```
import pandas as pd , numpy as np
import xgboost as xgb
import warnings
warnings.filterwarnings('ignore')

for root,direc,filename in
os.walk(os.path.join(os.getcwd(),'Downloads')):
    if direc =='project 1 mercedes benz':
        print(os.path.join(root,direc,train.csv))
```

```
<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>
```

```
train = pd.read_csv(os.path.join(os.getcwd(),'Downloads','project 1
mercedes benz','train.csv'))
test = pd.read_csv(os.path.join(os.getcwd(),'Downloads','project 1
mercedes benz','test.csv'))
```

```
<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>
```

```
train.head()
```

```
   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]
```

```
print(train.shape)
print(test.shape)
```

```
(4209, 378)
(4209, 377)
```

```
train.isna().sum().sum()
```

```
0
```

```
train.isna().any()[lambda x:x]
```

```
Series([], dtype: bool)
```

```
duplicate = train[train.duplicated(keep = 'last')]
print(duplicate)
```

```
Empty DataFrame
Columns: [ID, y, X0, X1, X2, X3, X4, X5, X6, X8, X10, X11, X12, X13,
X14, X15, X16, X17, X18, X19, X20, X21, X22, X23, X24, X26, X27, X28,
X29, X30, X31, X32, X33, X34, X35, X36, X37, X38, X39, X40, X41, X42,
X43, X44, X45, X46, X47, X48, X49, X50, X51, X52, X53, X54, X55, X56,
X57, X58, X59, X60, X61, X62, X63, X64, X65, X66, X67, X68, X69, X70,
X71, X73, X74, X75, X76, X77, X78, X79, X80, X81, X82, X83, X84, X85,
X86, X87, X88, X89, X90, X91, X92, X93, X94, X95, X96, X97, X98, X99,
X100, X101, ...]
Index: []

[0 rows x 378 columns]
```

```
varzero = []
for column in train.columns:
    if train[column].dtype != 'O':
        if train[column].var() == 0:
            varzero.append(column)
```

```
varzero
```

```
['X11',
 'X93',
 'X107',
 'X233',
 'X235',
 'X268',
 'X289',
 'X290',
 'X293',
 'X297',
 'X330',
 'X347']
```

```
train.drop(columns= varzero,inplace = True)
```

```
test = test.drop(columns = varzero)

print(train.shape)
print(test.shape)
```

```
(4209, 366)
(4209, 365)
```

```
train.dtypes.value_counts()
```

```
int64      357
object       8
float64      1
dtype: int64
```

```
train.isnull().any().any()
```

```
False
```

```
test.isnull().any()[lambda x:x]
```

```
Series([], dtype: bool)
```

```
train.nunique().sort_values(ascending = False)
```

```
ID      4209
y       2545
X0        47
X2        44
X5        29
        ...
X131       2
X130       2
X129       2
X128       2
X385       2
Length: 366, dtype: int64
```

```
# num_cols = [i for i in df.columns if df[i].dtype!= 'O']
cols = train.columns
num_cols = train._get_numeric_data().columns

# cat_cols = [i for i in df.columns if i not in num_cols]
cat_cols = list(set(cols) - set(num_cols))

cat_cols
```

```
['X0', 'X6', 'X3', 'X4', 'X1', 'X8', 'X5', 'X2']
```

```
for i in test.columns:
    if test[i].dtypes=='int64' or  test[i].dtypes=='float64':
        q1 = test[i].quantile(0.25)
        q3 = test[i].quantile(0.75)
```

```
        iqr = q3-q1
        low = q1-(1.5*iqr)
        hi = q3+(1.5*iqr)
        test[i] = np.where((test[i]<low)|
(test[i]>hi),train[i].median(),test[i])

for i in train.columns:
    if i!='ID' or i!='y':
        if train[i].dtypes=='int64' or  train[i].dtypes=='float64':
            q1 = train[i].quantile(0.25)
            q3 = train[i].quantile(0.75)
            iqr = q3-q1
            low = q1-(1.5*iqr)
            hi = q3+(1.5*iqr)
            train[i] = np.where((train[i]<low)|
(train[i]>hi),train[i].median(),train[i])

print(test.shape)
print(train.shape)
```

```
(4209, 365)
(4209, 366)
```

```
train.columns
```

```
Index(['ID', 'y', 'X0', 'X1', 'X2', 'X3', 'X4', 'X5', 'X6', 'X8',
       ...
