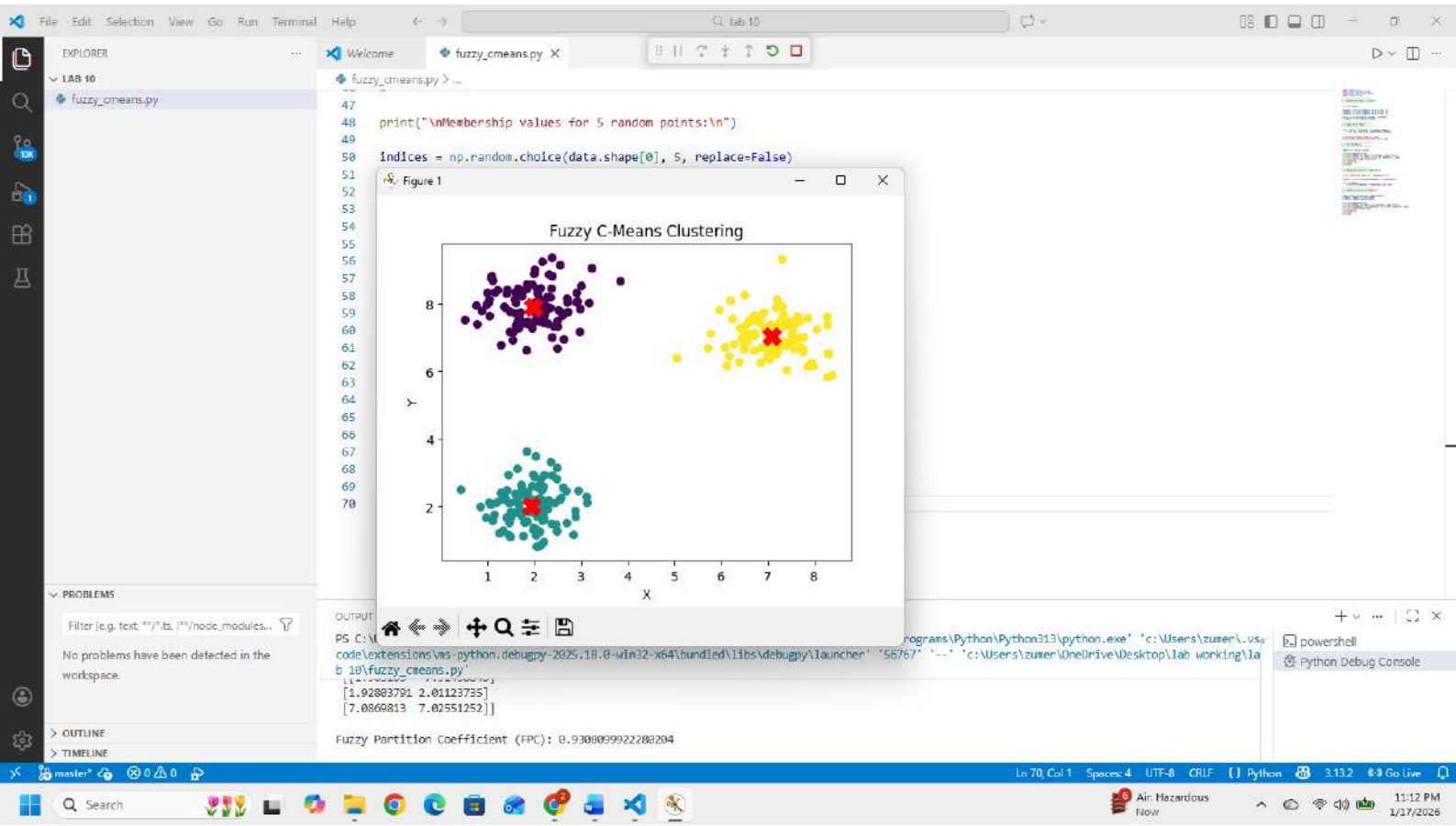
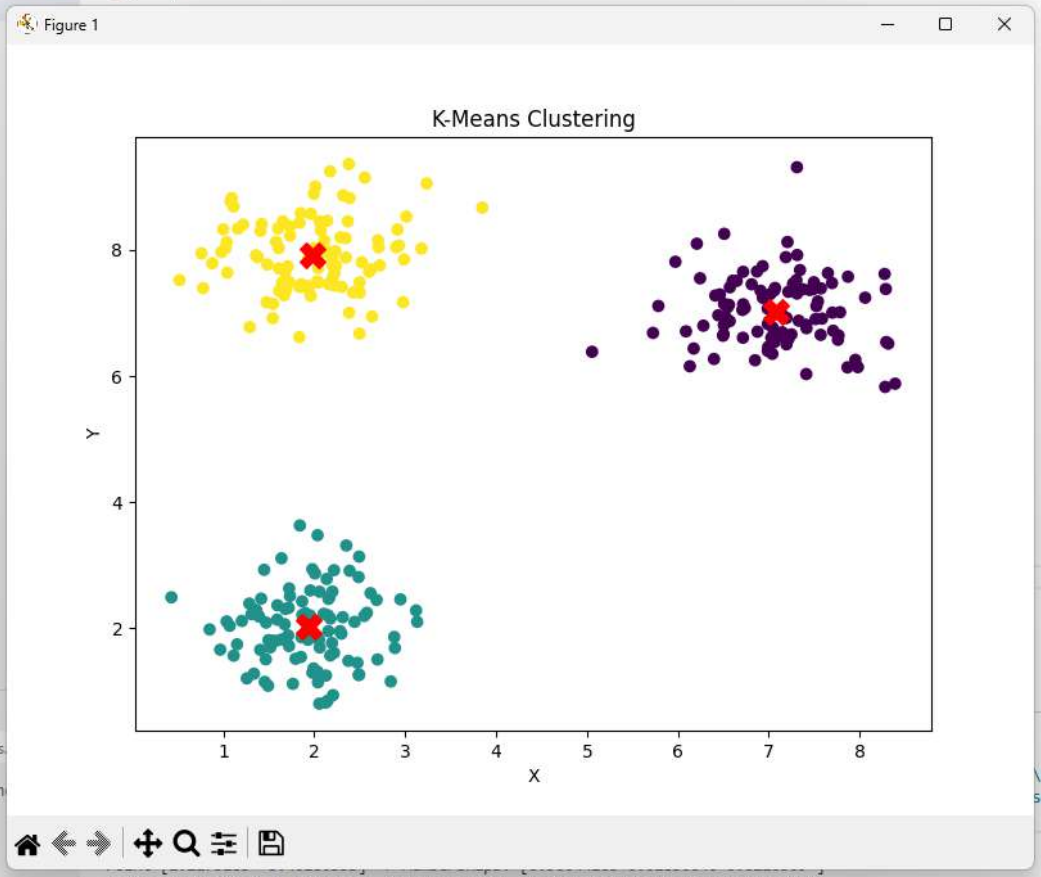

