

```
In [1]: 1 import pandas as pd
        2 import numpy as np
        3 import matplotlib.pyplot as plt
        4 from sklearn.preprocessing import normalize
        5 import scipy.cluster.hierarchy as shc
        6 from sklearn.cluster import AgglomerativeClustering
```

<frozen importlib.\_bootstrap>:219: RuntimeWarning: numpy.ufunc size changed, may indicate binary incompatibility. Expected 192 from C header, got 216 from PyObject

```
In [2]: 1 data = pd.read_csv('wholesale_customers_data.csv')
        2 data.head()
```

Out[2]:

	Channel	Region	Fresh	Milk	Grocery	Frozen	Detergents_Paper	Delicassen
0	2	3	12669	9656	7561	214	2674	1338
1	2	3	7057	9810	9568	1762	3293	1776
2	2	3	6353	8808	7684	2405	3516	7844
3	1	3	13265	1196	4221	6404	507	1788
4	2	3	22615	5410	7198	3915	1777	5185

```
In [3]: 1 data.shape
```

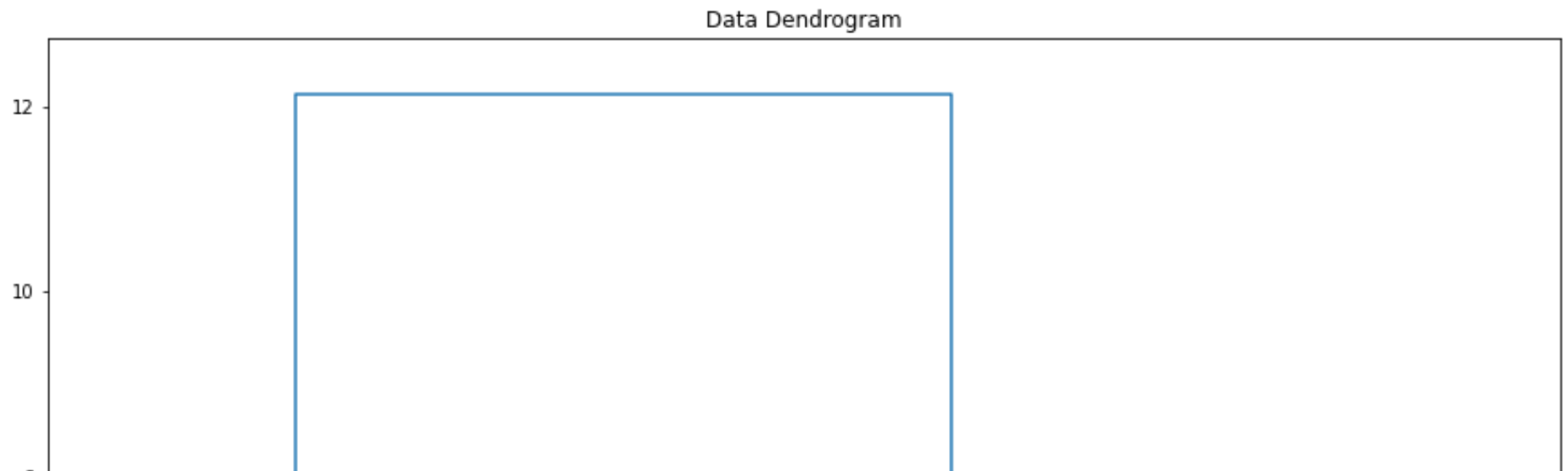
Out[3]: (440, 8)

