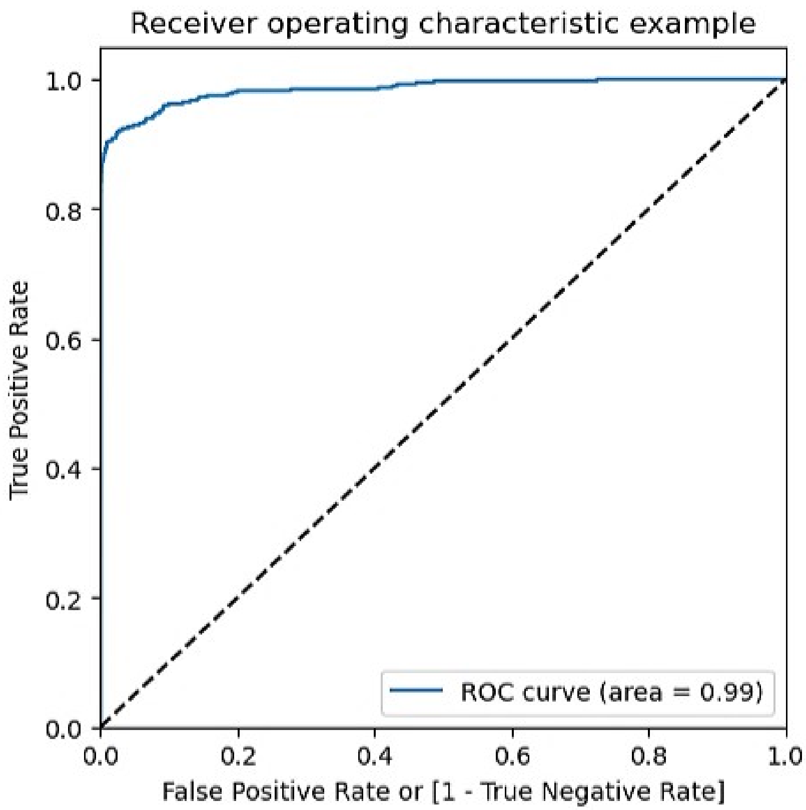
jupyter Credit_Card_Sayali Last Checkpoint: 20 minutes ago

File Edit View Run Kernel Settings Help   Not Trusted

Code   JupyterLab   Python 3 (ipykernel)

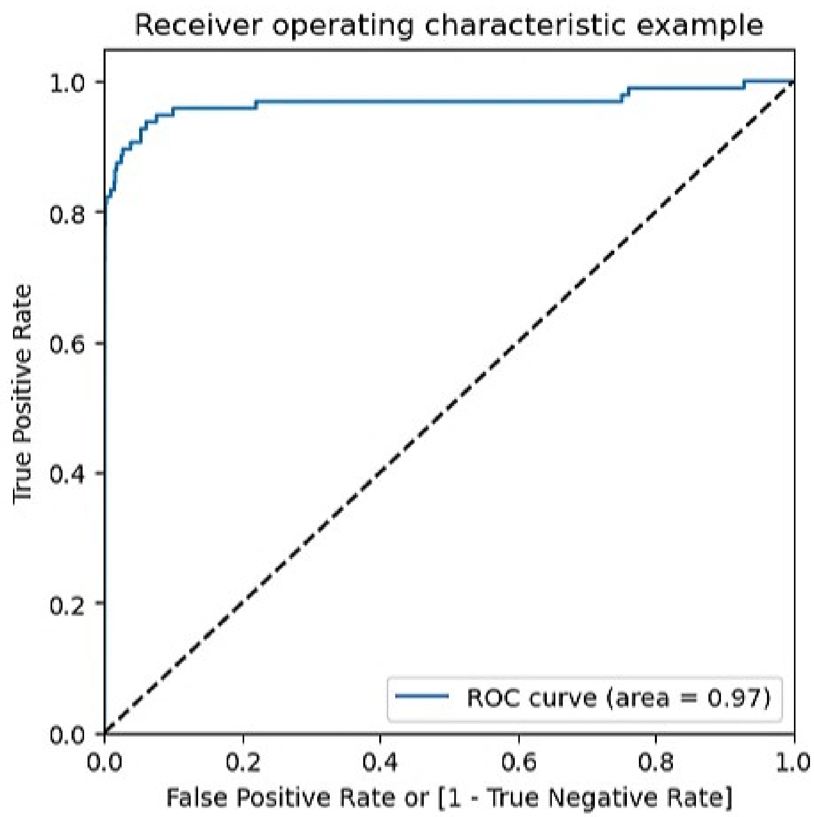
```
draw_roc(y_train, y_train_pred_proba)
```



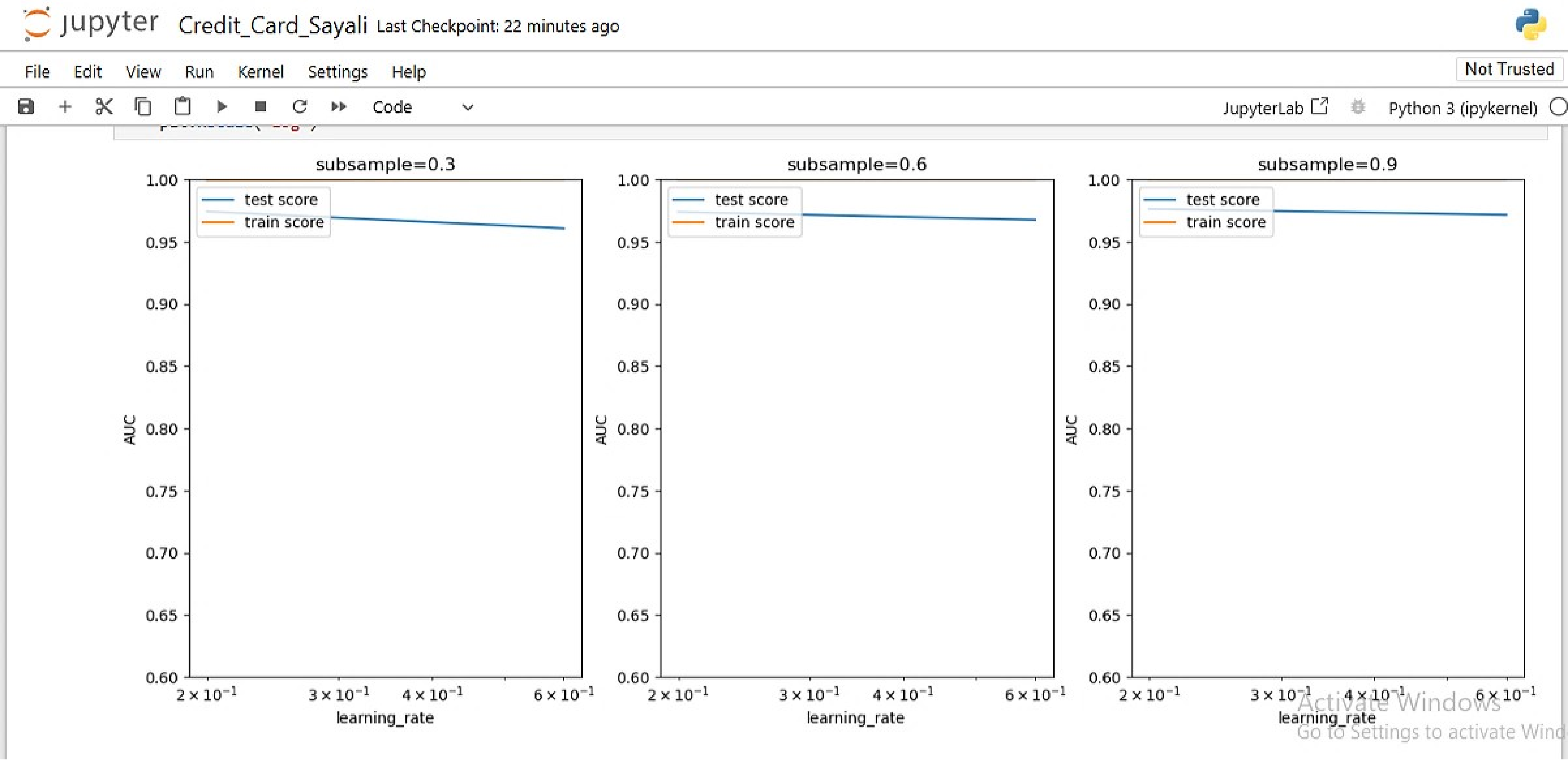
jupyter Credit_Card_Sayali Last Checkpoint: 21 minutes ago

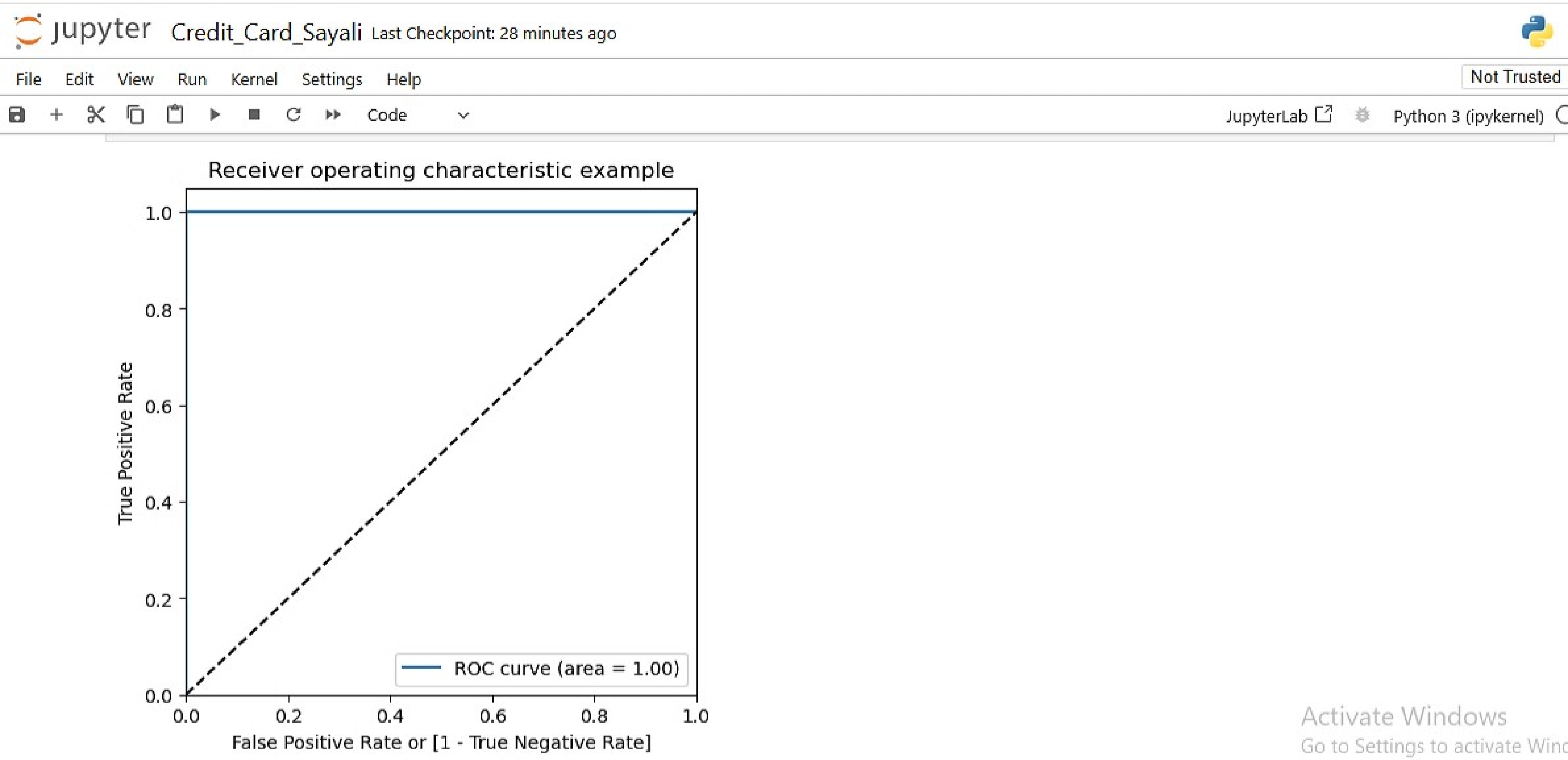
File Edit View Run Kernel Settings Help Not Trusted

Code JupyterLab Python 3 (ipykernel)

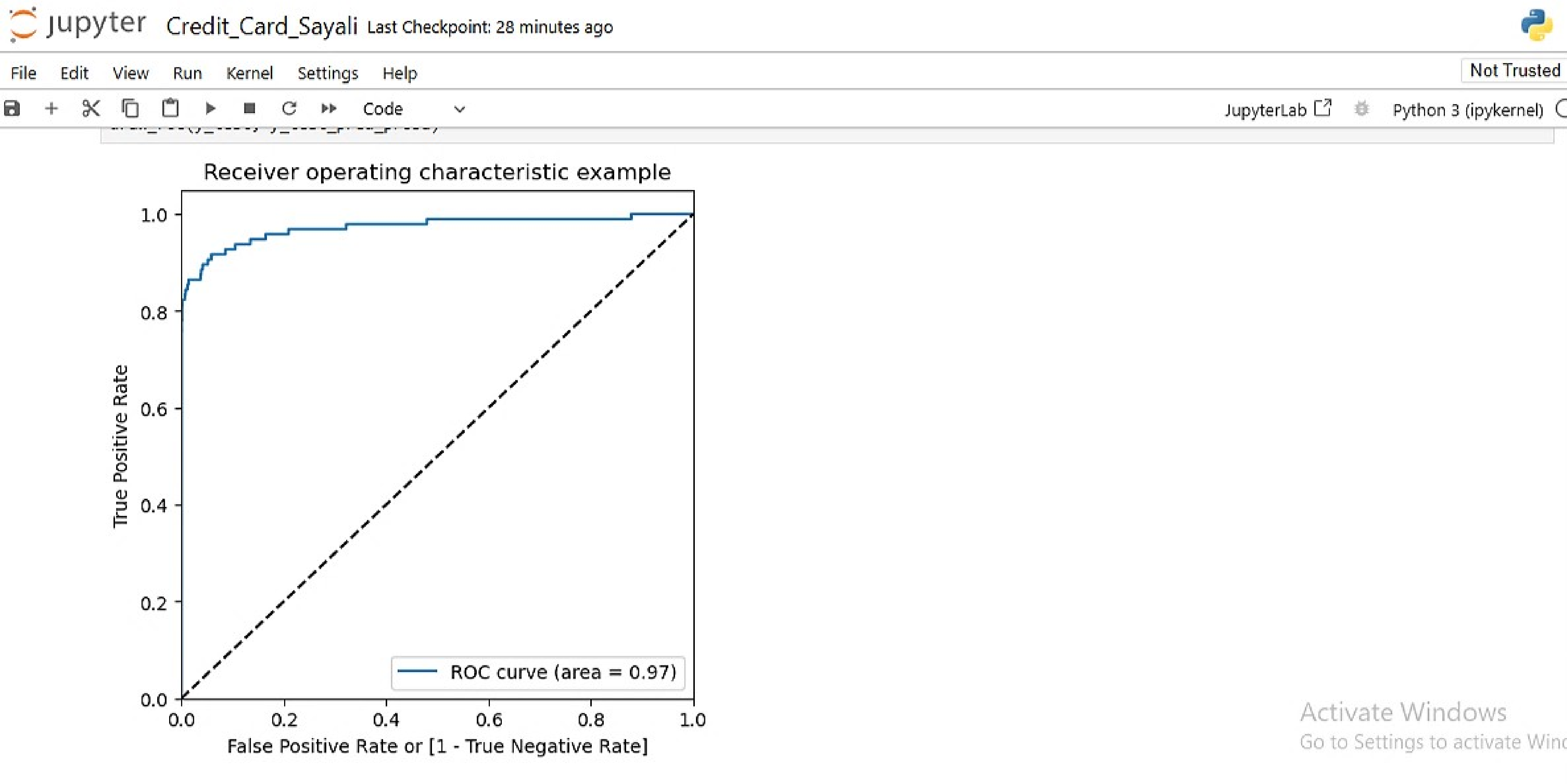


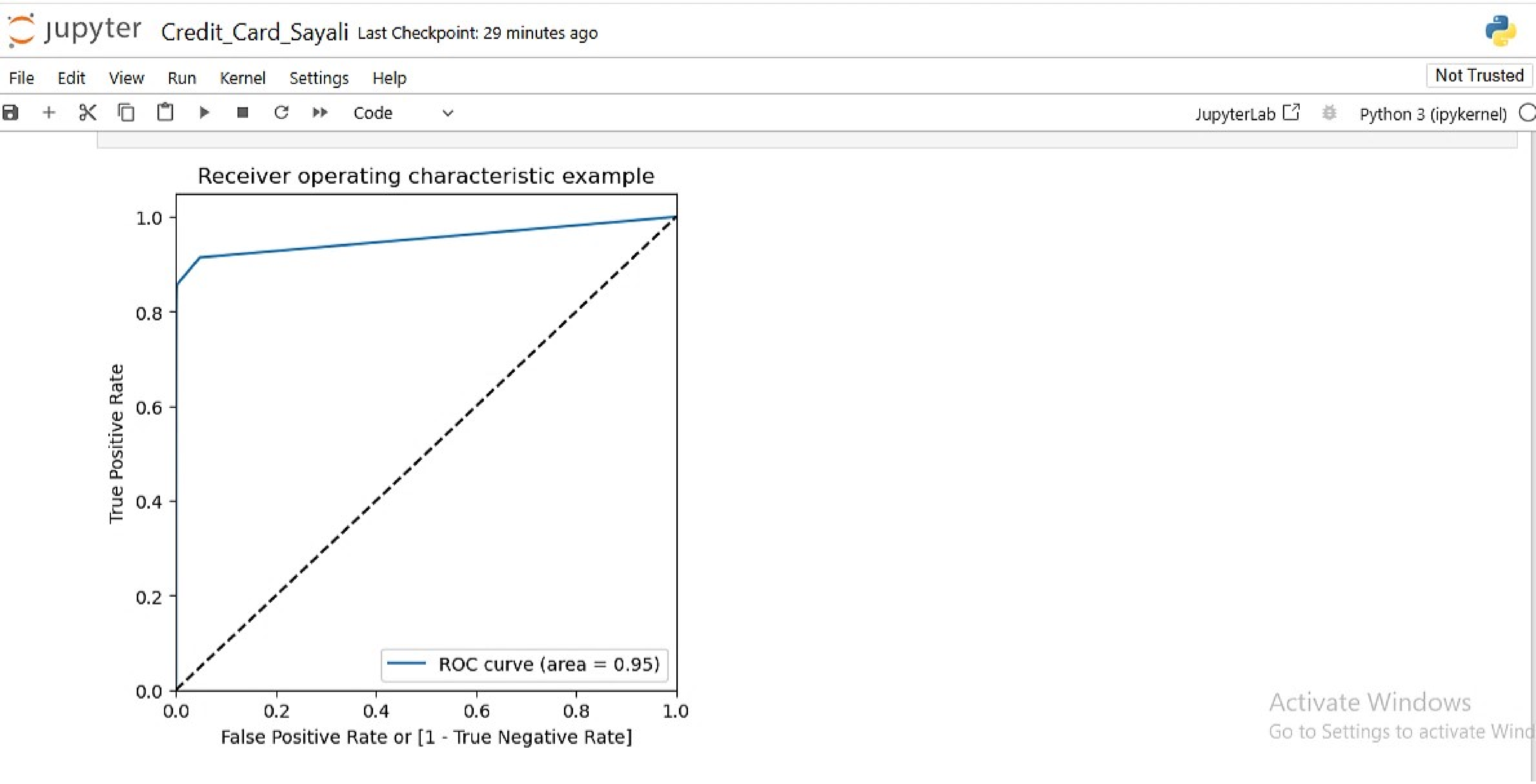
We can see that we have very good ROC on the test set 0.97, which is almost close to 1.

