```
[ ]:
```

```
[ ]:
```