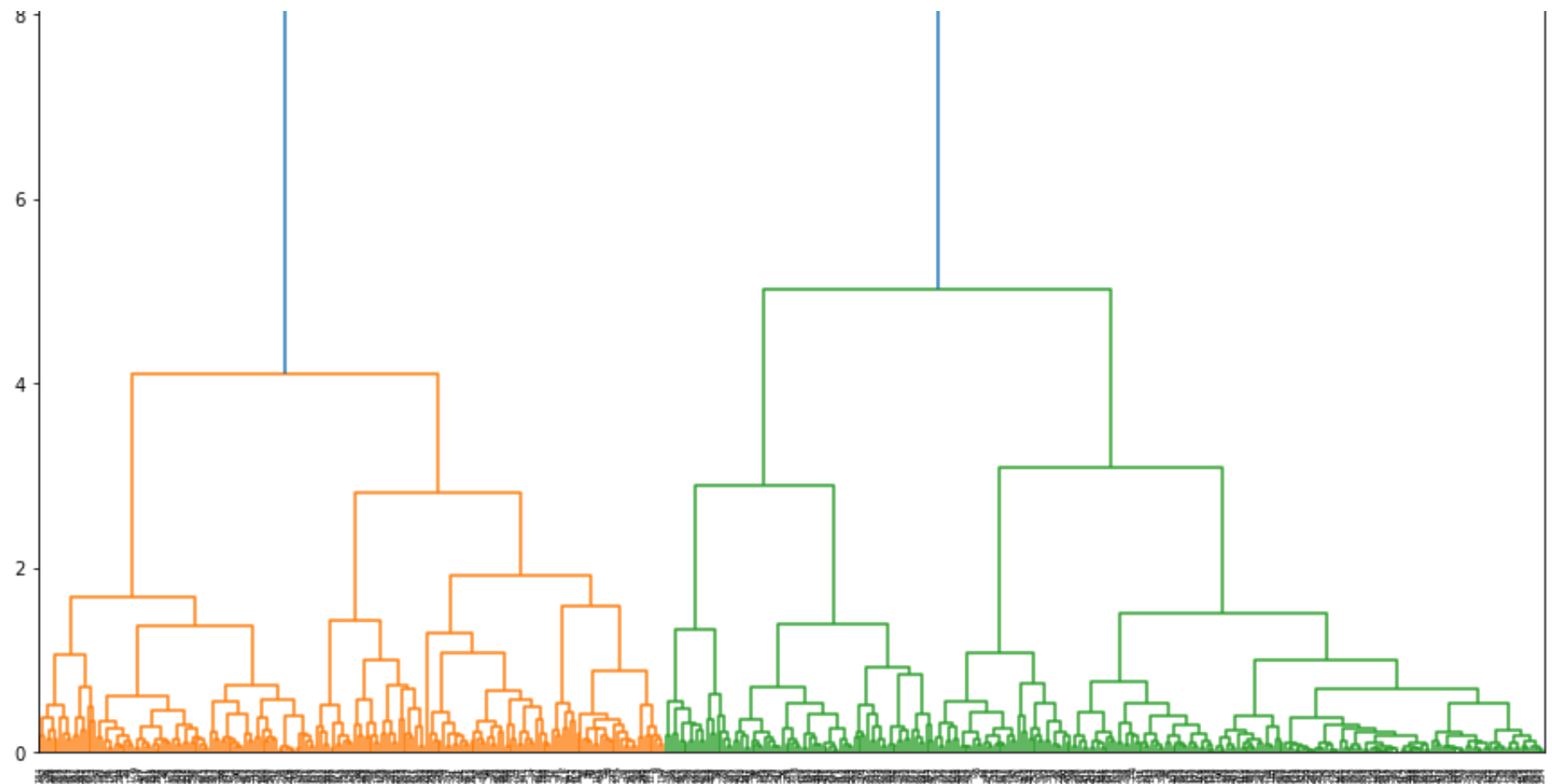
```
In [5]: 1 # normalize
        2
        3 data_scaled = normalize(data)
        4 data_scaled = pd.DataFrame(data_scaled, columns = data.columns)
        5 data_scaled.head()
```

Out [5]:

	Channel	Region	Fresh	Milk	Grocery	Frozen	Detergents_Paper	Delicassen
0	0.000112	0.000168	0.708333	0.539874	0.422741	0.011965	0.149505	0.074809
1	0.000125	0.000188	0.442198	0.614704	0.599540	0.110409	0.206342	0.111286
2	0.000125	0.000187	0.396552	0.549792	0.479632	0.150119	0.219467	0.489619
3	0.000065	0.000194	0.856837	0.077254	0.272650	0.413659	0.032749	0.115494
4	0.000079	0.000119	0.895416	0.214203	0.284997	0.155010	0.070358	0.205294

