

Homework3

Q1. PCA and 1- Nearest Neighbor classification error on test and train data.

Test Error:

Train Error:

Class	K = 2	K = 3	K = 8	K = 20	Class	K = 2	K = 3	K = 8	K = 20
0	0.47191	0.994382	1	0.994382	0	0	0	0	0
1	0.71978	0.956044	0.791209	0.807692	1	0	0	0	0
2	0.412429	0.926554	0.79096	0.830508	2	0	0	0	0
3	0.737705	0.830601	0.655738	0.617486	3	0	0	0	0
4	0.353591	0.475138	0.381215	0.486188	4	0	0	0	0
5	0.868132	0.840659	0.631868	0.532967	5	0	0	0	0
6	0.624309	0.646409	0.983425	0.983425	6	0	0	0	0
7	0.469274	0.592179	0.458101	0.418994	7	0	0	0	0
8	0.821839	0.712644	0.643678	0.781609	8	0	0	0	0
9	0.844444	0.983333	0.95	0.944444	9	0	0	0	0

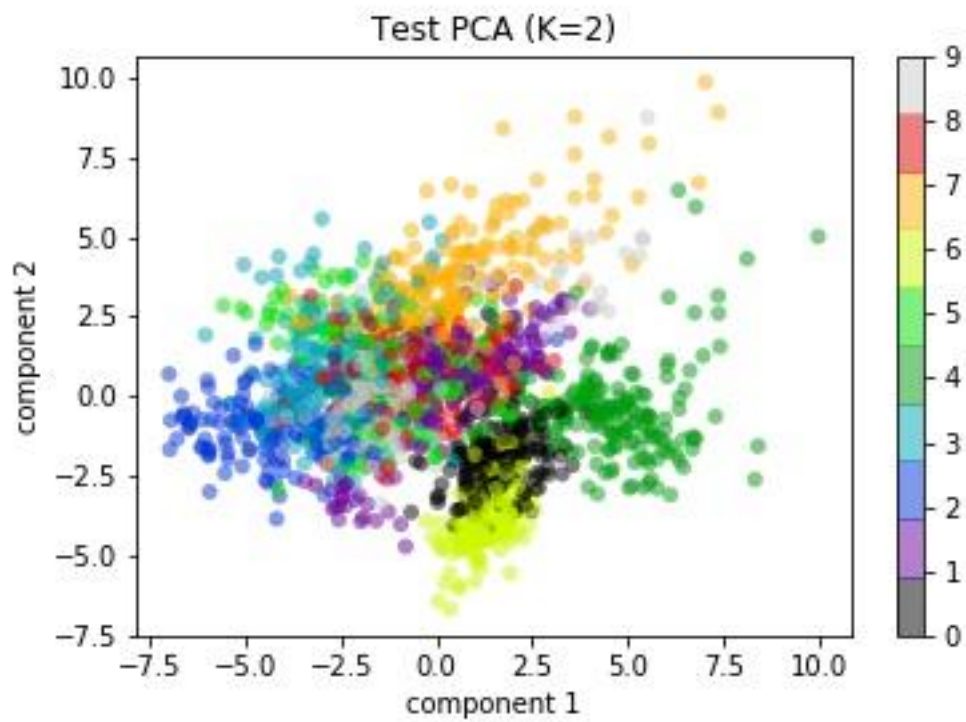
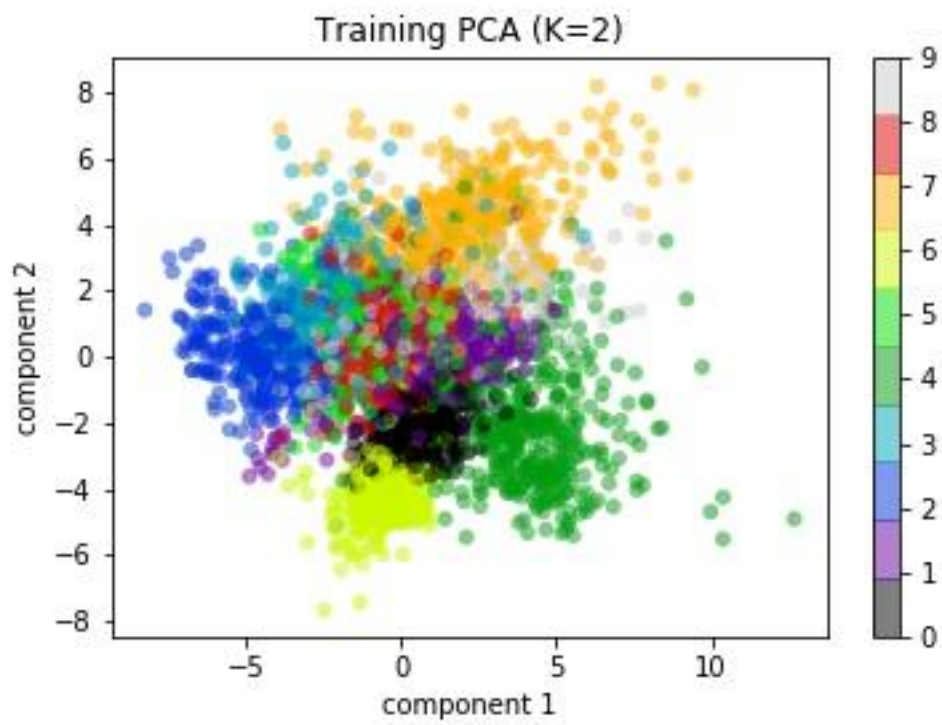
Q2. LDA and 1- Nearest Neighbor classification error on test and train data.