File Edit Selection View Go Run Terminal Help
lab 10
EXPLORER
LAB 10
fuzzy_cmeans.py
Welcome
fuzzy_cmeans.py
print("\nMembership values for 5 random points:\n")
Indices = np.random.choice(data.shape[0], 5, replace=False)
Figure 1
Fuzzy C-Means Clustering
X
Y
PROBLEMS
No problems have been detected in the workspace.
OUTLINE
TIMELINE
[1.92883791 2.01123735]
[7.0869813 7.02551252]]
Fuzzy Partition Coefficient (FPC): 0.9308099922280204
powershell
Python Debug Console
Search



Point [1.93578178 7.37885461] -> Memberships: [0.97963363 0.00978819 0.01057818]
Point [2.15029571 2.20786893] -> Memberships: [0.00268899 0.99546859 0.00184242]

Ln 70, Col 1 Spaces: 4 UTF-8 CRLF { } Python

Air: Hazardous
Now

```
OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>  & 'c:\Users\zumer\AppData\Local\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '56767' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\fuzzy_cmeans.py'
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>  c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Local\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '57869' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\iris_fcm.py'
Dataset shape: (150, 4)

Cluster Centers (FCM):
 [[0.67724888 0.44117882 0.77508644 0.81130969]
 [0.19571065 0.5897661  0.0825584  0.06383642]
 [0.43605739 0.30805893 0.56665884 0.5295761 ]]

Fuzzy Partition Coefficient (FPC): 0.7424816957392866

First 20 Predicted Clusters (FCM):
[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1]

First 20 Actual Labels:
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]

Cluster to Label Mapping: {np.int64(0): np.int64(2), np.int64(1): np.int64(0), np.int64(2): np.int64(1)}
FCM Accuracy: 0.8666666666666667

K-Means Accuracy: 0.88
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>
```