       'X375', 'X376', 'X377', 'X378', 'X379', 'X380', 'X382', 'X383',
'X384',
       'X385'],
      dtype='object', length=366)
```

```
from sklearn.preprocessing import LabelEncoder
for  i in cat_cols:
    zx = list(train[i].unique())+list(test[i].unique())
    le = LabelEncoder()
    le.fit(zx)
    train[i] = le.transform(train[i])
    test[i] = le.transform(test[i])

x_train = train.drop(columns = ['ID','y'])
y  = train[['y']]

x_train
```

```
      X0  X1  X2  X3  X4  X5  X6  X8  X10  X12  ...  X375  X376  X377
X378  \
0     37  23  20   0   3  27   9  14  0.0  0.0  ...   0.0   0.0   1.0
0.0
1     37  21  22   4   3  31  11  14  0.0  0.0  ...   1.0   0.0   0.0
0.0
2     24  24  38   2   3  30   9  23  0.0  0.0  ...   0.0   0.0   0.0
```

```
0.0
3     24  21  38   5   3  30  11   4  0.0  0.0  ...   0.0   0.0   0.0
0.0
4     24  23  38   5   3  14   3  13  0.0  0.0  ...   0.0   0.0   0.0
0.0
...   ..  ..  ..  ..  ..  ..  ..  ..  ...  ...  ...   ...   ...   ...
...
4204  10  20  19   2   3   1   3  16  0.0  0.0  ...   1.0   0.0   0.0
0.0
4205  36  16  44   3   3   1   7   7  0.0  0.0  ...   0.0   0.0   0.0
0.0
4206  10  23  42   0   3   1   6   4  0.0  0.0  ...   0.0   0.0   1.0
0.0
4207  11  19  29   5   3   1  11  20  0.0  0.0  ...   0.0   0.0   0.0
0.0
4208  52  19   5   2   3   1   6  22  0.0  0.0  ...   1.0   0.0   0.0
0.0

      X379  X380  X382  X383  X384  X385
0      0.0   0.0   0.0   0.0   0.0   0.0
1      0.0   0.0   0.0   0.0   0.0   0.0
2      0.0   0.0   0.0   0.0   0.0   0.0
3      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
...    ...   ...   ...   ...   ...   ...
