Project No. 1: Mercedes-Benz Greener Manufacturing

MainCode

```
# Step1: Import the required libraries
import numpy as np
import pandas as pd
from sklearn.decomposition import PCA

# Step2: Read the data from train.csv
df_train = pd.read_csv('train.csv')
print('Size of training set: {} rows and {} columns'
      .format(*df_train.shape))
df_train.head()

# Step3: Collect the Y values into an array
y_train = df_train['y'].values

# Step4: Understand the data types we have
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')
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) and 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
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                    '''
```

Code Snippet followed a Screenshot of the Output

Q1. Read the data from train.csv and Collect the Y values into an array

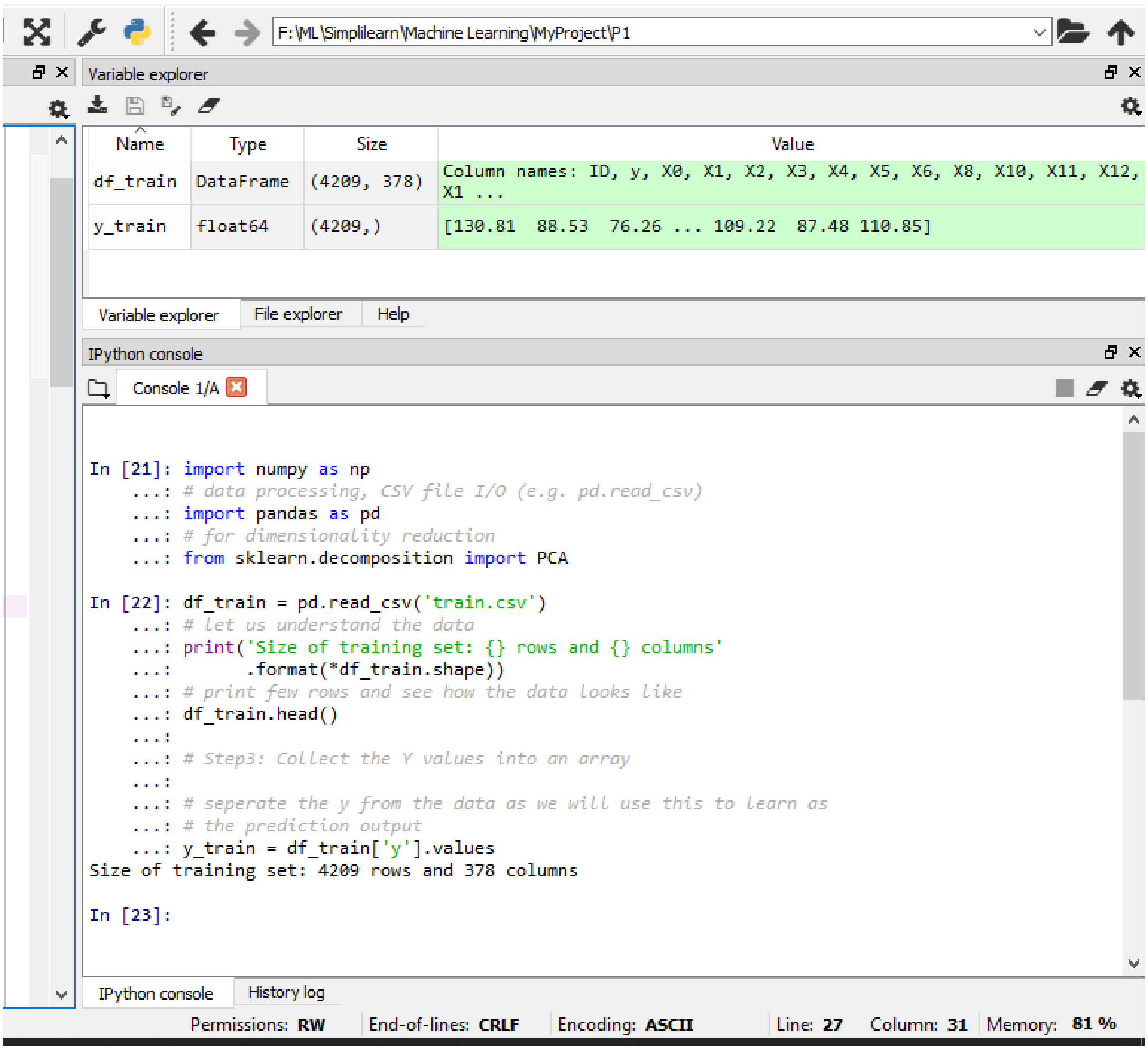
```
# Step2: Read the data from train.csv


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

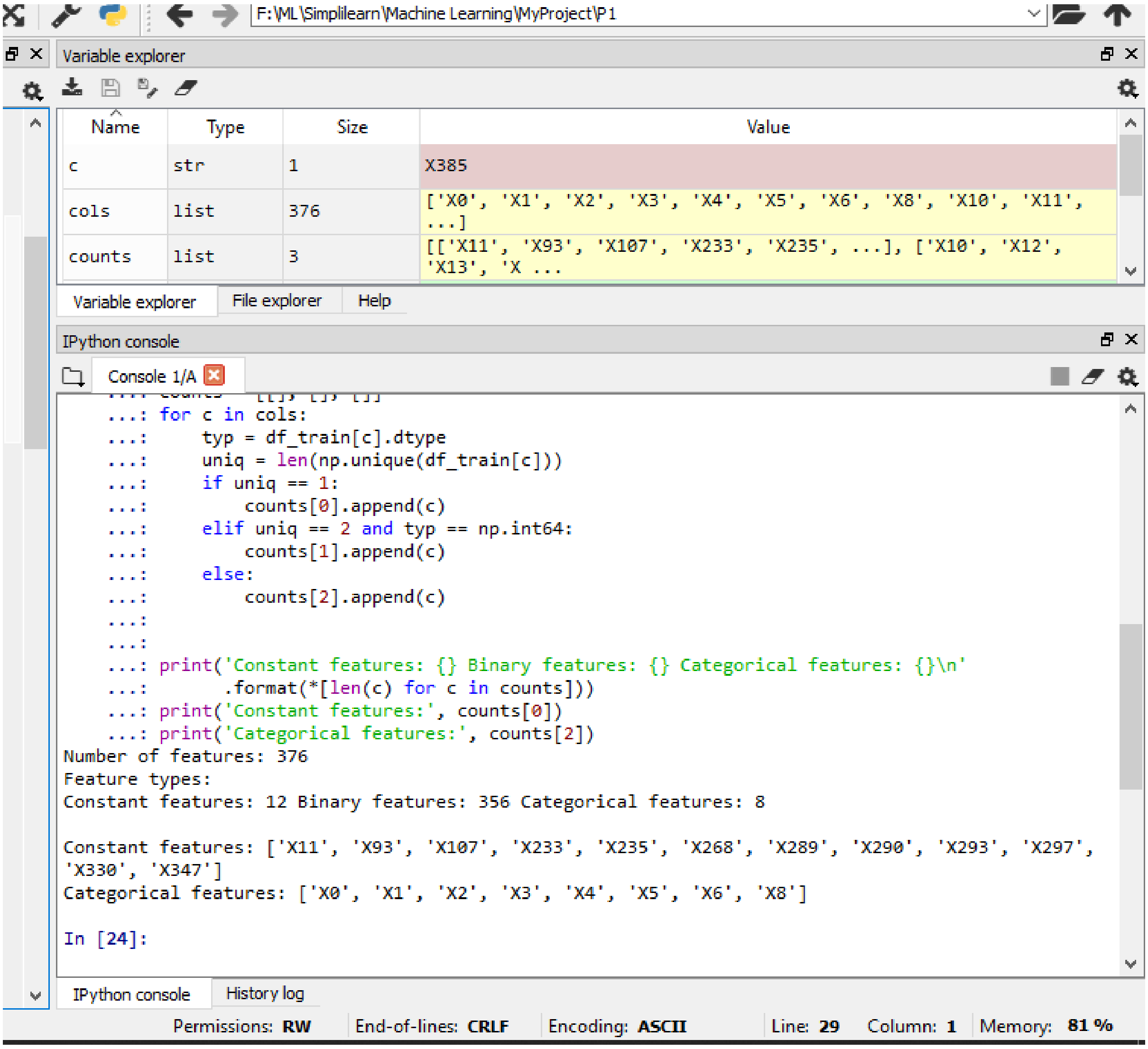


Q2. Understand the data types we have and Count the data in each of the columns

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'
```