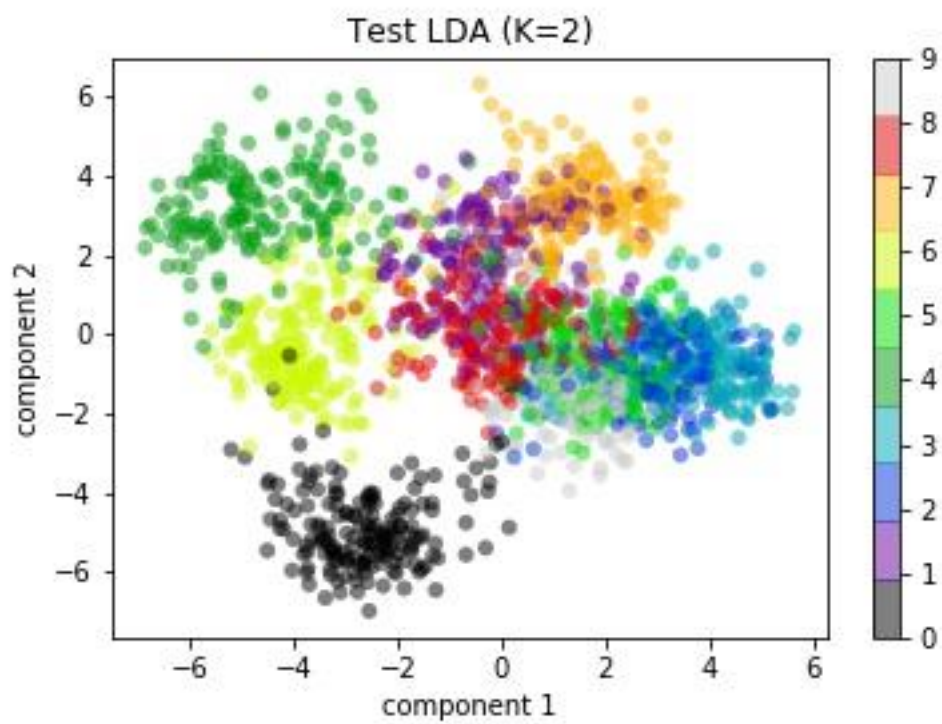
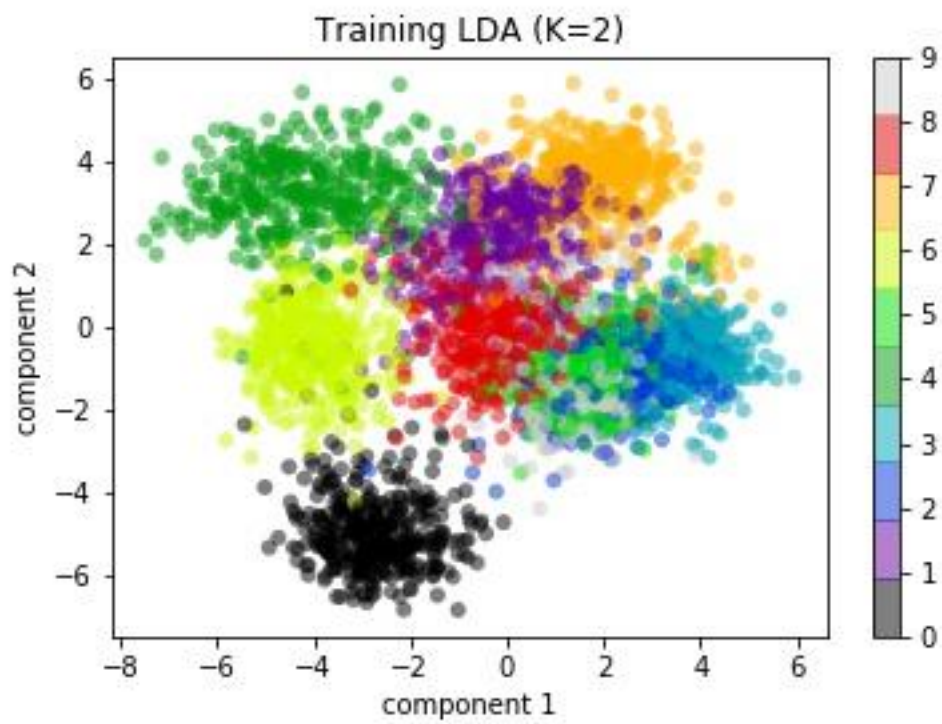
Test Error:

Train Error:

Class	K= 2	K=3	K=8	K=20	Class	K = 2	K = 3	K = 8	K = 20
0	0.08427	0.02809	0.016854	0.011236	0	0	0	0	0
1	0.527473	0.21978	0.049451	0.038462	1	0	0	0	0
2	0.734463	0.146893	0.028249	0.028249	2	0	0	0	0
3	0.36612	0.234973	0.054645	0.054645	3	0	0	0	0
4	0.093923	0.038674	0.033149	0.016575	4	0	0	0	0
5	0.708791	0.478022	0.021978	0.021978	5	0	0	0	0
6	0.127072	0.121547	0.016575	0.016575	6	0	0	0	0
7	0.346369	0.145251	0.100559	0.072626	7	0	0	0	0
8	0.454023	0.333333	0.132184	0.126437	8	0	0	0	0
9	0.655556	0.538889	0.055556	0.044444	9	0	0	0	0

Q3. Plots.





Q5. K-means

k-means Clustering Error PCA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	0.91573	0.629213	0.010638	0.179775	0.02809	0.005618
Class=1	0.681319	0.93956	0.660668	0.582418	0.549451	0.153846
Class=2	0.785311	0.903955	0.331579	0.412429	0.587571	1
Class=3	0.956284	0.89071	0.203085	0.759563	0.393443	1
Class=4	0.839779	0.801105	0.105943	0.486188	0.98895	0.044199
Class=5	1	0.901099	1	0.631868	0.307692	0.483516
Class=6	1	0.861878	0.119363	0.19337	0.077348	0.044199
Class=7	0.614525	0.905028	0.232558	0.256983	0.039106	0.044693
Class=8	1	0.896552	0.210526	1	1	0.247126
Class=9	0.783333	0.794444	0.353403	1	0.616667	0.227778