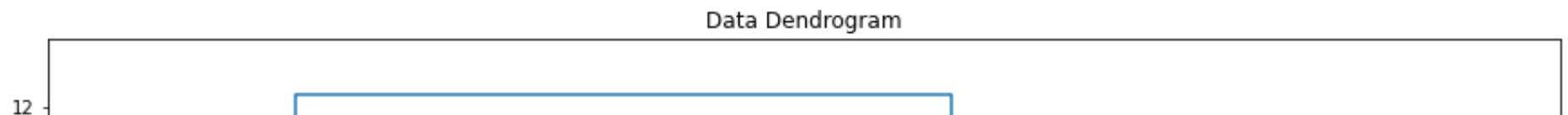
```
In [7]: 1 # Plot dendrograms
        2
        3 plt.figure(figsize = (15,12))
        4 plt.title("Data Dendrogram")
        5 den = shc.dendrogram(shc.linkage(data_scaled, method = 'ward'))
```

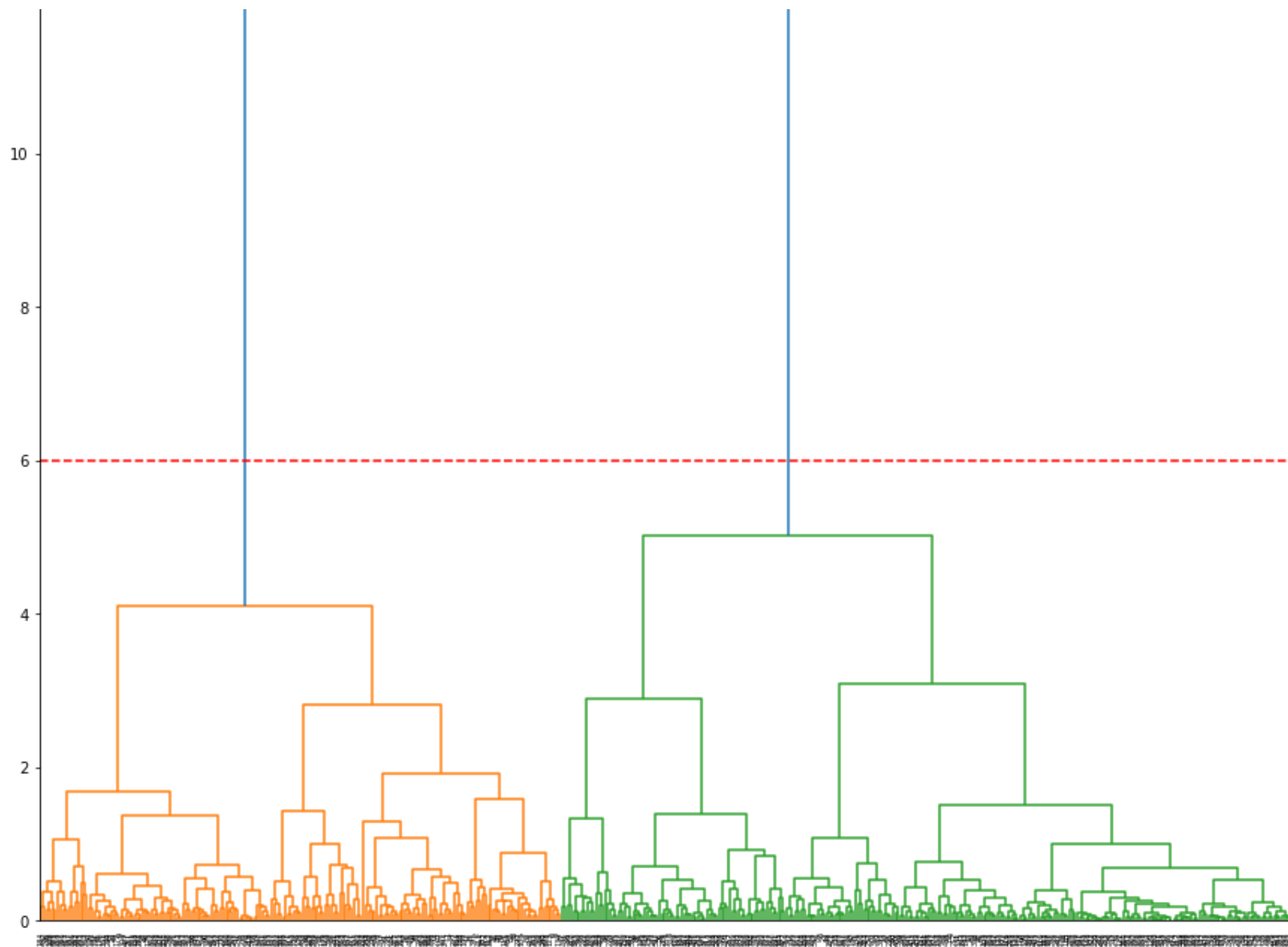




```
In [8]: 1 # Plot dendrograms
        2
        3 plt.figure(figsize = (15,12))
        4 plt.title("Data Dendrogram")
        5 den = shc.dendrogram(shc.linkage(data_scaled,method = 'ward'))
        6 plt.axhline(y = 6, color = 'r',linestyle = '--')
```

