Report

Screencapture / Output

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□duong □ Assignment6 □ ➜ (□ master) □ ♥ 22:57 □ uv run .\main.py
Python: 3.12.5 (tags/v3.12.5:ff3bc82, Aug  6 2024, 20:45:27) [MSC v.1940 64 bit
(AMD64)]
scipy: 1.14.1
numpy: 2.1.3
pandas: 2.2.3
sklearn: 1.5.2
minisom: 2.3.3
matplotlib: 3.9.2

Part 1:
Enter the elbow_k observed from the plot: 3
Confusion Matrix for k=elbow_k:
[[50  0  0]
 [ 0 47  3]
 [ 0 14 36]]
Accuracy for k=elbow_k: 0.8866666666666667
Confusion Matrix for k=3:
[[50  0  0]
 [ 0 47  3]
 [ 0 14 36]]
Accuracy for k=3: 0.8866666666666667

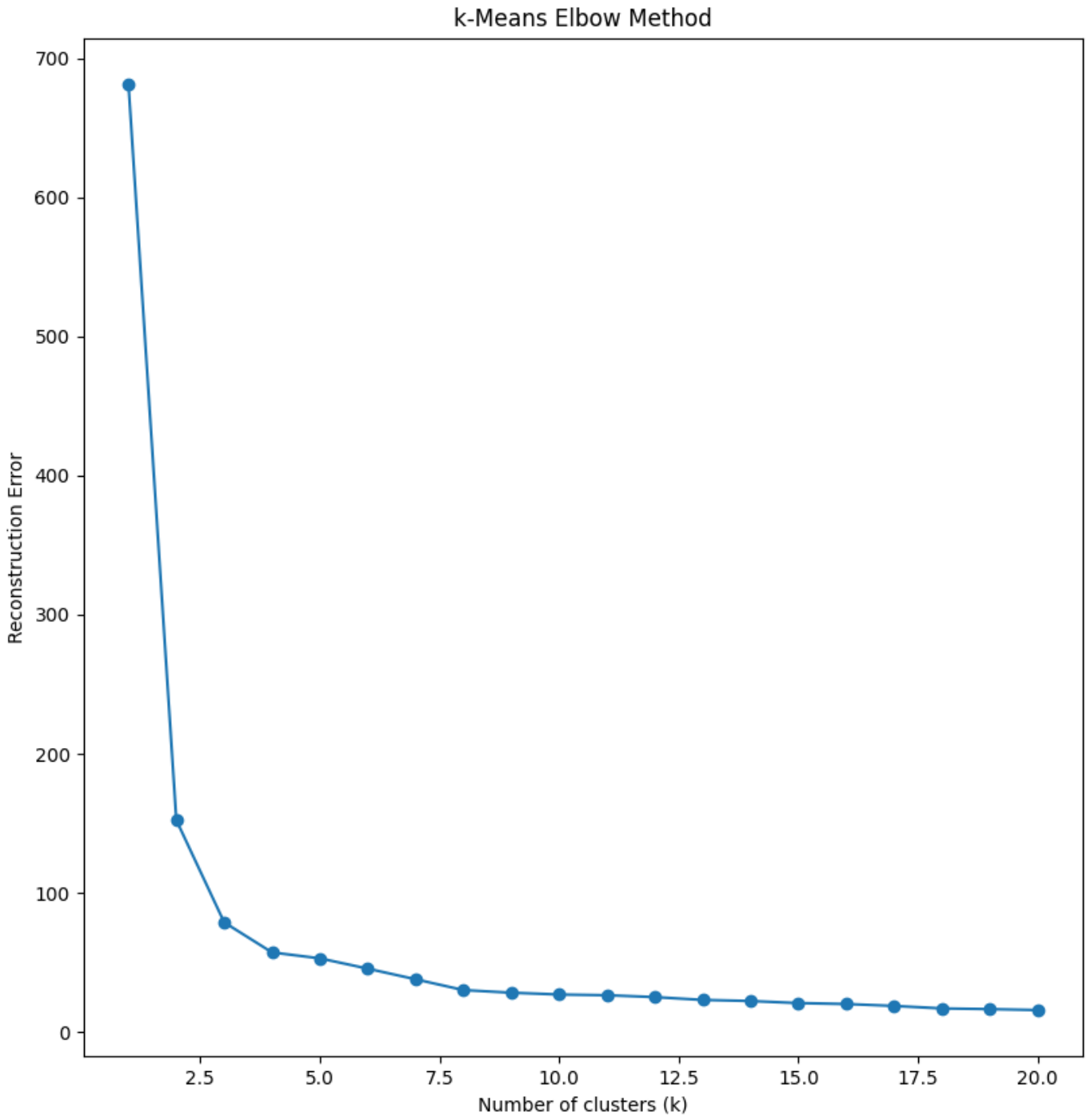
Part 2:

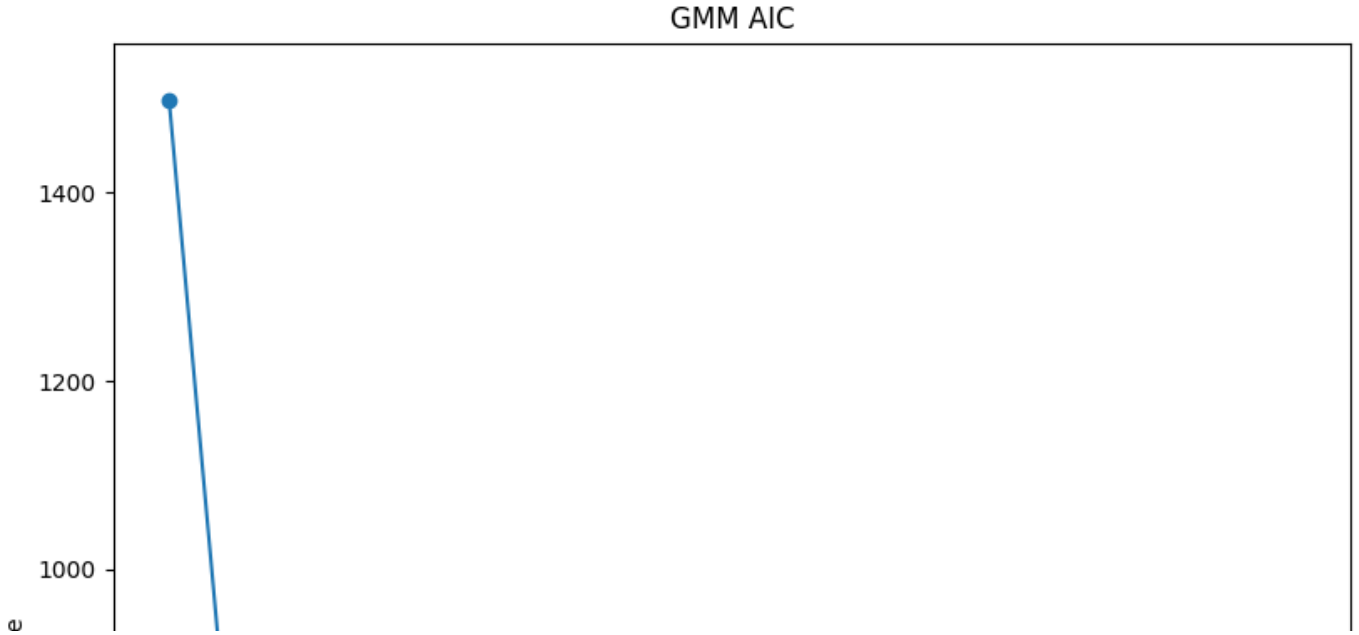
Enter the aic_elbow_k value from the AIC plot: 3
Enter the bic_elbow_k observed from the BIC plot: 3

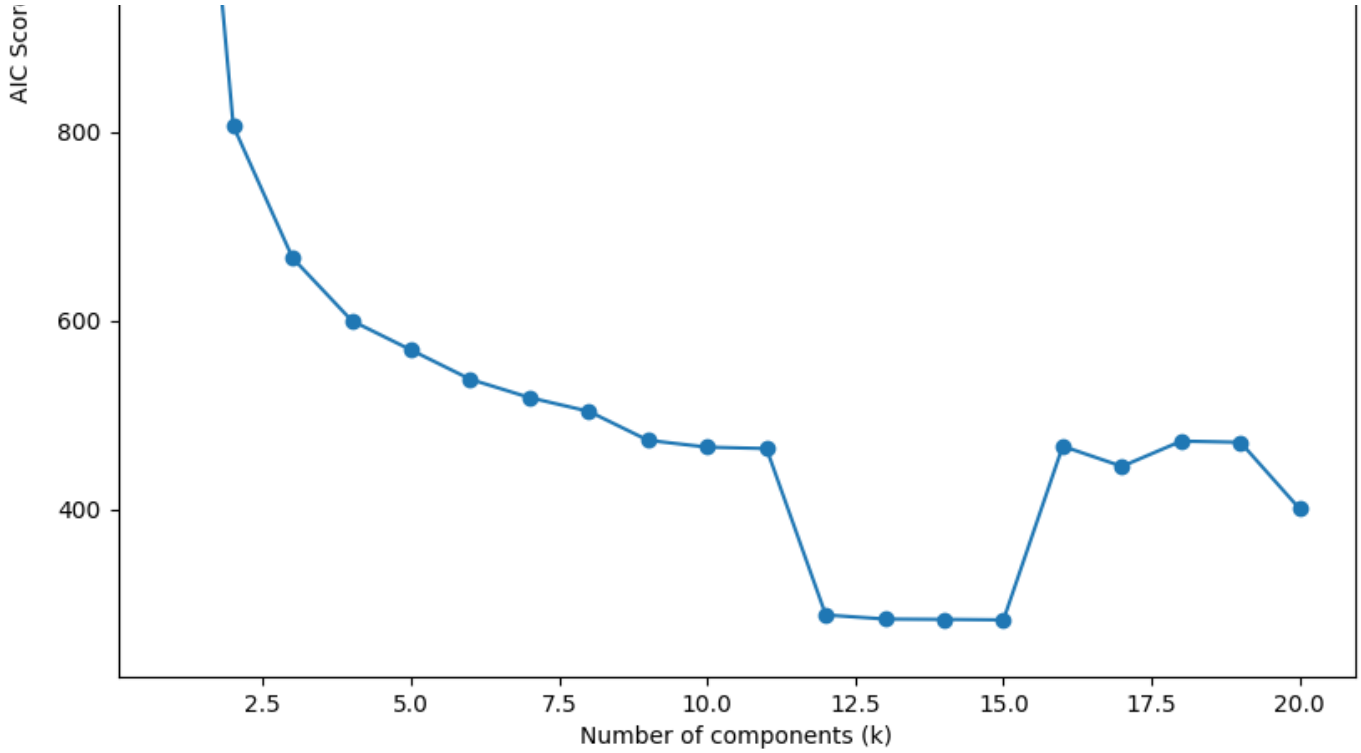
Confusion Matrix for aic_elbow_k:
[[50  0  0]
 [ 0 49  1]