k-means Clustering Error LDA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	0.904494	0.668539	0.010638	0.106742	1	0.005618
Class=1	0.78022	0.60989	0.660668	0.565934	0.346154	0.153846
Class=2	0.80791	0.824859	0.331579	0.700565	0.259887	1
Class=3	0.715847	1	0.203085	0.273224	0.038251	1
Class=4	0.944751	0.889503	0.105943	0.513812	0.679558	0.044199
Class=5	1	0.785714	1	0.708791	0.021978	0.483516
Class=6	1	0.917127	0.119363	0.060773	0.016575	0.044199
Class=7	0.793296	1	0.232558	0.675978	0.357542	0.044693
Class=8	1	1	0.210526	0.804598	0.16092	0.247126
Class=9	0.633333	0.927778	0.353403	0.461111	0.327778	0.227778

Q6. GMM

GMM Clustering Error PCA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	1	0.007979	1	1	1	1
Class=1	1	0.015424	1	1	1	1
Class=2	0.010526	1	0.442105	0.19209	0.248588	0.610169
Class=3	1	1	1	1	1	1
Class=4	0.162791	1	0.741602	1	1	1
Class=5	1	1	0.109043	0.153846	1	1
Class=6	0.015915	1	0.02122	0	0.005525	0.005525
Class=7	0.124031	0.178295	1	0.435754	0.128492	0.888268
Class=8	1	1	1	1	1	1
Class=9	1	1	1	1	1	1

GMM Clustering Error LDA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	1	1	1	1	1	1
Class=1	1	0.005141	1	1	1	1
Class=2	1	1	0.442105	1	0.00565	0.610169
Class=3	0	1	1	0.010929	1	1
Class=4	1	0.010336	0.741602	1	0.005525	1
Class=5	1	1	0.109043	1	0	1
Class=6	0.015915	1	0.02122	1	0.027624	0.005525
Class=7	0.067183	0.002584	1	0.039106	1	0.888268
Class=8	1	1	1	1	1	1
Class=9	1	1	1	1	1	1

Q7. Agglomerative

Agglomerative Clustering Error PCA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	0.212766	0.005319	0.005319	0.702247	0.005618	0
Class=1	0.832905	0.174807	0.735219	0.637363	0.016484	0.175824
Class=2	0.360526	0.055263	0.297368	0.305085	1	0.706215
Class=3	1	0.316195	0.210797	0.650273	1	1
Class=4	0.54522	1	0.385013	0.093923	0.447514	0.077348
Class=5	1	0.611702	0.079787	0.510989	0.10989	0.824176
Class=6	0.076923	1	0.106101	0.138122	0.049724	0.005525
Class=7	0.108527	0.178295	0.865633	0.916201	0.396648	0.156425
Class=8	0.428947	0.215789	0.05	1	0.701149	0.982759
Class=9	1	0.117801	0.748691	0.944444	0.238889	1

Agglomerative Clustering Error LDA reduced	k=2 dim	k=8 dim	k=64 dim	k=2 dim	k=8 dim	k=64 dim
	Training Error			Test Error		
Class=0	0.093085	0.005319	0.005319	0.078652	0.011236	0
Class=1	0.390746	0.041131	0.735219	1	0.631868	0.175824
Class=2	1	0.028947	0.297368	0.734463	0.079096	0.706215
Class=3	0.25964	0.028278	0.210797	0.644809	0.081967	1
Class=4	0.514212	0.082687	0.385013	0.138122	0.033149	0.077348
Class=5	0.827128	0.034574	0.079787	1	0.791209	0.824176
Class=6	0.249337	0.01061	0.106101	0.171271	0.773481	0.005525
Class=7	0.571059	0.79845	0.865633	0.251397	0.027933	0.156425
Class=8	1	0.692105	0.05	0.356322	1	0.982759
Class=9	0.575916	1	0.748691	0.361111	0.027778	1