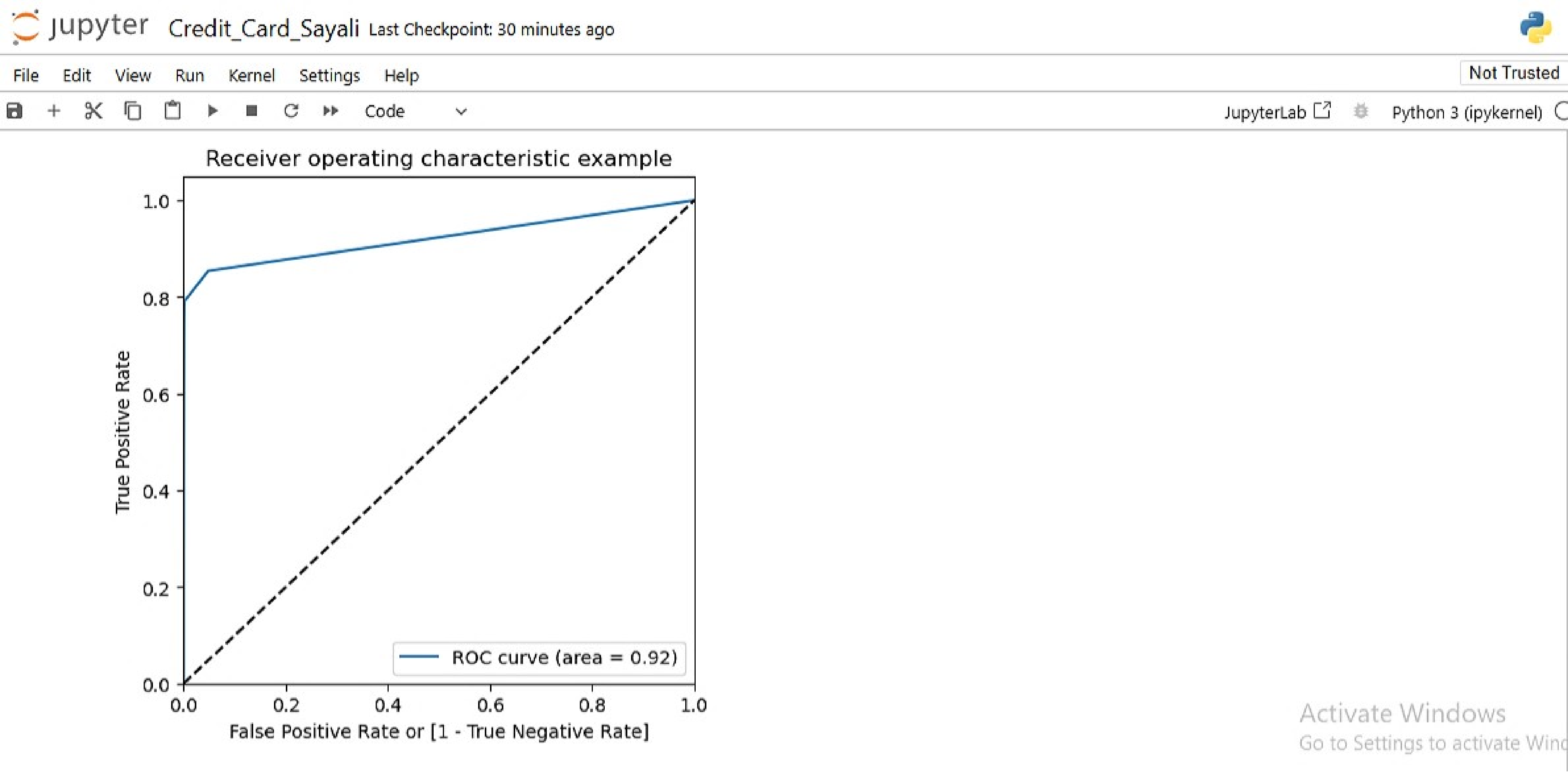

jupyter
Credit_Card_Sayali Last Checkpoint: 22 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
subsample=0.3
subsample=0.6
subsample=0.9
test score
train score
AUC
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
2×10^{-1}
3×10^{-1}
4×10^{-1}
6×10^{-1}
learning_rate
Activate Windows
Go to Settings to activate Windows

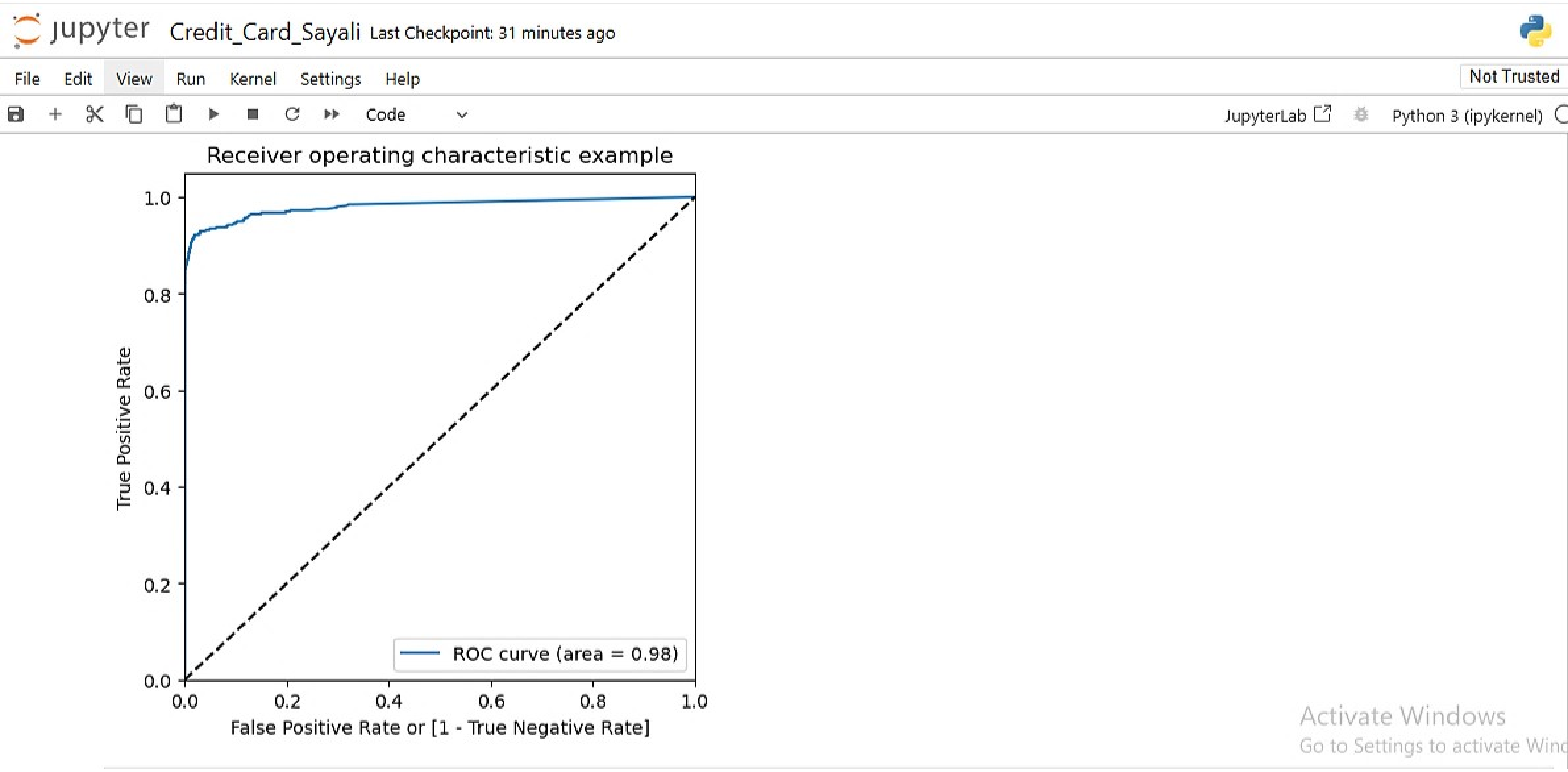


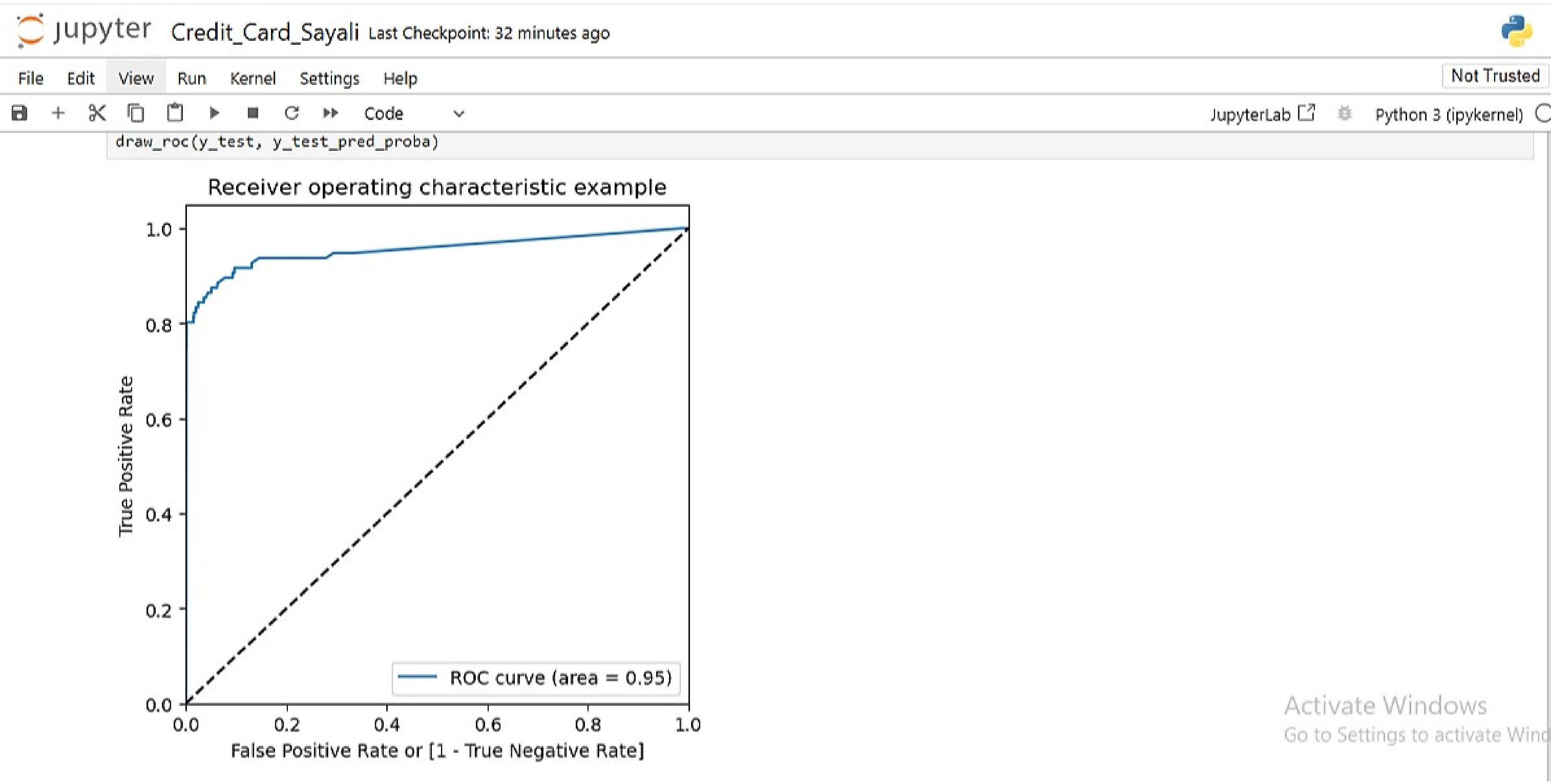
jupyter Credit_Card_Sayali Last Checkpoint: 28 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 1.00)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows

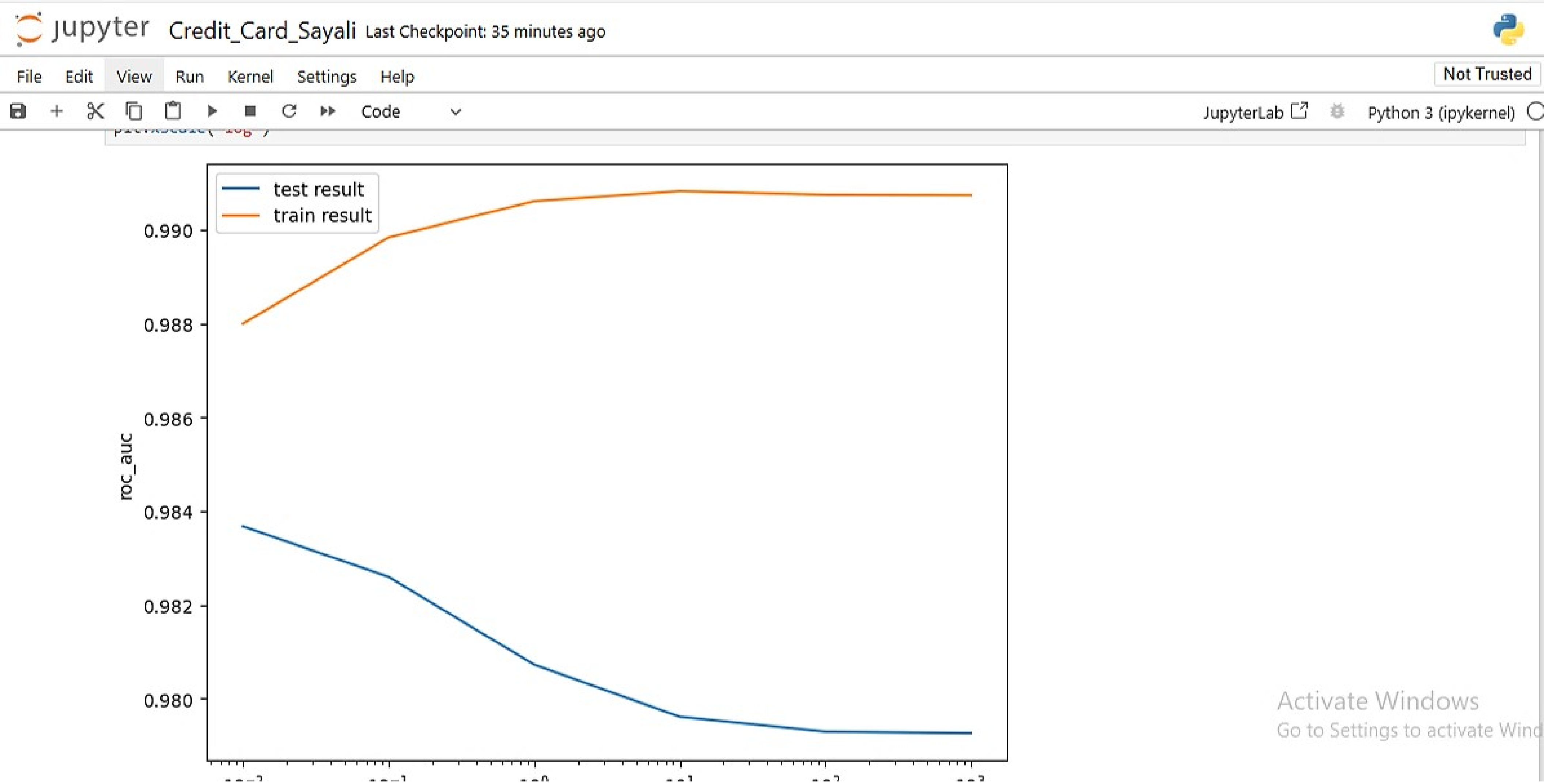

jupyter
Credit_Card_Sayali
Last Checkpoint: 28 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows


jupyter
Credit_Card_Sayali Last Checkpoint: 29 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.95)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

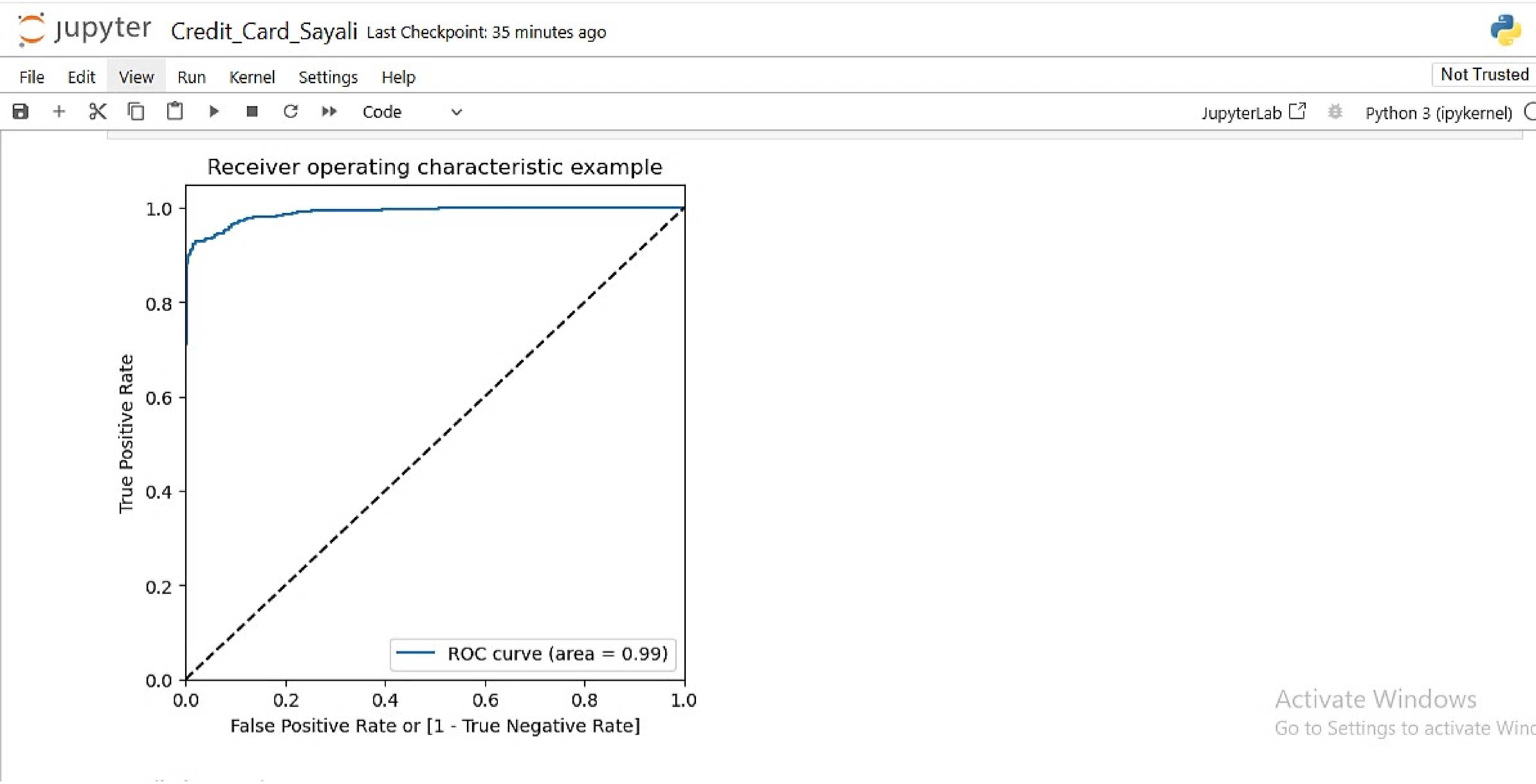

jupyter
Credit_Card_Sayali
Last Checkpoint: 30 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
0.0
0.2
0.4
0.6
0.8
1.0
ROC curve (area = 0.92)
Activate Windows
Go to Settings to activate Wind