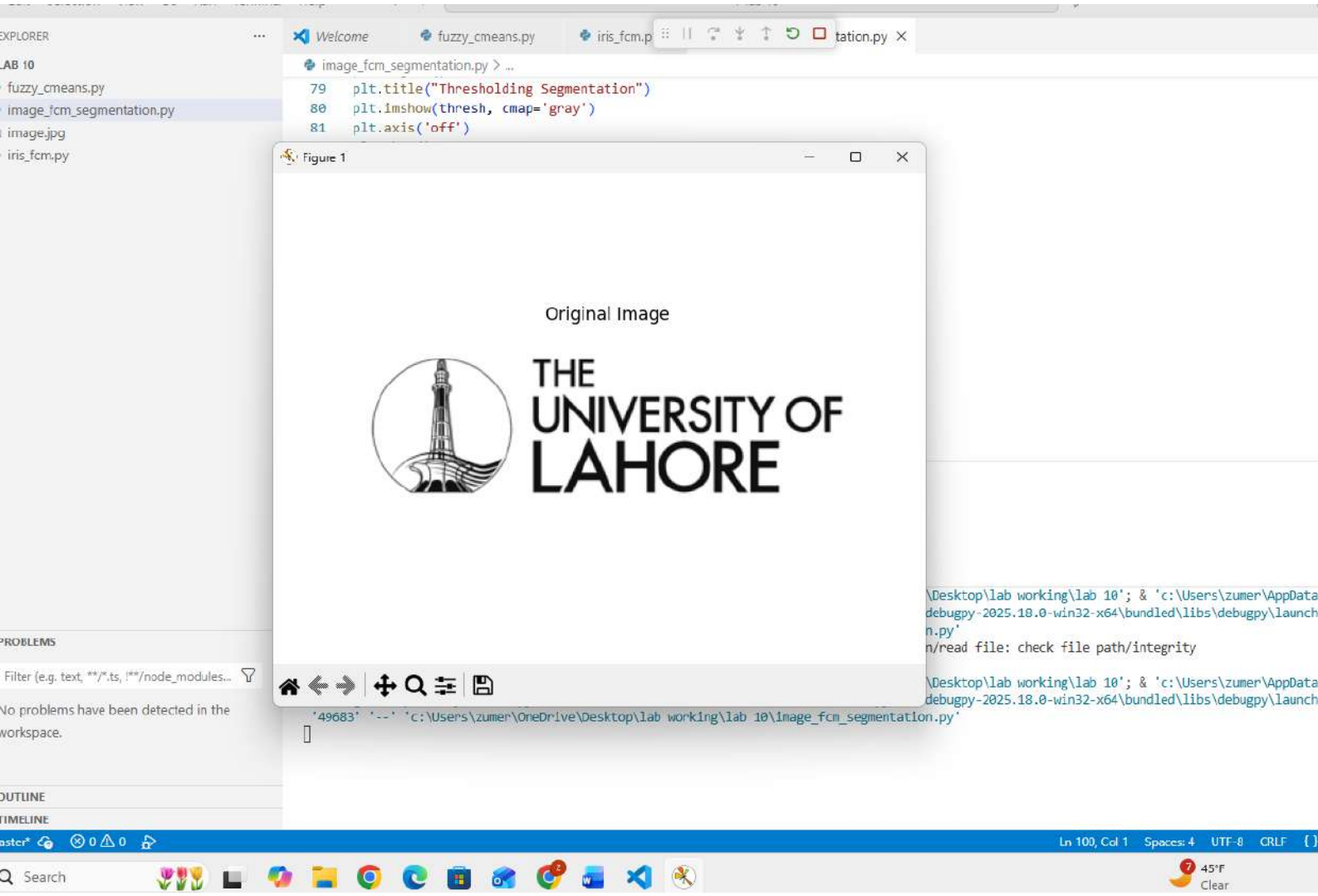
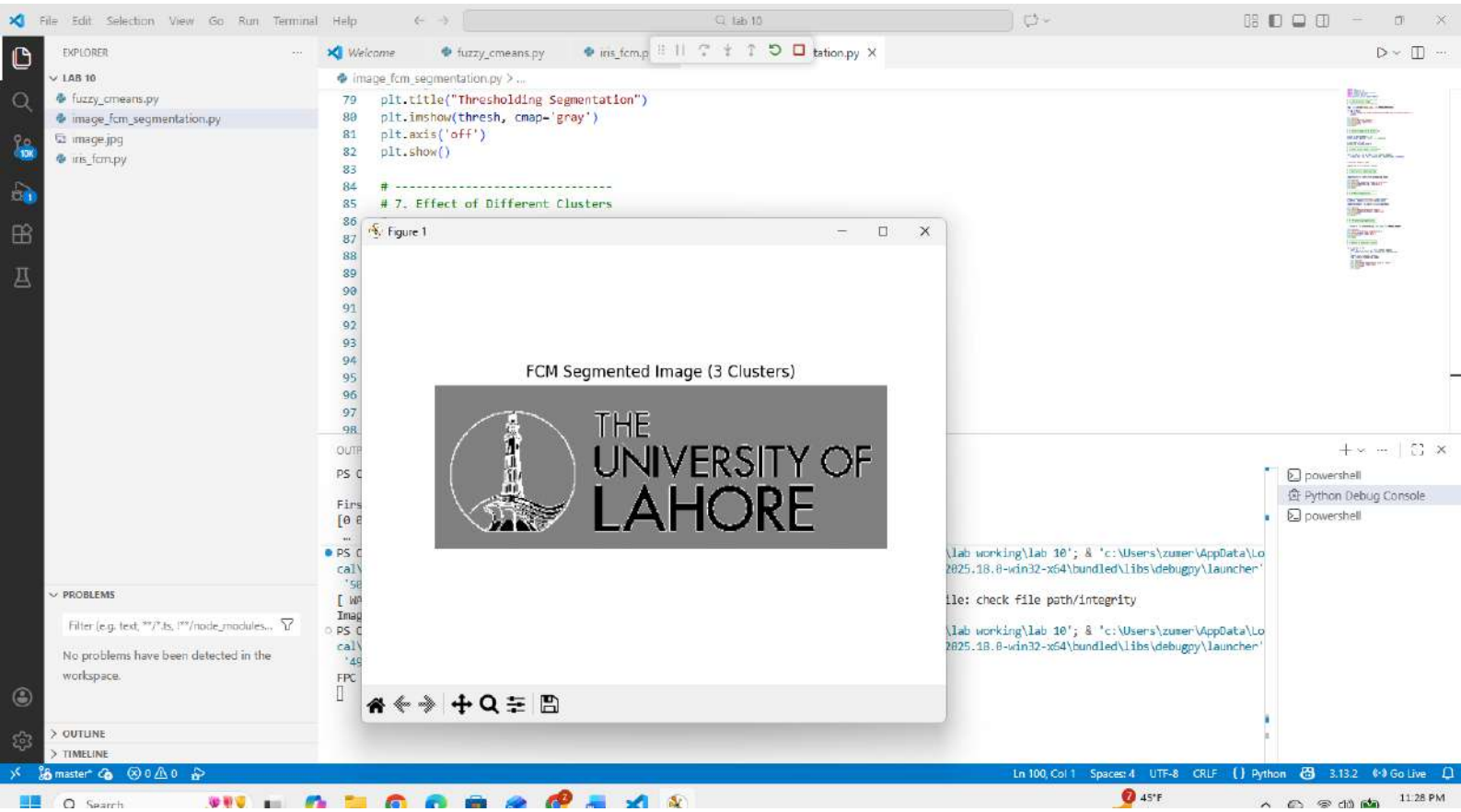
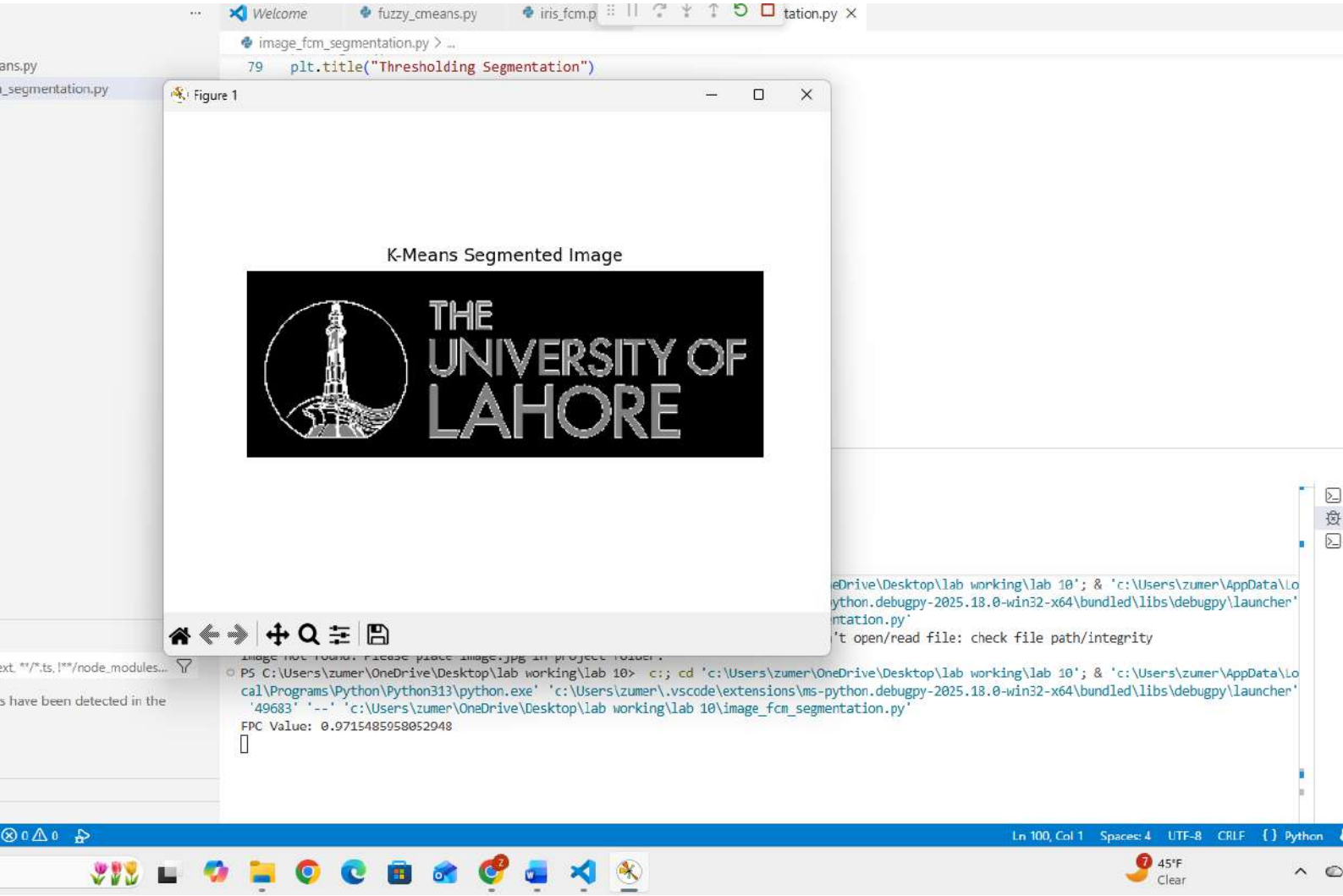
