ASSIGNMENT 2

MAHENDRA ENGINEERING COLLEGE FOR WOMEN

NAME:ARCHANA.S

CLASS: 4 YEAR ECE

SUBJECT:IBM

REGISTER NO:611419106011

```
#libraries
import pandas as
pdimport numpy as
np
import matplotlib.pyplot as plt
%matplotlib inline
```

```
#load dataset
```

\	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age
0	1	15634602	Hargrave	619	France	Female	42
1	2	15647311	Hill	608	Spain	Female	41
2	3	15619304	Onio	502	France	Female	42

		04					
3	4	15701354	Boni	699	France	Female	39
4	5	15737888	Mitchell	850	Spain	Female	43
5	6	15574012	Chu	645	Spain	Male	44
6	7	15592531	Bartlett	822	France	Male	50
7	8	15656148	Obinna	376	Germany	Female	29
8	9	15792365	He	501	France	Male	44

		65					
9	10	15592389	H?	684	France	Male	27

	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\
0	2	0.00	1	1	1	
1	1	83807.86	1	0	1	
2	8	159660.80	3	1	0	
3	1	0.00	2	0	0	
4	2	125510.82	1	1	1	
5	8	113755.78	2	1	0	
6	7	0.00	2	1	1	
7	4	115046.74	4	1	0	
8	4	142051.07	2	0	1	

9	2	134603.88	1	1	1	

	EstimatedSalary	Exited
0	101348.88	1
1	112542.58	0
2	113931.57	1

```
df = pd.read_csv(r"/content/Churn_Modelling.csv")

df.head(10)
```

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 df.info()	71725.73	0

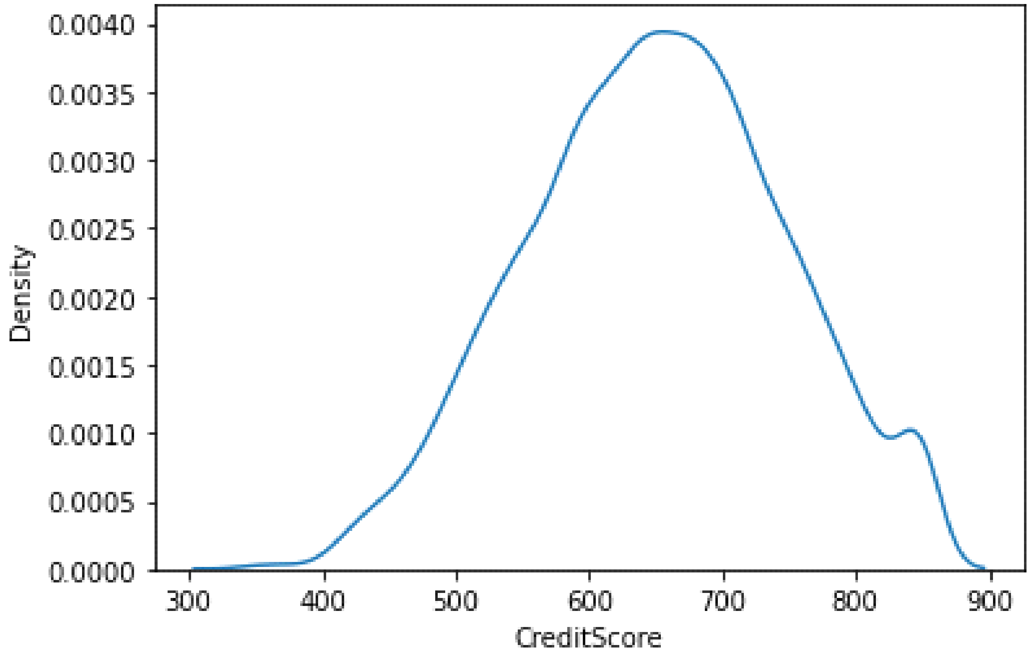
```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to
9999 Data columns (total 14
columns):
 #   Column           Non-Null Count  Dtype

 •   RowNumber        10000 non-null  int64
 •   CustomerId       10000 non-null  int64
 •   Surname          10000 non-null  object
 •   CreditScore      10000 non-null  int64
 •   Geography        10000 non-null  object
 •   Gender           10000 non-null  object
 •   Age              10000 non-null  int64
 •   Tenure           10000 non-null  int64
 •   Balance          10000 non-null  float64
 •   NumOfProducts    10000 non-null  int64
 •   HasCrCard        10000 non-null  int64
 •   IsActiveMember   10000 non-null  int64
 •   EstimatedSalary  10000 non-null  float64
 •   Exited           10000 non-null
int64dtypes: float64(2), int64(9),
object(3) memory usage: 1.1+ MB
```

```
#Visualizations
#Univariate
Analysis import
seaborn as sns
```

```
sns.kdeplot(df['CreditScore'])
```