 [ 0 14 36]]
Accuracy for aic_elbow_k: 0.9

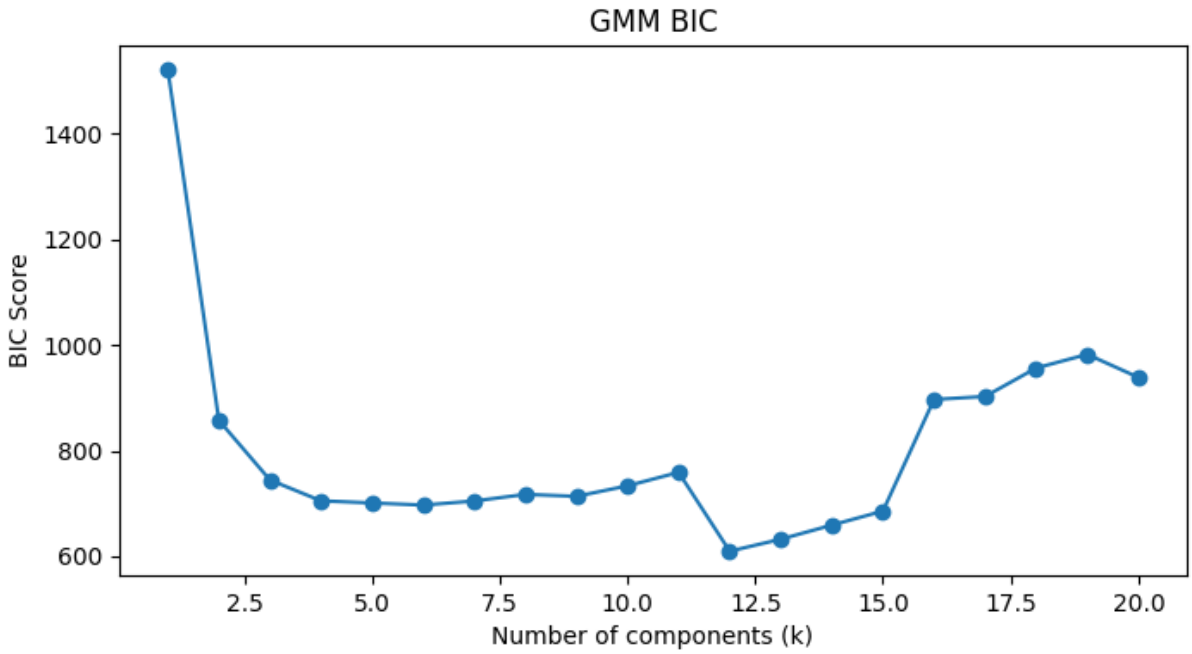
Confusion Matrix for bic_elbow_k:
[[50  0  0]
 [ 0 49  1]
 [ 0 14 36]]
Accuracy for bic_elbow_k: 0.9

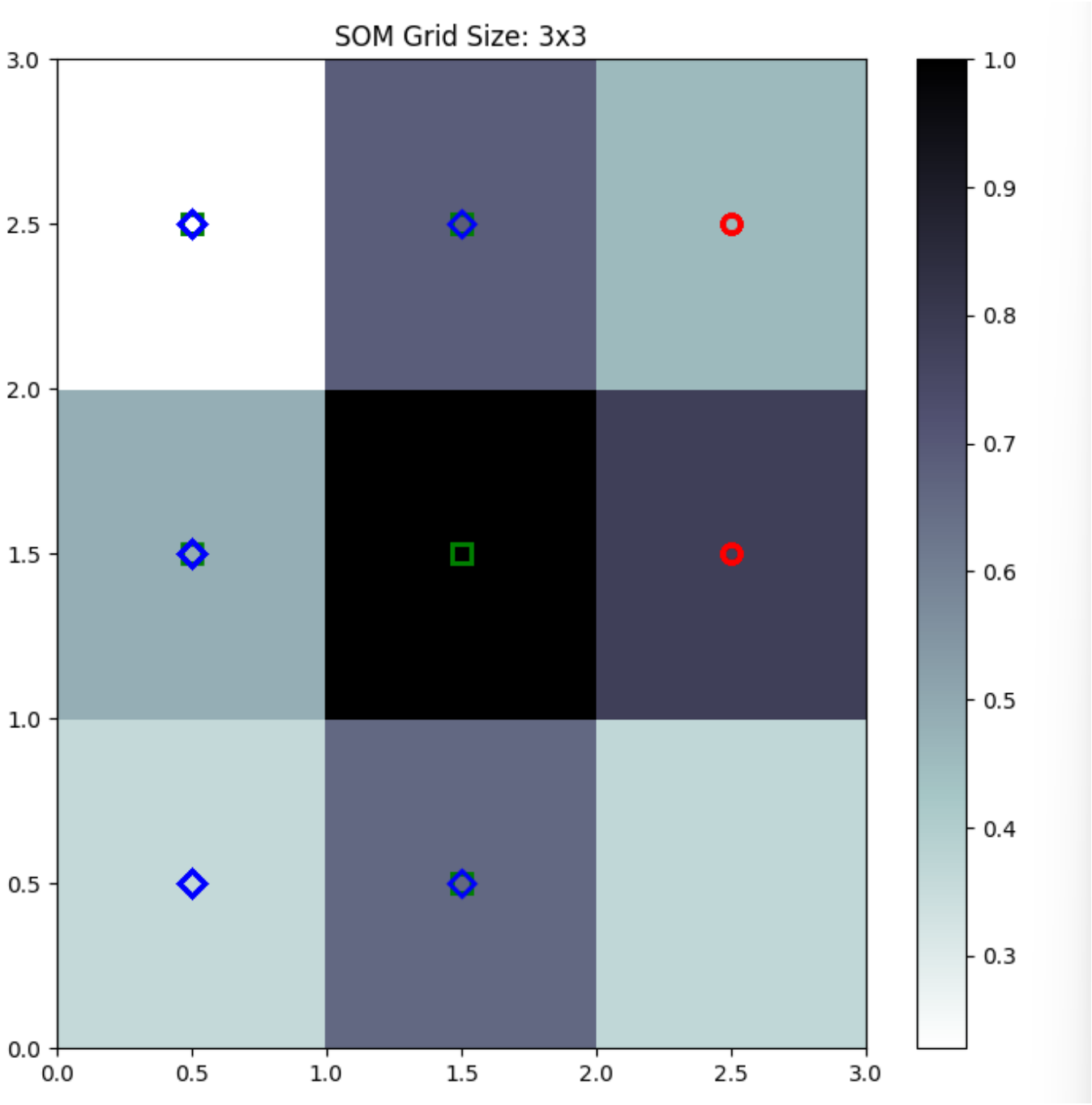
Part 3:
Grid Size 3x3: Quantization Error = 0.13850112974789824
Grid Size 7x7: Quantization Error = 0.07347528763730608
Grid Size 15x15: Quantization Error = 0.05224851074726213
Grid Size 25x25: Quantization Error = 0.049989083203201515