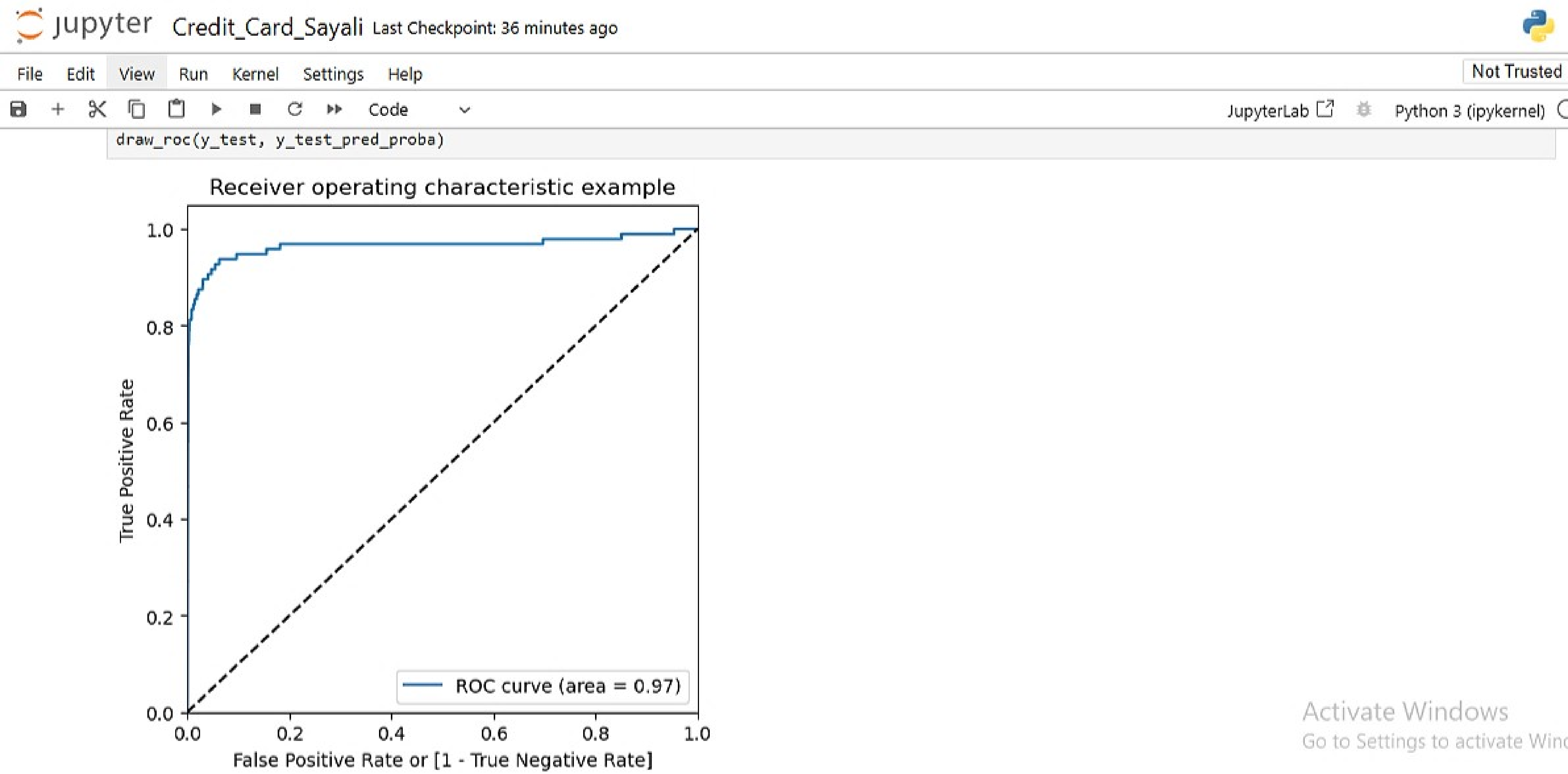

jupyter
Credit_Card_Sayali
Last Checkpoint: 31 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.98)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind


jupyter Credit_Card_Sayali Last Checkpoint: 32 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.95)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind



jupyter Credit_Card_Sayali Last Checkpoint: 35 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
test result
train result
roc_auc
0.990
0.988
0.986
0.984
0.982
0.980
Activate Windows


jupyter
Credit_Card_Sayali
Last Checkpoint: 35 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
ROC curve (area = 0.99)
False Positive Rate or [1 - True Negative Rate]
Activate Windows
Go to Settings to activate Winc



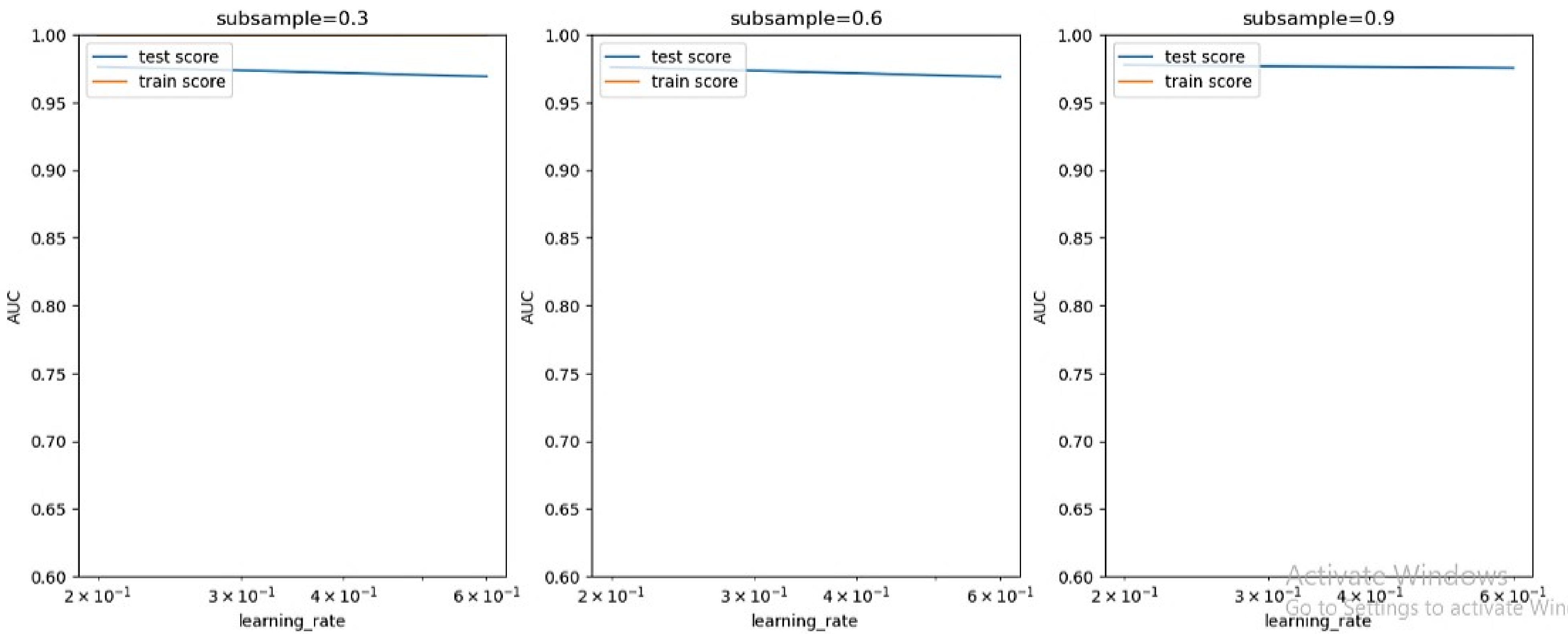
jupyter Credit_Card_Sayali Last Checkpoint: 36 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Winc

jupyter Credit_Card_Sayali Last Checkpoint: 37 minutes ago

File Edit View Run Kernel Settings Help Not Trusted

Code JupyterLab Python 3 (ipykernel)

```
plt.legend(['test score', 'train score'], loc='upper left')
plt.xscale('log')
```

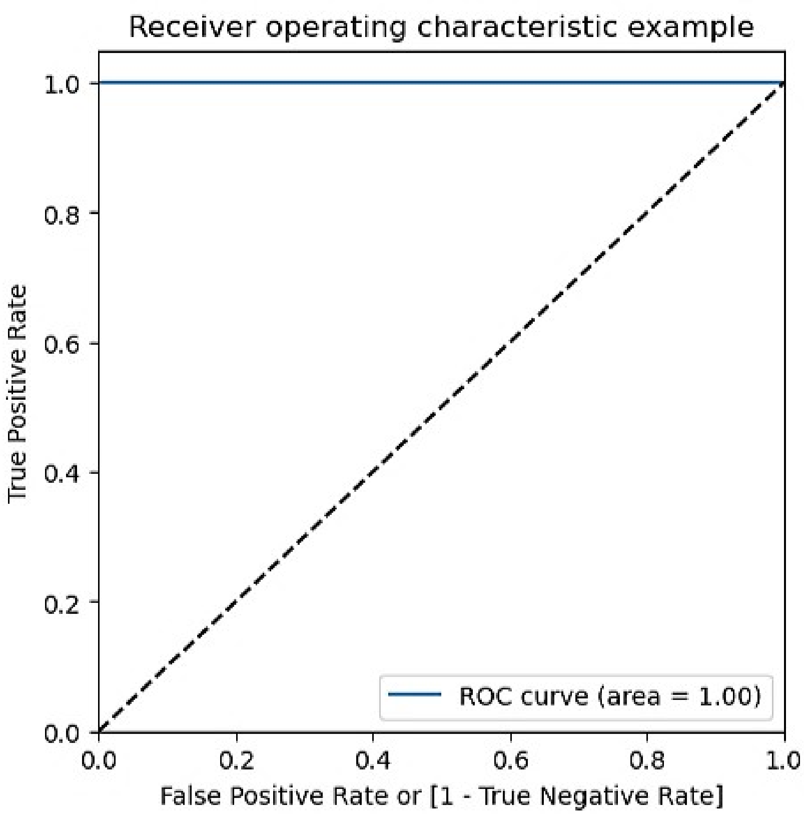


jupyter Credit_Card_Sayali Last Checkpoint: 40 minutes ago

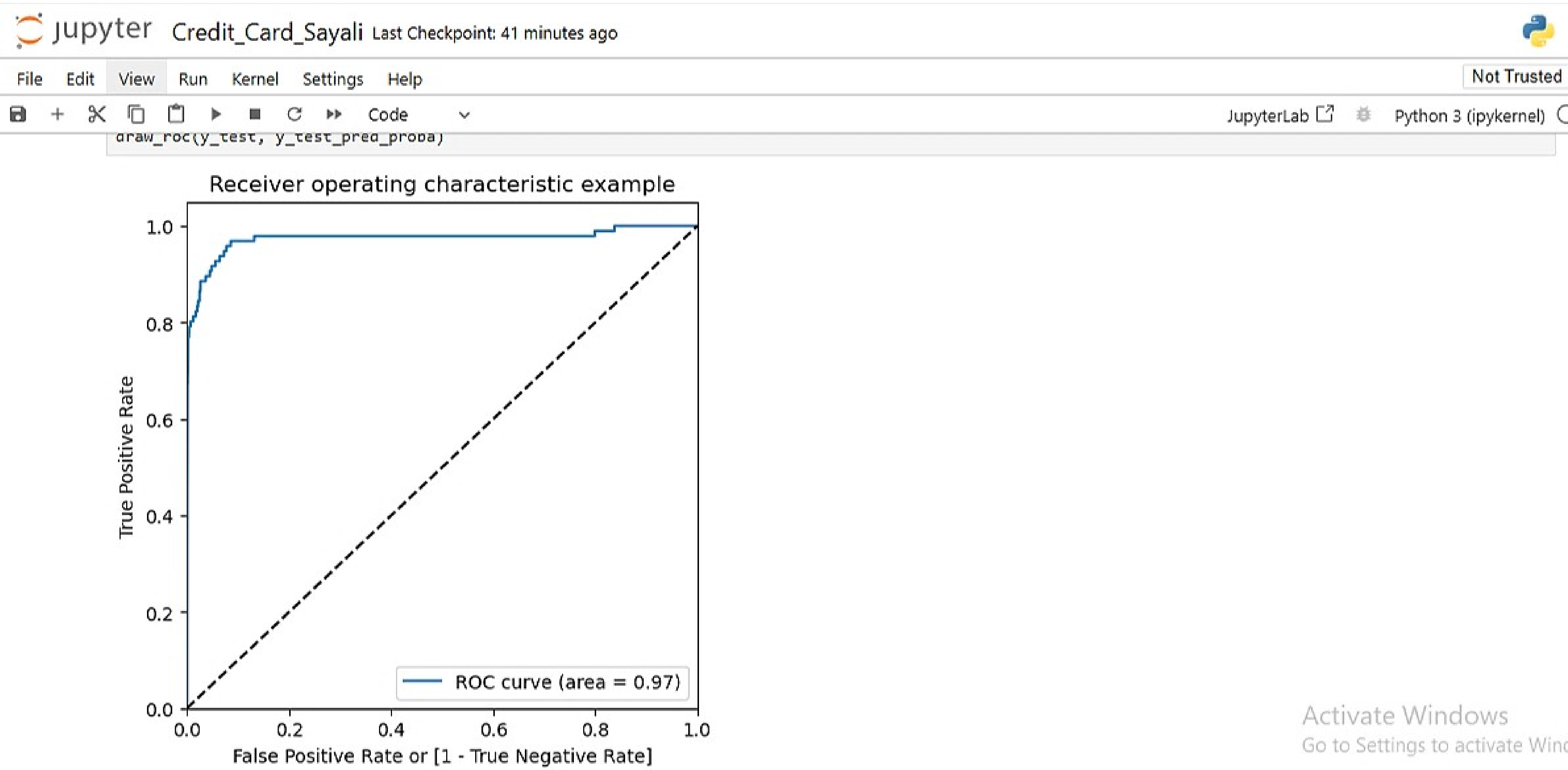
File Edit View Run Kernel Settings Help | Not Trusted

Code | JupyterLab | Python 3 (ipykernel)

```
draw_roc(y_train_rus, y_train_pred_proba)
```



Activate Windows
Go to Settings to activate Wind

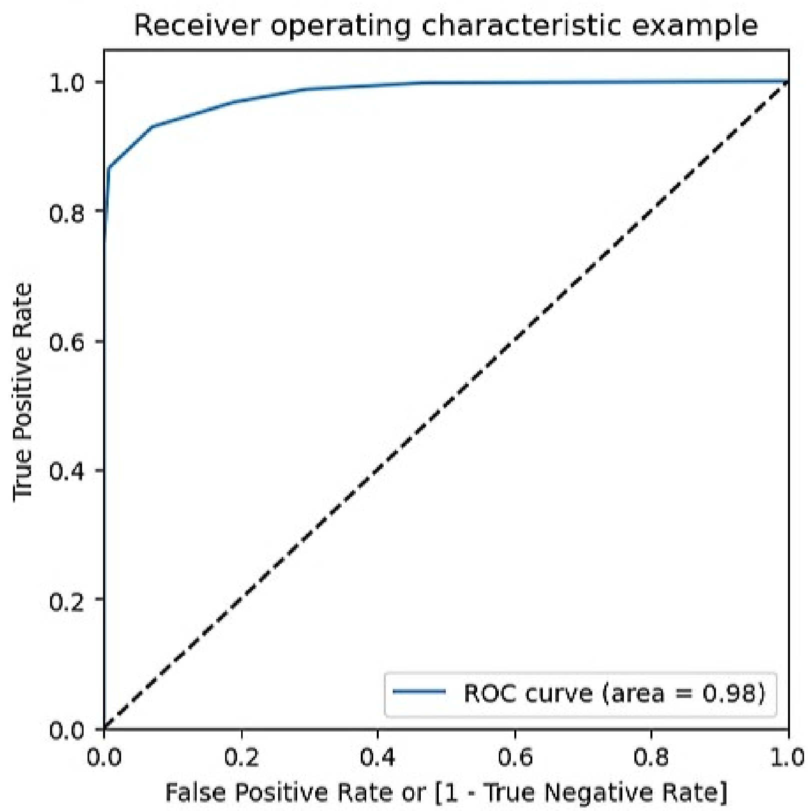

jupyter
Credit_Card_Sayali Last Checkpoint: 41 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

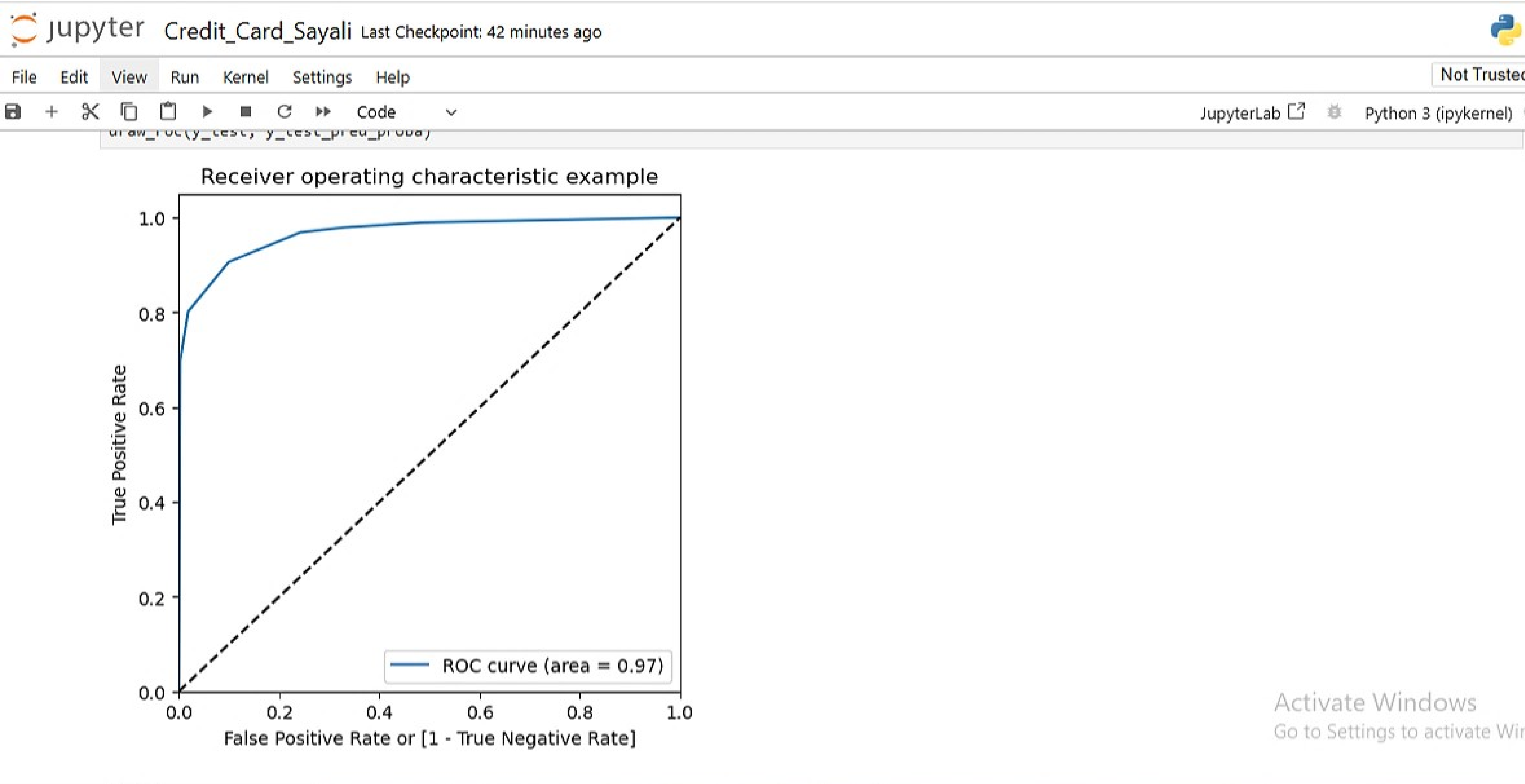
jupyter Credit_Card_Sayali Last Checkpoint: 41 minutes ago

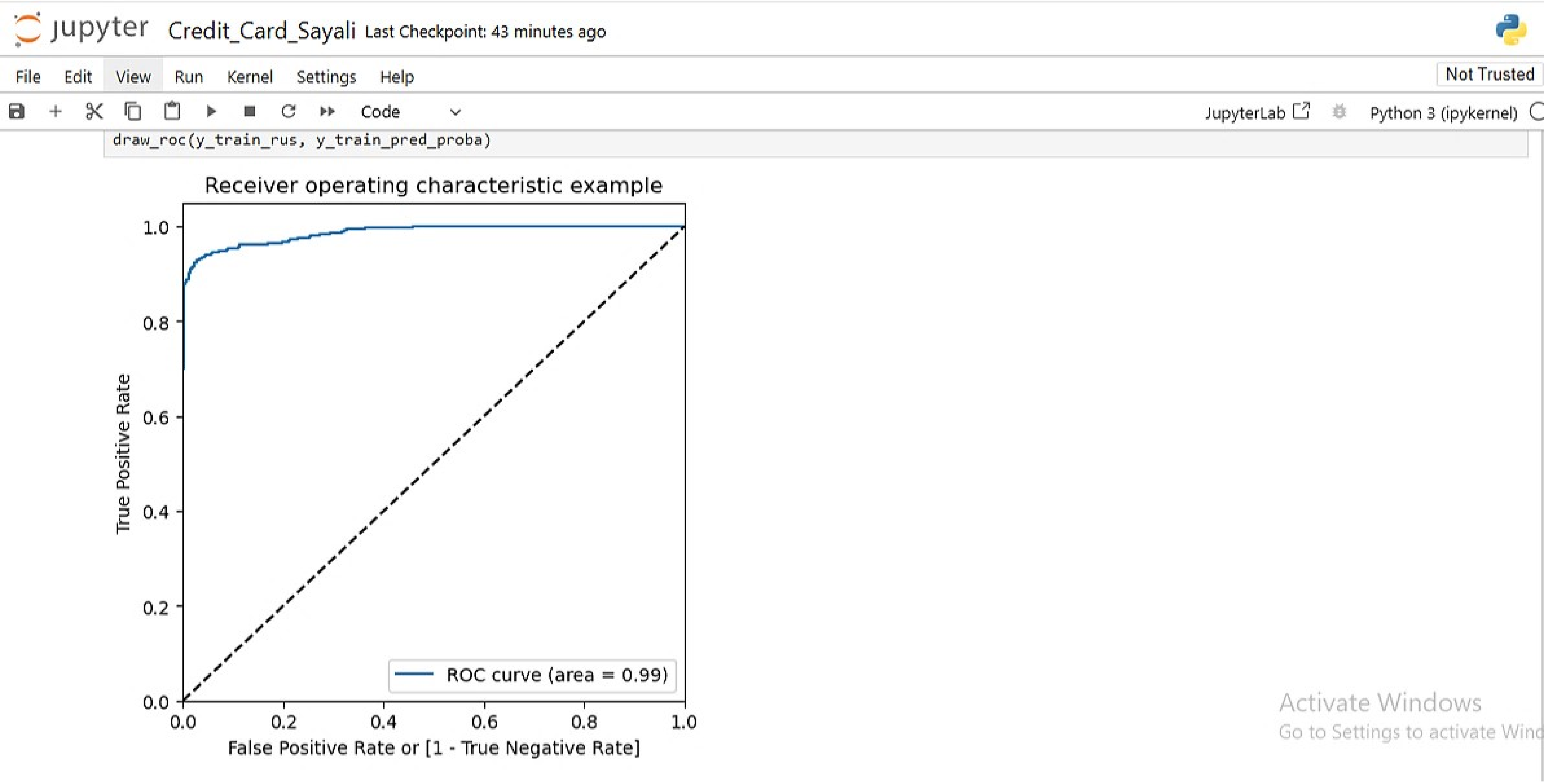
File Edit View Run Kernel Settings Help   Not Trusted