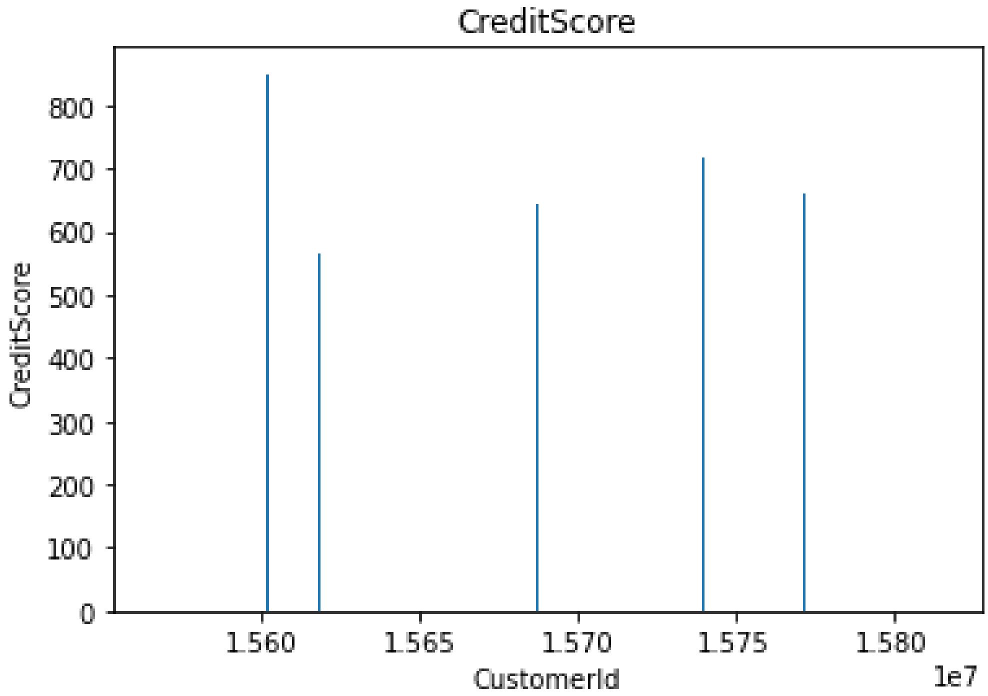
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc4a0cd2790>
```