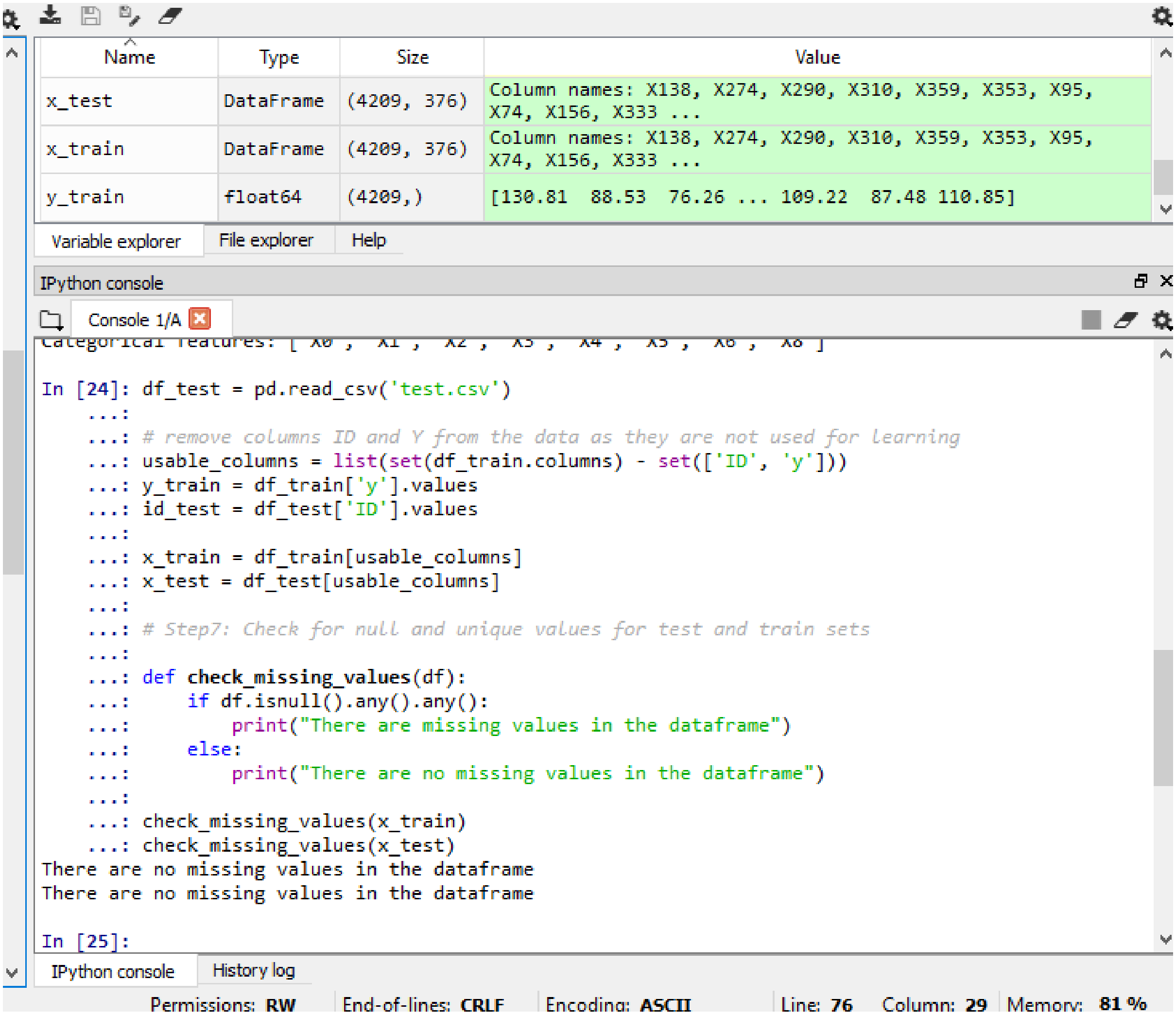
```
        .format(*[len(c) for c in counts]))
print('Constant features:', counts[0])
print('Categorical features:', counts[2])
```



