MAHENDRA ENGINEERING COLLEGE FOR WOMEN

ASSIGNMENT-2 SOLUTION

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YEAR/DEPARTMENT:1V-ECE

```
/data/user/0/com.microsoft.office.word/app_EmailAttachments2fd50a3fd
92b-4d15-b6e3-26f436f53ac3/DOC-20220926-WA0004..pdf#libraries import
pandas as pd import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline

#load dataset
df = pd.read_csv(r"/content/Churn_Modelling.csv")

df.head(10)
```

```
 RowNumber CustomerId Surname Credi
\
0           1   15634602 Hargrave

1           2   15647311   Hill

2           3   15619304   Onio

3           4   15701354   Boni

4           5   15737888 Mitchell

5           6   15574012   Chu

6           7   15592531 Bartlett

7           8   15656148   Obinna

8           9   15792365   He

9           10  15592389   H?
```

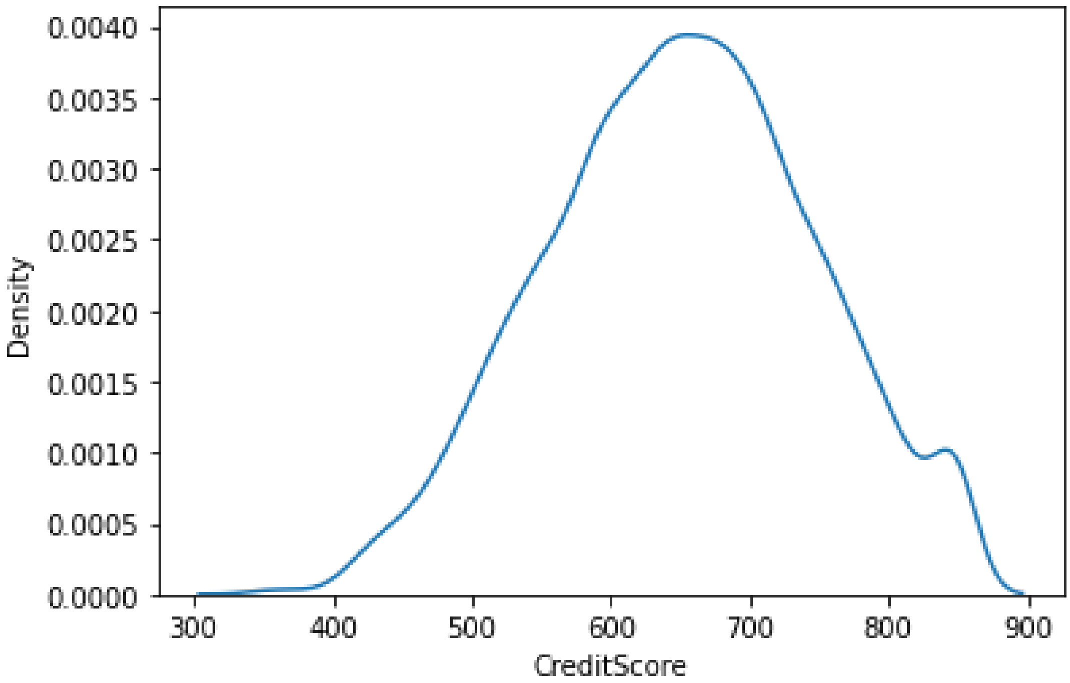
```
 3   93826.63   0
 4   79084.10   0
 5   149756.71  1
 6   10062.80   0
 7   119346.88 1 8 74940.50 0
9           71725.73       0
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count Dtype

----  --------          -----------------  -------
 0   RowNumber         10000 non-null int64
 1   CustomerId        10000 non-null int64
 2   Surname          10000 non-null  object