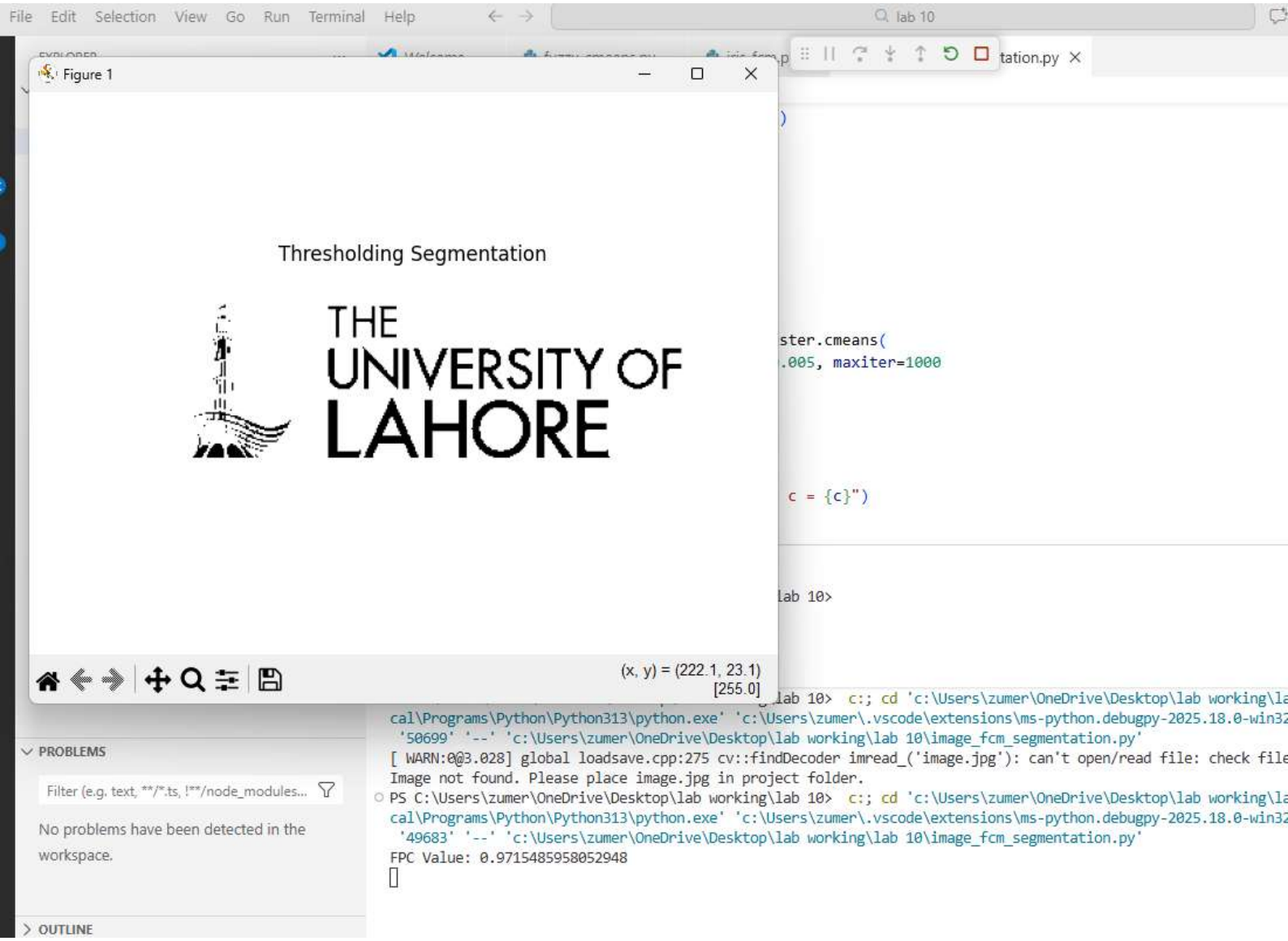
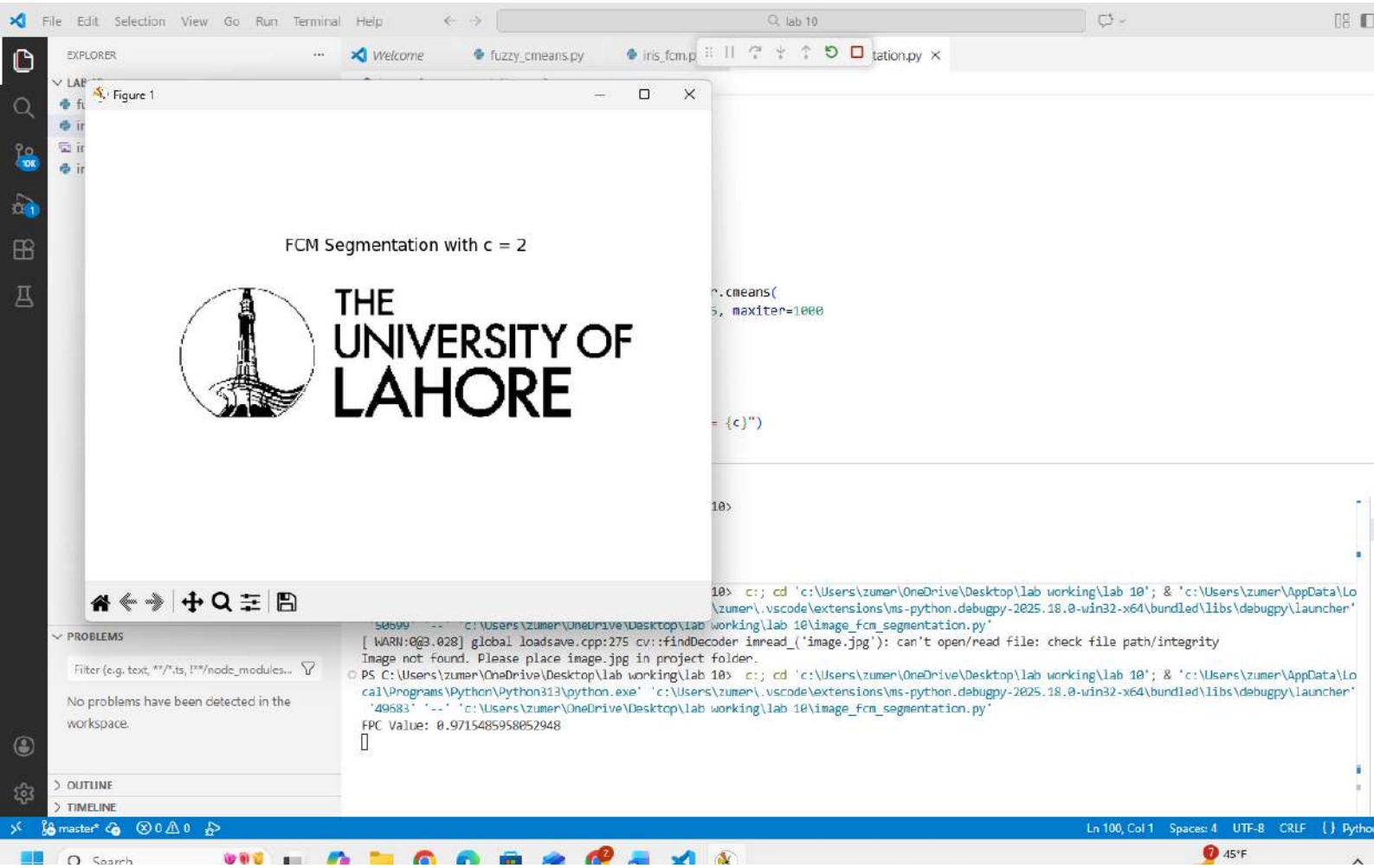