4204   0.0   0.0   0.0   0.0   0.0   0.0
4205   0.0   0.0   0.0   0.0   0.0   0.0
4206   0.0   0.0   0.0   0.0   0.0   0.0
4207   0.0   0.0   0.0   0.0   0.0   0.0
4208   0.0   0.0   0.0   0.0   0.0   0.0

[4209 rows x 364 columns]
```

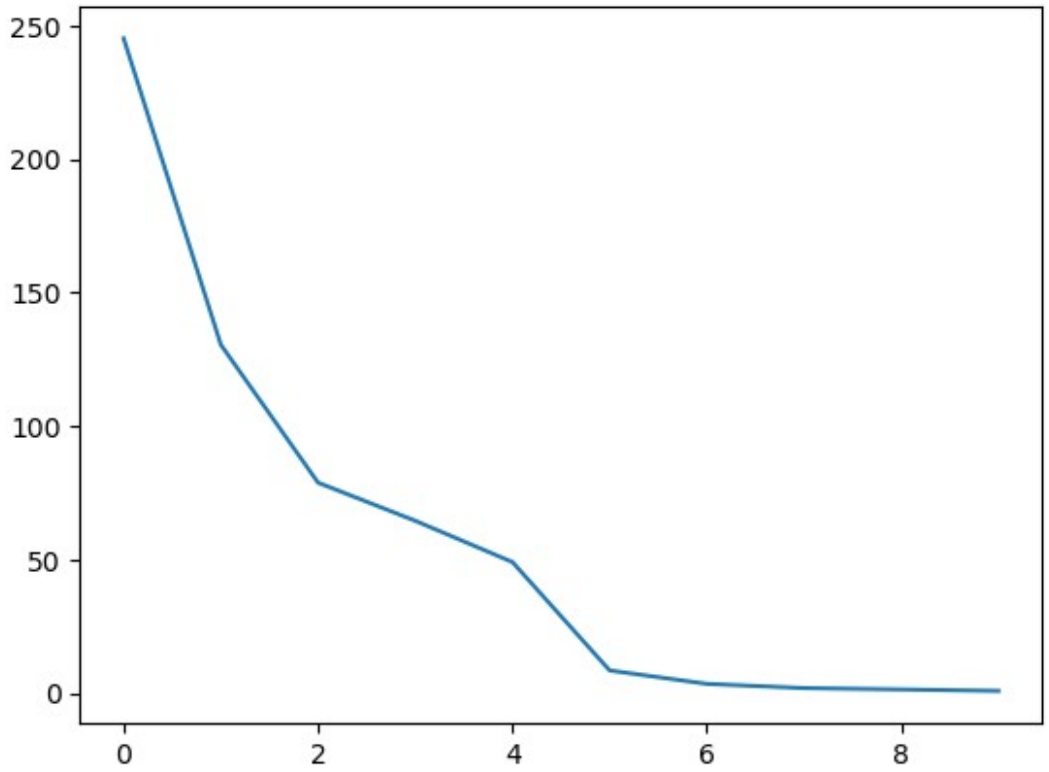
```
from sklearn.decomposition import PCA

pc = PCA(n_components = 10)
pc.fit(x_train)
```

```
PCA(n_components=10)
```

```
import matplotlib.pyplot as plt
%matplotlib inline
plt.plot(pc.explained_variance_)
```

```
[<matplotlib.lines.Line2D at 0x1c693fc2250>]
```



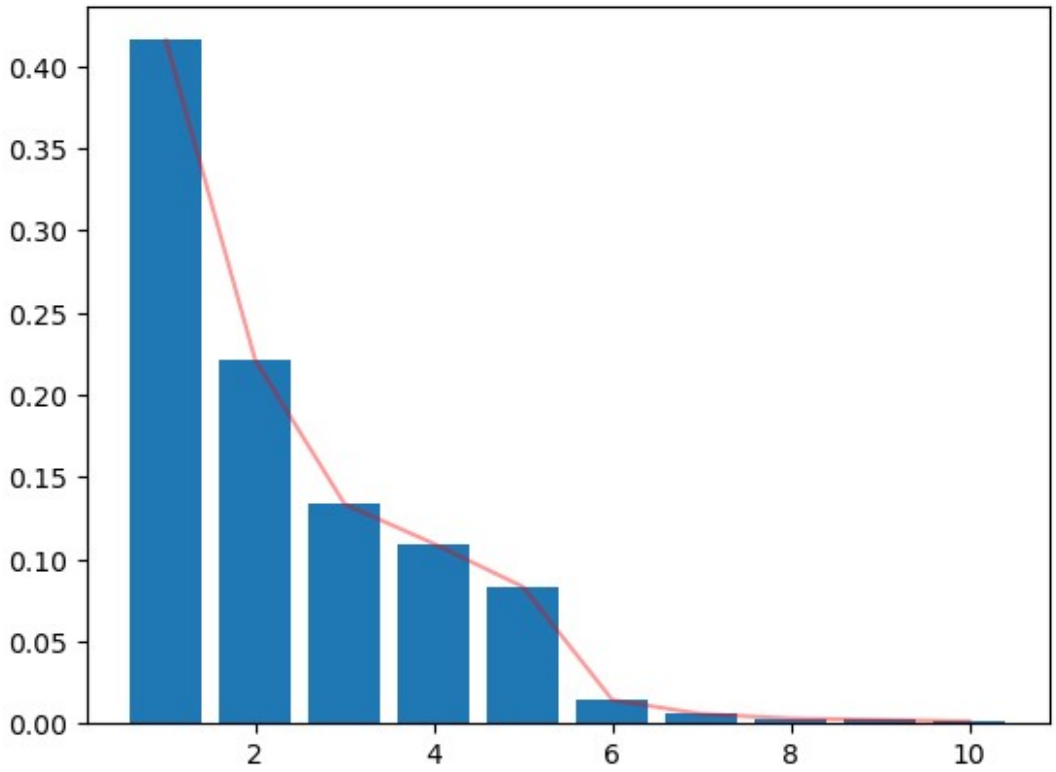

```
x_pca = pc.transform(x_train)
```

```
x_pca.shape
```

```
(4209, 10)
```

```
plt.plot(range(1,11),pc.explained_variance_ratio_,color = 'r',alpha=
0.4)
plt.bar(range(1,11),pc.explained_variance_ratio_)
```

```
<BarContainer object of 10 artists>
```




```
pca = PCA(n_components =6)
pca.fit(x_train)
x_pca = pca.transform(x_train)
x_pca.shape
```

```
(4209, 6)
```

```
test_ID = test['ID']
```

```
test_pca = pca.transform(test.drop(['ID'],axis=1))
```

```
from sklearn.model_selection import train_test_split as tts
x_train,x_test,y_train,y_test = tts(x_pca,y,test_size =
0.25,random_state = 123)
```

```
import xgboost as xgb_
from sklearn.model_selection import RandomizedSearchCV
from sklearn.metrics import r2_score , mean_squared_error as mse
```

basic XGB regressor

```
xgbbasic = xgb_.XGBRegressor(objective ='reg:linear', random_state  =
123)
xgbbasic.fit(x_train,y_train)
```

```
[12:16:08] WARNING: C:/buildkite-agent/builds/buildkite-windows-cpu-
autoscaling-group-i-030221e36e1a46bfb-1/xgboost/xgboost-ci-windows/