Out[8]: <matplotlib.lines.Line2D at 0x7f7f363551f0>





```
In [9]: 1 # as threshold line cuts dendrogram at 6, it intersects with two bars. therefore we have 2 clusters
```

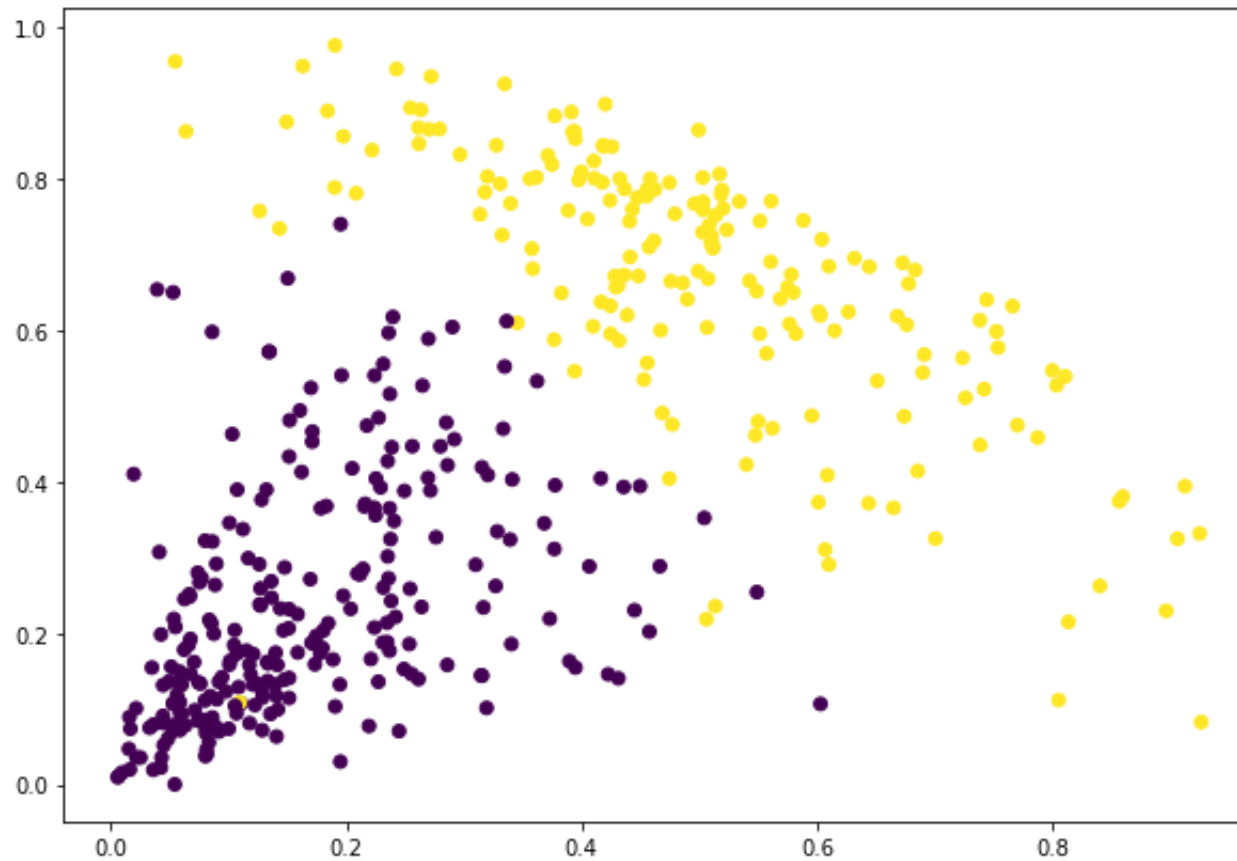
```
In [12]: 1 cluster = AgglomerativeClustering(n_clusters=2,affinity='euclidean',linkage = 'ward')  
2 cluster.fit_predict(data_scaled)
```

```
Out[12]: array([1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0,  
0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1,  
1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1,  
1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0,  
0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1,  
0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0,  
0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1,  
0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1,  
0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1,  
0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0,  
0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,  
0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1,  
1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,  
0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0,  
0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0,  
0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1,  
1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0,  
0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0,  
1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 1,  
1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1])
```