 3   CreditScore       10000 non-null int64
 4   Geography         10000 non-null object
 5   Gender            10000 non-null object
 6   Age               10000 non-null int64
 7   Tenure            10000 non-null int64
 8   Balance             10000 non-null float64
 9   NumOfProducts     10000 non-null int64
 10  HasCrCard         10000 non-null int64
 11  IsActiveMember 10000 non-null int64
 12  EstimatedSalary 10000 non-null  float64
 13  Exited           10000 non-null int64
dtypes: float64(2), int64(9), object(3)
memory usage: 1.1+ MB
```

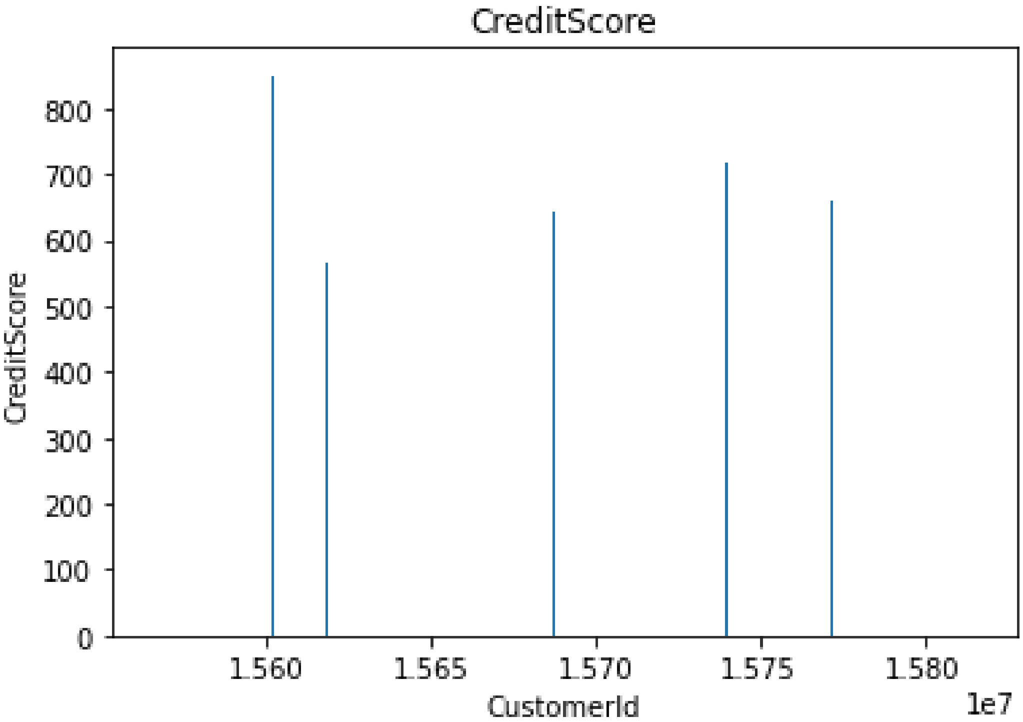
```
#Visualizations #Univariate
Analysis import seaborn as
sns
sns.kdeplot(df['CreditScore'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc4a0cd2790>
```



```
#Bi - Variate Analysis
plt.bar(df.CustomerId, df.CreditScore)
plt.title('CreditScore')
plt.xlabel('CustomerId')
plt.ylabel('CreditScore')
```

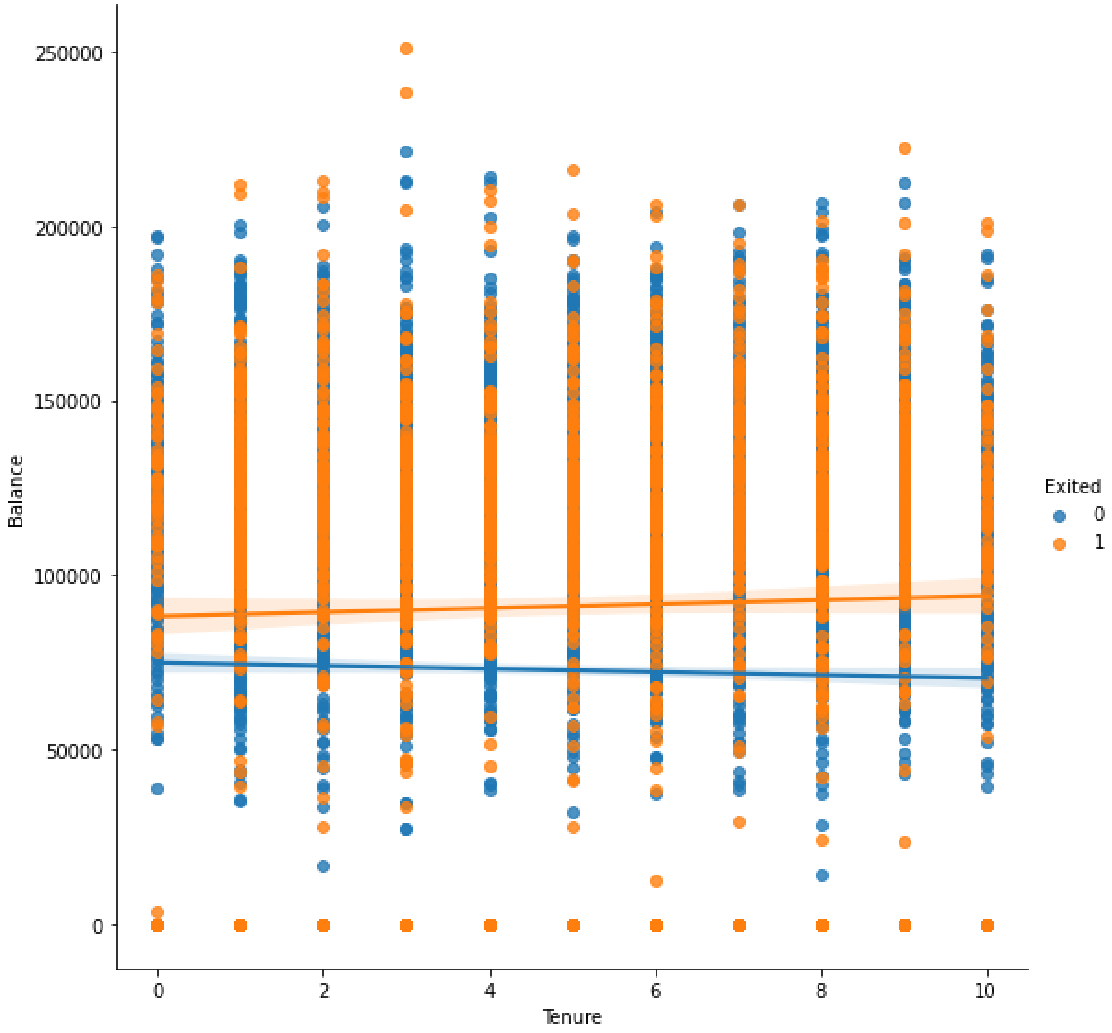
```
Text(0, 0.5, 'CreditScore')
```



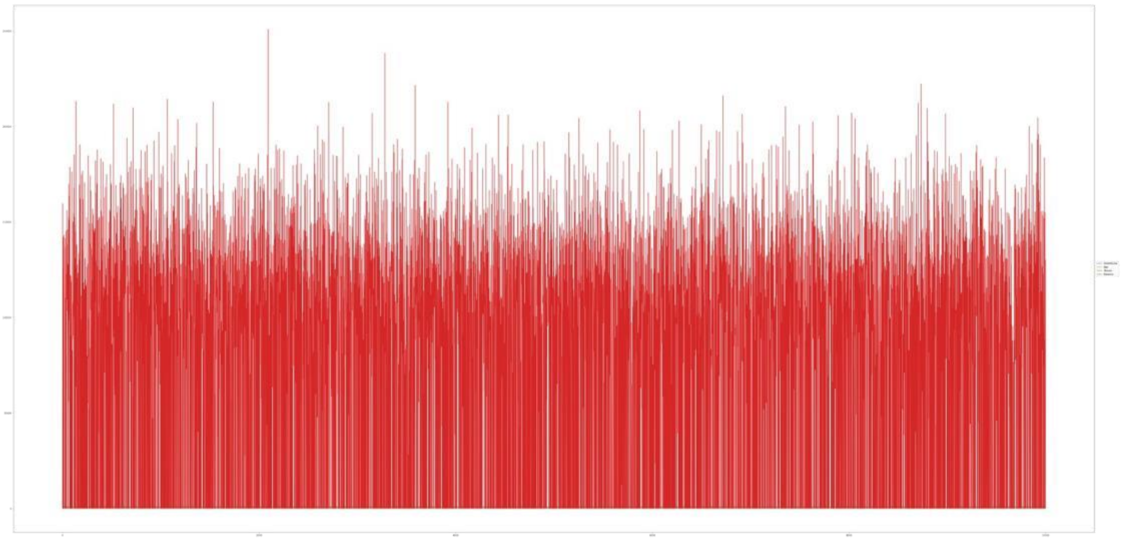
```
sns.lmplot(x='Tenure', y='Balance', data=df ,hue='Exited',size=8)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/regression.py:581:
UserWarning: The `size` parameter has been renamed to `height`;
please update your code. warnings.warn(msg, UserWarning)
