Jae Park
Data Mining HW 7
Expectation Maximization Clustering

Classwise mean vectors

0: [4.30351004 22.12035699 40.43842357 21.20814266 39.65698719
 22.75029518 39.19889762 21.42391236 39.13435506 20.03117278
 50.81735501 10.42404562 43.69109486 20.8001456 35.40238568
 22.37893396 42.56882793 19.94363213 41.48259326 9.58073249
755.54594518 73.35122285 4.24747044 37.13167797 4.4797671
 22.7354121]

1: [4.53096984 21.39978004 40.67738261 19.87612408 41.22721555
 21.91658195 39.79458739 20.44209494 39.63191613 19.28343446
 52.06308179 6.42903984 64.88370003 19.80267717 36.08566401
 21.68410753 43.88635402 19.08031013 42.12418876 6.16579144
755.17045402 84.47149308 4.03441864 38.70975741 3.54376304
 26.09975802]

2: [2.7233933 22.0972917 39.72068373 20.90387045 39.55708331
 22.80235677 38.44070441 21.455311 38.17990613 20.06812551
 49.72744886 9.75336079 40.38296892 20.95251219 34.46447951
 22.57216011 41.68040188 20.11080091 40.7664349 8.95474995
755.97961189 74.34071386 3.95719592 37.70116321 4.14687006
 25.57232959]

3: [4.00258089 21.35729779 40.31948405 19.87100333 40.77700407
 21.84383562 39.55498187 20.39432438 39.26274646 19.20579906
 51.08903451 6.45444364 63.81617899 19.7796437 35.63877635
 21.6429357 43.43812207 19.02931501 41.82929362 6.17087498
755.39521187 83.11691908 4.06501769 39.14340643 3.24867173
 23.70564824]

Classwise covariance matrix:

0: [[7.27659634e+01 -9.75487615e-01 3.66245006e+00 -1.80819606e+00
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 4.55828434e+00 -1.84896161e+00 1.15966438e+01 -8.38522023e+00
 5.82589349e+01 -3.19092575e+00 1.87549958e+00 -1.59721960e+00
 1.82132852e+00 -3.28104222e+00 3.38323800e-01 -6.85100894e+00

-3.29008130e-01 2.00708544e+01 1.39188489e+00 2.07559117e+00
 -2.06167712e+00 1.66039766e+00]
[-9.75487615e-01 2.97917902e+00 8.67989732e-01 3.67333273e+00
 -9.13374592e-01 3.36640002e+00 -4.76190544e-01 3.40811326e+00
  3.99182915e-01 3.11383302e+00 -7.79786061e-01 8.42669068e+00
 -3.92010037e+01 3.41135746e+00 1.04491885e+00 2.93768978e+00
 -2.74714967e-01 3.25699341e+00 2.03269448e-01 7.59133195e+00
 -2.15537569e+00 -1.29794591e+01 -4.93422142e-01 -5.55961556e-01
  4.36496105e+00 4.19790587e-01]
[3.66245006e+00 8.67989732e-01 1.86239124e+01 1.69319593e+00
  1.65659120e+01 2.13166158e+00 1.24161447e+01 5.64554499e-01
  1.73222712e+01 1.54400220e+00 1.30296264e+01 5.63216452e+00
  4.24885401e+01 -2.45725807e-02 1.89671023e+01 -3.11874094e-01
  1.84655573e+01 9.86765959e-01 1.46110078e+01 5.19844291e+00
 -1.04581892e+01 2.93824535e+01 1.41230098e+00 3.22707605e-01
  1.19530660e+01 7.53166653e-01]
[-1.80819606e+00 3.67333273e+00 1.69319593e+00 6.21195726e+00
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  1.26788609e+00 3.79665332e+00 -9.73884468e-01 1.43780189e+01
 -5.67732410e+01 4.14952252e+00 2.14299779e+00 3.18159482e+00
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 -2.27670297e+00 -2.40129040e+01 -2.70086128e-01 -1.45034449e-01
  6.31356483e+00 1.11827010e+00]
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  1.61964527e+01 -3.56803338e-02 1.36763103e+01 -5.63459993e+00
  8.02258892e+01 -1.79473084e+00 1.79240134e+01 -1.24511384e+00
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  8.88551356e+00 -8.30389014e-01]
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  1.03048147e+00 3.85309511e+00 -1.49045236e+00 1.07835272e+01
 -4.98436187e+01 4.19961743e+00 1.95656911e+00 3.48249119e+00
  4.72647234e-01 4.22365852e+00 9.55302944e-01 9.44899194e+00
 -3.30490562e+00 -1.33667714e+01 -6.65323370e-01 -1.17748827e+00