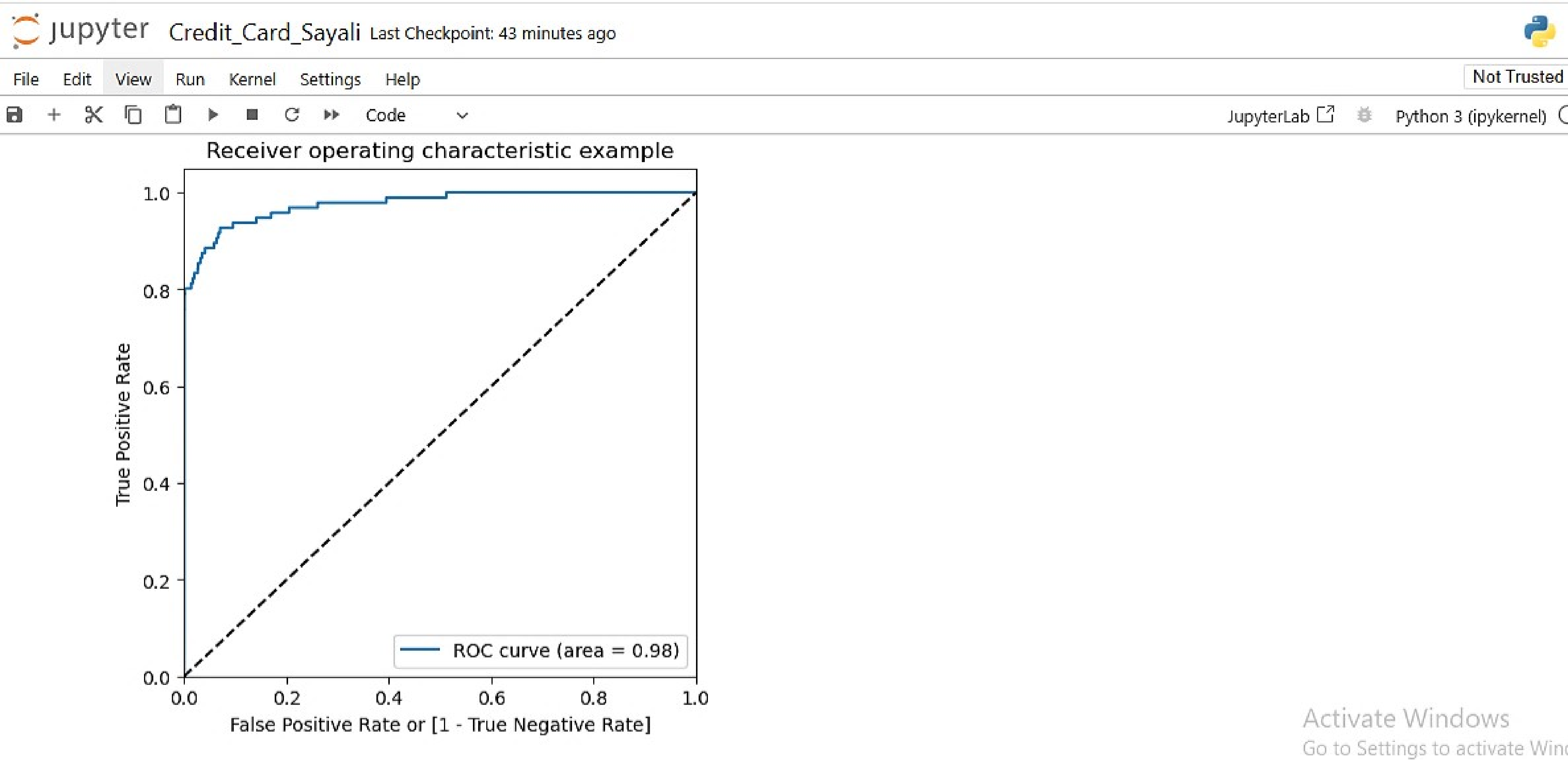
Code   JupyterLab   Python 3 (ipykernel)

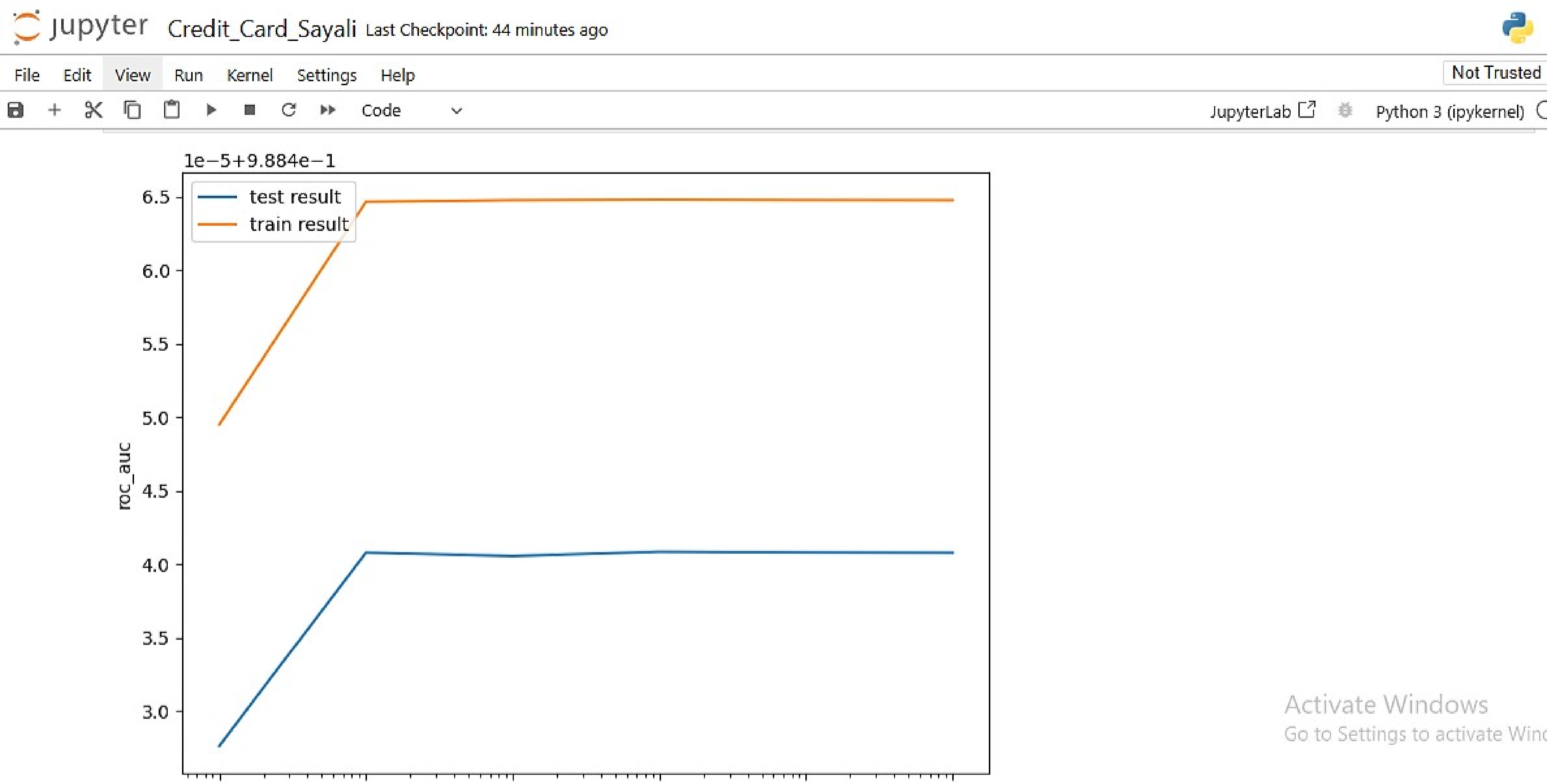
```
draw_roc(y_train_rus, y_train_pred_proba)
```

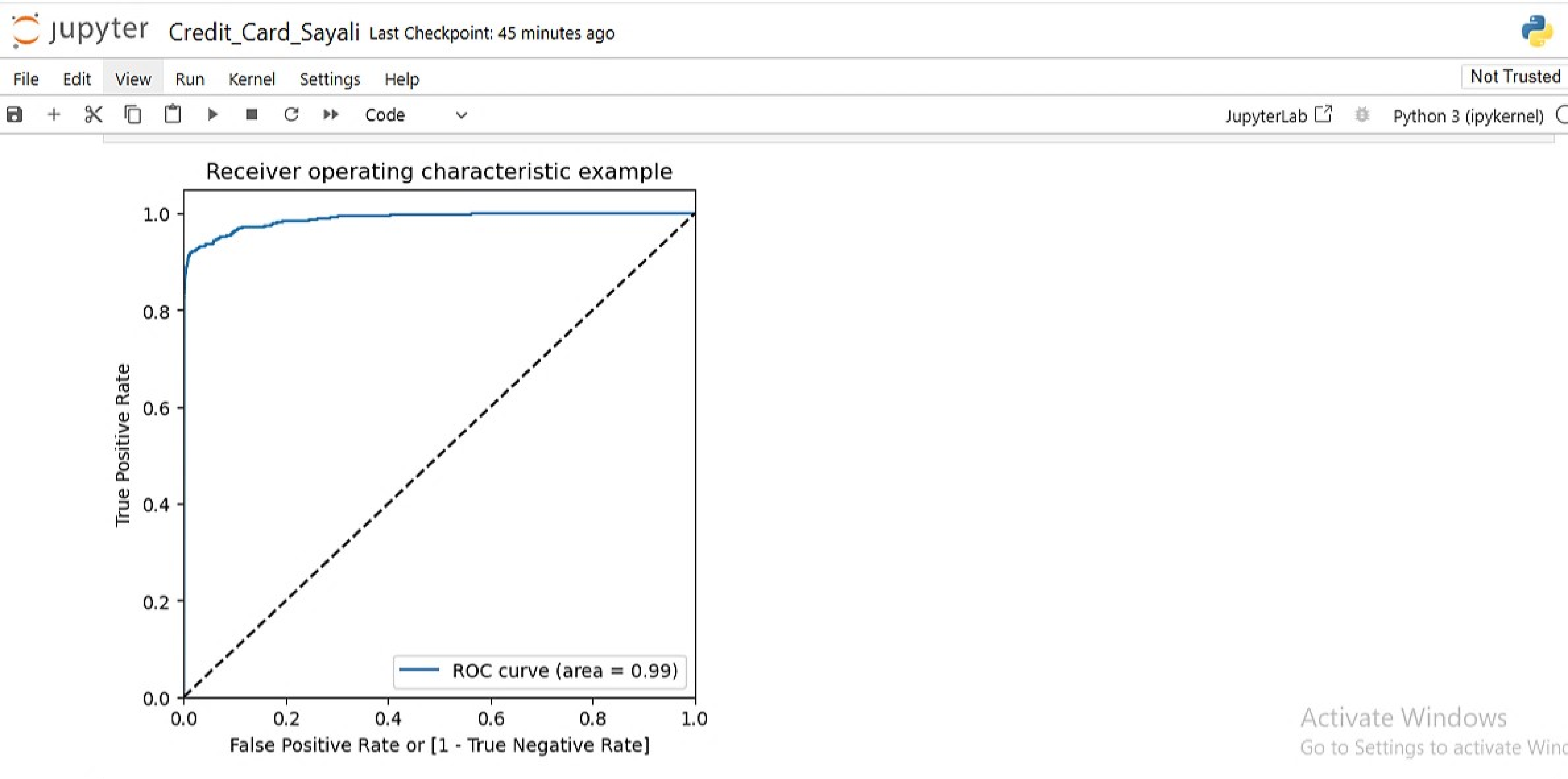


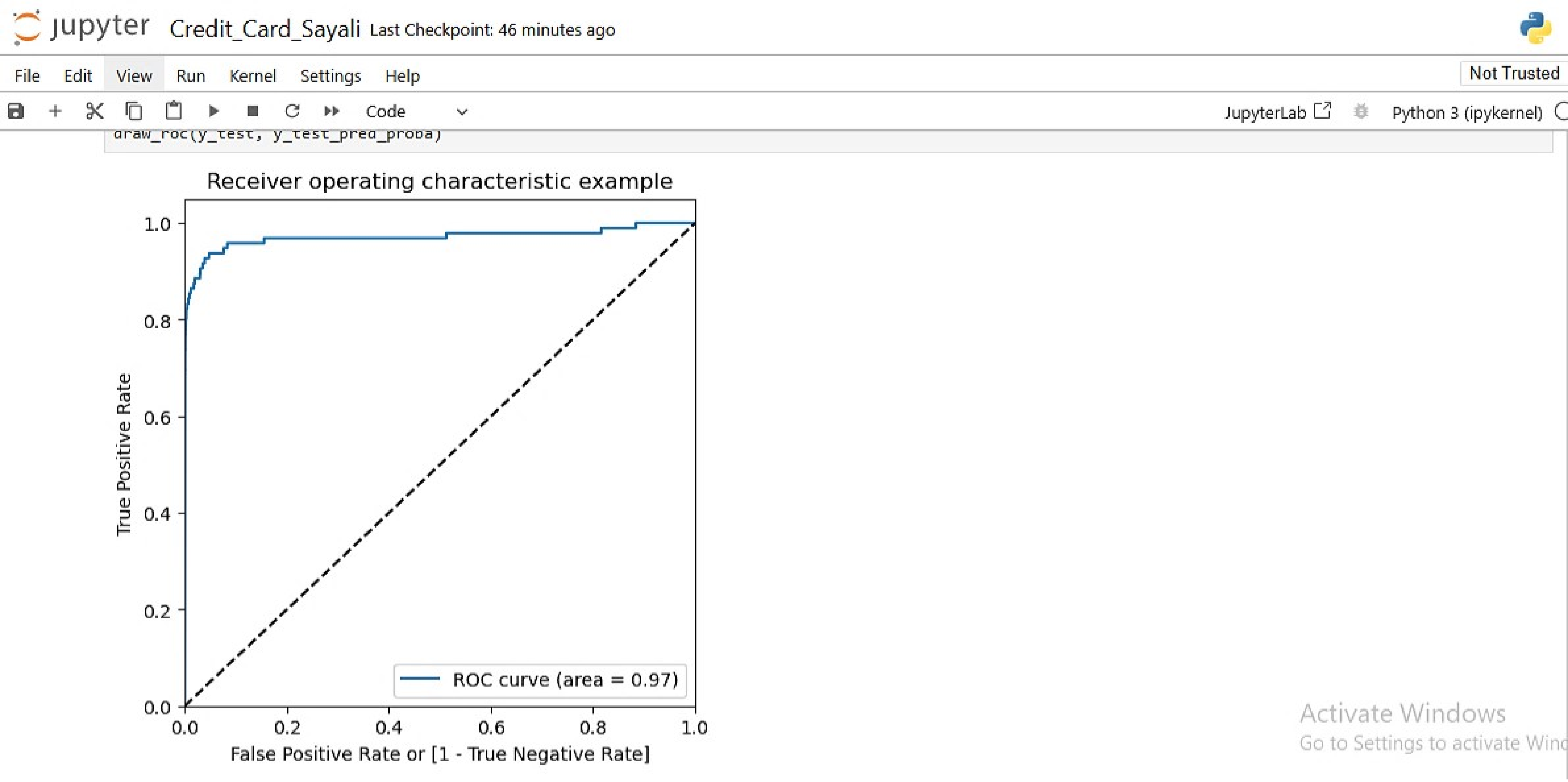

jupyter Credit_Card_Sayali Last Checkpoint: 42 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Win


jupyter Credit_Card_Sayali Last Checkpoint: 43 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_train_rus, y_train_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.99)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind


jupyter
Credit_Card_Sayali
Last Checkpoint: 43 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
1.0
0.8
0.6
0.4
0.2
0.0
True Positive Rate
ROC curve (area = 0.98)
0.0
0.2
0.4
0.6
0.8
1.0
False Positive Rate or [1 - True Negative Rate]
Activate Windows
Go to Settings to activate Wind


jupyter
Credit_Card_Sayali
Last Checkpoint: 44 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
1e−5+9.884e−1
test result
train result
roc_auc
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Activate Windows
Go to Settings to activate Wind


jupyter
Credit_Card_Sayali
Last Checkpoint: 45 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
0.0
0.2
0.4
0.6
0.8
1.0
ROC curve (area = 0.99)
Activate Windows
Go to Settings to activate Windows

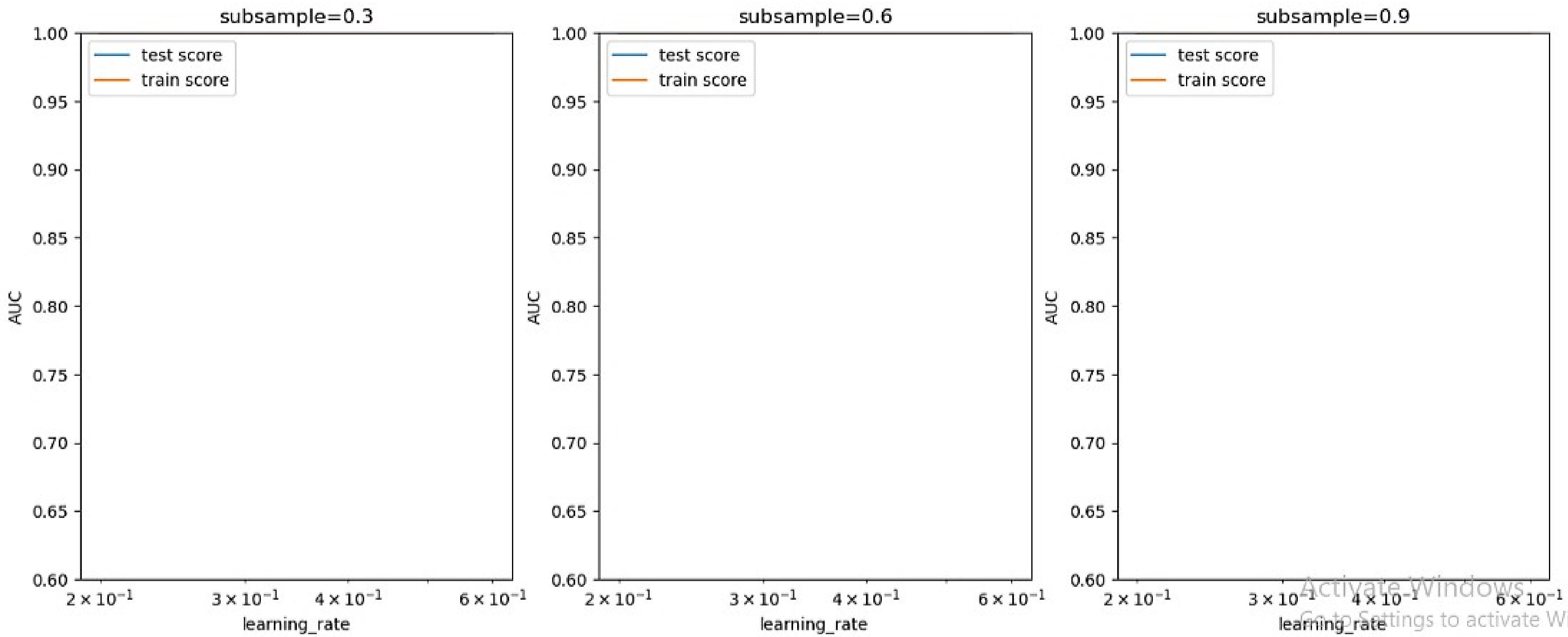

jupyter
Credit_Card_Sayali
Last Checkpoint: 46 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