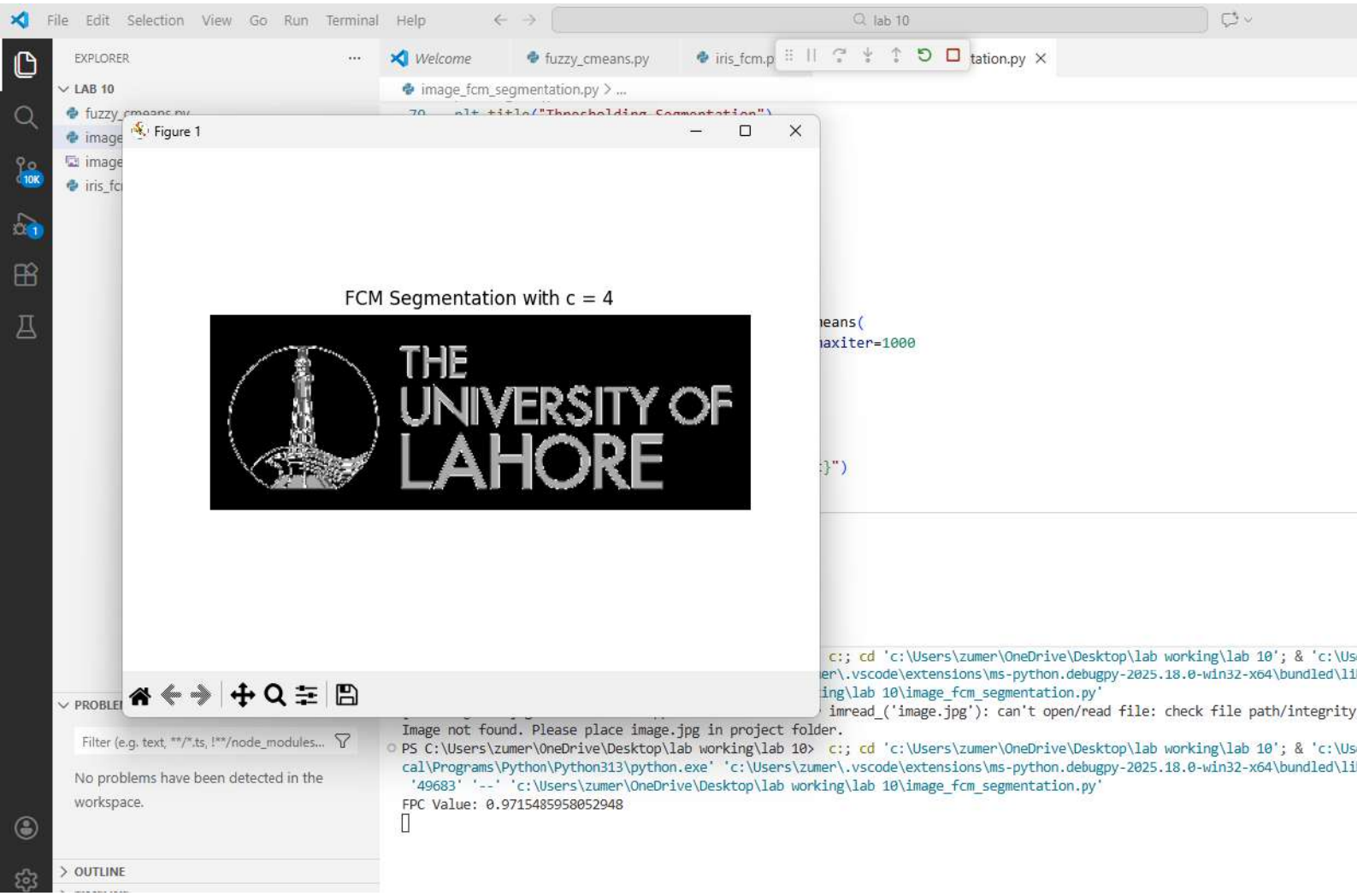
Figure 1
Original Image
THE
UNIVERSITY OF
LAHORE