6.16253755e+00 2.41585215e-01]
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   6.52919438e+01 -2.09623592e+00 1.54100343e+01 -2.00934850e+00
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  -6.81992334e+00 2.84607180e+01 1.65304408e+00 1.26768240e+00
   6.29542796e+00 6.10821883e-01]
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  -8.35580564e-01 3.88530045e+00 -2.43249270e+00 1.08213254e+01
  -5.63555720e+01 4.48011576e+00 2.57973864e-01 3.61385519e+00
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  -1.55281949e+00 -1.81457533e+01 -1.11788526e+00 -1.35843175e+00
   5.12161977e+00 6.65780007e-01]
 [4.55828434e+00 3.99182915e-01 1.73222712e+01 1.26788609e+00
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   1.21424284e+01 8.09375778e-01]
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  -2.81680705e+00 -1.23964205e+01 -7.55705539e-01 -6.96564212e-01
   5.21541046e+00 3.72139357e-01]
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   1.59170030e+01 2.68844258e-01 9.38666159e+01 -8.57420240e+00
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   3.99637445e+00 -3.77589226e-01]

[-8.38522023e+00 8.42669068e+00 5.63216452e+00 1.43780189e+01
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  4.16193977e+00 9.29534963e+00 -8.57420240e+00 4.62220302e+01
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  2.10164559e+01 2.49215180e+00]
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  6.83583927e+01 -4.52799997e+01 9.68812709e+01 -1.72933032e+02
  1.22130164e+03 -6.14470131e+01 7.28320491e+01 -4.85891414e+01
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  4.82061803e+00 3.89208225e-01]
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 -4.85891414e+01 4.07868663e+00 -1.33680503e+00 4.07971488e+00
 -2.41512872e+00 3.80193818e+00 -1.54423045e+00 6.85645685e+00
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  3.56644295e+00 1.59224150e-01]
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    2.20567264e+01 1.02045868e-01 2.04547252e+01 1.03368175e-01
    9.94451646e+01 -2.72559644e+00 2.71164250e+01 -2.41512872e+00
    3.07131079e+01 -1.31586231e+00 2.09248001e+01 1.26842789e+00
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    6.59582602e+01 -1.09313837e+00 2.04390773e+01 -1.54423045e+00
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   -8.98515487e+00 6.11740778e-01]
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    5.35552340e+01 -1.53197885e+01 3.36674123e+01 -6.45343876e+01
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    3.41062076e+00 -6.06577440e+00]
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    1.93637356e+00 -1.00676844e+00 1.84968352e+00 9.41494038e-01
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    2.94737601e+00 -1.59439198e+00 1.09249819e+00 2.44333458e-01
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    2.31639538e-01 -3.45919429e+00]
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   -8.98515487e+00 3.41062076e+00 2.60824770e-01 2.31639538e-01
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    4.44388398e-01 3.50864287e-01 4.90225766e-02 2.13450919e+00
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    6.59446858e-01 2.12069360e+02]]
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   9.48900668e-01 2.30965165e+00 5.35602749e-01 4.50853211e+00
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   3.45809413e+00 4.23364245e-01]
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   1.46487732e+01 1.53978724e+00 9.70267542e+00 9.56584048e+00
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   1.42697550e+01 8.84178832e-01 1.22038010e+01 9.10715131e+00