Press Ctrl+C to exit
```

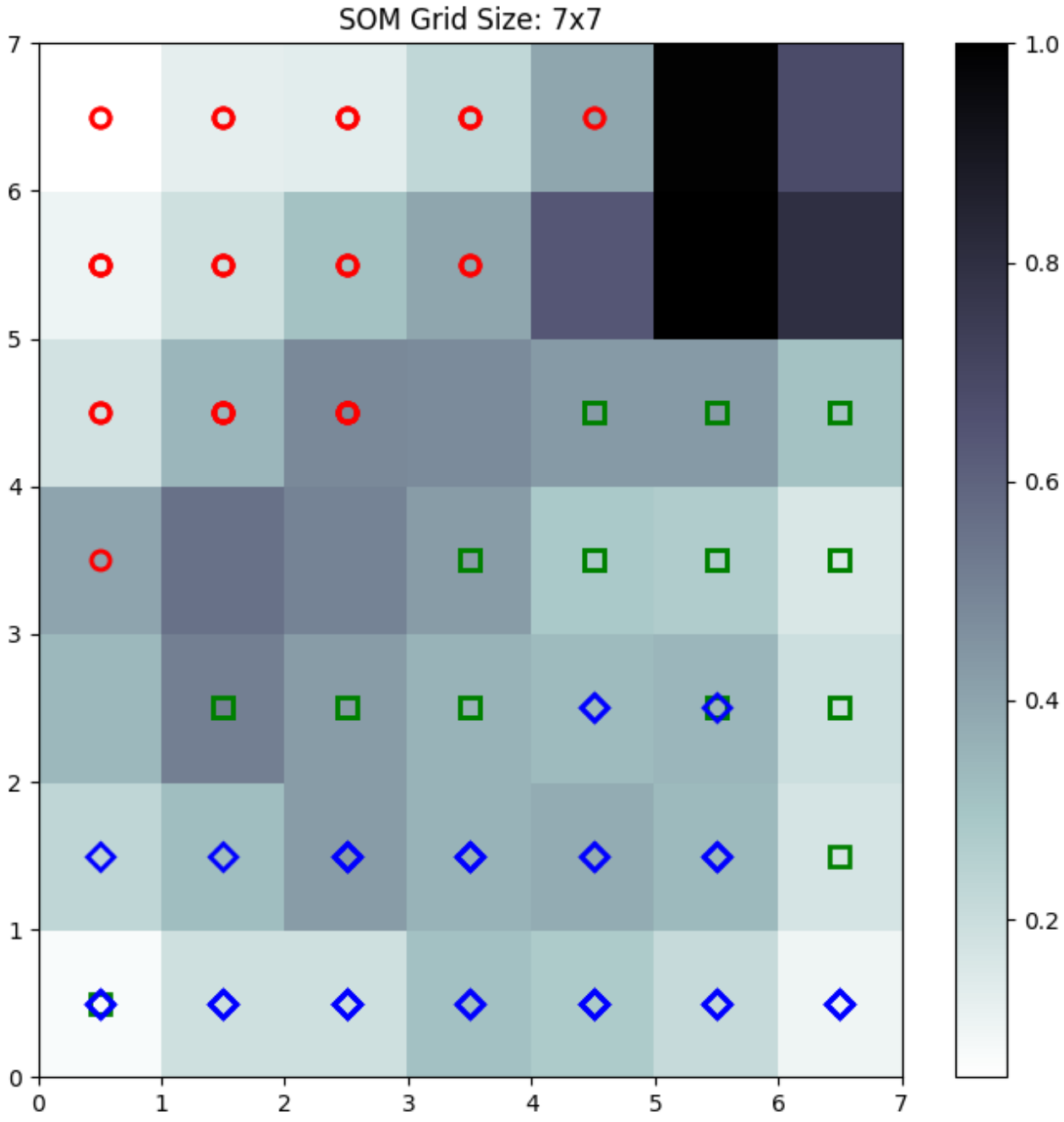

k-Means Elbow Method
Reconstruction Error
Number of clusters (k)
0
100
200
300
400
500
600
700
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0

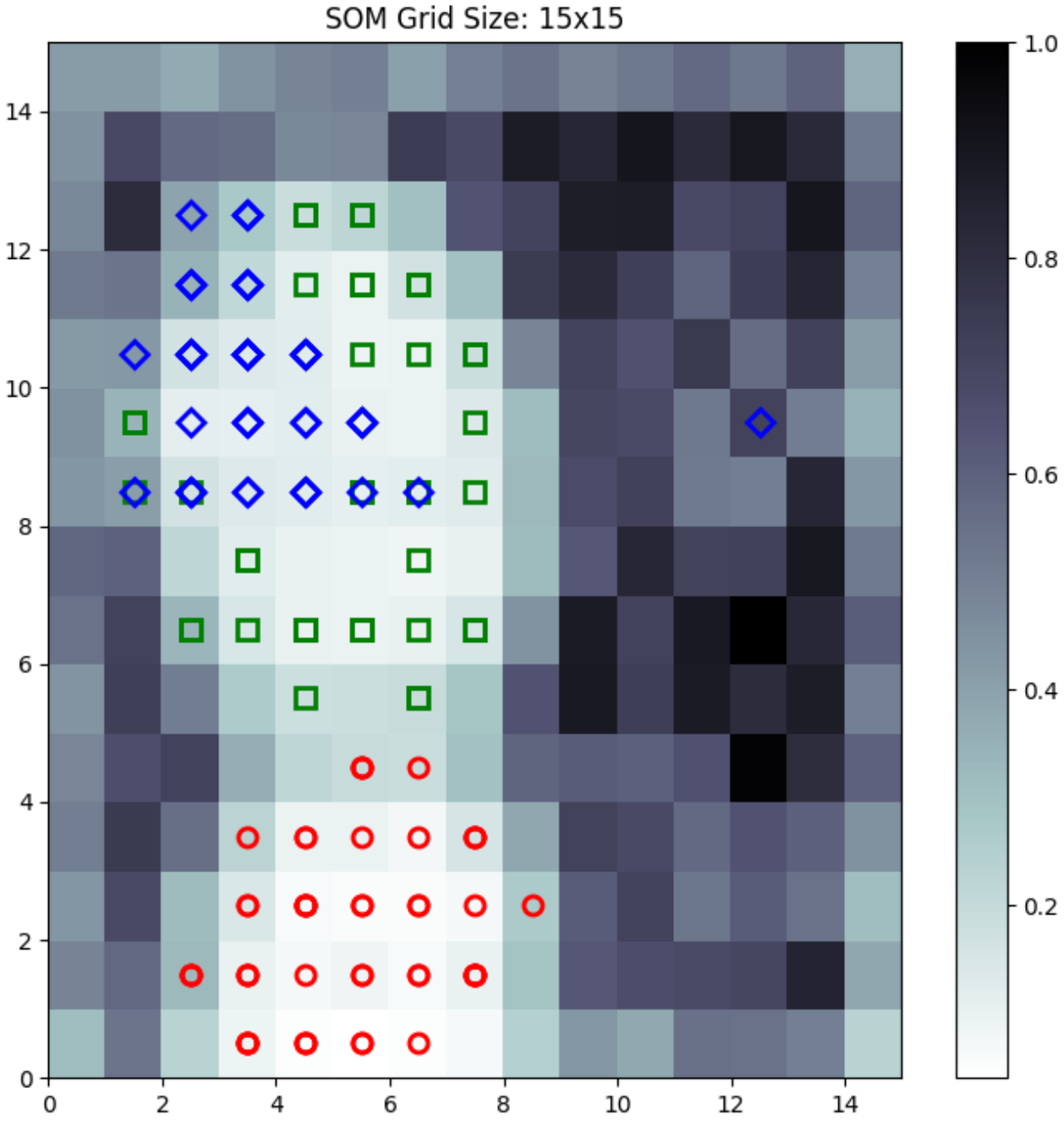

GMM AIC
1000
1200
1400

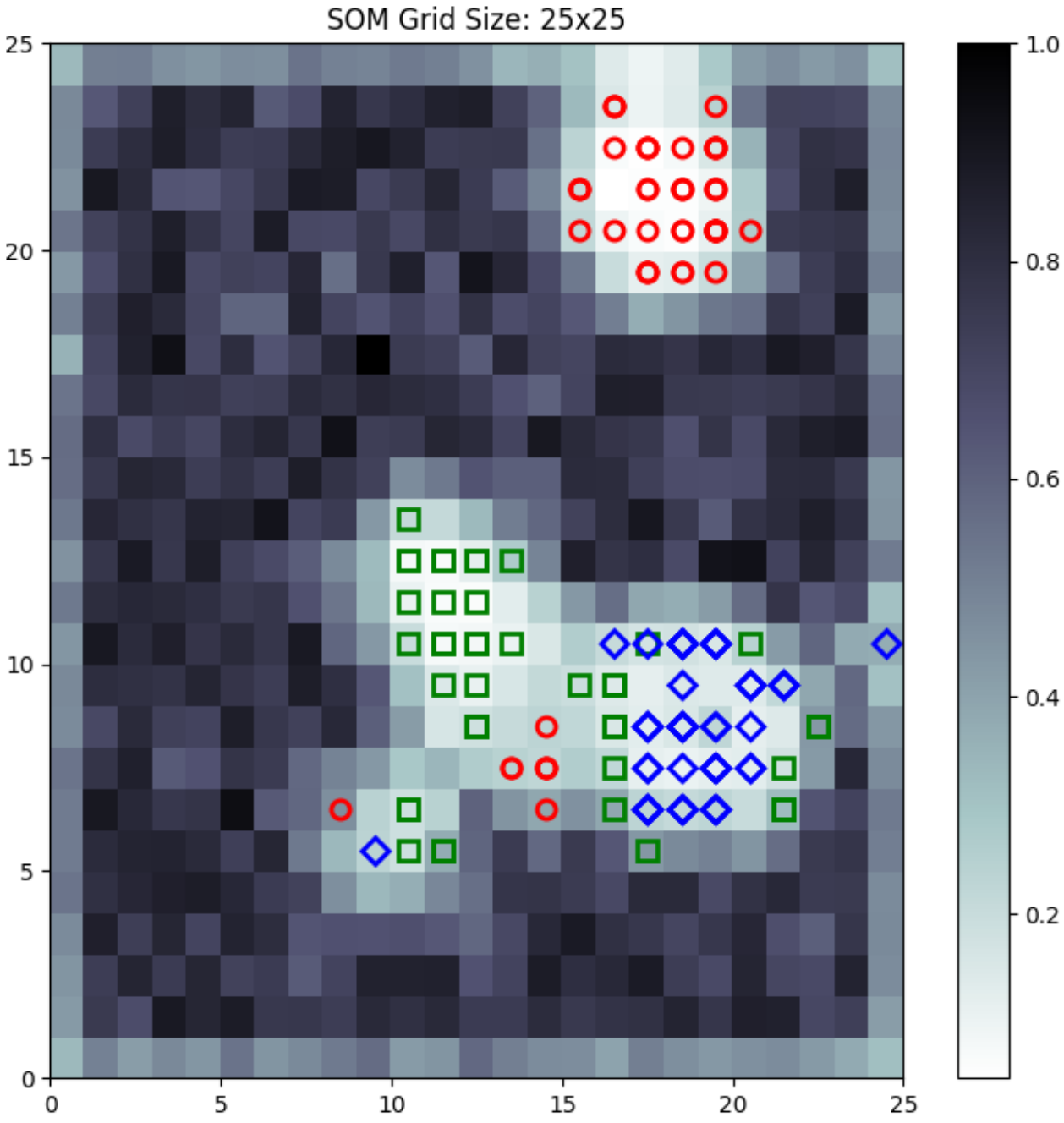

AIC Scor
800
600
400
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Number of components (k)

