```
##############################################################################
'''    Project No. 1: Mercedes-Benz Greener Manufacturing      '''
##############################################################################

# Step1: Import the required libraries


# linear algebra
import numpy as np
# data processing, CSV file I/O (e.g. pd.read_csv)
import pandas as pd
# for dimensionality reduction
from sklearn.decomposition import PCA

# Step2: Read the data from train.csv

df_train = pd.read_csv('train.csv')
# let us understand the data
print('Size of training set: {} rows and {} columns'
    .format(*df_train.shape))
# print few rows and see how the data looks like
df_train.head()

# Step3: Collect the Y values into an array

# seperate the y from the data as we will use this to learn as
# the prediction output
y_train = df_train['y'].values
```

```
# Step4: Understand the data types we have


# iterate through all the columns which has X in the name of the column
cols = [c for c in df_train.columns if 'X' in c]
print('Number of features: {}'.format(len(cols)))


print('Feature types:')
df_train[cols].dtypes.value_counts()


# Step5: Count the data in each of the columns


counts = [[], [], []]
for c in cols:
    typ = df_train[c].dtype
    uniq = len(np.unique(df_train[c]))
    if uniq == 1:
        counts[0].append(c)
    elif uniq == 2 and typ == np.int64:
        counts[1].append(c)
    else:
        counts[2].append(c)


print('Constant features: {} Binary features: {} Categorical features: {}\n'
      .format(*[len(c) for c in counts]))
print('Constant features:', counts[0])
print('Categorical features:', counts[2])
```

```
# Step6: Read the test.csv data


df_test = pd.read_csv('test.csv')


# remove columns ID and Y from the data as they are not used for learning

usable_columns = list(set(df_train.columns) - set(['ID', 'y']))

y_train = df_train['y'].values

id_test = df_test['ID'].values


x_train = df_train[usable_columns]

x_test = df_test[usable_columns]


# Step7: Check for null and unique values for test and train sets


def check_missing_values(df):

   if df.isnull().any().any():

      print("There are missing values in the dataframe")

   else:

      print("There are no missing values in the dataframe")

check_missing_values(x_train)

check_missing_values(x_test)


# Step8: If for any column(s), the variance is equal to zero,

# then you need to remove those variable(s).

# Apply label encoder
```

```
for column in usable_columns:
    cardinality = len(np.unique(x_train[column]))
    if cardinality == 1:
        x_train.drop(column, axis=1) # Column with only one
        # value is useless so we drop it
        x_test.drop(column, axis=1)
    if cardinality > 2: # Column is categorical
        mapper = lambda x: sum([ord(digit) for digit in x])
        x_train[column] = x_train[column].apply(mapper)
        x_test[column] = x_test[column].apply(mapper)
x_train.head()

# Step9: Make sure the data is now changed into numericals

print('Feature types:')
x_train[cols].dtypes.value_counts()

# Step10: Perform dimensionality reduction
# Linear dimensionality reduction using Singular Value Decomposition of
# the data to project it to a lower dimensional space.
n_comp = 12
pca = PCA(n_components=n_comp, random_state=420)
pca2_results_train = pca.fit_transform(x_train)
pca2_results_test = pca.transform(x_test)

# Step11: Training using xgboost
```

```
import xgboost as xgb
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split

x_train, x_valid, y_train, y_valid = train_test_split(
        pca2_results_train,
        y_train, test_size=0.2,
        random_state=4242)

d_train = xgb.DMatrix(x_train, label=y_train)
d_valid = xgb.DMatrix(x_valid, label=y_valid)
#d_test = xgb.DMatrix(x_test)
d_test = xgb.DMatrix(pca2_results_test)

params = {}
params['objective'] = 'reg:linear'
params['eta'] = 0.02
params['max_depth'] = 4

def xgb_r2_score(preds, dtrain):
    labels = dtrain.get_label()
    return 'r2', r2_score(labels, preds)

watchlist = [(d_train, 'train'), (d_valid, 'valid')]

clf = xgb.train(params, d_train,
                1000, watchlist, early_stopping_rounds=50,
```

```
            feval=xgb_r2_score, maximize=True, verbose_eval=10)


# Step12: Predict your test_df values using xgboost


p_test = clf.predict(d_test)


sub = pd.DataFrame()

sub['ID'] = id_test

sub['y'] = p_test

sub.to_csv('xgb.csv', index=False)


sub.head()


#############################################################################

'''                 End                 '''

#############################################################################
```