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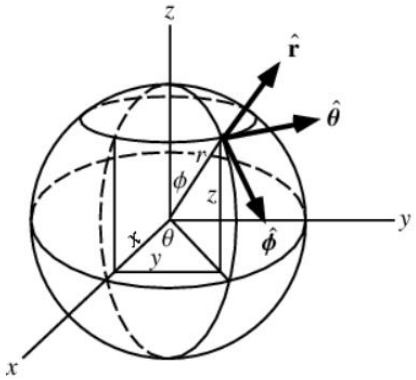
EE 550 Artificial Neural Networks
Homework 5

1. Training Data

I determined clusters on unit sphere using spherical coordinates.

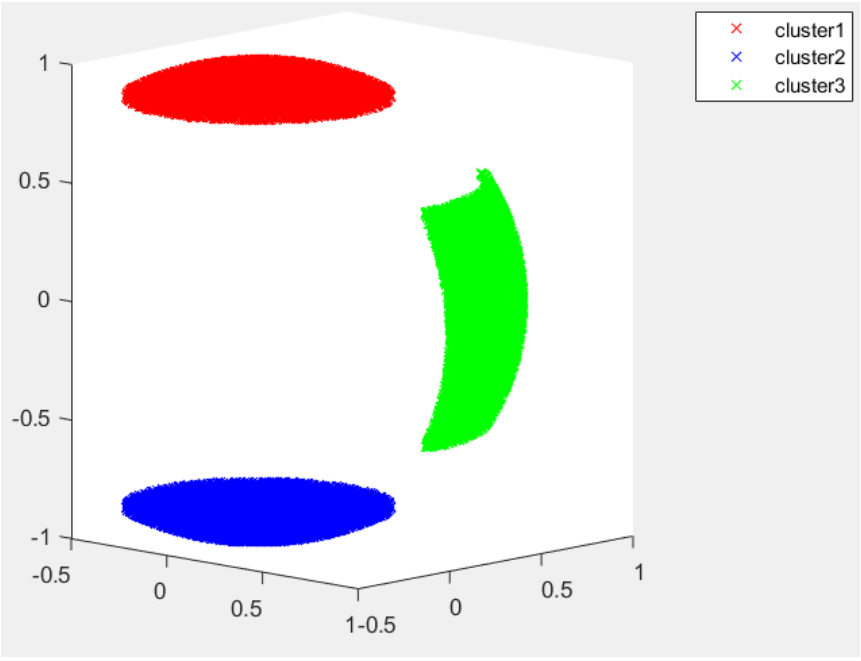


r is 1 for all cluster.