```

```
src/objective/regression_obj.cu:213: reg:linear is now deprecated in
favor of reg:squarederror.

XGBRegressor(base_score=0.5, booster='gbtree', callbacks=None,
             colsample_bylevel=1, colsample_bynode=1,
colsample_bytree=1,
             early_stopping_rounds=None, enable_categorical=False,
             eval_metric=None, feature_types=None, gamma=0, gpu_id=-1,
             grow_policy='depthwise', importance_type=None,
             interaction_constraints='', learning_rate=0.300000012,
max_bin=256,
             max_cat_threshold=64, max_cat_to_onehot=4,
max_delta_step=0,
             max_depth=6, max_leaves=0, min_child_weight=1,
missing=nan,
             monotone_constraints='()', n_estimators=100, n_jobs=0,
             num_parallel_tree=1, objective='reg:linear',
predictor='auto', ...)

print(r2_score(y_train,xgbbasic.predict(x_train)))
print(r2_score(y_test,xgbbasic.predict(x_test)))

0.8964805327873763
0.39481771868545823

print(mse(y_train,xgbbasic.predict(x_train)))
print(mse(y_test,xgbbasic.predict(x_test)))

13.265168266067267
80.09716221115828
```

xgb regressor using DMatrix

```
matrix = xgb_.DMatrix(x_pca,label = y)
params = {'objective':'reg:linear'}
modelcv = xgb_.cv(dtrain =matrix , params = params , nfold =
3 ,num_boost_round = 50,early_stopping_rounds = 10,metrics =
'rmse',as_pandas = True,seed = 7)

[12:17:19] WARNING: C:/buildkite-agent/builds/buildkite-windows-cpu-
autoscaling-group-i-030221e36e1a46bfb-1/xgboost/xgboost-ci-windows/
src/objective/regression_obj.cu:213: reg:linear is now deprecated in
favor of reg:squarederror.