File Edit Selection View Go Run Terminal Help
lab 10
EXPLORER
LAB 10
fuzzy_cmeans.py
image_fcm_segmentation.py
image.jpg
iris_fcm.py
Welcome
fuzzy_cmeans.py
image_fcm_segmentation.py > ...
plt.title("Thresholding Segmentation")
plt.imshow(thresh, cmap='gray')
plt.axis('off')
plt.show()
# ------------------------------
# 7. Effect of Different Clusters
Figure 1
FCM Segmented Image (3 Clusters)
THE UNIVERSITY OF LAHORE
PROBLEMS
No problems have been detected in the workspace.
OUTLINE
TIMELINE
powershell
Python Debug Console
powershell
master
Ln 100, Col 1
Spaces: 4
UTF-8
CRLF
Python
3.13.2
Go Live
11:28 PM


Welcome
fuzzy_cmeans.py
iris_fcm.p
tation.py
image_fcm_segmentation.py > ...
79 plt.title("Thresholding Segmentation")
ans.py
_segmentation.py
Figure 1
K-Means Segmented Image
THE UNIVERSITY OF LAHORE
eDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Lo
ython.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
ntation.py'
't open/read file: check file path/integrity
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Lo
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
'49683' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
FPC Value: 0.9715485958052948
s have been detected in the
Ln 100, Col 1 Spaces: 4 UTF-8 CRLF { } Python
45°F
Clear


File Edit Selection View Go Run Terminal Help
lab 10
Figure 1
Thresholding Segmentation
THE
UNIVERSITY OF
LAHORE
(x, y) = (222.1, 23.1)
[255.0]
tation.py
ster.cmeans(
.005, maxiter=1000
c = {c}")
lab 10>
lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\la
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32
'50699' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
[WARN:0@3.028] global loadsave.cpp:275 cv::findDecoder imread_('image.jpg'): can't open/read file: check file
Image not found. Please place image.jpg in project folder.
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\la
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32
'49683' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
FPC Value: 0.9715485958052948
PROBLEMS
Filter (e.g. text, **/*.ts, !**/node_modules...
No problems have been detected in the workspace.
OUTLINE


File Edit Selection View Go Run Terminal Help
lab 10
EXPLORER
Welcome
fuzzy_cmeans.py
iris_fcm.p
tation.py
Figure 1
FCM Segmentation with c = 2
THE
UNIVERSITY OF
LAHORE
.cmeans(
5, maxiter=1000
= {c}")
10>
10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Lo
\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
working\lab 10\image_fcm_segmentation.py'
[WARN:0@3.028] global loadsave.cpp:275 cv::findDecoder imread_('image.jpg'): can't open/read file: check file path/integrity
Image not found. Please place image.jpg in project folder.
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Lo
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
'49683' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
FPC Value: 0.9715485958852948
PROBLEMS
Filter (e.g. text, **/*.ts, !**/node_modules...
No problems have been detected in the workspace.
OUTLINE
TIMELINE
master*
Ln 100, Col 1
Spaces: 4
UTF-8
CRLF
45°F


File Edit Selection View Go Run Terminal Help
lab 10
EXPLORER
LAB 10
Welcome
fuzzy_cmeans.py
iris_fcm.p
tation.py
image_fcm_segmentation.py > ...
Figure 1
FCM Segmentation with c = 4
THE UNIVERSITY OF LAHORE
PROBLEMS
Filter (e.g. text, **/*.ts, !**/node_modules...
No problems have been detected in the workspace.
OUTLINE
Image not found. Please place image.jpg in project folder.
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>
FPC Value: 0.9715485958052948

File Edit Selection View Go Run Terminal Help

lab 10

EXPLORER

LAB 10

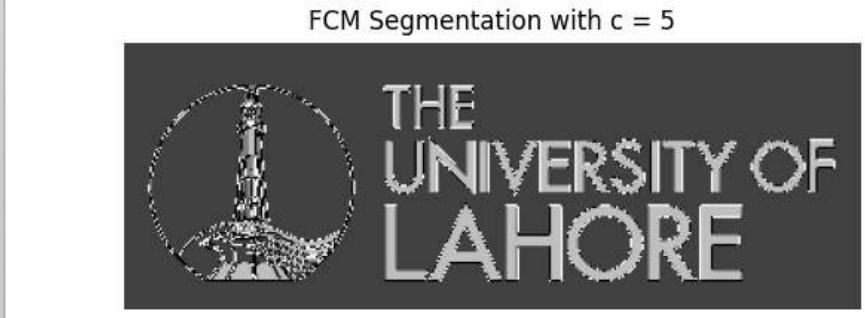
- fuzzy_cmeans.py
- image_fcm_segmentation.py
- image.jpg
- iris_fcm.py

Welcome | fuzzy_cmeans.py | iris_fcm.p | tation.py

image_fcm_segmentation.py > ...

```
79  plt.title("Thresholding Segmentation")
80  plt.imshow(thresh, cmap='gray')
```