Q3. Read the test.csv data and Check for null and unique values for test and train sets

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

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

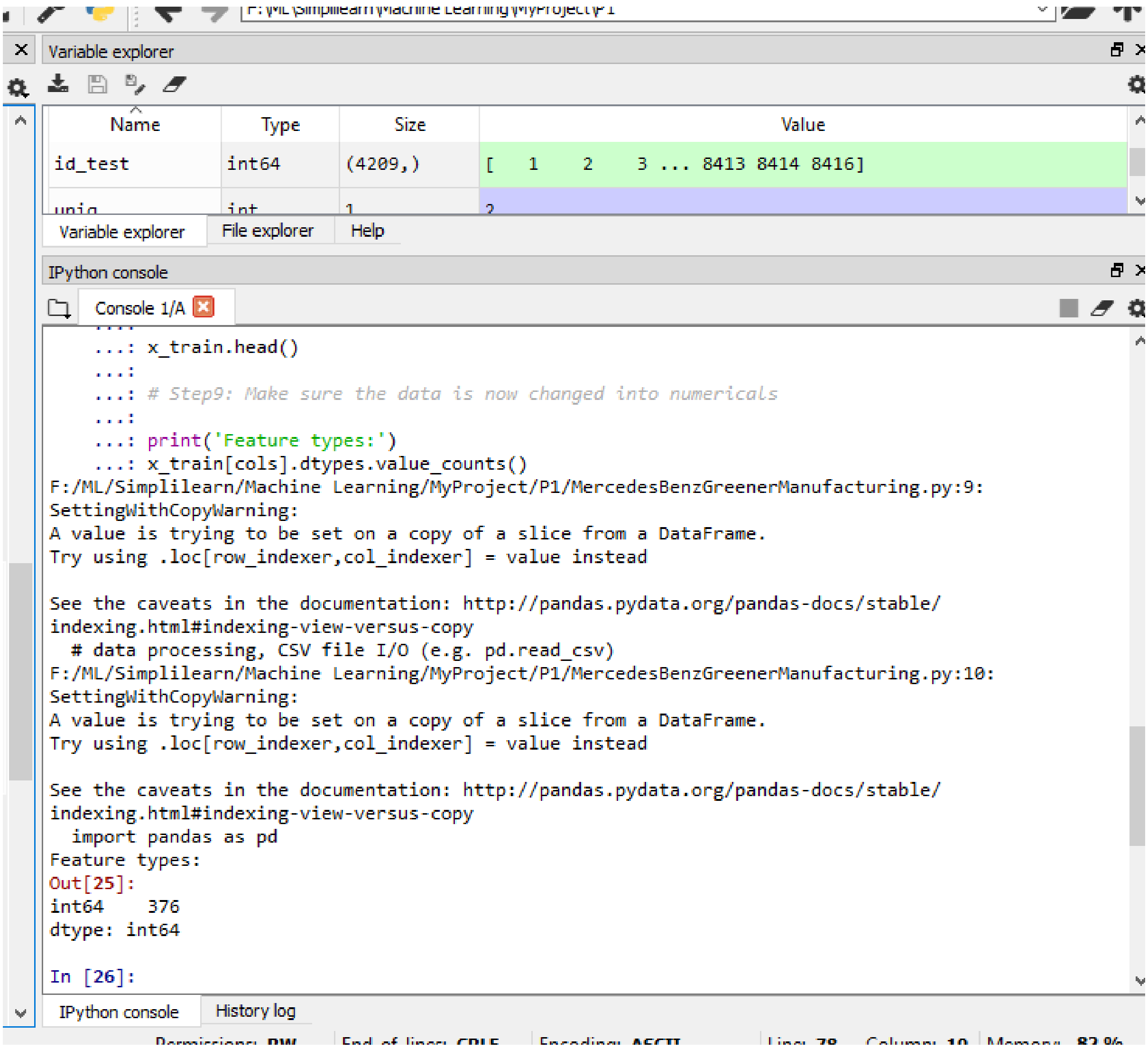
```
# remove columns ID and Y from the data as they are not used for learning
usable_columns = list(set(df_train.columns) - set(['ID', 'y']))
y_train = df_train['y'].values
id_test = df_test['ID'].values

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)
```