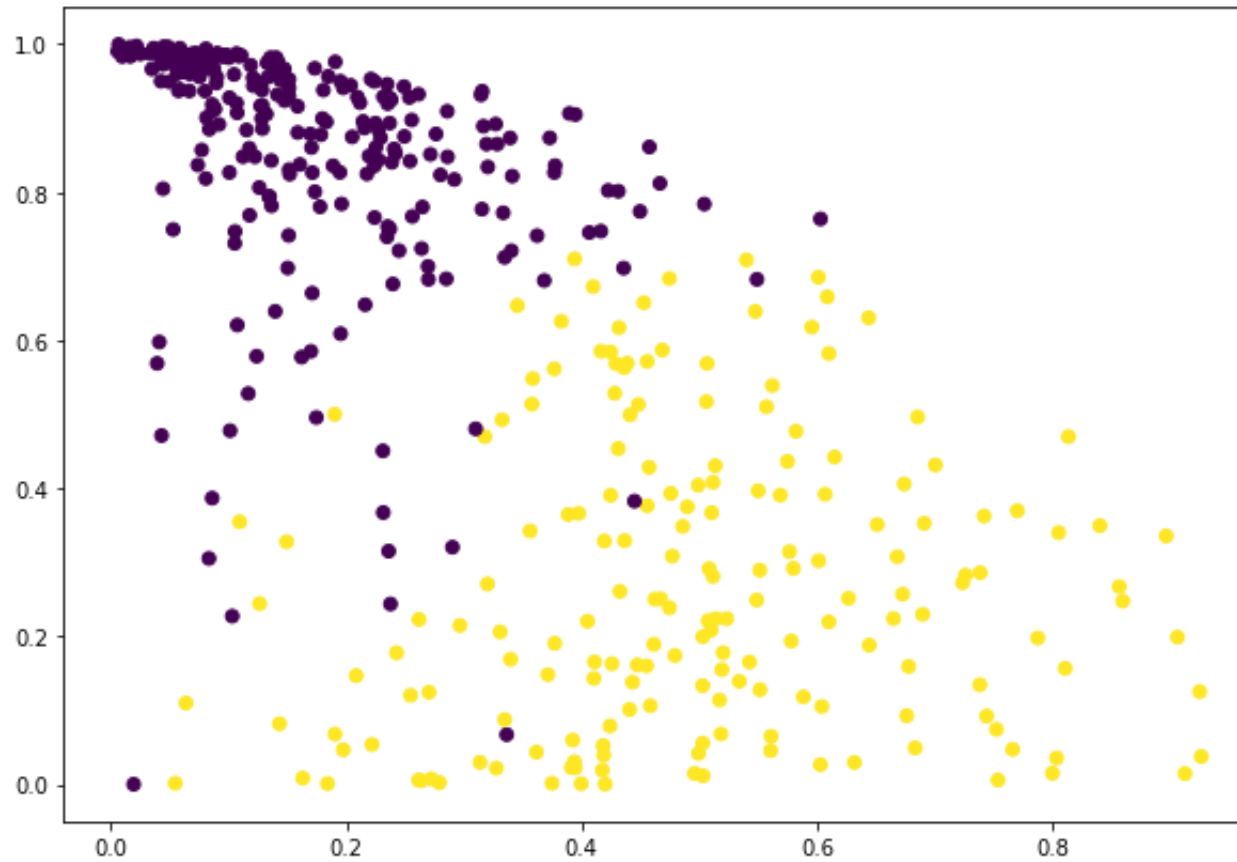
```
In [ ]: 1 # lets visualize these 2 clusters
```

In [15]:

```
1 plt.figure(figsize = (10,7))
2 plt.scatter(data_scaled['Milk'],data_scaled['Grocery'],c =cluster.labels_ )
3
4 plt.show()
```



```
In [16]: 1 plt.figure(figsize = (10,7))  
2 plt.scatter(data_scaled['Milk'],data_scaled['Fresh'],c =cluster.labels_  
3 plt.show()
```



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In [ ]: 1
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