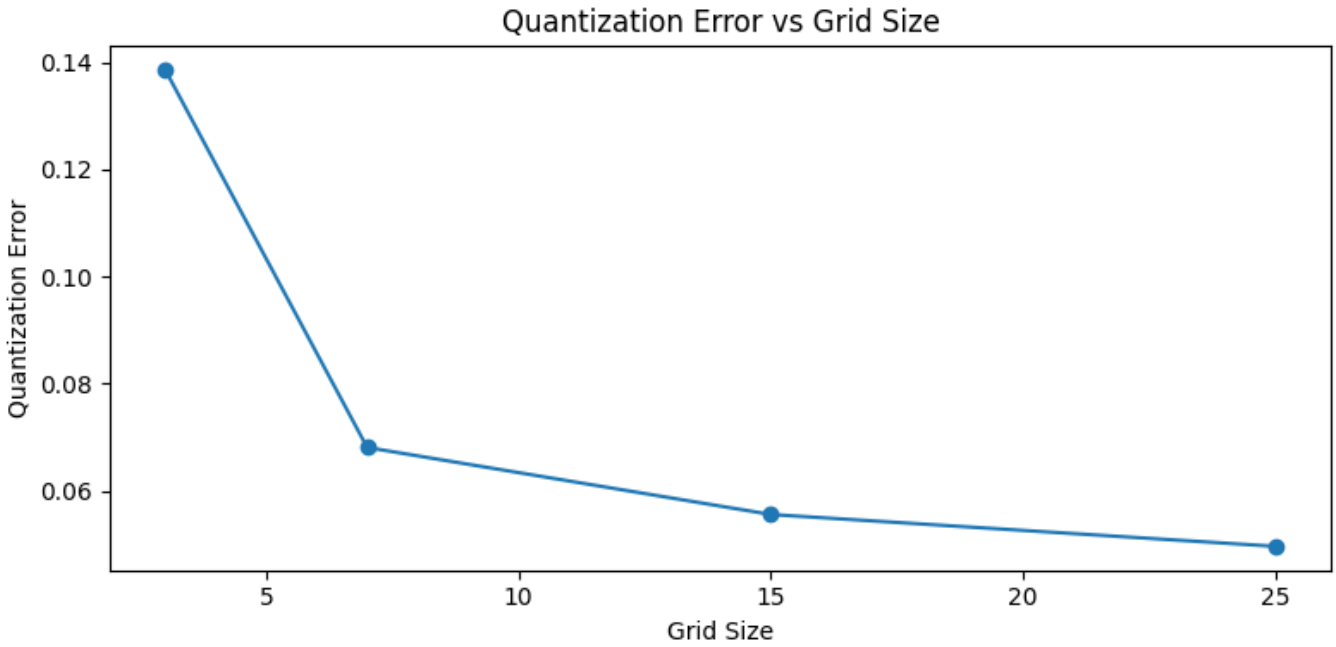

GMM BIC
BIC Score
1400
1200
1000
800
600
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Number of components (k)


SOM Grid Size: 3x3
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3


SOM Grid Size: 7x7
0
1
2
3
4
5
6
7
0.2
0.4
0.6
0.8
1.0


SOM Grid Size: 15x15
0
2
4
6
8
10
12
14
0.2
0.4
0.6
0.8
1.0


SOM Grid Size: 25x25
0
5
10
15
20
25
0.2
0.4
0.6
0.8
1.0



Questions

Q1 Yes. There are three species of iris represented in this data set according to the K-means clusters versus reconstruction error plot.

Q2a Yes. There is an intepretation of the graph such that there are 3 classes for the iris species in the AIC graph. It may also be possible to intepret the the k from ranging anywhere 3-5, or 11-12 with additional complexity.

Q2b Yes. There is an intepretation of the graph such that there are 3 classes for the iris species in the BIC graph. It may also be possible to intepret the the k from ranging anywhere 3-5, or 10-12 with additional complexity.

Q3a Using the quantization error graph I would select an elbow of size 7x7 up to 15x15. More points will help evaluate this. This part of the graph is relatively flat. I would worry about going up to 25x25 with overfitting (without seeing quantization error past 25x25) it's hard to make this determination

Q3b As the grid size increases, the quantization error generally decreases, improving the SOM's ability to represent the data. However, beyond a certain point, increasing the grid size yields diminishing returns and may lead to overfitting.

Q3c I think 15x15 would be a perfect fit for the iris data set, due to it's relatively low quantization error compared to 3x3 and 7x7, while not having concerns for overfitting at 25x25.