Q4. If for any column(s), the variance is equal to zero, then you need to remove those variable(s) and Apply label encoder

```
# 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()
```



Q5. Perform dimensionality reduction

Step10: Perform dimensionality reduction

Linear dimensionality reduction using Singular Value Decomposition of

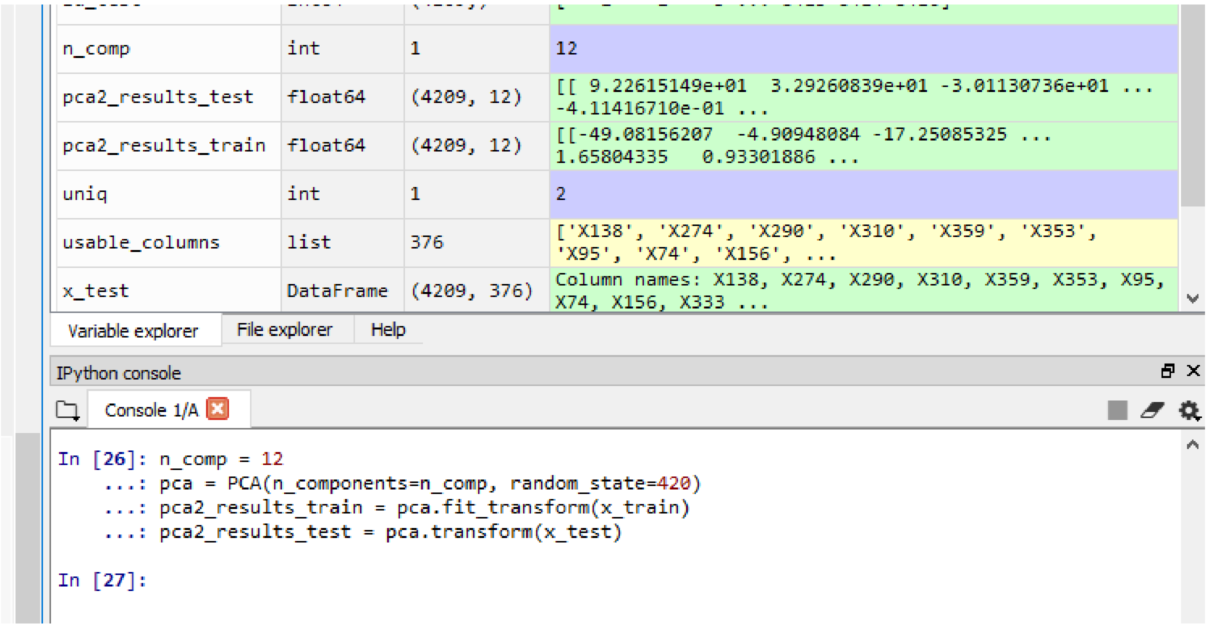
the data to project it to a lower dimensional space.

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)