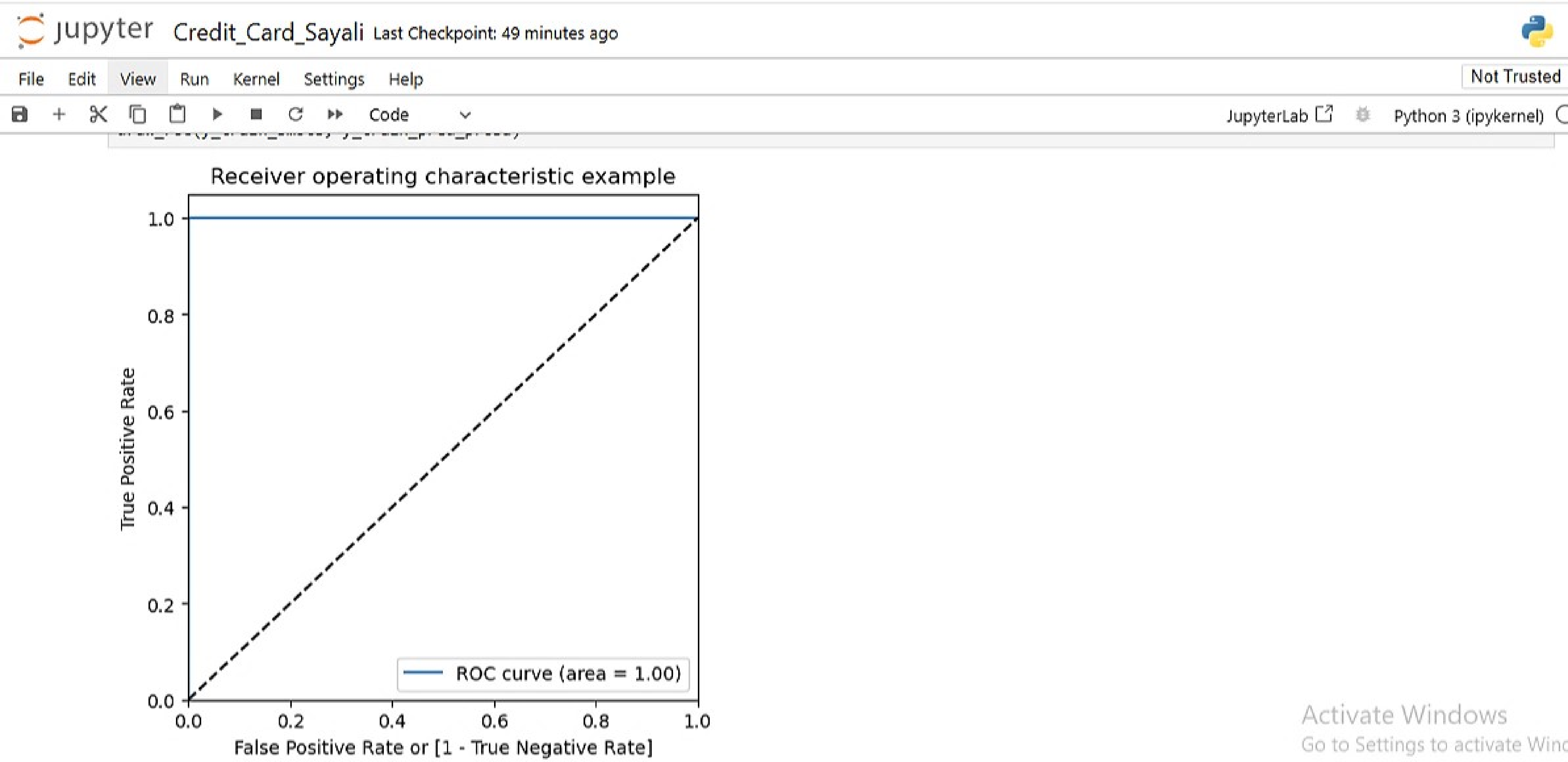
jupyter Credit_Card_Sayali Last Checkpoint: 46 minutes ago

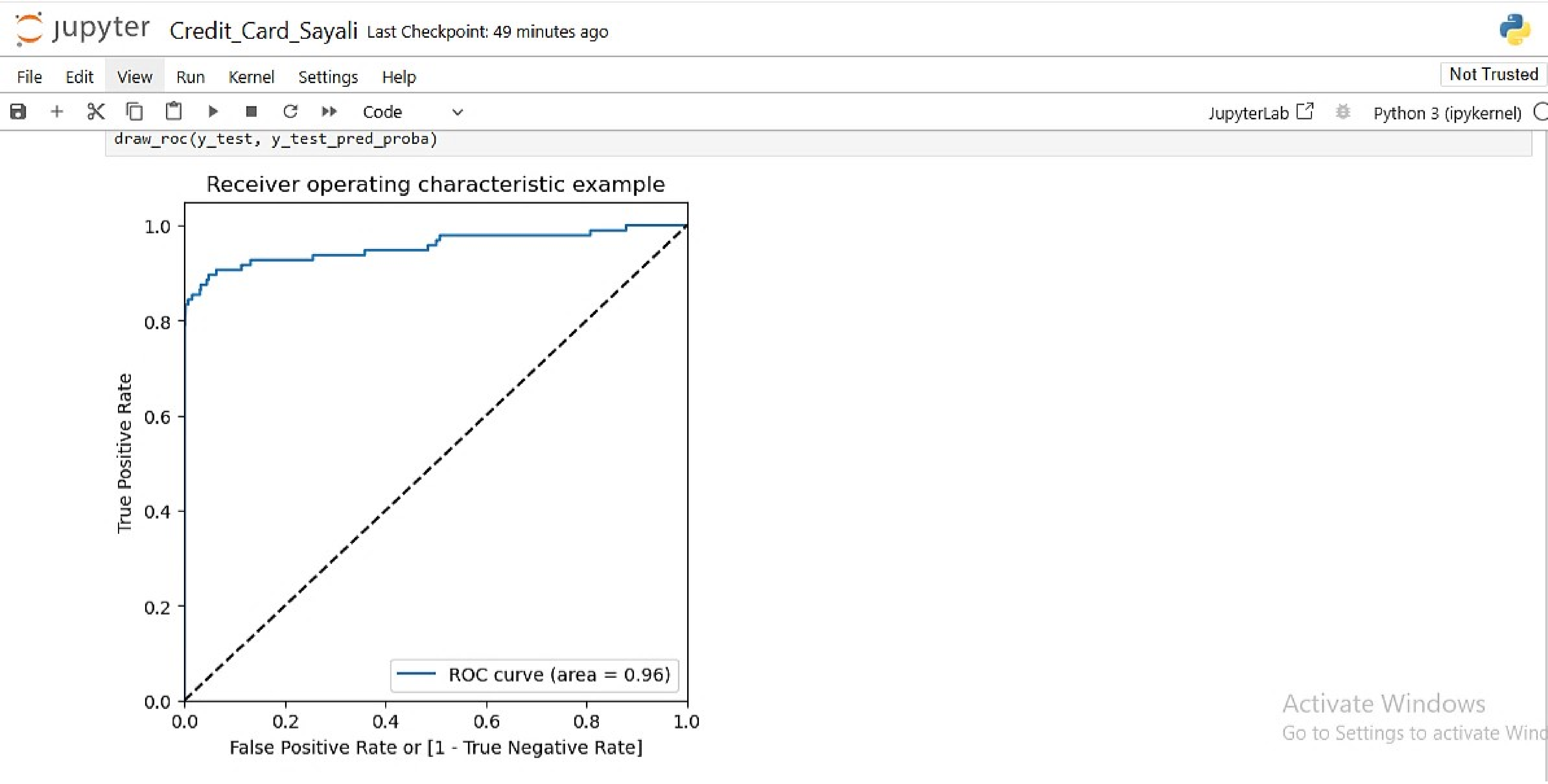
File Edit View Run Kernel Settings Help Not Trusted

Code JupyterLab Python 3 (ipykernel)

```
plt.xscale('log')
```




jupyter
Credit_Card_Sayali
Last Checkpoint: 49 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 1.00)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind


jupyter
Credit_Card_Sayali
Last Checkpoint: 49 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.96)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

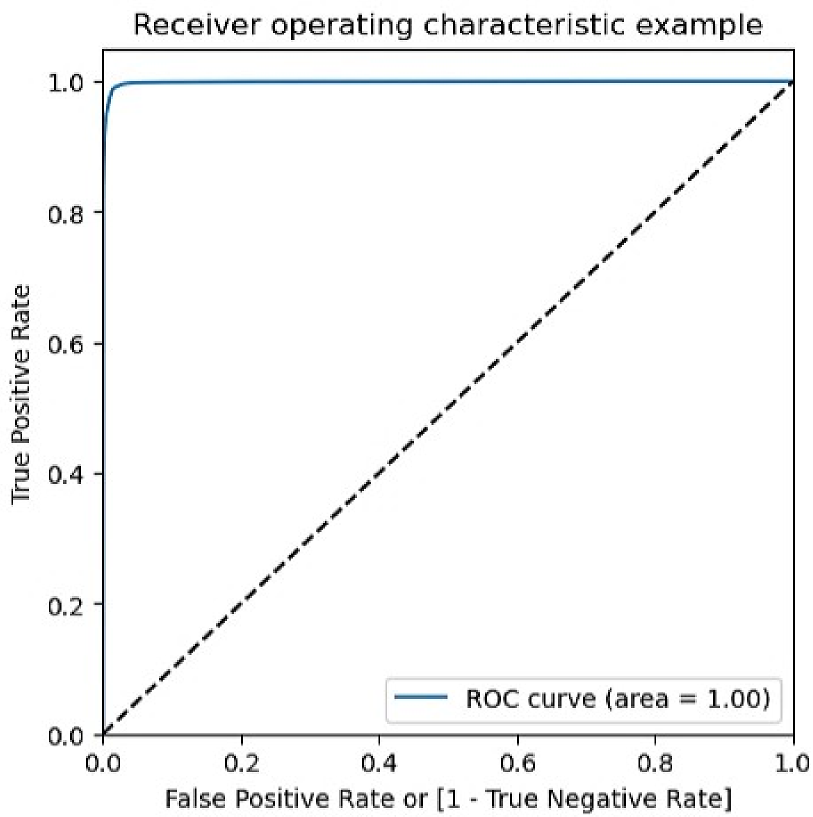
jupyter Credit_Card_Sayali Last Checkpoint: 50 minutes ago

File Edit View Run Kernel Settings Help

Not Trusted

Code

JupyterLab Python 3 (ipykernel)



jupyter Credit_Card_Sayali Last Checkpoint: 51 minutes ago

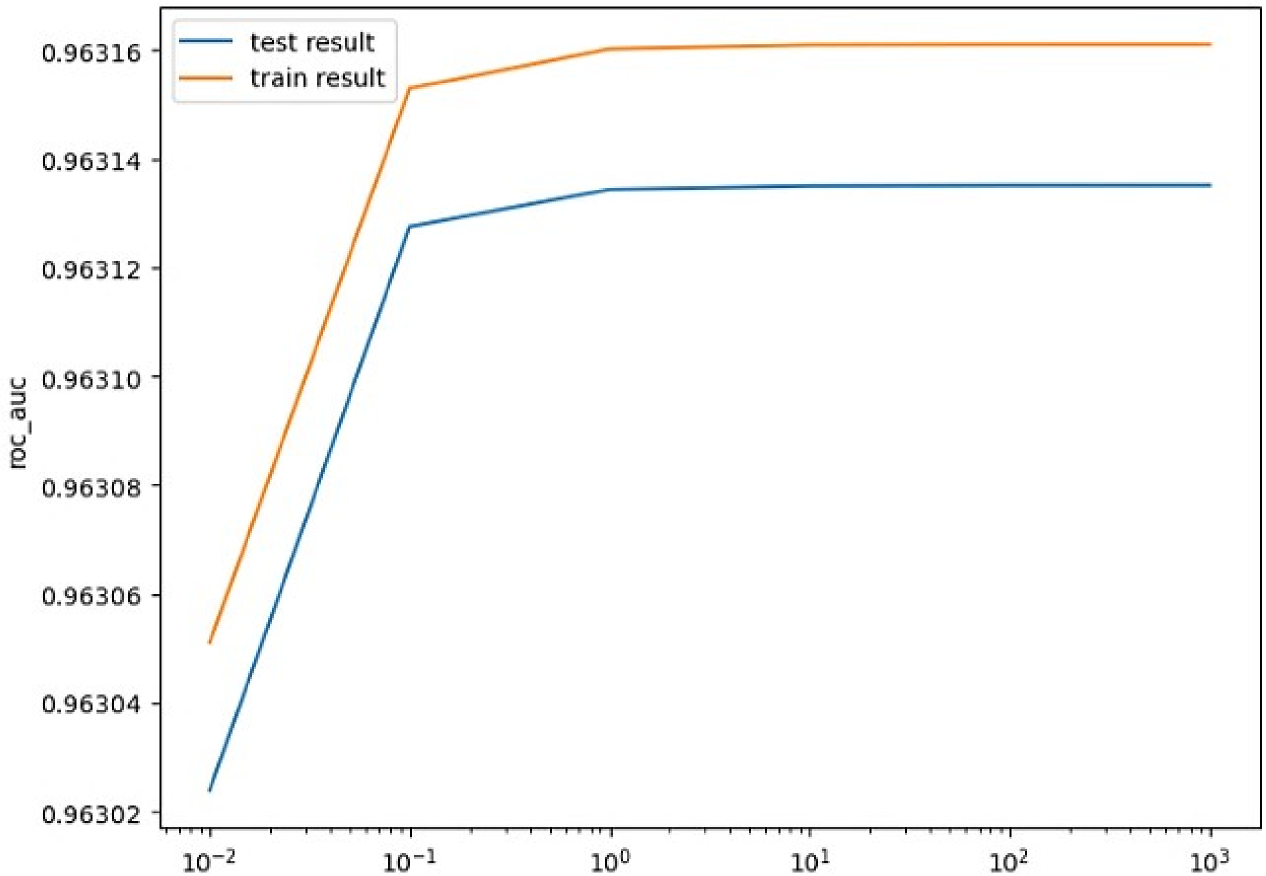
File Edit View Run Kernel Settings Help

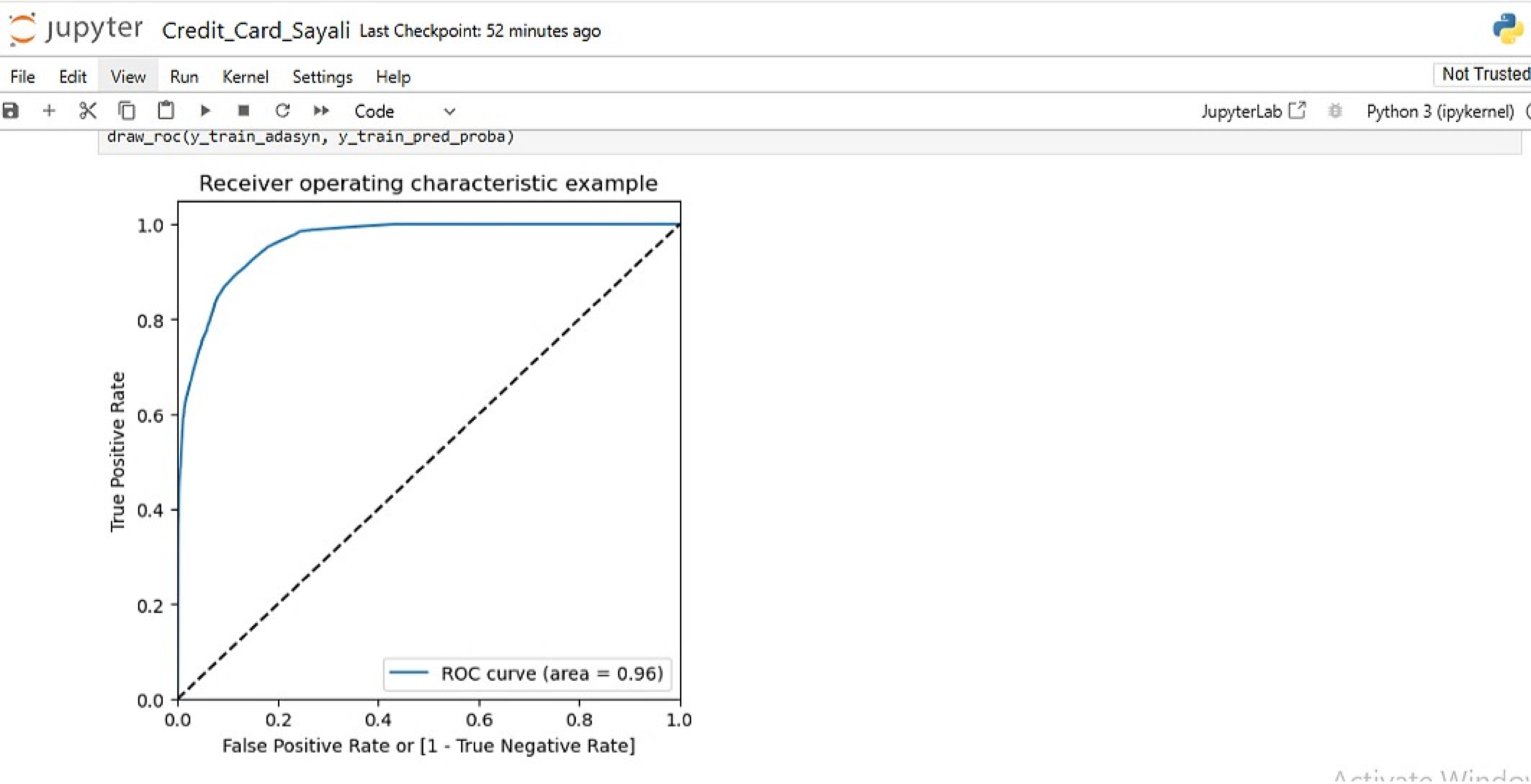
Not Trusted

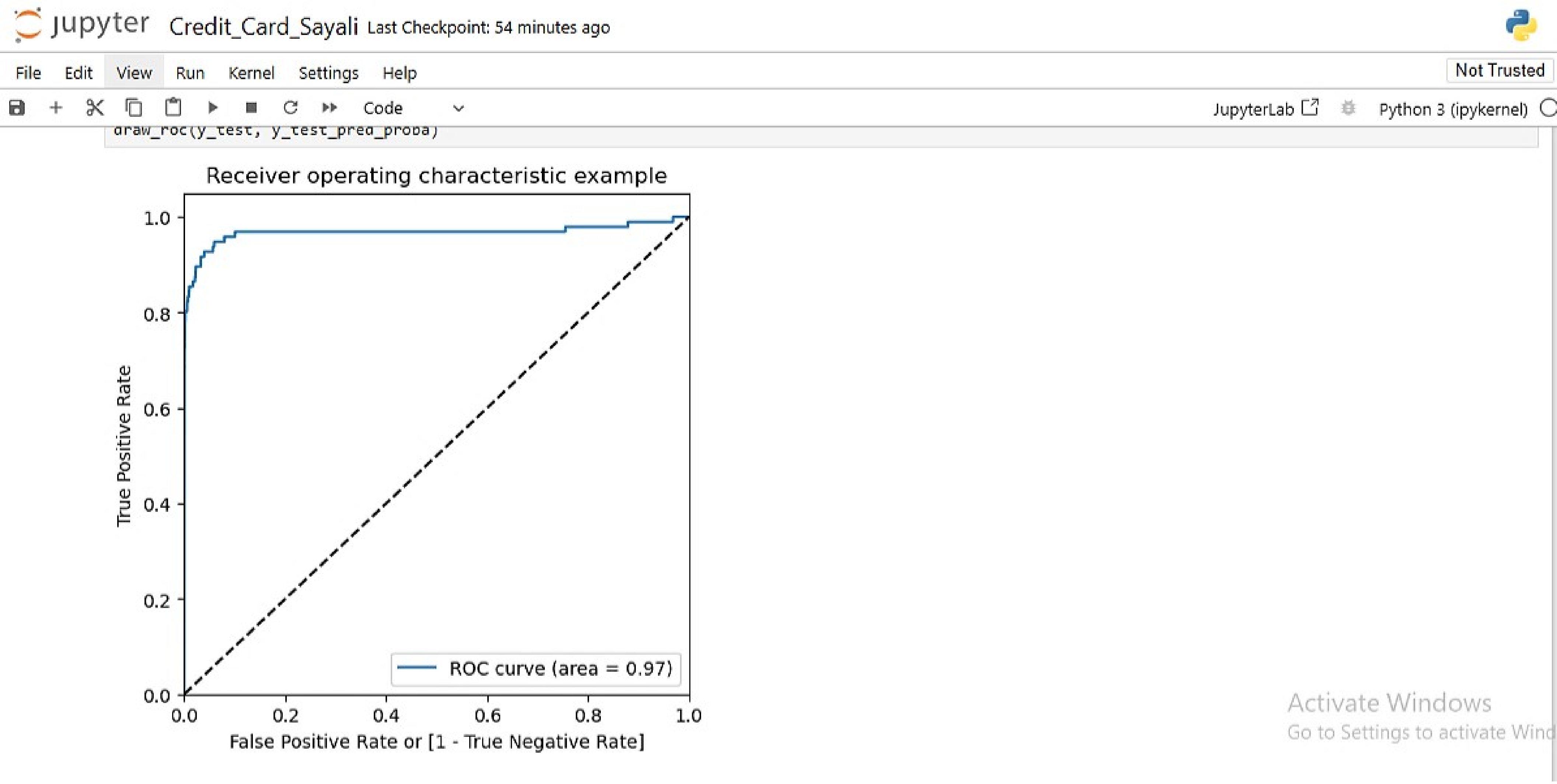
Code

JupyterLab Python 3 (ipykernel)

```
plt.ylabel('roc_auc')
plt.legend(['test result', 'train result'], loc='upper left')
plt.xscale('log')
```




jupyter
Credit_Card_Sayali
Last Checkpoint: 52 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_train_adasyn, y_train_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.96)
0.0
0.2
0.4
0.6
0.8
1.0