Figure 1



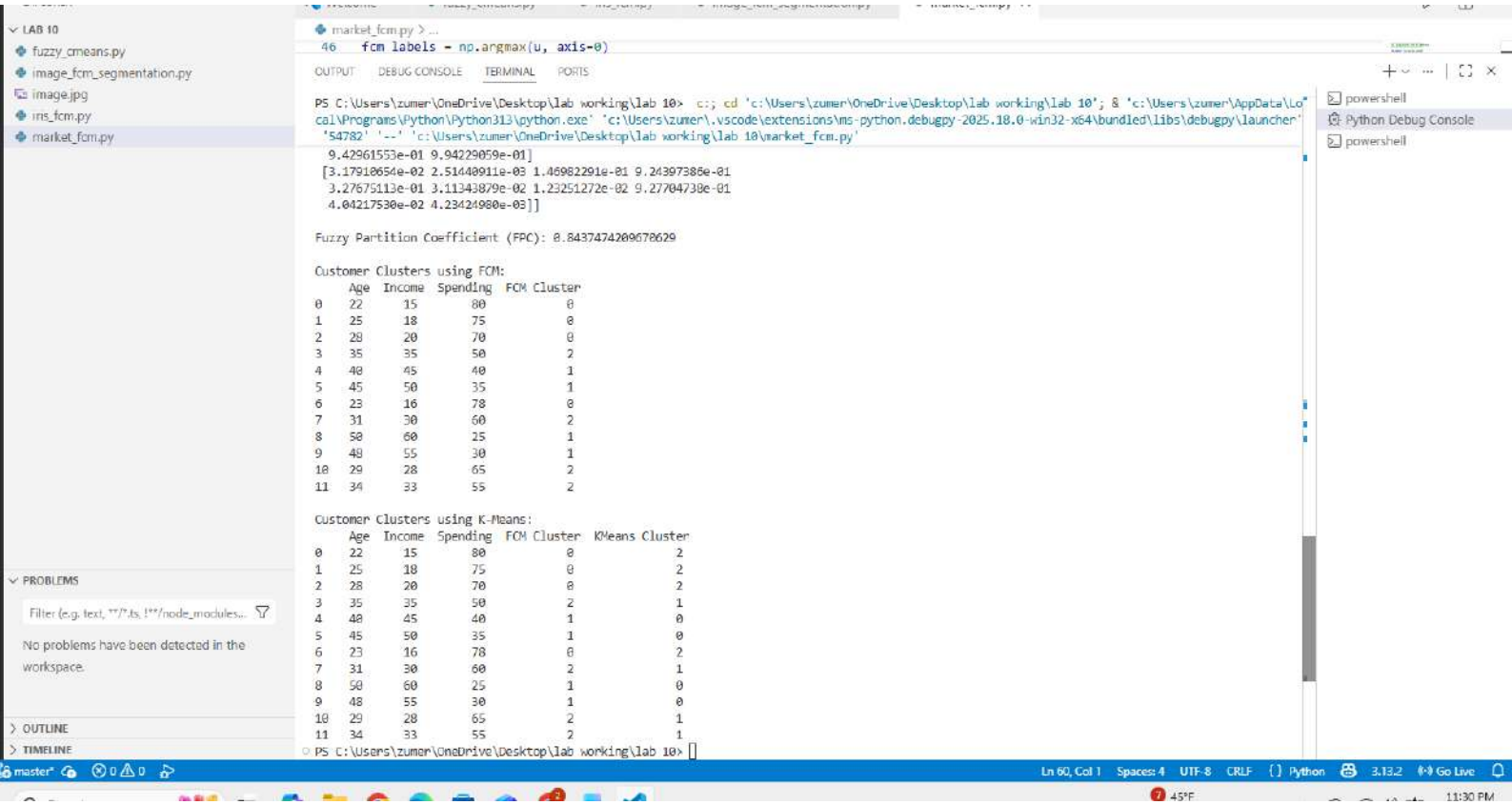

```
s(
ter=1000
```

PROBLEMS

Filter (e.g. te

No problems have been detected in the workspace.

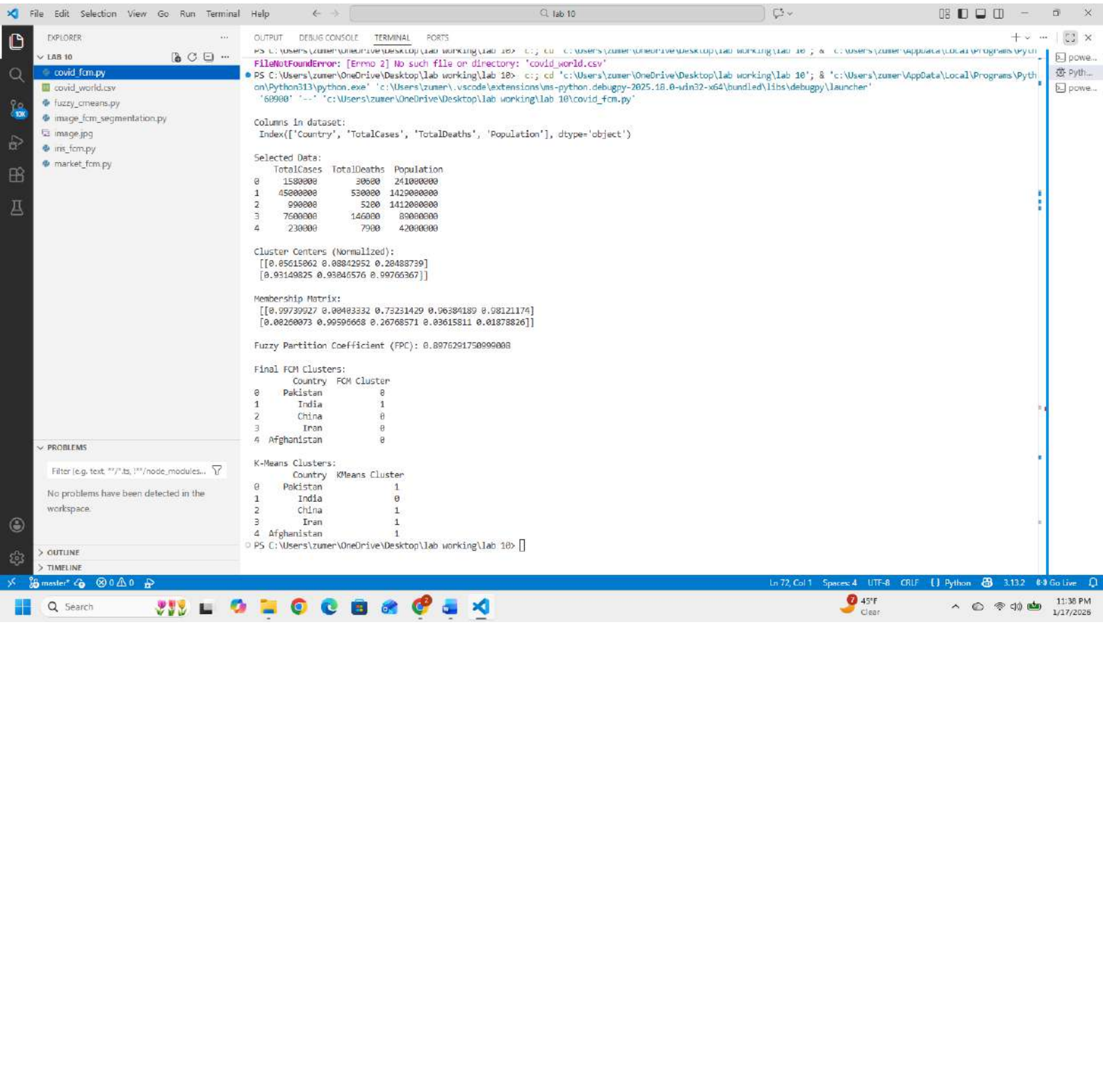
```
cd 'c:\Users\zumer\OneDrive\Desktop\lab wo
vscode\extensions\ms-python.debugpy-2025.18
lab 10\image_fcm_segmentation.py'
ead_('image.jpg'): can't open/read file: ch
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab wo
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18
 '49683' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
FPC Value: 0.9715485958052948
```