```

```
<seaborn.axisgrid.FacetGrid at 0x7fc4a149e2d0>
```

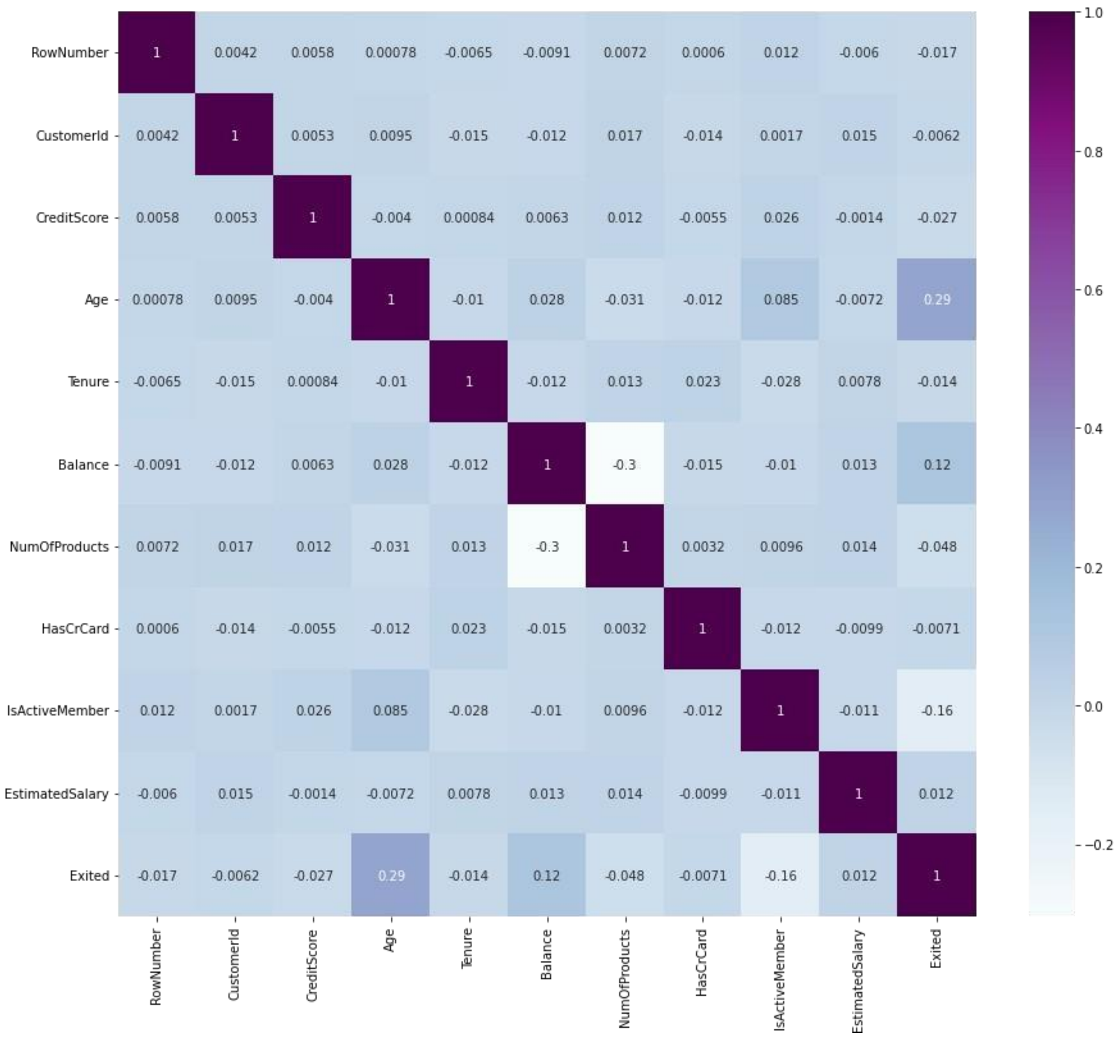


```
#Multi - Variate Analysis ax =
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40)
) ax.legend(loc='center left', bbox_to_anchor=(1, 0.5));
```



```
df.isnull().sum()

RowNumber          0

CustomerId         0

Surname            0

CreditScore        0

Geography          0

Gender             0

Age                0

Tenure             0

Balance            0

NumOfProducts      0

HasCrCard          0

IsActiveMember     0

EstimatedSalary    0

Exited             0

dtype: int64
```

```
 plt.figure(figsize=(15,13))
 sns.heatmap(df.corr(),annot=True,cmap='BuPu')
 plt.show()
```



```
df.drop(['RowNumber', 'CustomerId','Surname'],axis=1,inplace=True)
```

```
df.head()
```

```
   CreditScore Geography Gender Age Tenure     Balance NumOfProducts
\
0          619    France Female   42       2        0.00

1
1          608     Spain Female   41       1 83807.86

1
2          502    France Female   42       8 159660.80

3
3          699    France Female   39       1        0.00

2
```

```
4          850     Spain Female    43       2 125510.82

1

   HasCrCard IsActiveMember EstimatedSalary Exited 0  1
    1     101348.88  1