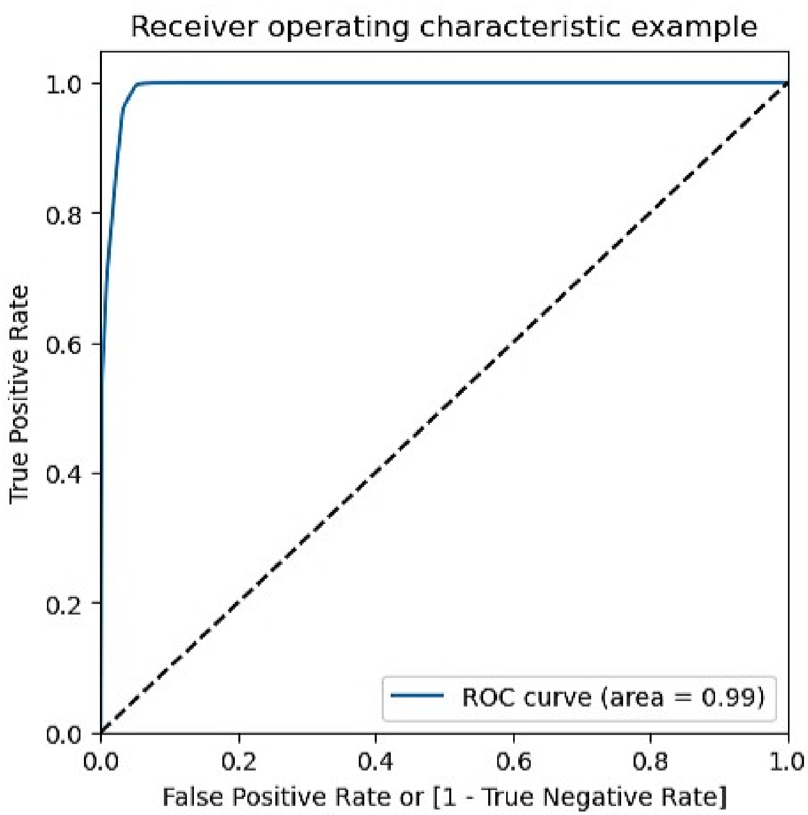

jupyter
Credit_Card_Sayali Last Checkpoint: 54 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.97)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

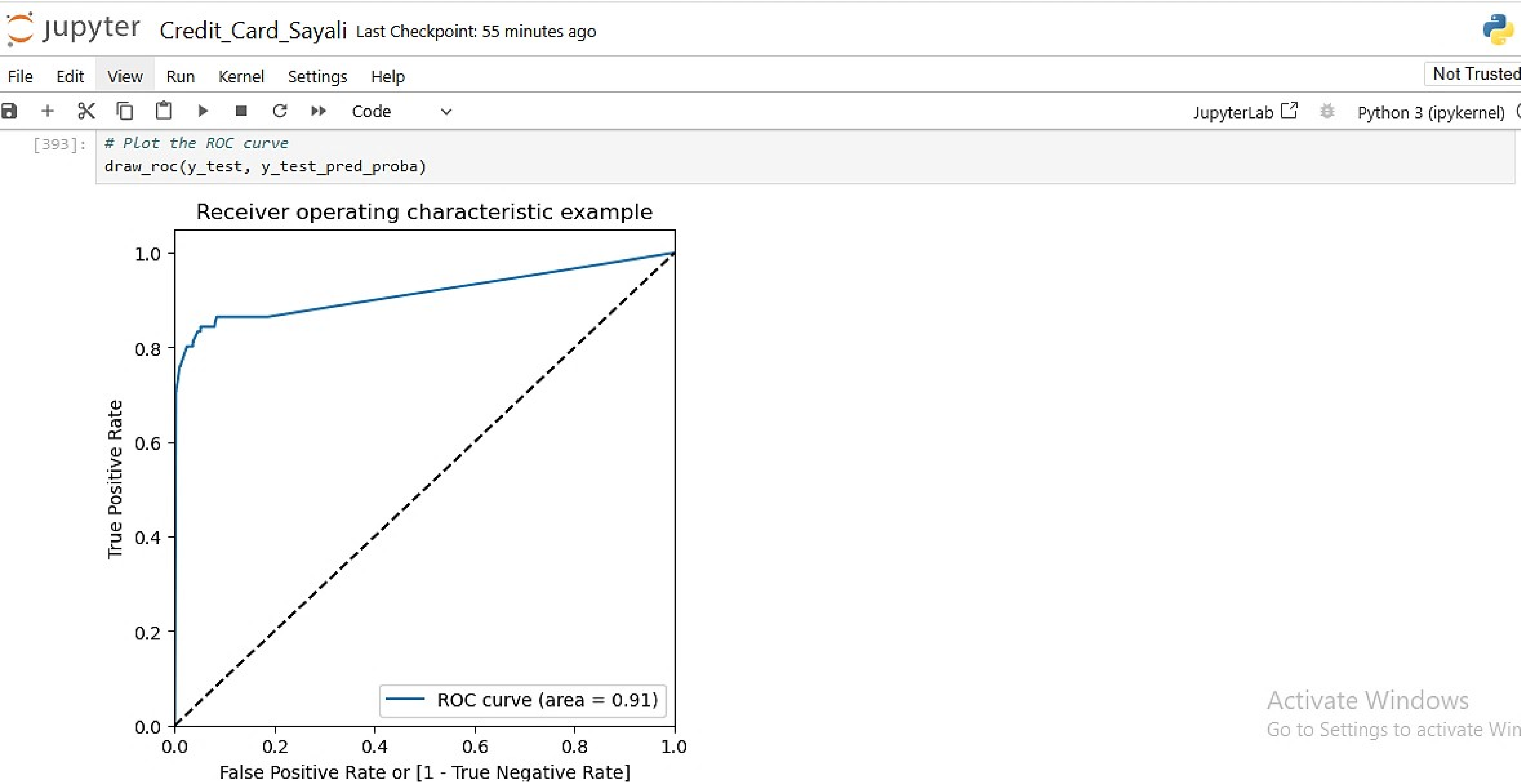
jupyter Credit_Card_Sayali Last Checkpoint: 54 minutes ago

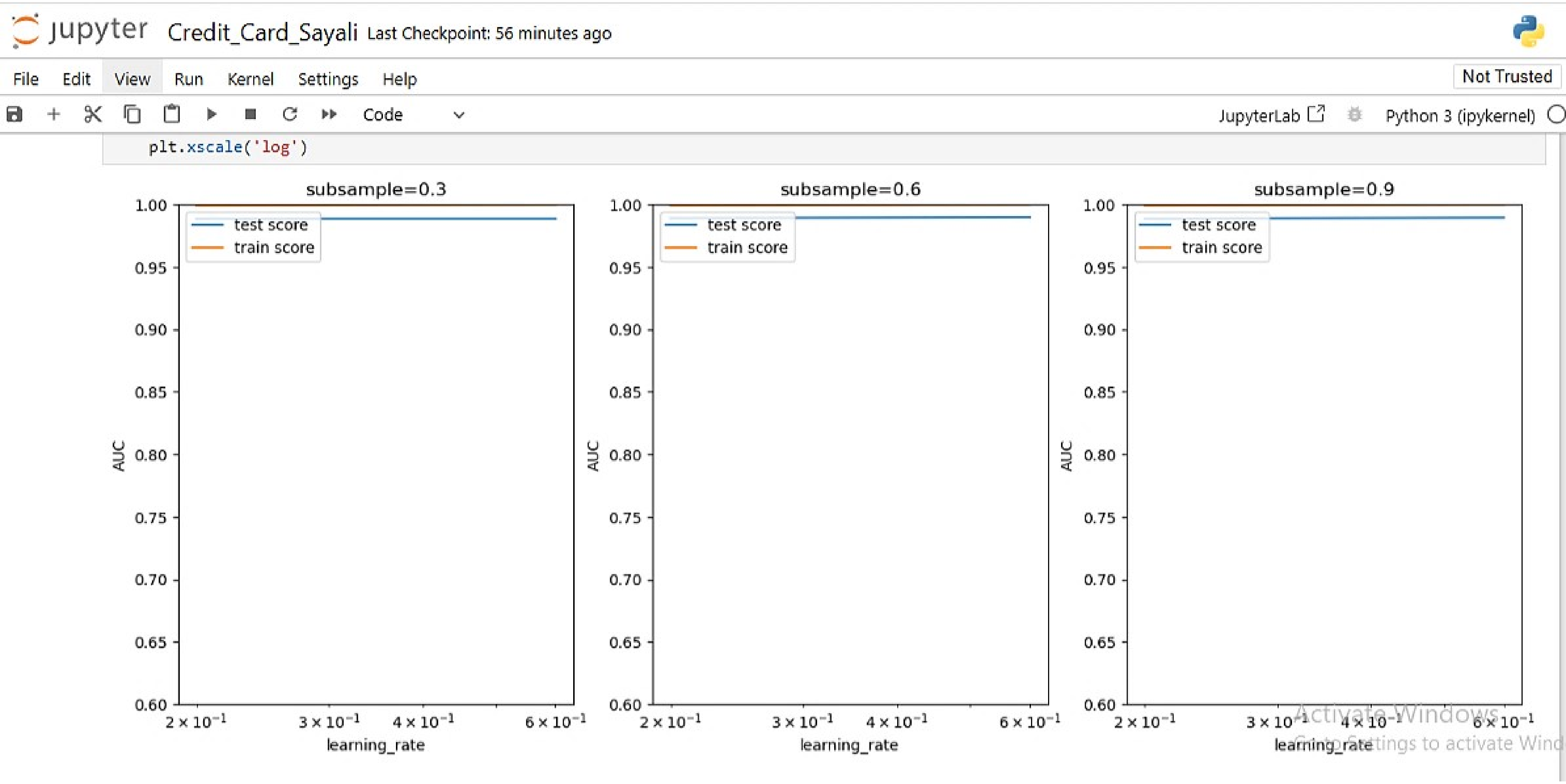
File Edit View Run Kernel Settings Help Not Trusted

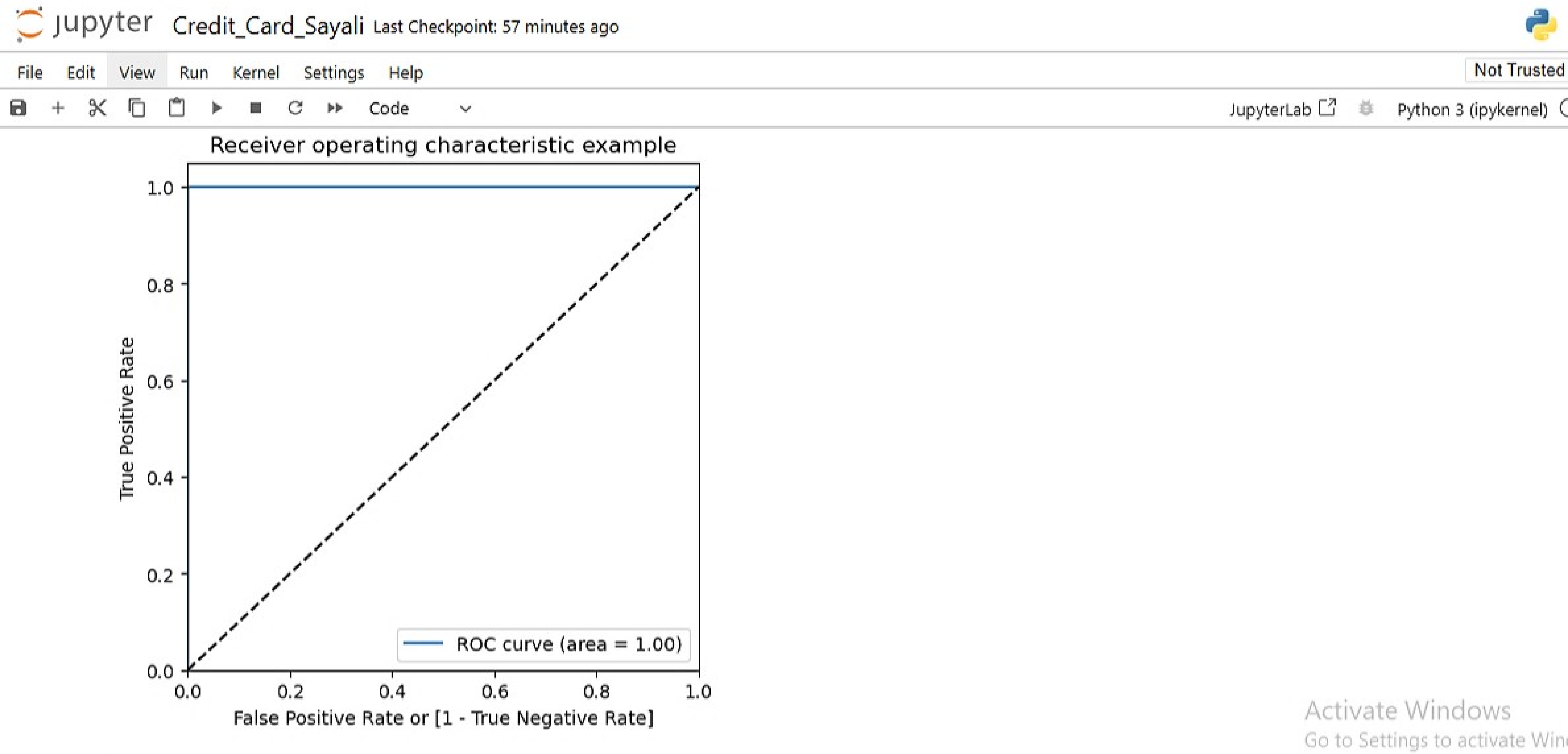
Code JupyterLab Python 3 (ipykernel)

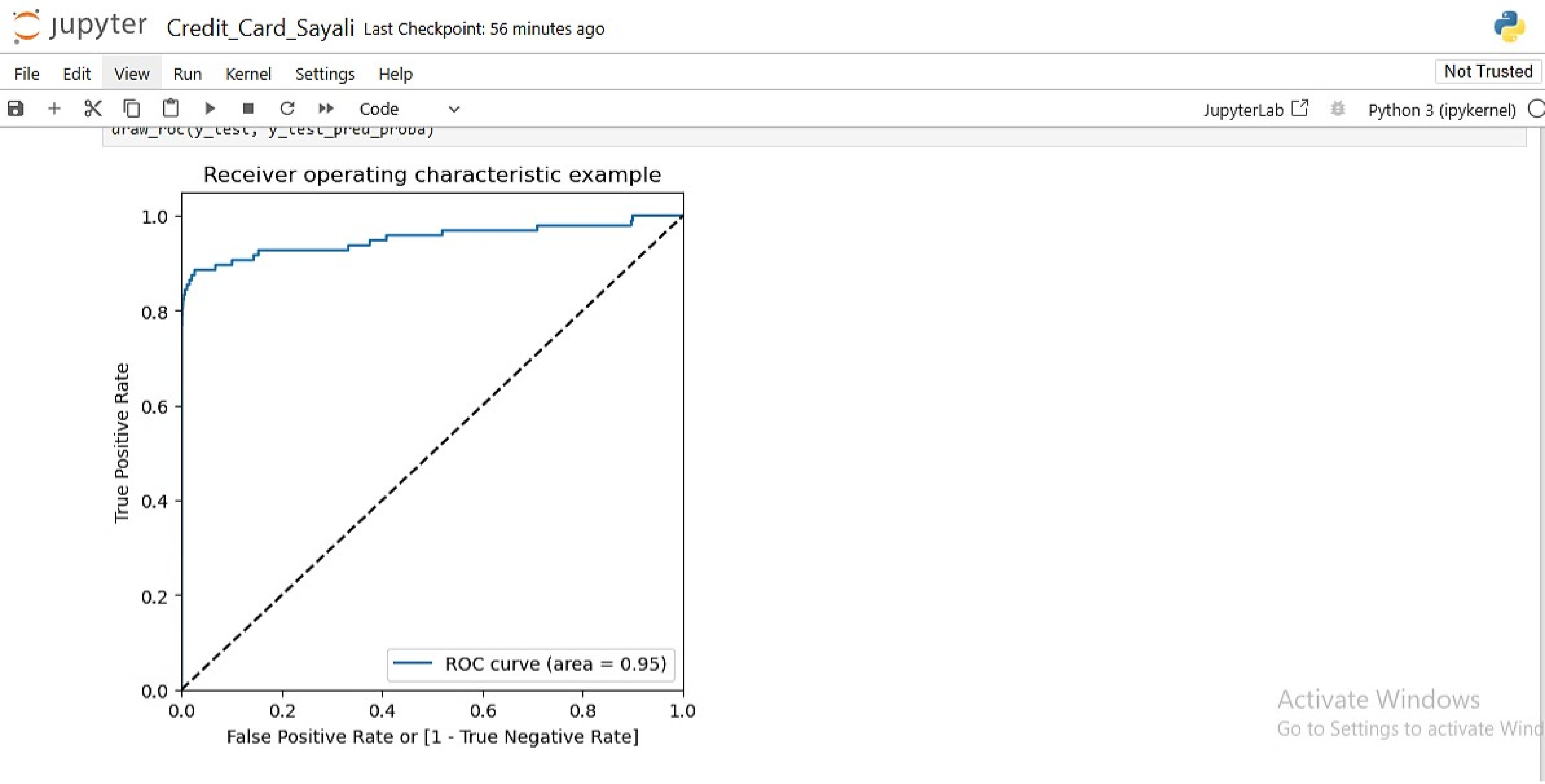
```
draw_roc(y_train_adasyn, y_train_pred_proba)
```




jupyter Credit_Card_Sayali Last Checkpoint: 55 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
[393]:
# Plot the ROC curve
draw_roc(y_test, y_test_pred_proba)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.91)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind


jupyter Credit_Card_Sayali Last Checkpoint: 56 minutes ago
File Edit View Run Kernel Settings Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
plt.xscale('log')
subsample=0.3
subsample=0.6
subsample=0.9
test score
train score
AUC
learning_rate
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
2 × 10⁻¹
3 × 10⁻¹
4 × 10⁻¹
6 × 10⁻¹
Activate Windows
Go to Settings to activate Wind


jupyter
Credit_Card_Sayali Last Checkpoint: 57 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 1.00)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Win


jupyter
Credit_Card_Sayali
Last Checkpoint: 56 minutes ago
File
Edit
View
Run
Kernel
Settings
Help
Not Trusted
Code
JupyterLab
Python 3 (ipykernel)
Receiver operating characteristic example
True Positive Rate
False Positive Rate or [1 - True Negative Rate]
ROC curve (area = 0.95)
0.0
0.2
0.4
0.6
0.8
1.0
Activate Windows
Go to Settings to activate Wind

jupyter Credit_Card_Sayali Last Checkpoint: 33 minutes ago

File Edit View Run Kernel Settings Help

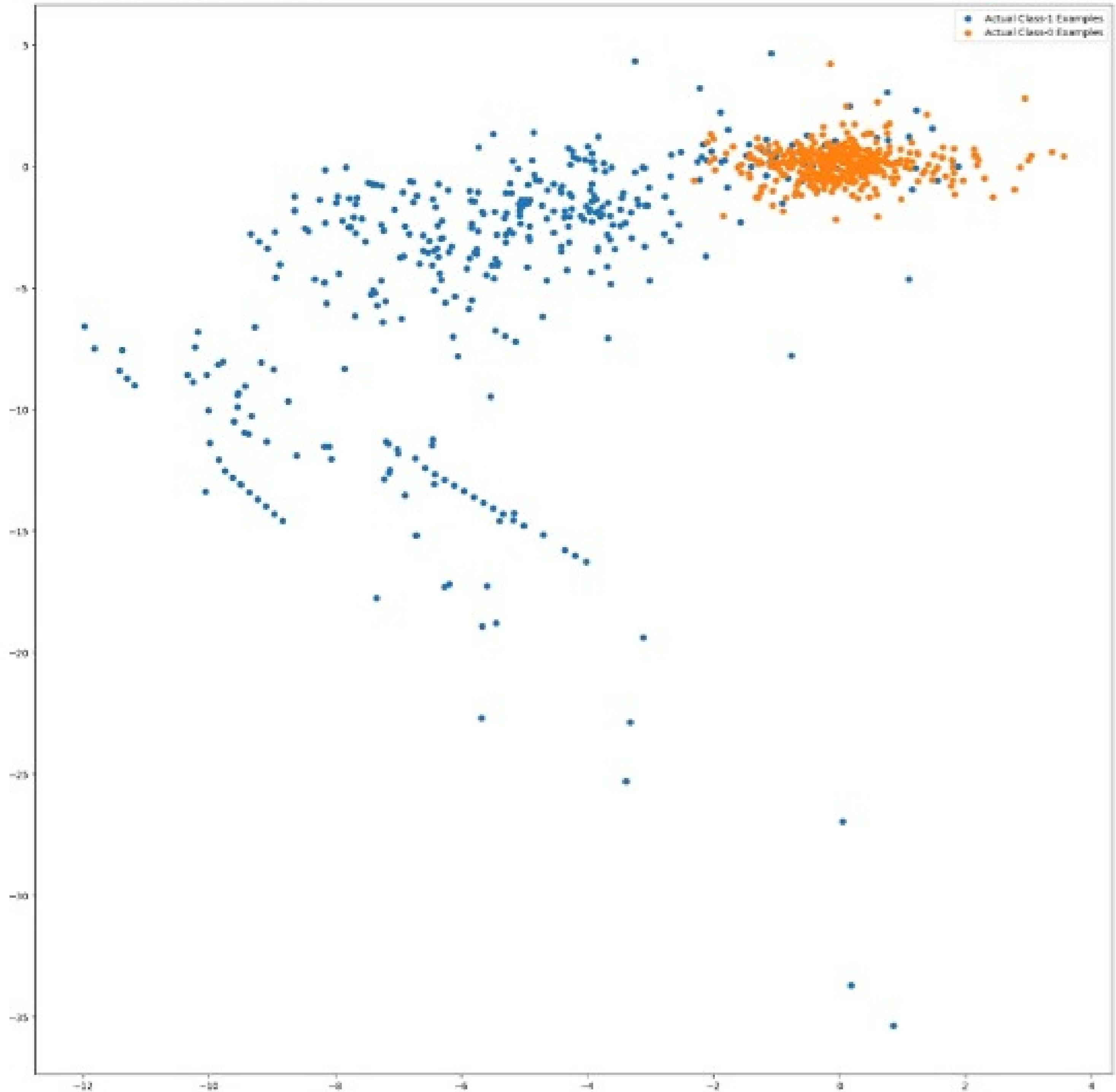
Not Trusted

Code

JupyterLab

Python 3 (ipykernel)

```
[117]: <matplotlib.legend.Legend at 0x192809d8d90>
```



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Markdown | JupyterLab | Python 3 (ipykernel)

```
from datetime import date
today = date.today()
print(today)
```


```
2025-03-13
```

