

EN.580.694 ASSIGNMENT # 05

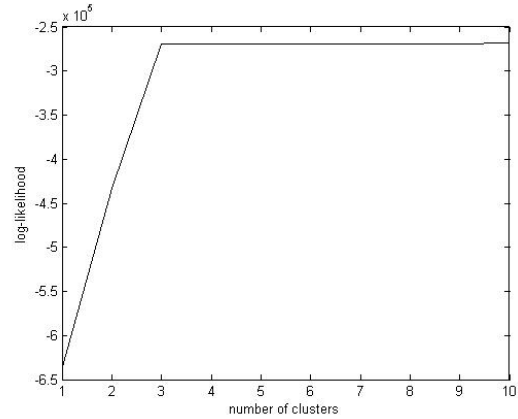
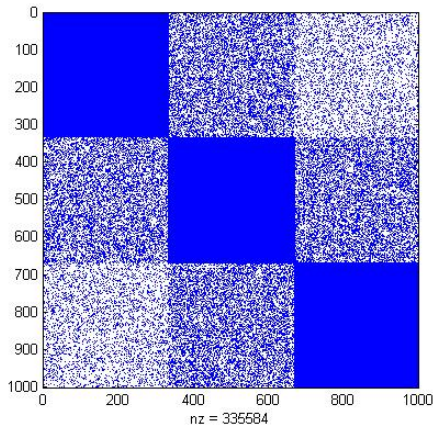
HEATHER G. PATSOLIC
STATISTICAL CONNECTOMICS

First, I created a Stochastic Block Model generator which produces a matrix with n vertices and k clusters along with generating the block probability matrix and vertex assignments. This can be found in the folder and is titled `SBMrand.m`. Running `loglike.m` then produces a plot of the sum-log-likelihood for the matrix A with a variety of clusters from 1 to `maxk` where `maxk` is input by the user.

An example of output from running the SBM code with $n = 1000$ and $k = 3$ yielded the following matrix A , using `spy(A)`, shown below on the left, with block probabilities defined by

$$B = \begin{bmatrix} 0.9108 & 0.0735 & 0.0323 \\ 0.0735 & 0.8603 & 0.0773 \\ 0.0323 & 0.0773 & 0.8846 \end{bmatrix}.$$

The image below on the right shows the log-likelihood plot created from this algorithm using this A matrix.



As can be seen in the diagrams, A has three clusters. Using the log-likelihood function we find that the log-likelihood increased from 1 to 3 clusters after which there was little to no increase as the number of clusters increased.

Interestingly, using more clusters, for example 7, while using the same number of nodes I got a different plot for log-likelihood. I think this is due to the probabilities on the off diagonals being higher than they were in the previous example. The random block matrix was:

B =						
0.9317	0.2497	0.2337	0.1650	0.1552	0.0957	0.1266
0.2497	0.9802	0.1969	0.2358	0.0117	0.2495	0.2072
0.2337	0.1969	0.8463	0.1250	0.1686	0.0687	0.0427
0.1650	0.2358	0.1250	0.9234	0.1731	0.1727	0.0360
0.1552	0.0117	0.1686	0.1731	0.9945	0.0568	0.2423
0.0957	0.2495	0.0687	0.1727	0.0568	0.8198	0.0678

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0.1266 0.2072 0.0427 0.0360 0.2423 0.0678 0.9859

Generating a matrix, A, from this probability distribution and plotting the log-likelihood curve, it was of interest that the correct number of clusters, 7, has a lower sum(log-likelihood) value than 8 clusters.