```
#Bi - Variate Analysis

plt.bar(df.CustomerId,
df.CreditScore)
plt.title('CreditScore')
plt.xlabel('CustomerId')
plt.ylabel('CreditScore')
```

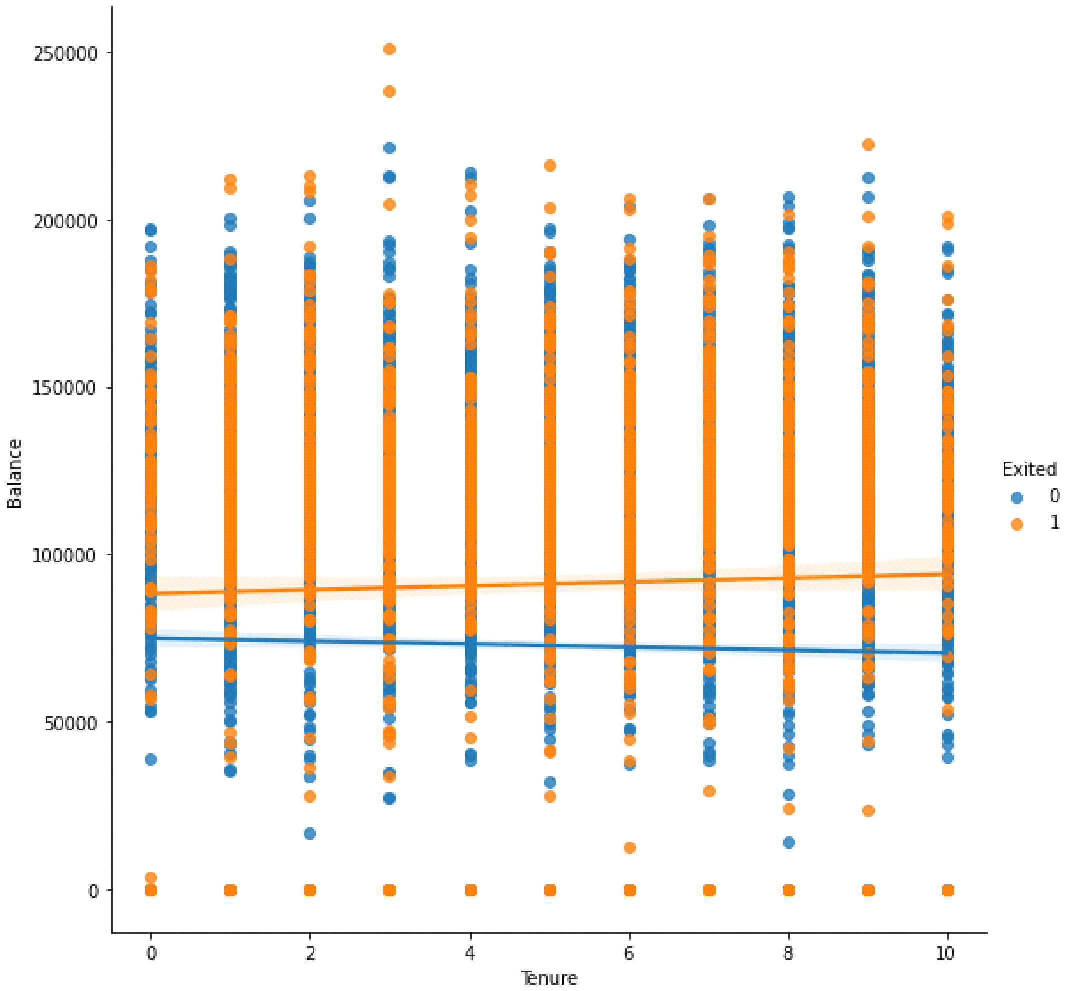
```
Text(0, 0.5, 'CreditScore')
```



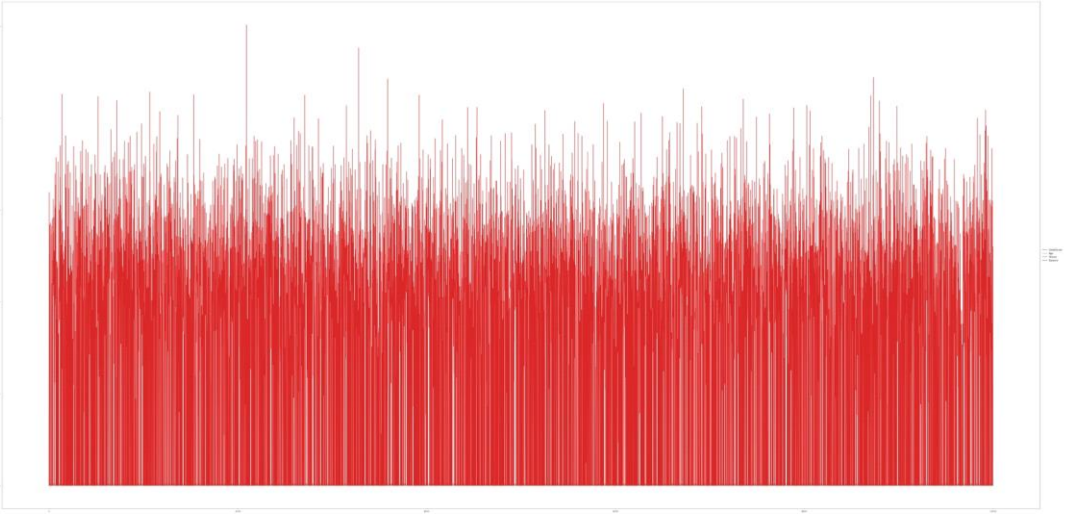
```
sns.lmplot(x='Tenure', y='Balance', data=df ,hue='Exited',size=8)
```

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

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



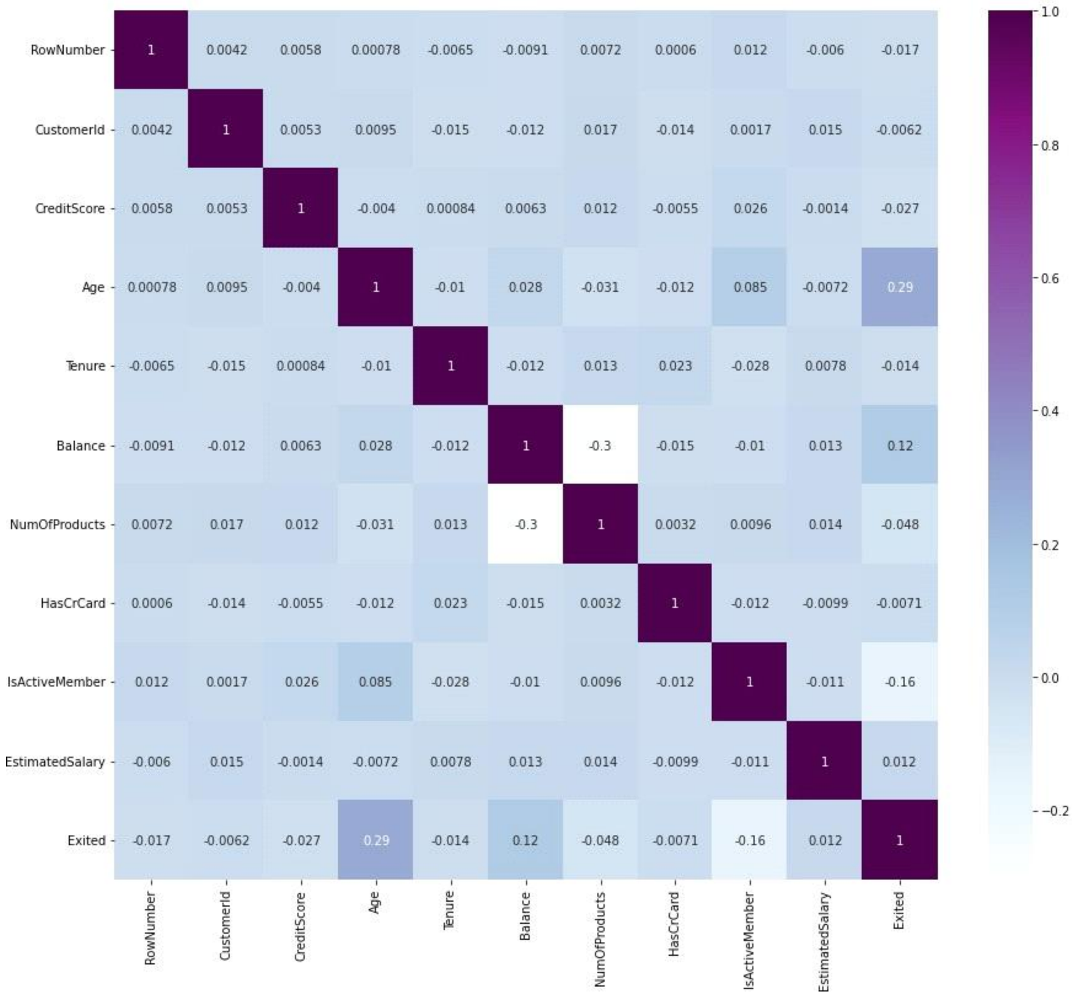
```
#Multi - Variate Analysis
ax =
df[["CreditScore","Age","Tenure","Balance"]].plot(figsize=(80,40)
)ax.legend(loc='center left', bbox_to_anchor=(1, 0.5));
```