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Markdown JupyterLab Python 3 (ipykernel)

[21]:
```
# Read csv File from locally stored file :

file_path = r"C:\Users\Admin\Desktop\creditcard\creditcard.csv"
df = pd.read_csv(file_path)
df.head()
```

[21]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	V21	V22	V23	V24	V25	
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698	0.363787	...	-0.018307	0.277838	-0.110474	0.066928	0.128539	-0.18
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102	-0.255425	...	-0.225775	-0.638672	0.101288	-0.339846	0.167170	0.12
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676	-1.514654	...	0.247998	0.771679	0.909412	-0.689281	-0.327642	-0.13
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436	-1.387024	...	-0.108300	0.005274	-0.190321	-1.175575	0.647376	-0.22
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533	0.817739	...	-0.009431	0.798278	-0.137458	0.141267	-0.206010	0.50

5 rows × 31 columns

[3]:
```
df.shape
```

[3]: (284807, 31)

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Code

JupyterLab Python 3 (ipykernel)

[3]: (284807, 31)

[4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 284807 entries, 0 to 284806
Data columns (total 31 columns):
 #   Column  Non-Null Count   Dtype
---  ------  --------------   -----
 0   Time    284807 non-null  float64
 1   V1      284807 non-null  float64
 2   V2      284807 non-null  float64
 3   V3      284807 non-null  float64
 4   V4      284807 non-null  float64
 5   V5      284807 non-null  float64
 6   V6      284807 non-null  float64
 7   V7      284807 non-null  float64
 8   V8      284807 non-null  float64
 9   V9      284807 non-null  float64
 10  V10     284807 non-null  float64
 11  V11     284807 non-null  float64
 12  V12     284807 non-null  float64
 13  V13     284807 non-null  float64
 14  V14     284807 non-null  float64
 15  V15     284807 non-null  float64
 16  V16     284807 non-null  float64
 17  V17     284807 non-null  float64
 18  V18     284807 non-null  float64
 19  V19     284807 non-null  float64
 20  V20     284807 non-null  float64
```

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Code JupyterLab Python 3 (ipykernel)

[5]:
```
df.describe()
```

[5]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	
count	284807.000000	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	...	2.8
mean	94813.859575	1.168375e-15	3.416908e-16	-1.379537e-15	2.074095e-15	9.604066e-16	1.487313e-15	-5.556467e-16	1.213481e-16	-2.406331e-15	...	1.6
std	47488.145955	1.958696e+00	1.651309e+00	1.516255e+00	1.415869e+00	1.380247e+00	1.332271e+00	1.237094e+00	1.194353e+00	1.098632e+00	...	7.3
min	0.000000	-5.640751e+01	-7.271573e+01	-4.832559e+01	-5.683171e+00	-1.137433e+02	-2.616051e+01	-4.355724e+01	-7.321672e+01	-1.343407e+01	...	-3.4
25%	54201.500000	-9.203734e-01	-5.985499e-01	-8.903648e-01	-8.486401e-01	-6.915971e-01	-7.682956e-01	-5.540759e-01	-2.086297e-01	-6.430976e-01	...	-2.2
50%	84692.000000	1.810880e-02	6.548556e-02	1.798463e-01	-1.984653e-02	-5.433583e-02	-2.741871e-01	4.010308e-02	2.235804e-02	-5.142873e-02	...	-2.9
75%	139320.500000	1.315642e+00	8.037239e-01	1.027196e+00	7.433413e-01	6.119264e-01	3.985649e-01	5.704361e-01	3.273459e-01	5.971390e-01	...	1.8
max	172792.000000	2.454930e+00	2.205773e+01	9.382558e+00	1.687534e+01	3.480167e+01	7.330163e+01	1.205895e+02	2.000721e+01	1.559499e+01	...	2.7

8 rows × 31 columns

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Code

JupyterLab Python 3 (ipykernel)

[6]:
```
# Cheking percent of missing values in columns
df_missing_columns = (round(((df.isnull().sum()/len(df.index))*100),2).to_frame('null')).sort_values('null', ascending=False)
df_missing_columns
```

[6]:

	null
Time	0.0
V16	0.0
Amount	0.0
V28	0.0
V27	0.0
V26	0.0
V25	0.0
V24	0.0
V23	0.0
V22	0.0
V21	0.0
V20	0.0
V19	0.0

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Code

JupyterLab Python 3 (ipykernel)

Checking the distribution of the classes

[7]:
```
classes = df['Class'].value_counts()
classes
```

[7]:
```
Class
0    284315
1       492
Name: count, dtype: int64
```

[8]:
```
normal_share = round((classes[0]/df['Class'].count()*100),2)
normal_share
```

[8]:
```
99.83
```

[9]:
```
fraud_share = round((classes[1]/df['Class'].count()*100),2)
fraud_share
```

[9]:
```
0.17
```

We can see that there is only 0.17% frauds. We will take care of the class imbalance later.

[10]:
```
# Bar plot for the number of fraudulent vs non-fraudulent transcations
sns.countplot(x='Class', data=df)
plt.title('Number of fraudulent vs non-fraudulent transcations')
plt.show()
```

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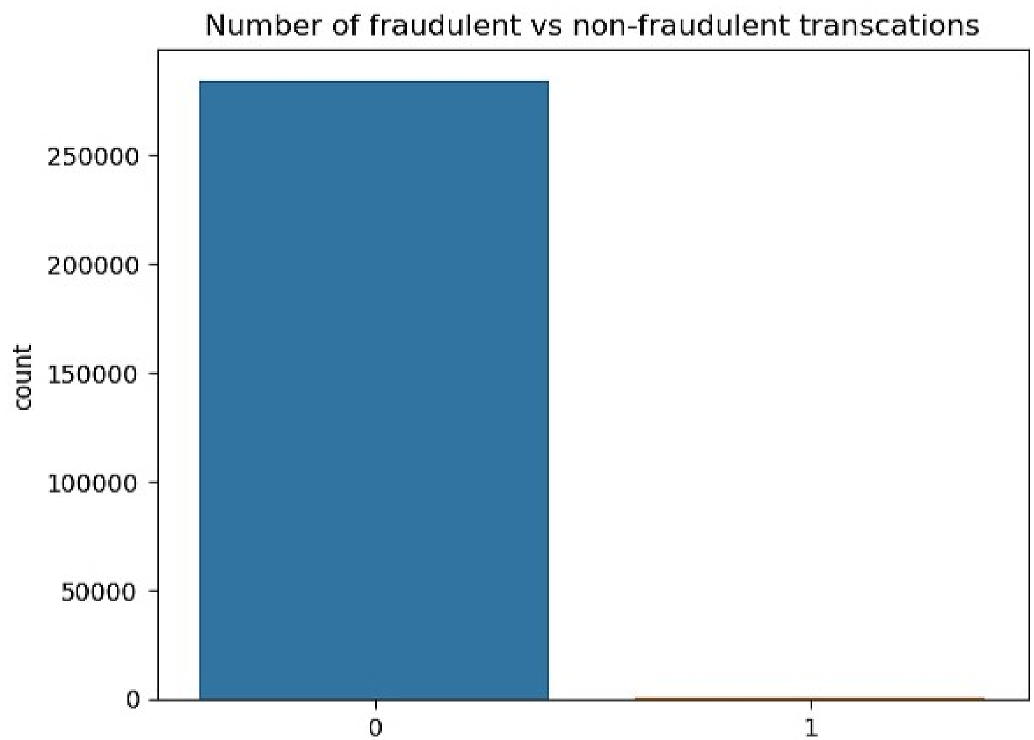
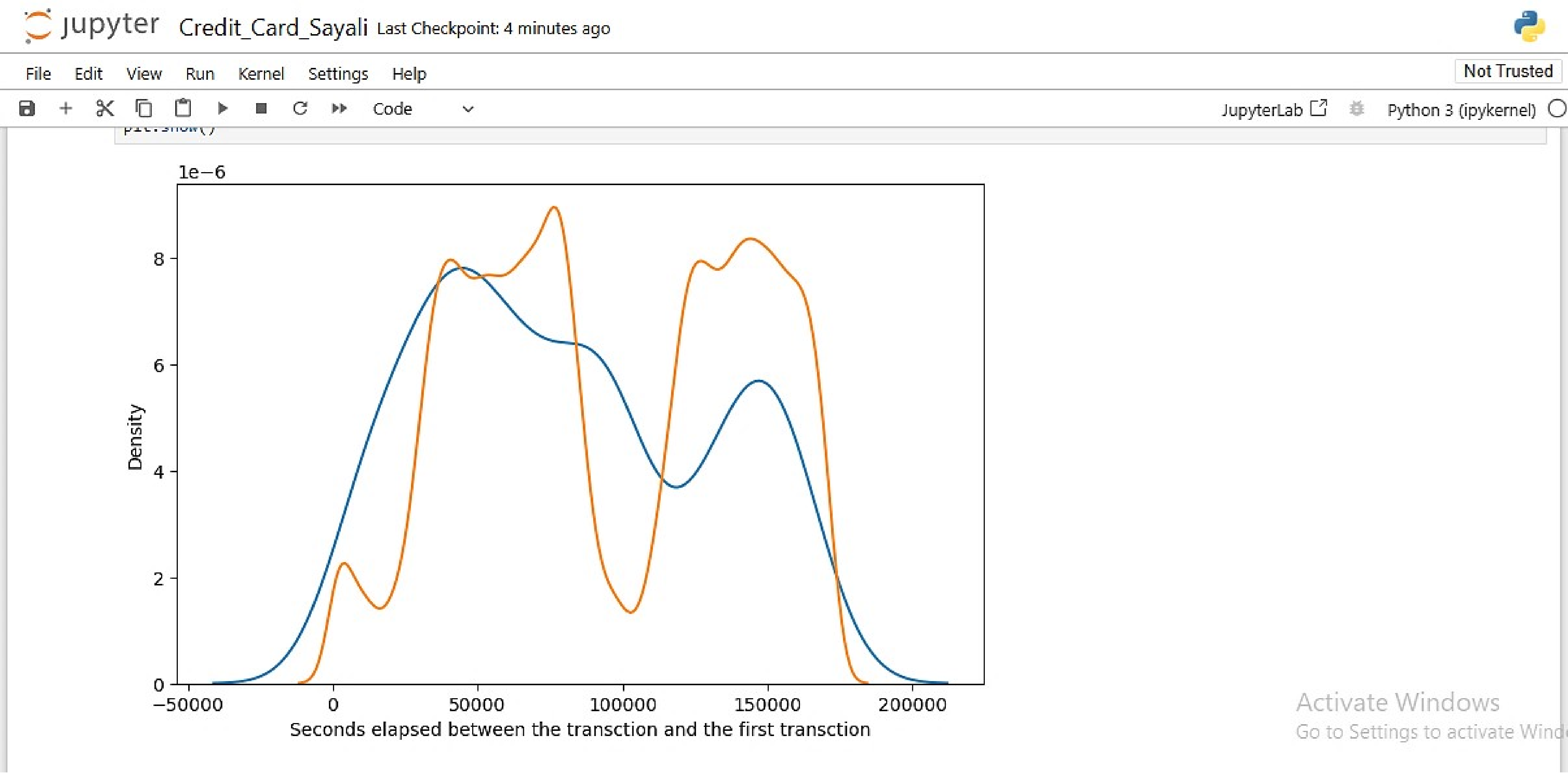
Code

JupyterLab Python 3 (ipykernel)

[10]:

```
# Bar plot for the number of fraudulent vs non-fraudulent transcations
sns.countplot(x='Class', data=df)
plt.title("Number of fraudulent vs non-fraudulent transcations')
plt.show()
```

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Code
JupyterLab
Python 3 (ipykernel)
1e−6
8
6
4
2
0
Density
−50000
0
50000
100000
150000
200000
Seconds elapsed between the transction and the first transction
Activate Windows

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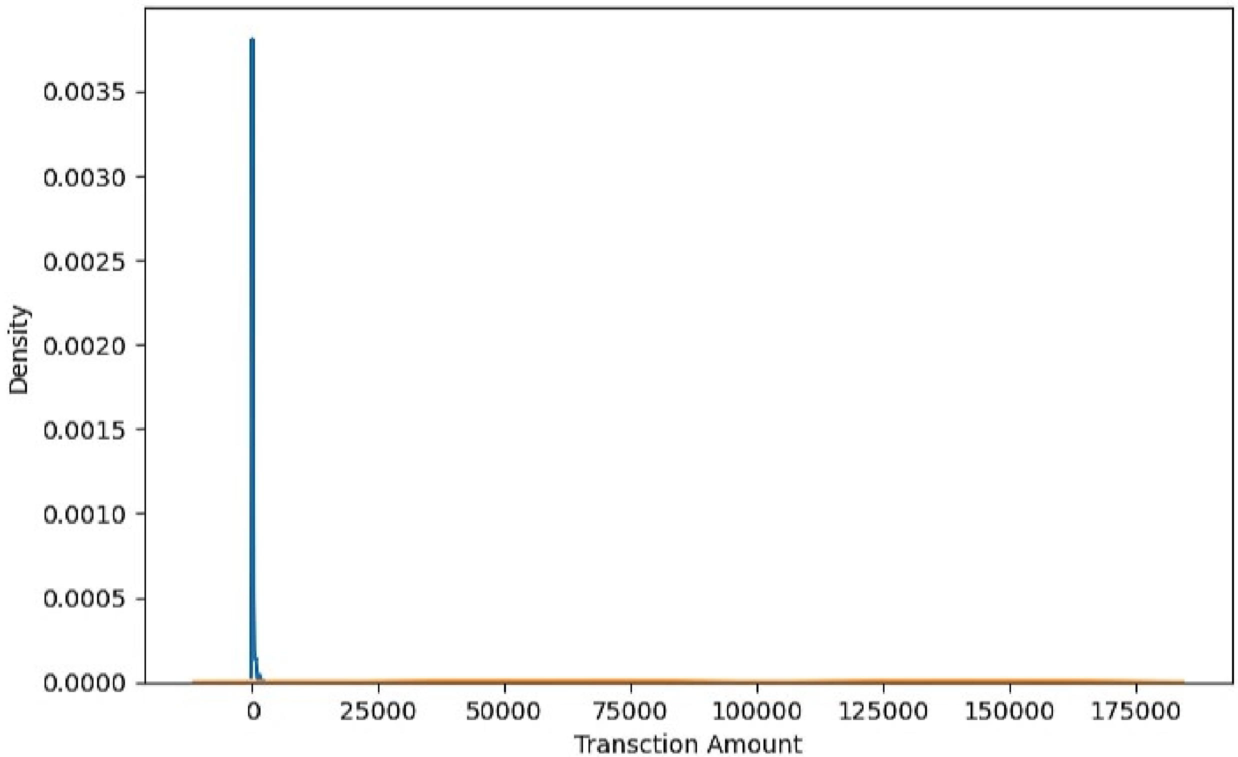
Code JupyterLab Python 3 (ipykernel)

```
ax.set(xlabel='Transction Amount')
plt.show()
```



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Code

JupyterLab

Python 3 (ipykernel)