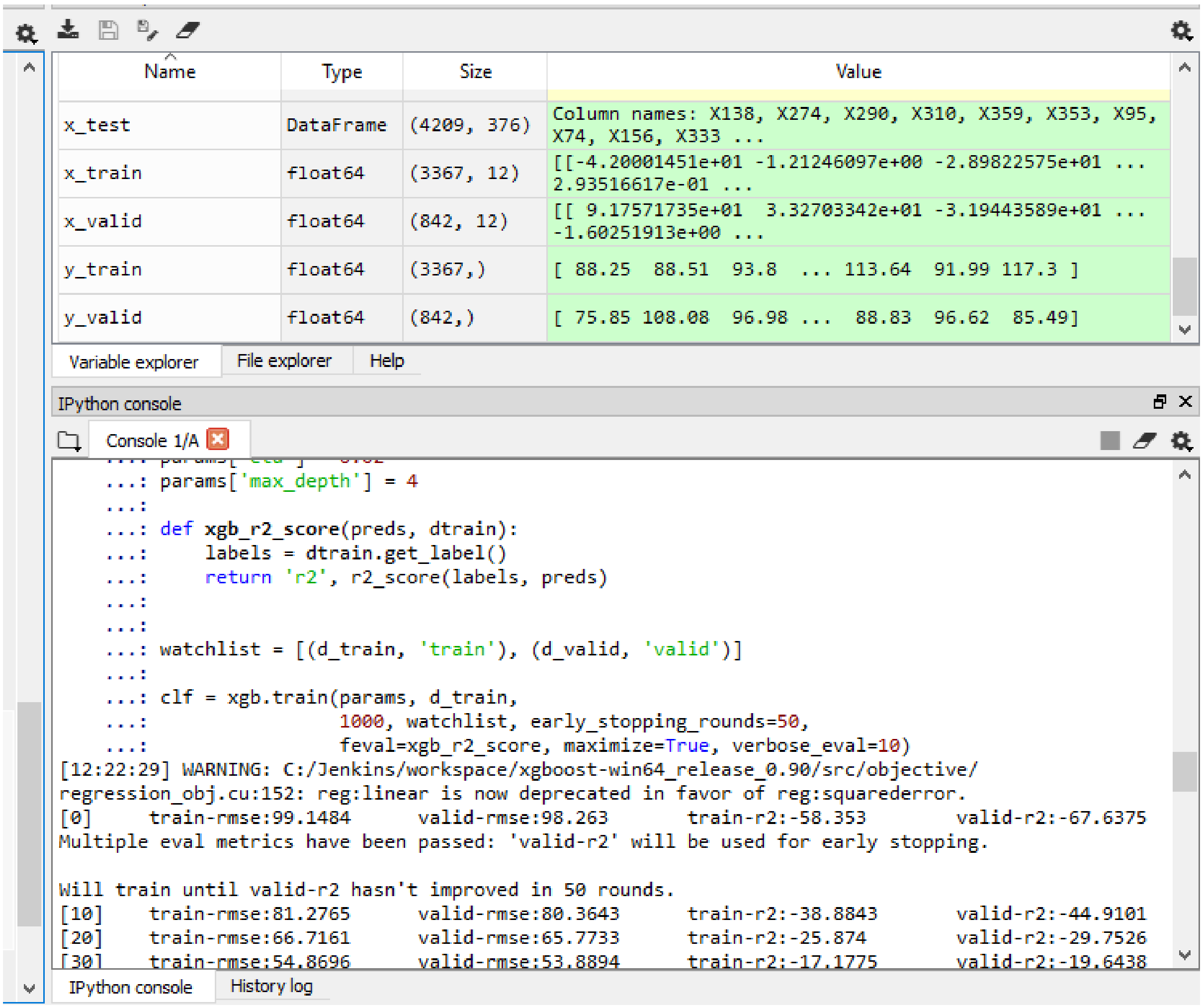


Q6. Training using xgboost

Step11: Training using xgboost

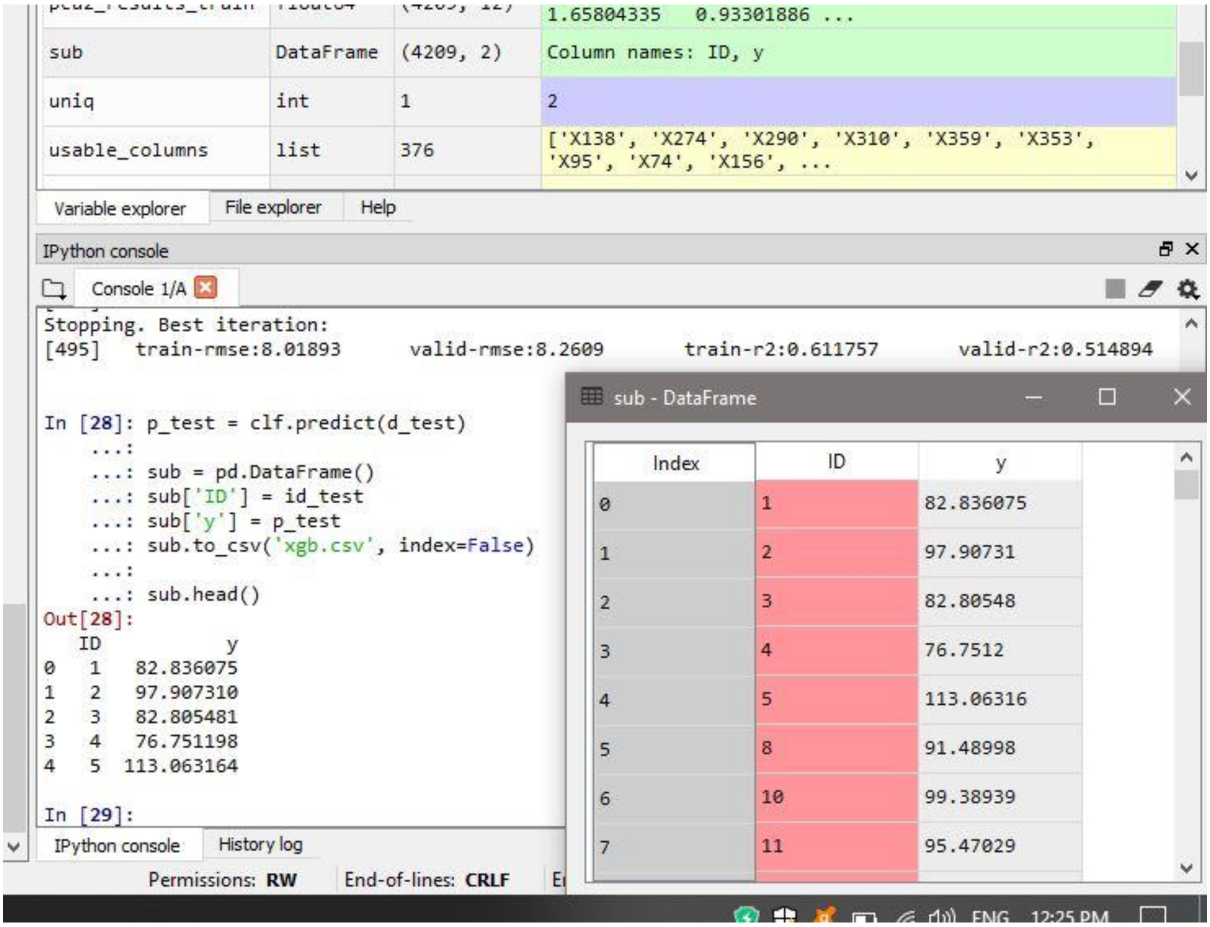
```
import xgboost as xgb
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split

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)
```



Q7. 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( )
```


1.65804335 0.93301886 ...
sub DataFrame (4209, 2) Column names: ID, y
uniq int 1 2
usable_columns list 376 ['X138', 'X274', 'X290', 'X310', 'X359', 'X353', 'X95', 'X74', 'X156', ...
Variable explorer
File explorer
Help
IPython console
Console 1/A
Stopping. Best iteration:
[495] train-rmse:8.01893 valid-rmse:8.2609 train-r2:0.611757 valid-r2:0.514894
In [28]: 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()
Out[28]:
ID y
0 1 82.836075
1 2 97.907310
2 3 82.805481
3 4 76.751198
4 5 113.063164
In [29]:
sub - DataFrame
Index ID y
0 1 82.836075
1 2 97.90731
2 3 82.80548
3 4 76.7512
4 5 113.06316
5 8 91.48998
6 10 99.38939
7 11 95.47029
IPython console
History log
Permissions: RW
End-of-lines: CRLF

*****End*****