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   1.04863805e+01 -7.24055440e-01]
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   3.04787778e+00 2.22259062e+00 2.27029242e+00 6.78284646e+00
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   4.53672840e+00 4.45865197e-01]
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  -9.39989138e-01 2.88787022e+00 -2.66644384e+00 5.96472061e+00
  -3.85323774e+01 3.51068981e+00 -3.74336565e-01 3.16767449e+00
  -1.56256067e+00 3.57239279e+00 -3.60516919e-01 5.26916337e+00
  -2.34059486e+00 -5.78176377e+00 -8.52329175e-01 -2.35506886e+00
   3.90760497e+00 -8.38713540e-01]
 [-5.77590859e-02 4.48996838e-01 1.21697632e+01 1.64378148e+00
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   1.56250449e+01 4.32870007e-01 1.06729443e+01 5.55023442e+00
   4.71840104e+01 -9.56888397e-01 1.83034687e+01 -1.56109376e+00
   1.86581977e+01 -3.60516919e-01 1.73027056e+01 5.87108633e+00
  -3.91248421e+00 1.76976553e+01 3.24536981e+00 -9.16356949e-02
   9.29274957e+00 5.44985865e-01]
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   7.46613330e+00 4.66811784e+00 -1.86059267e+00 2.47781552e+01
  -7.13238526e+01 4.95281515e+00 8.40526697e+00 3.73659478e+00
   4.47512883e+00 5.26916337e+00 5.87108633e+00 2.25595409e+01
  -4.90308920e+00 -2.92302496e+01 3.42755208e+00 -5.33861584e+00
   1.58564322e+01 -2.87596210e+00]
 [-1.21463941e+00 -1.79356306e+00 -7.13803657e+00 -2.18307648e+00
  -5.83255585e+00 -2.75641475e+00 -4.49816222e+00 -1.14309248e+00
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 -7.22427148e+00 -2.34059486e+00 -3.91248421e+00 -4.90308920e+00
  6.09866473e+01 -8.44316077e+00 -4.85410474e+00  4.84967005e+00
 -6.46861360e+00 -1.05181097e-01]
[ 6.18884155e+00 -4.81594108e+00  1.26597779e+01 -9.83205427e+00
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  1.76024534e+01 -4.03686444e+00  2.08481105e+01 -3.26916680e+01
  2.31464116e+02 -8.52344515e+00  2.42281761e+01 -5.49021794e+00
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 -8.44316077e+00  1.68771686e+02 -6.19601220e+00  1.63787078e+01
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  4.03053135e+00 -6.19029258e-01  2.42548536e+00  3.47074557e+00
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 -4.85410474e+00 -6.19601220e+00  6.41566832e+00 -7.77580099e-01
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[ 2.48450562e+00 -1.42425678e+00 -1.59656693e+00 -1.80539566e+00
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 -5.53910532e-01 -1.80833390e+00 -2.51618331e+00 -6.01181512e+00
  3.73567227e+01 -2.71908974e+00 -1.47540203e+00 -1.20055075e+00
  2.29205880e+00 -2.35506886e+00 -9.16356949e-02 -5.33861584e+00
  4.84967005e+00  1.63787078e+01 -7.77580099e-01  1.58885277e+02
 -2.23419219e+00  1.03946626e+00]
[-6.02099930e-01  3.14236457e+00  9.80393023e+00  4.19148137e+00
  8.62848887e+00  4.48754630e+00  5.50466244e+00  3.44606006e+00
  1.09141346e+01  3.65341765e+00  2.58594436e+00  1.72753724e+01
 -2.23967896e+01  3.03956287e+00  1.30718244e+01  2.47348199e+00
  1.06390917e+01  3.90760497e+00  9.29274957e+00  1.58564322e+01
 -6.46861360e+00  5.47130606e+00  2.27320920e+00 -2.23419219e+00
  1.65101422e+01 -9.71544189e-01]
[-3.47182903e-02 -6.69903899e-01  1.30673790e-01 -9.54195789e-01
  6.90932163e-01 -8.11079023e-01  6.61615444e-01 -8.21341588e-01
  4.73131014e-01 -7.81691150e-01 -1.07455571e+00 -3.33267297e+00
  2.09600939e+01 -9.56433484e-01  8.50458512e-01 -8.10272511e-01
```

1.46989741e+00 -8.38713540e-01 5.44985865e-01 -2.87596210e+00
 -1.05181097e-01 9.31229787e+00 -3.70005120e-01 1.03946626e+00
 -9.71544189e-01 2.08827064e+02]]

Classwise cluster size:
class0: 2003
class1: 9784
class2: 5683
class3: 2265

Purity Score: 0.3764378008614137