```python
scaler = StandardScaler()
```

[19]:
```python
# Fit the data into scaler and transform
X_train['Amount'] = scaler.fit_transform(X_train[['Amount']])
```

[20]:
```python
X_train.head()
```

[20]:

V5	V6	V7	V8	V9	V10	...	V20	V21	V22	V23	V24	V25	V26	V27	V28	Amount
486	0.283718	-0.674694	0.192230	1.124319	-0.037763	...	-0.171390	-0.195207	-0.477813	0.340513	0.059174	-0.431015	-0.297028	-0.000063	-0.046947	-0.345273
846	0.089253	0.626708	-0.049137	-0.732566	0.297692	...	0.206709	-0.124288	-0.263560	-0.110568	-0.434224	-0.509076	0.719784	-0.006357	0.146053	-0.206439
918	-0.195727	-0.462586	0.919341	-0.612193	-0.966197	...	0.842838	0.274911	-0.319550	0.212891	-0.268792	0.241190	0.318445	-0.100726	-0.365257	0.358043
376	-1.232633	0.248573	-0.539483	-0.813368	0.785431	...	-0.196551	-0.406722	-0.899081	0.137370	0.075894	-0.244027	0.455618	-0.094066	-0.031488	0.362400
734	-1.438232	-0.119942	-0.449263	-0.717258	0.851668	...	-0.045417	0.050447	0.125601	0.215531	-0.080485	-0.063975	-0.307176	-0.042838	-0.063872	-0.316109

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Code JupyterLab Python 3 (ipykernel)

Scaling the test set

We don't fit scaler on the test set. We only transform the test set.

[21]:
```
# Transform the test set
X_test['Amount'] = scaler.transform(X_test[['Amount']])
X_test.head()
```

[21]:

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	...	V20	V21	V22	V23	V
49089	1.229452	-0.235478	-0.627166	0.419877	1.797014	4.069574	-0.896223	1.036103	0.745991	-0.147304	...	-0.057922	-0.170060	-0.288750	-0.130270	1.025
154704	2.016893	-0.088751	-2.989257	-0.142575	2.675427	3.332289	-0.652336	0.752811	1.962566	-1.025024	...	-0.147619	-0.184153	-0.089661	0.087188	0.570
67247	0.535093	-1.469185	0.868279	0.385462	-1.439135	0.368118	-0.499370	0.303698	1.042073	-0.437209	...	0.437685	0.028010	-0.384708	-0.128376	0.286
251657	2.128486	-0.117215	-1.513910	0.166456	0.359070	-0.540072	0.116023	-0.216140	0.680314	0.079977	...	-0.227278	-0.357993	-0.905085	0.223474	-1.075
201903	0.558593	1.587908	-2.368767	5.124413	2.171788	-0.500419	1.059829	-0.254233	-1.959060	0.948915	...	0.249457	-0.035049	0.271455	0.381606	0.332

5 rows × 29 columns

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Code JupyterLab Python 3 (ipykernel)

Checking the Skewness

[22]:
```
# Listing the columns
cols = X_train.columns
cols
```

[22]:
```
Index(['V1', 'V2', 'V3', 'V4', 'V5', 'V6', 'V7', 'V8', 'V9', 'V10', 'V11',
       'V12', 'V13', 'V14', 'V15', 'V16', 'V17', 'V18', 'V19', 'V20', 'V21',
       'V22', 'V23', 'V24', 'V25', 'V26', 'V27', 'V28', 'Amount'],
      dtype='object')
```

[23]:
```
# Plotting the distribution of the variables (skewness) of all the columns
k=0
plt.figure(figsize=(17,28))
for col in cols :
    k=k+1
    plt.subplot(6, 5,k)
    sns.distplot(X_train[col])
    plt.title(col+' '+str(X_train[col].skew()))
```

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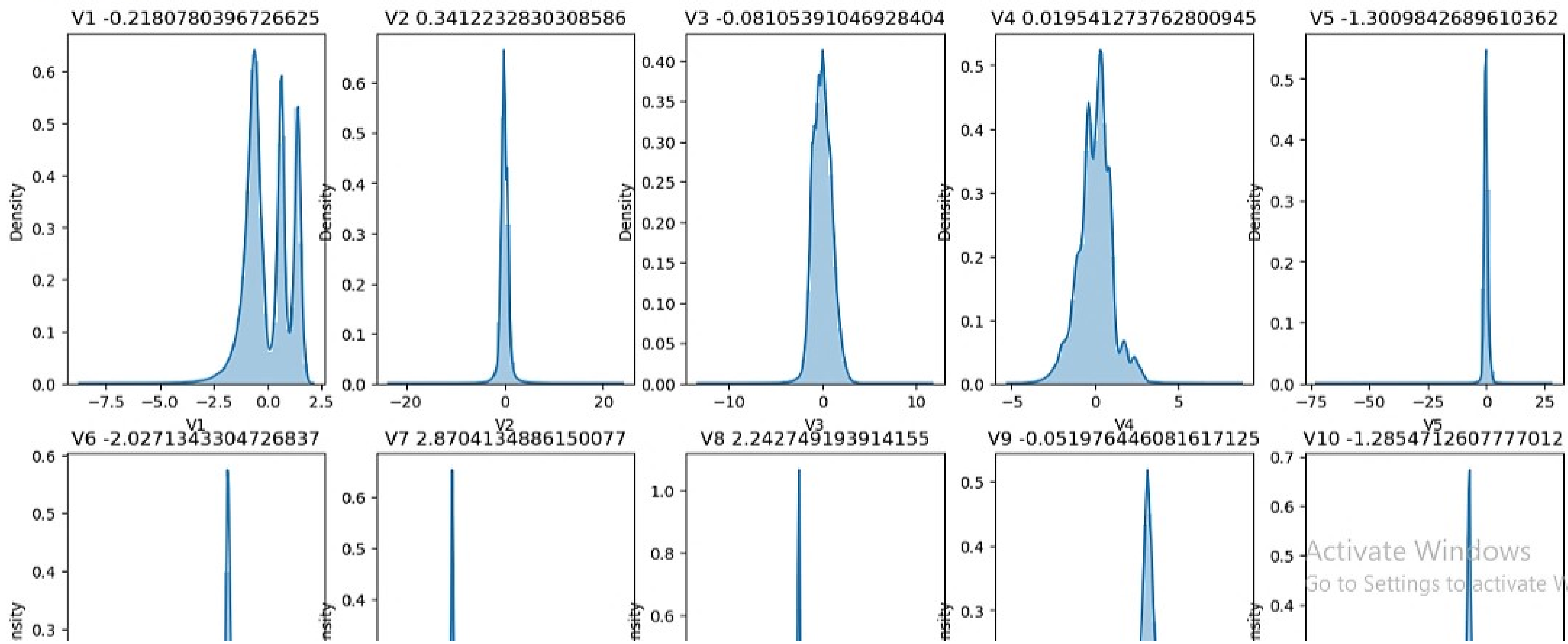
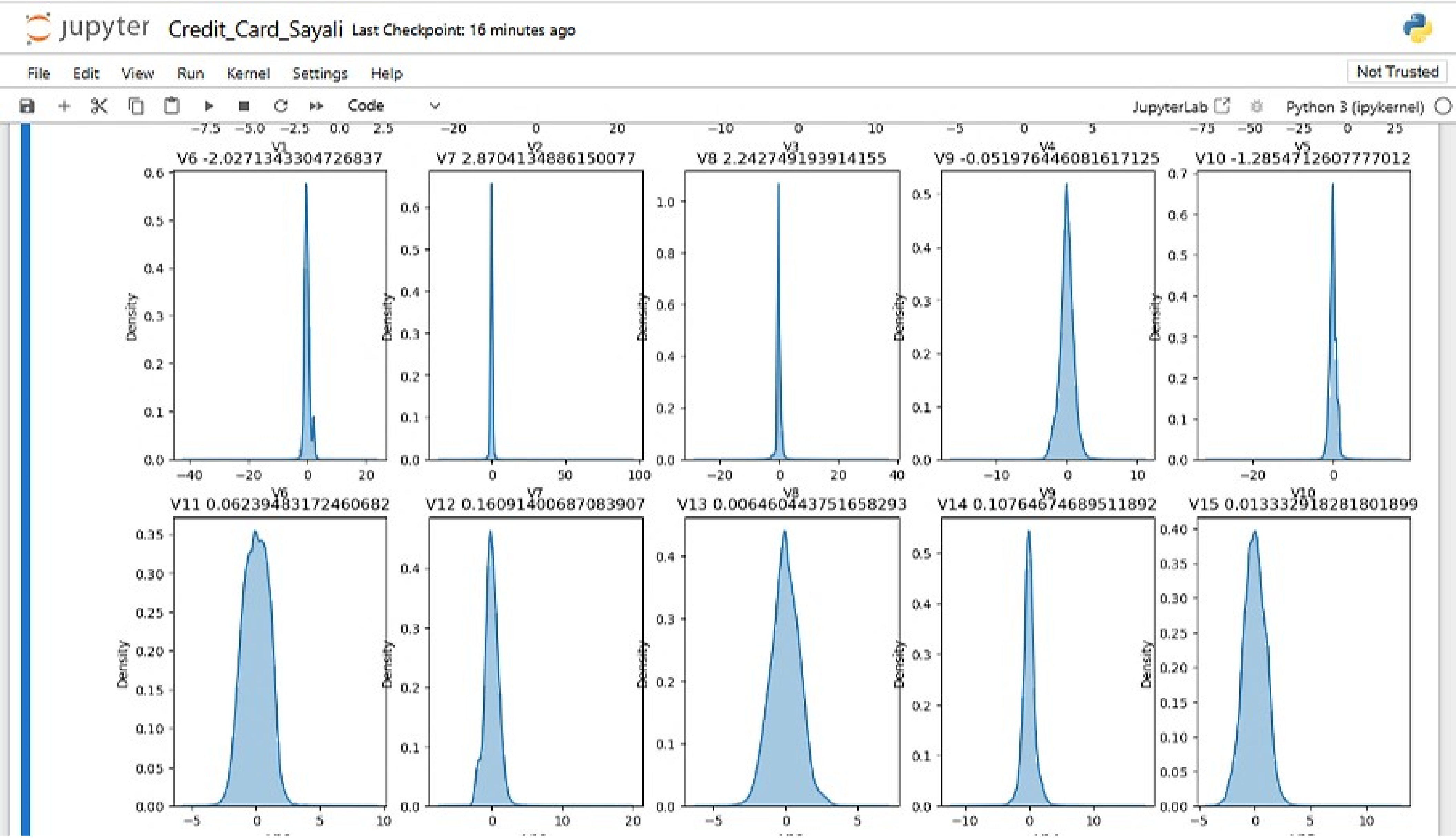
Markdown JupyterLab Python 3 (ipykernel)

```python
plt.subplot(6, 5,k)
sns.distplot(X_train[col])
plt.title(col+' '+str(X_train[col].skew()))
```





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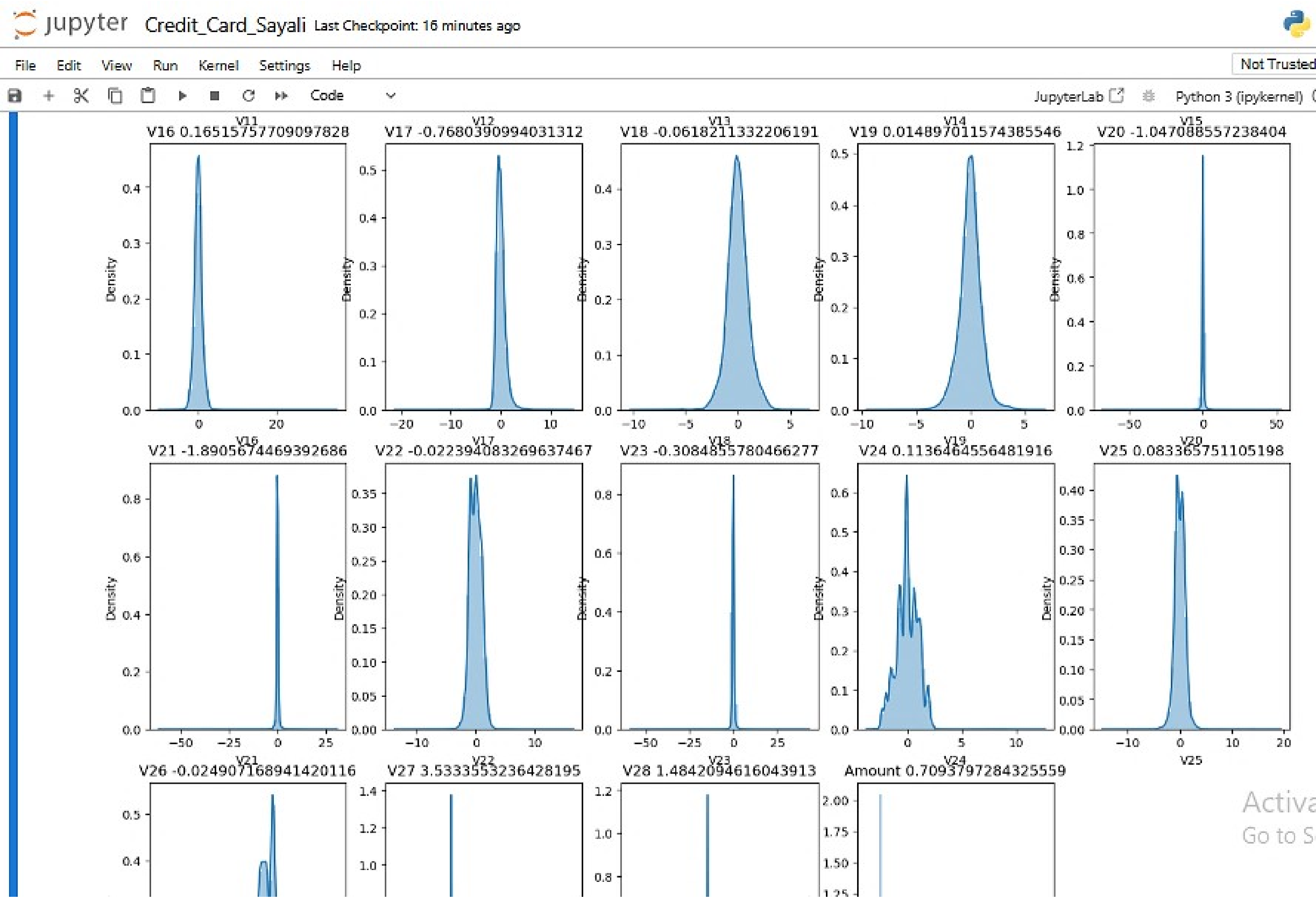
Code
JupyterLab
Python 3 (ipykernel)
V6 -2.0271343304726837
V7 2.8704134886150077
V8 2.242749193914155
V9 -0.051976446081617125
V10 -1.2854712607777012
V11 0.06239483172460682
V12 0.16091400687083907
V13 0.006460443751658293
V14 0.10764674689511892
V15 0.013332918281801899
Density



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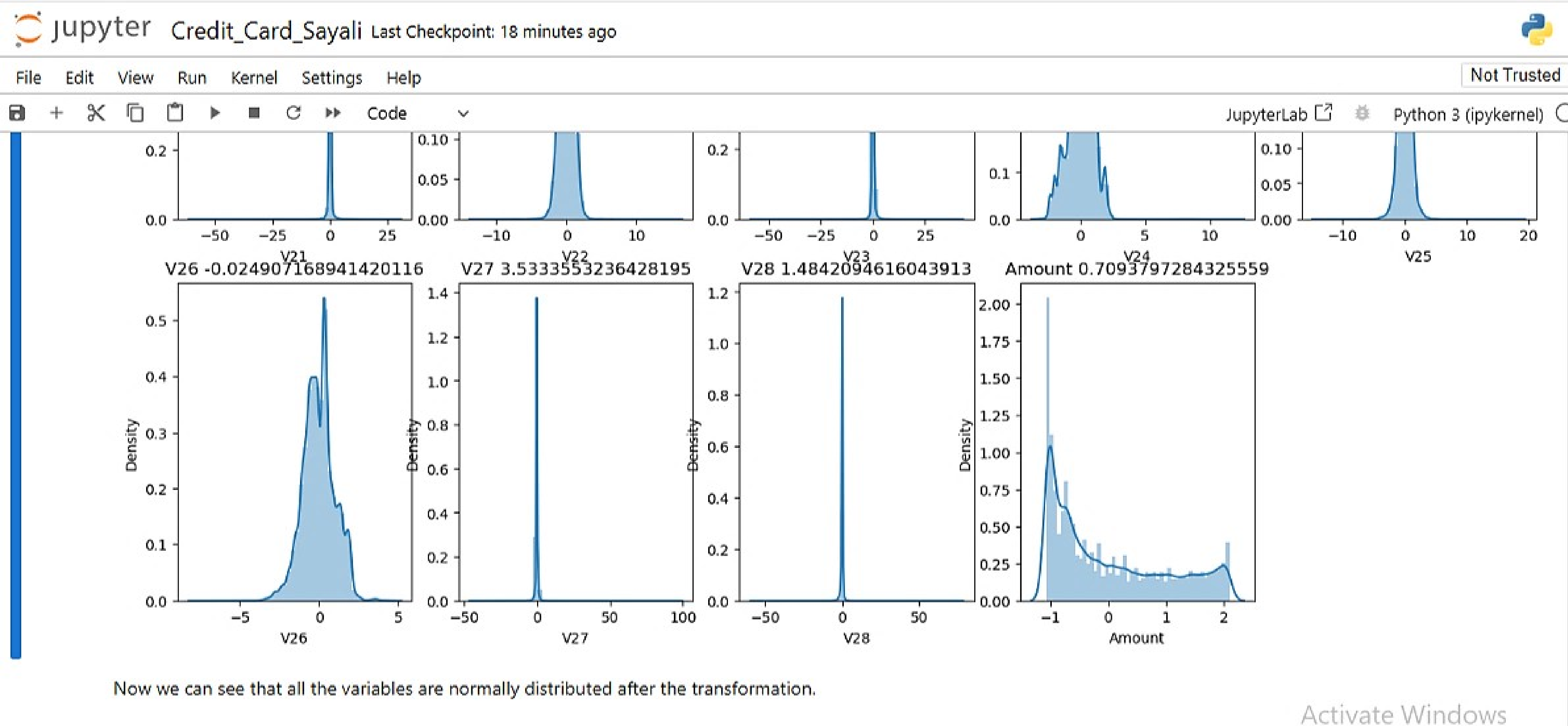
Code
JupyterLab
Python 3 (ipykernel)
V16 0.16515757709097828
V17 -0.7680390994031312
V18 -0.0618211332206191
V19 0.014897011574385546
V20 -1.047088557238404
V21 -1.8905674469392686
V22 -0.022394083269637467
V23 -0.3084855780466277
V24 0.1136464556481916
V25 0.083365751105198
V26 -0.024907168941420116
V27 3.5333553236428195
V28 1.4842094616043913
Amount 0.7093797284325559
Density
V25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Code
JupyterLab
Python 3 (ipykernel)
V21
V22
V23
V24
V25
V26 -0.02490716894142011б
V27 3.5333553236428195
V28 1.4842094616043913
Amount 0.7093797284325559
Density
V26
V27
V28
Amount
Now we can see that all the variables are normally distributed after the transformation.
Activate Windows

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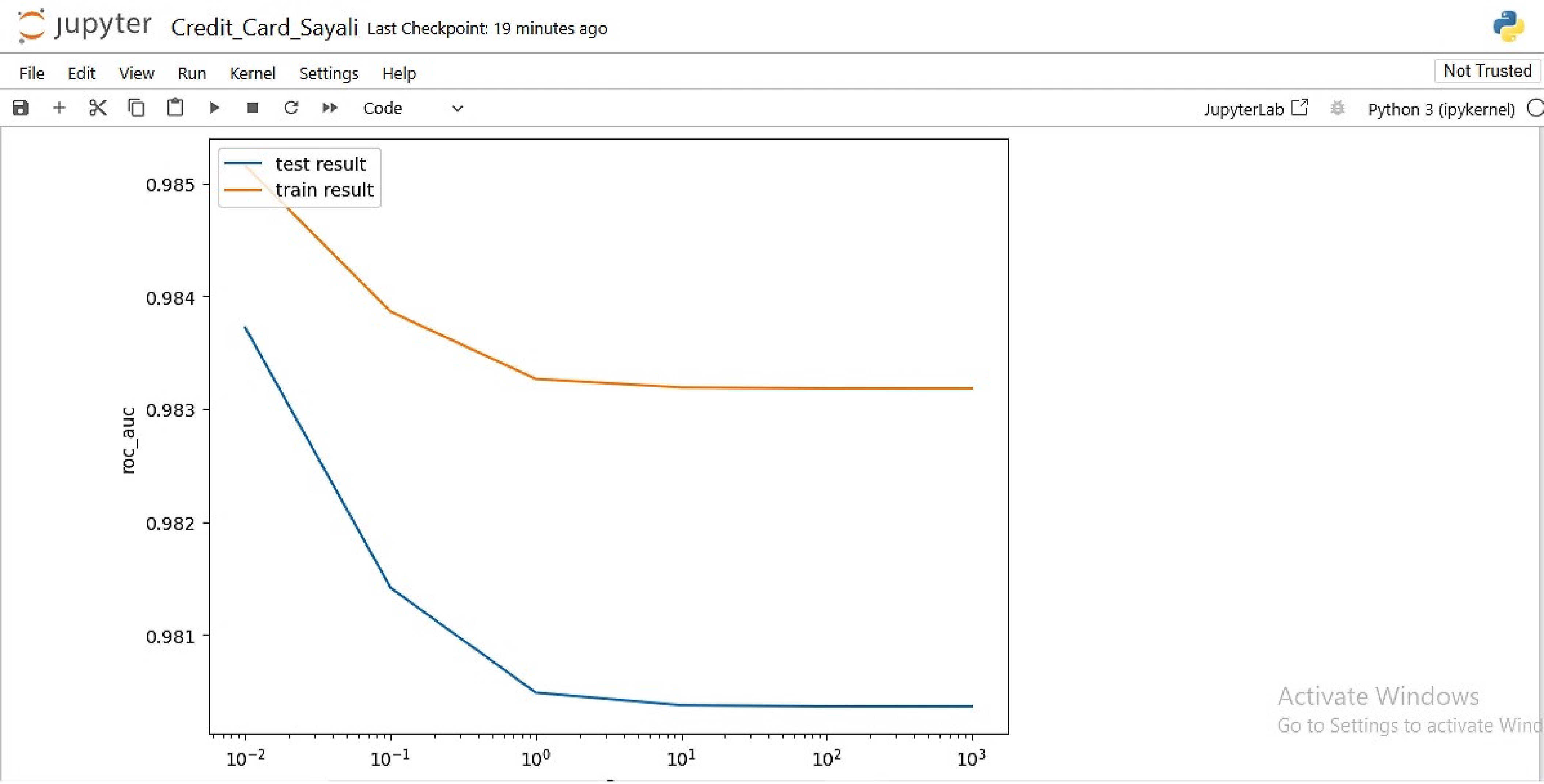
Code JupyterLab Python 3 (ipykernel)

On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

[30]:
```
# results of grid search CV
cv_results = pd.DataFrame(model_cv.cv_results_)
cv_results
```

[30]:

an_test_score	std_test_score	rank_test_score	split0_train_score	split1_train_score	split2_train_score	split3_train_score	split4_train_score	mean_train_score	std_train_score
0.983719	0.008479	1	0.984043	0.984587	0.988474	0.985596	0.983075	0.985155	0.001849
0.981416	0.010893	2	0.982402	0.983785	0.987917	0.984018	0.981187	0.983862	0.002270
0.980484	0.011635	3	0.981722	0.983322	0.987492	0.983305	0.980489	0.983266	0.002365
0.980375	0.011715	4	0.981632	0.983262	0.987435	0.983216	0.980404	0.983190	0.002375
0.980365	0.011722	5	0.981625	0.983256	0.987429	0.983207	0.980396	0.983182	0.002376
0.980363	0.011723	6	0.981623	0.983256	0.987428	0.983206	0.980395	0.983182	0.002376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Code
JupyterLab
Python 3 (ipykernel)
test result
train result
roc_auc
0.985
0.984
0.983
0.982
0.981
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
Activate Windows
Go to Settings to activate Wind