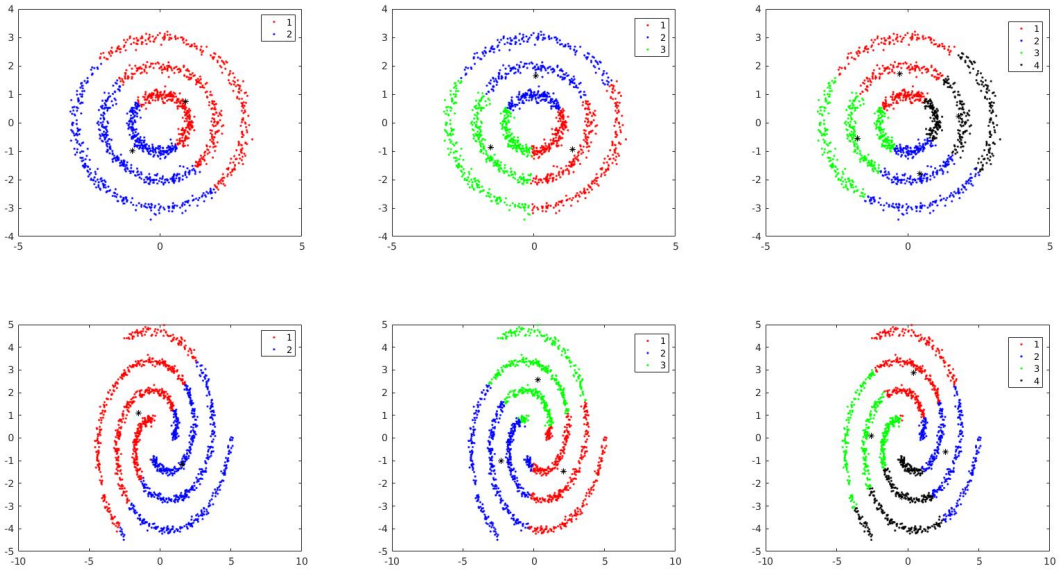
1.

a)This graph is Kmean cluster for D1(top) and D2(bottom), with K = 1(left). 2(middle), 3(right)



The L2 distance sum to centroid for circle:

km2 2.4005e+03 2.0549e+03

km3 1.0137e+03 982.7834 935.9432

km4 461.8469 563.0441 548.7791 547.7456

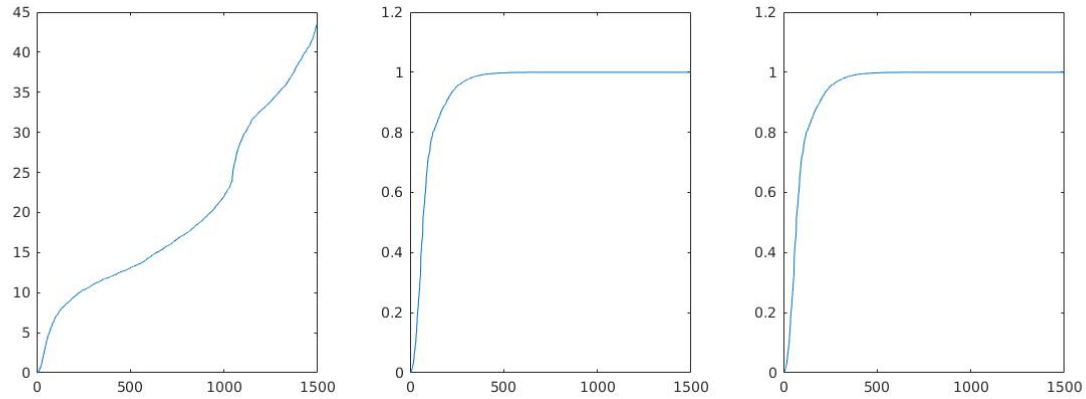
For spiral

km2 = 4.3184e+03 5.5044e+03

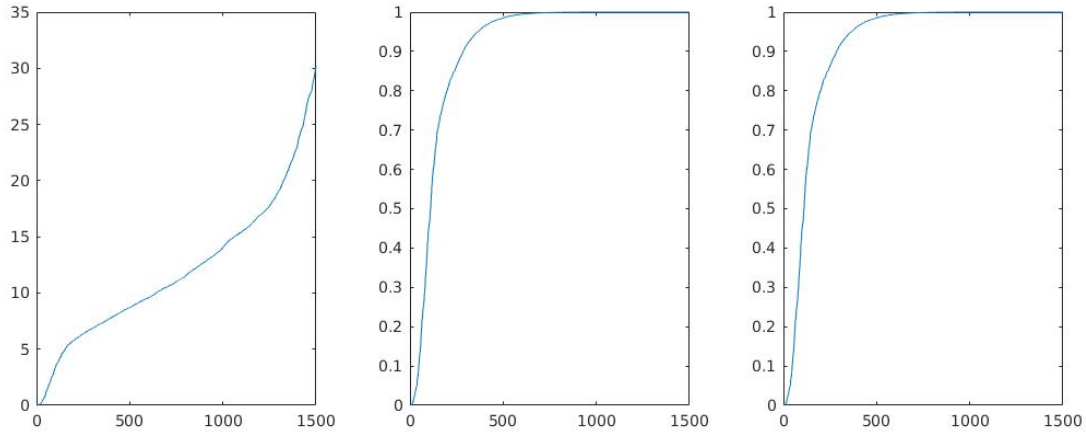
km3 = 1.8498e+03 2.0210e+03 1.8893e+03

km4 = 791.2946 1.4424e+03 1.1530e+03 1.0835e+03

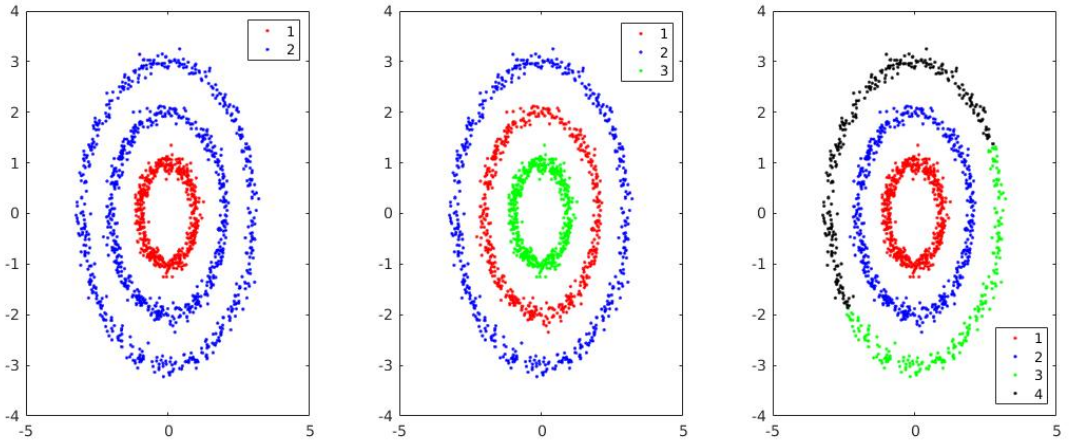
b) The following graphs are eigenvalue L(left), Lrw(middle), Lsym(right) for D1.