1     0     1     112542.58                         0
2     1     0     113931.57 3      0     0            1
     93826.63                                       0
4          1              1         79084.10        0
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 11 columns):
# Column                Non-Null Count Dtype
----  --------          ----------------  -------
 0   CreditScore      10000 non-null int64
 1   Geography  10000 non-null object
 2   Gender     10000 non-null object
 3   Age   10000 non-null int64
 4   Tenure     10000 non-null int64
 5   Balance    10000 non-null float64
 6   NumOfProducts    10000 non-null int64
 7   HasCrCard  10000 non-null int64
 8   IsActiveMember 10000 non-null int64
 9   EstimatedSalary 10000 non-null  float64
 10  Exited     10000 non-null int64
dtypes: float64(2), int64(7), object(2)
memory usage: 859.5+ KB
df["Geography"].unique() array(['France', 'Spain',

'Germany'], dtype=object) df["Gender"].unique()

array(['Female', 'Male'], dtype=object)

geo=pd.get_dummies(df["Geography"],drop_first=False

) geo.head()
```

```
   France Germany Spain
0       1       0     0
1       0       0     1
2       1       0     0
3       1       0     0
```

```
4       0       0     1

gen=pd.get_dummies(df["Gender"],drop_first=False

) df=pd.concat([df, geo,gen], axis=1) df

       CreditScore Geography Gender Age Tenure      Balance
NumOfProducts \
 0



             619      France Female 42         2       0.00
1
 1           608    Spain Female 41  1 83807.86
1
 2           502    France Female 42      8 159660.80
3
 3           699    France Female 39      1     0.00
2
4            850       Spain Female 43         2 125510.82
 1

 ...           ...        ...      ... ...      ...         ...

 ...

 9995          771   France     Male   39       5       0.00

 2

 9996          516   France     Male   35      10   57369.61

 1

 9997          709    France Female    36       7       0.00

 1

 9998          772   Germany    Male   42       3   75075.31

 2

9999           792      France Female 28         4 130142.79
1


      HasCrCard IsActiveMember EstimatedSalary Exited France
 Germany \
0            1  1     101

0

1            0  1     112

0

2            1  0     113

0

3            0  0     93
```

```
 1



0

4          1  1    79

0

...        ...          ...

...

9995       1  0    96

0

9996       1  1    101

0

 1       1   0
 2       0   1    0
 3       0   1    0
 4       1   1    0
...     ...     ... ...