For the first cluster: $0 < \theta < 2\pi$ and $0 < \varphi < \pi/6$

For the second cluster: $0 < \theta < 2\pi$ and $5\pi/6 < \varphi < \pi$

For the third cluster: $0 < \theta < \pi/3$ and $\pi/3 < \varphi < 2\pi/3$



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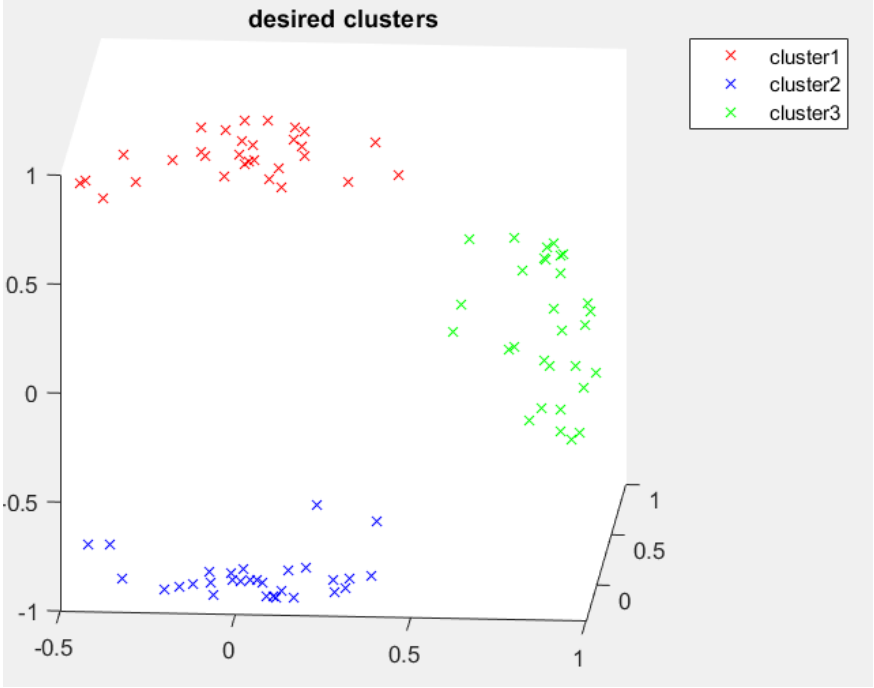
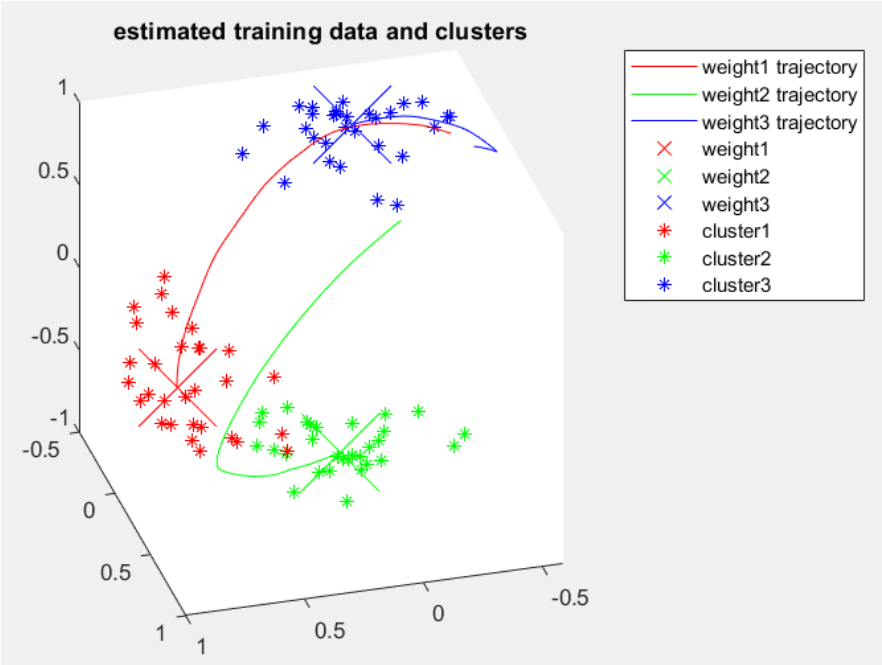
Firstly, random 30 points for each cluster are generated.



2. Training Part

Secondly, for the training, 3 initial weights are determined on the unit sphere randomly. Then, these weights are updated with normalized learning rule until they become the centers of the clusters.



The clusters, weight trajectories and final weights can be seen at the 3D plot.

All 90 training data is clustered and weights converge to the centers of clusters correctly.

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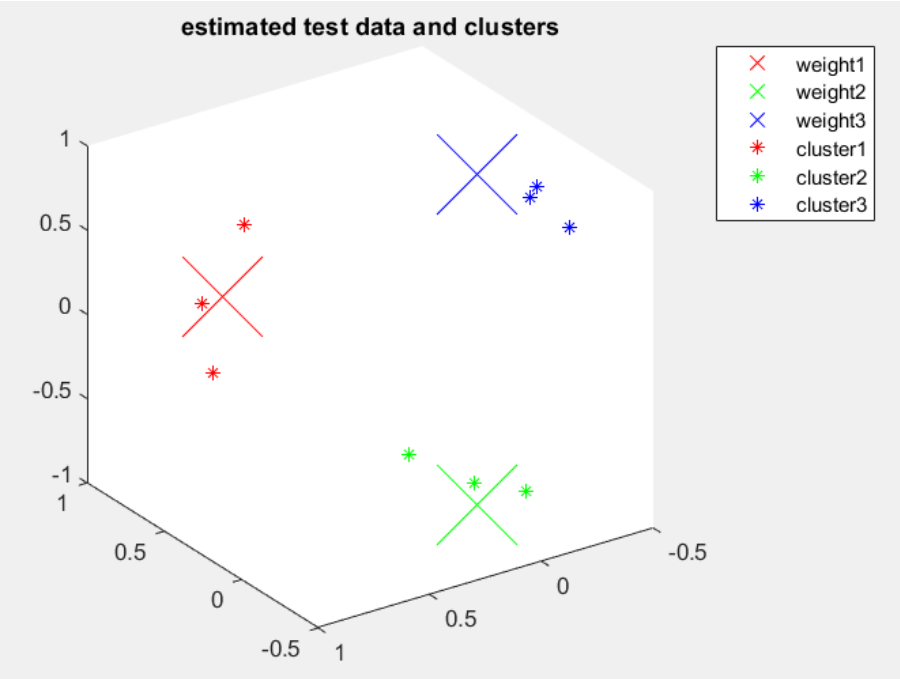
3. Test Part

Lastly, random 3 points for each cluster are generated for the test part.



These 9 points are clustered correctly.

At some rare cases, one weight is not updated and there exist 2 clusters due to the initial random weights. One weight represents two clusters as one cluster, one weight represent another cluster and another weight which is not updated doesn't represent any cluster. At these cases, 9 test data is seperated as 2 clusters.

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