LAB 10
fuzzy_cmeans.py
image_fcm_segmentation.py
image.jpg
ins_fcm.py
market_fcm.py
market_fcm.py > ...
46 fcm_labels = np.argmax(u, axis=0)
OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Local\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '54782' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\market_fcm.py'
9.42961553e-01 9.94229059e-01]
[3.17910654e-02 2.51440911e-03 1.46982291e-01 9.24397386e-01
3.27675113e-01 3.11343879e-02 1.23251272e-02 9.27704730e-01
4.04217530e-02 4.23424980e-03]]
Fuzzy Partition Coefficient (FPC): 0.8437474200678629
Customer Clusters using FCM:
Age Income Spending FCM Cluster
0 22 15 80 0
1 25 18 75 0
2 28 20 70 0
3 35 35 50 2
4 40 45 40 1
5 45 50 35 1
6 23 16 78 0
7 31 30 60 2
8 50 60 25 1
9 48 55 30 1
10 29 28 65 2
11 34 33 55 2
Customer Clusters using K-Means:
Age Income Spending FCM Cluster KMeans Cluster
0 22 15 80 0 2
1 25 18 75 0 2
2 28 20 70 0 2
3 35 35 50 2 1
4 40 45 40 1 0
5 45 50 35 1 0
6 23 16 78 0 2
7 31 30 60 2 1
8 50 60 25 1 0
9 48 55 30 1 0
10 29 28 65 2 1
11 34 33 55 2 1
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>
powershell
Python Debug Console
powershell
PROBLEMS
Filter (e.g. text, **/*.ts, !**/node_modules...
No problems have been detected in the workspace.
OUTLINE
TIMELINE
master* 0 0
Ln 60, Col 1 Spaces: 4 UTF-8 CRLF Python 3.13.2 Go Live
45°F
11:30 PM

```
46    fcm_labels = np.argmax(u, axis=0)
```

OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
 '49683' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\image_fcm_segmentation.py'
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>  c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Lo
cal\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher'
 '54782' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\market_fcm.py'

Original Dataset:
    Age  Income  Spending
0    22      15        80
1    25      18        75
2    28      20        70
3    35      35        50
4    40      45        40
5    45      50        35
6    23      16        78
7    31      30        60
8    50      60        25
9    48      55        30
10   29      28        65
11   34      33        55

Cluster Centers (Normalized):
 [[0.08676598 0.05385106 0.92281015]
 [0.8839077  0.86158369 0.11331992]
 [0.39233425 0.38680373 0.56182238]]

Membership Matrix (first 10 customers):
 [[9.61388563e-01 9.97075943e-01 8.36118832e-01 3.59578885e-02
  6.64769716e-02 9.29254734e-03 9.85254898e-01 5.79441231e-02
  1.66166940e-02 1.53669153e-03]
 [6.82037192e-03 4.09647465e-04 1.68988776e-02 3.96447254e-02
  6.05847915e-01 9.59573065e-01 2.41997521e-03 1.43511392e-02
  9.42961553e-01 9.94229059e-01]
 [3.17910654e-02 2.51440911e-03 1.46982291e-01 9.24397386e-01
  3.27675113e-01 3.11343879e-02 1.23251272e-02 9.27704738e-01
  4.04217530e-02 4.23424980e-03]]

Fuzzy Partition Coefficient (FPC): 0.8437474209670629

Customer Clusters using FCM:
```


File Edit Selection View Go Run Terminal Help
lab 10
EXPLORER
LAB 10
covid_fcm.py
covid_world.csv
fuzzy_cmeans.py
image_fcm_segmentation.py
image.jpg
iris_fcm.py
market_fcm.py
OUTPUT DEBUG CONSOLE TERMINAL PORTS
FileNotFoundError: [Errno 2] No such file or directory: 'covid_world.csv'
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10> c:; cd 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10'; & 'c:\Users\zumer\AppData\Local\Programs\Python\Python313\python.exe' 'c:\Users\zumer\.vscode\extensions\ms-python.debugpy-2025.18.0-win32-x64\bundled\libs\debugpy\launcher' '60980' '--' 'c:\Users\zumer\OneDrive\Desktop\lab working\lab 10\covid_fcm.py'
Columns in dataset:
Index(['Country', 'TotalCases', 'TotalDeaths', 'Population'], dtype='object')
Selected Data:
TotalCases TotalDeaths Population
0 1580000 30600 241000000
1 45000000 530000 1429000000
2 990000 5200 1412000000
3 7600000 146000 89000000
4 230000 7900 42000000
Cluster Centers (Normalized):
[[0.05615862 0.08842952 0.28488739]
[0.93149825 0.93846576 0.99766367]]
Membership Matrix:
[[0.99739927 0.00483332 0.73231429 0.96384189 0.98121174]
[0.00260073 0.99596668 0.26768571 0.03615811 0.01878826]]
Fuzzy Partition Coefficient (FPC): 0.897629175099008
Final FCM Clusters:
Country FCM Cluster
0 Pakistan 0
1 India 1
2 China 0
3 Iran 0
4 Afghanistan 0
K-Means Clusters:
Country KMeans Cluster
0 Pakistan 1
1 India 0
2 China 1
3 Iran 1
4 Afghanistan 1
PS C:\Users\zumer\OneDrive\Desktop\lab working\lab 10>
PROBLEMS
No problems have been detected in the workspace.
OUTLINE
TIMELINE
master*
Ln 72, Col 1 Spaces: 4 UTF-8 CRLF Python 3.13.2 Go Live
Search
45°F Clear
11:38 PM 1/17/2026