 9995    0   0    1
 9996    0   0    1
 9997    0   1    0
 9998    0   0    1
 9999    0   1    0

 [10000      rows      x      16      columns]
```

```
df.drop(["Geography","Gender"], axis=1, inplace=True)

df.head()
```

```
    CreditScore Age Tenure      Balance NumOfProducts HasCrCard \
 0          619 42    2     0.00      1     1
 1          608 41    1 83807.86      1     0
 2          502 42    8 159660.80     3     1
 3          699 39    1    0.00  2     0
 4          850 43    2 125510.82     1     1

   IsActiveMember EstimatedSalary Exited France Germany Spain
 Female \
 0              1    101348.88  1     1     0     0
 2


1
 1               1    112542.58  0     0     0     1
1
 2               0    113931.57  1     1     0     0
1
 3               0    93826.63   0     1     0     0
1
 4               1    79084.10   0     0     0     1
1

  Male
 0                                                                      6
 1                                                                      0
 2                                                                      0
 3                                                                      3
 4                                                                      3
```

```
x=df.drop('Exited',axis=1)
```

```
x
```

```
 CreditScore Age Tenure    Balance 0  619
 42  2     0.00 502 42      8 159660.80
    3     1
 3             699 39       1     0.00  2     0
 4             850 43       2 125510.82      1     1
... ... ... ... ... ... ...
 9995          771 39 5 0.00 2 1
 9996          516 35       10 57369.61      1     1
 9997          709 36       7     0.00  1     0
 9998          772 42       3 75075.31       2     1
 9999          792 28       4 130142.79      1     1

           IsActiveMember EstimatedSalary France Germany Spain Female
 Male
 0                  1      101348.88  1     0     0     1
0
 1                  1      112542.58  0     0     1     1
0
 2                  0      113931.57  1     0     0     1
0
```

```
 3



 3                  0      93826.63   1     0     0     1
0
 4                  1      79084.10   0     0     1     1
0
...               ...               ...     ...      ...    ...     ...
...
 9995               0      96270.64   1     0     0     0
1
 9996               1      101699.77  1     0     0     0
1
 9997               1      42085.58   1     0     0     1
0
 9998               0      92888.52   0     1     0     0
1
 9999               0      38190.78   1     0     0     1
0

 [10000 rows x 13 columns]
```

```
 y=df['Exited']
```

```
 y
```

```
 0       1
 1       0
 2       1
 3       0
 4       0
        ..
 9995    0
 9996    0
 9997    1
 9998    1
```

```
9999    0
Name: Exited, Length: 10000, dtype: int64

df.shape (10000, 14)

x.shape

(10000, 13)

y.shape (10000,) from sklearn.model_selection

import train_test_split

x_train,x_test, y_train,y_test =

train_test_split(x,y, test_size=0.2,random_state=0)

x_train.shape (8000, 13) x_test.shape (2000, 13)

y_test.shape (2000,) from sklearn.preprocessing

import StandardScaler sc = StandardScaler() x_train =

sc.fit_transform(x_train) x_train

array([[ 0.16958176, -0.46460796, 0.00666099, ..., 1.74309049,
         1.09168714, -1.09168714],
       [-2.30455945, 0.30102557, -1.37744033, ..., -0.57369368,
        -0.91601335, 0.91601335],
       [-1.19119591, -0.94312892, -1.031415 , ..., -0.57369368,
         1.09168714, -1.09168714],
       ...,
       [ 0.9015152 , -0.36890377, 0.00666099, ..., -0.57369368,
        -0.91601335, 0.91601335],
       [-0.62420521, -0.08179119, 1.39076231, ..., 1.74309049,
         1.09168714, -1.09168714],
       [-0.28401079, 0.87525072, -1.37744033, ..., -0.57369368,
         1.09168714, -1.09168714]])

x_test = sc.transform(x_test)
x_test

array([[-0.55204276, -0.36890377, 1.04473698, ..., -0.57369368,
         1.09168714, -1.09168714],
       [-1.31490297, 0.10961719, -1.031415 , ..., -0.57369368,
         1.09168714, -1.09168714],
       [ 0.57162971, 0.30102557, 1.04473698, ..., 1.74309049,
         1.09168714, -1.09168714],
       ...,
       [-0.74791227, -0.27319958, -1.37744033, ..., 1.74309049,
        -0.91601335, 0.91601335],
[-0.00566991, -0.46460796, -0.33936434, ..., -0.57369368,
 -0.91601335, 0.91601335],
[-0.79945688, -0.84742473, 1.04473698, ..., -0.57369368,
 -0.91601335, 0.91601335]])
```