[12:17:19] WARNING: C:/buildkite-agent/builds/buildkite-windows-cpu-
```

```
autoscaling-group-i-030221e36e1a46bfb-1/xgboost/xgboost-ci-windows/
src/objective/regression_obj.cu:213: reg:linear is now deprecated in
favor of reg:squarederror.
[12:17:19] WARNING: C:/buildkite-agent/builds/buildkite-windows-cpu-
autoscaling-group-i-030221e36e1a46bfb-1/xgboost/xgboost-ci-windows/
src/objective/regression_obj.cu:213: reg:linear is now deprecated in
favor of reg:squarederror.
```

```
modelcv.tail()
```

	train-rmse-mean	train-rmse-std	test-rmse-mean	test-rmse-std
20	6.669510	0.097852	8.565662	0.211388
21	6.593094	0.136217	8.578226	0.212417
22	6.540634	0.138946	8.572695	0.207196
23	6.479749	0.104328	8.564559	0.216491
24	6.408362	0.136584	8.562477	0.214235

using random search cv

```
params = {
    'objective':['reg:squarederror'],
    'max_depth' : [3,8,13,19],
    'booster':['gbtree','gblinear'],
    'learning_rate' : [0.05,0.10,0.15,0.20,0.25,0.30],
    'max_depth': [3,4,5,6,8,10,12,15],
    'min_child_weight': [1,3,5,7],
    'gamma': [0.0,0.1,0.2,0.3,0.4],
    'colsample_bytree': [0.3,0.4,0.5,0.7],
    'eval_metric': ['rmse']
}
```

```
xgb = xgb_.XGBRegressor(nthread = -1,random_state=30)
random_search = RandomizedSearchCV(xgb,param_distributions =
params,n_iter=100,cv = 5,scoring = 'neg_mean_squared_error',n_jobs = -
1 )
```

```
import time
start = time.time()
random_search.fit(x_train,y_train)
print(f'took {(time.time()-start)}  seconds for completion .')
```

```
took 68.20517253875732  seconds for completion .
```

```
final_model = random_search.best_estimator_
```

```
final_model = final_model.fit(x_train,y_train)
```

```
y_pred = final_model.predict(x_test)
```

```
print('rmse for train set is  :
',mse(y_train,final_model.predict(x_train),squared=False))
print('rmse for validation set is  :
',mse(y_test,y_pred,squared=False))
```

```
rmse for train set is  :   6.005712603105041
rmse for validation set is  :   8.481882535225662
```

```
print('r2_score for train  set is  :
',r2_score(y_train,final_model.predict(x_train)))
print('r2_score for validation  set is  :
',r2_score(y_test,final_model.predict(x_test)))
```

```
r2_score for train  set is  :    0.7185259537942881
r2_score for validation  set is  :    0.45643237535087966
```

prediction the test set for submission using best estimator from RandomSearcCV

```
test_pred = final_model.predict(test_pca)
```

```
submission = pd.DataFrame()
submission['predictions'] = test_pred.tolist()
submission['ID'] = test_ID
```

```
submission = submission.loc[:,['ID','predictions']]
```

```
submission
```

```
          ID  predictions
0        1.0    79.733963
1        2.0    95.458893
2        3.0    90.824066
3        4.0    79.345421
4        5.0   102.808243
...      ...          ...
4204  8410.0   106.894798
4205  8411.0    93.920967
4206  8413.0    99.669518
4207  8414.0   107.443001
4208  8416.0    94.466583

[4209 rows x 2 columns]
```