```
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 NumOfProducts		Geography \	Gender	Age	Tenure	Balance
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
Exited0     1                 1        101348.88        1
```

1	0	1	112542.58	0
2	1	0	113931.57	1
3	0	0	93826.63	0
4 df.info()	1	1	79084.10	0

```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to
9999 Data columns (total 11
columns):
 #   Column           Non-Null Count  Dtype
 •   CreditScore      10000 non-null  int64
 •   Geography        10000 non-null  object
 •   Gender           10000 non-null  object
 •   Age              10000 non-null  int64
 •   Tenure           10000 non-null  int64
 •   Balance          10000 non-null  float64
 •   NumOfProducts    10000 non-null  int64
 •   HasCrCard        10000 non-null  int64
 •   IsActiveMember   10000 non-null  int64
 •   EstimatedSalary  10000 non-null  float64
 •   Exited           10000 non-null
int64dtypes: 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
Spain0  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
                                                    Balan
ceNumOfProducts \
```

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						

0	1		1013 48.88	1	1
0					
1	0		1125 42.58	0	0
0					
2	1		1139 31.57	1	1
0					
3	0		9382 6.63	0	1
0					
4	1		7908 4.10	0	0
0 9995	. .. 1	. ..	.. . 96270.6 4	. ..	. .. 1

0					
9 996	1		1016 99.77	0	1
0					
9 997	0		4208 5.58	1	1
0					
9 998	1		9288 8.52	1	0
1					
9 999	1		3819 0.78	0	1
0					
0	pain	F emale 1	M ale 0		

```
      HasCrCard IsActiveMember EstimatedSalary Exited France
Germany \
```

1	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	101 348	1	1	0	0

			.88				
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	0
1	0
2	0
3	0
4	0

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	\
0	619	42	2	0.00	1	1	
1	608	41	1	83807.86	1	0	

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

1)x
```

2	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

Male	IsActiveMember	EstimatedSalary	France	Germany	Spain	Female
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	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:

int64df.shape

(10000, 14)

x.shape

(10000, 13)

y.shap

e

(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.sha

pe(8000,

13)

x_test.sha

pe(2000,

13)

y_test.sha

pe(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,
```