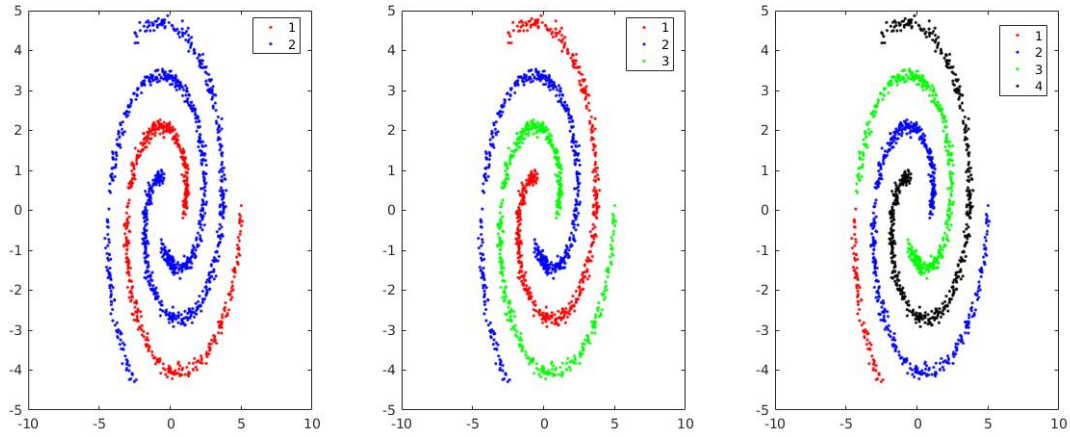


The following graphs are eigenvalue L(left), Lrw(middle), Lsym(right) for D2

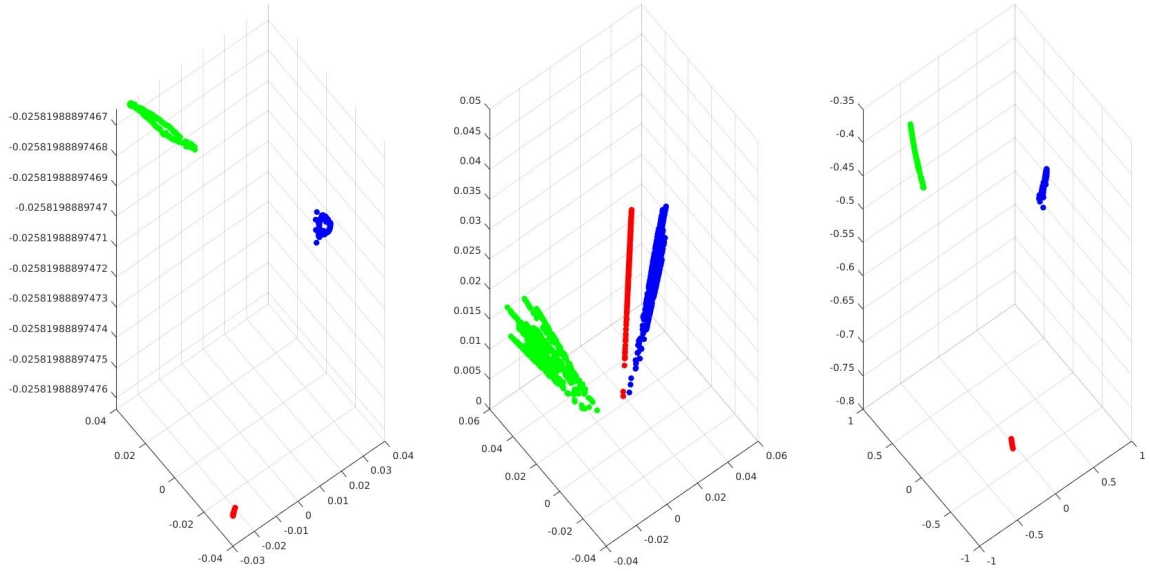


the spectral clustering result for D1(top) and D2(bottom), with K = 1(left). 2(middle), 3(right) are:

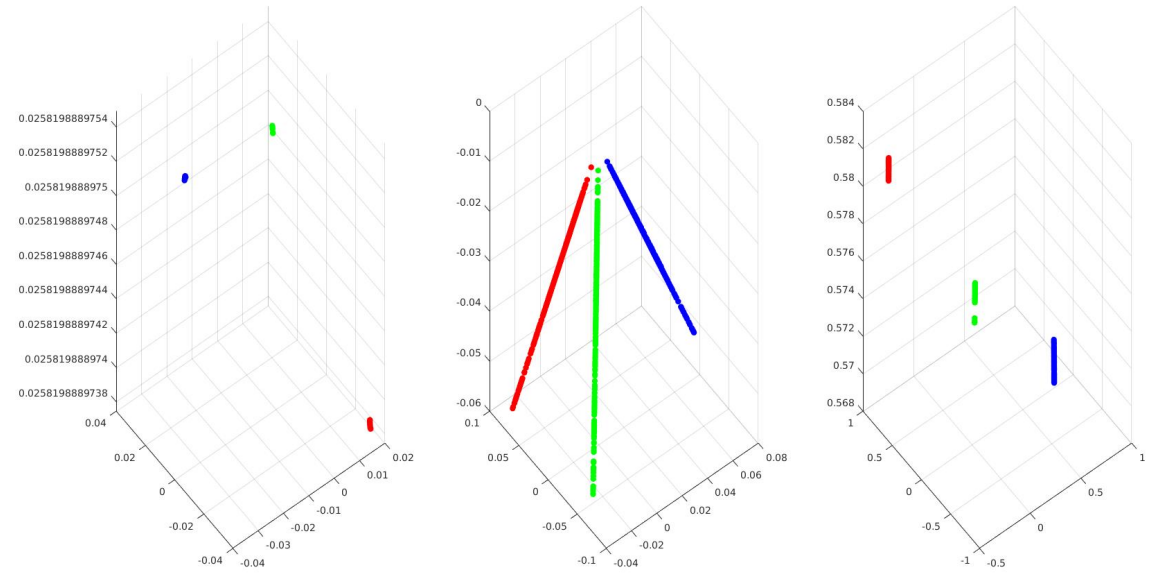




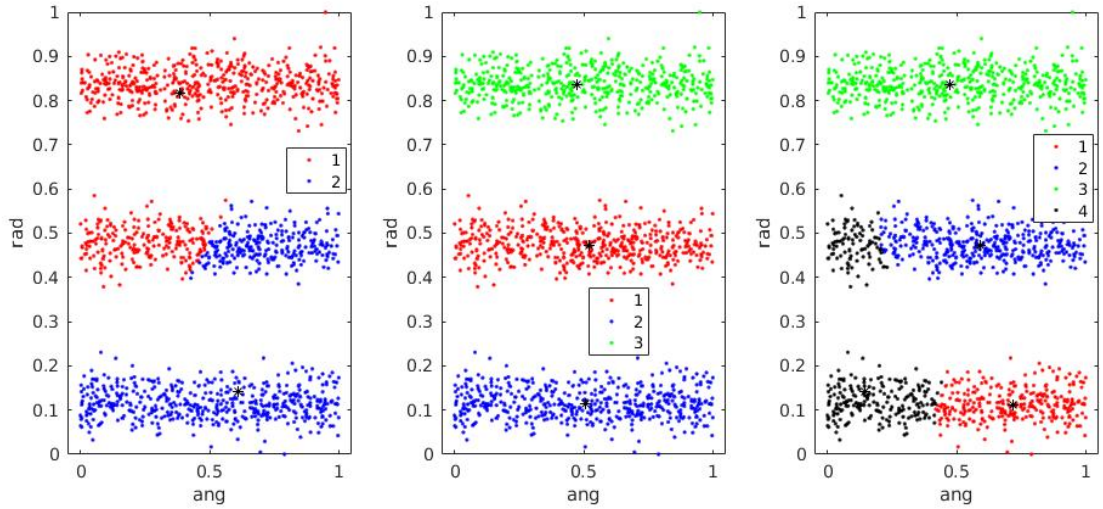
the V matrix for SC-1, SC-2, and SC-3 according to D1 are:



the V matrix for SC-1, SC-2, and SC-3 according to D2 are:



c)By transfrom into normalized polar coordinate. The clusting result of kmean are:



The L1 distance sum to centroid:
kmeans2 = 260.6107 280.2193
kmeans3 = 130.4495 143.3223 136.9302
kmeans4 = 49.8707 83.6410 136.9302 69.4808

2: This graph show how the purity grows with the cluster number getting bigger