Math 420, Spring 2018
Sixth Team Homework

due Tuesday, 17 April, 2018

Consider the dataset assigned to your project. Consider the SDP program that determines a geometric graph from a set of pairwise distances. Write a Matlab script that performs the following tasks, then execute it on your data file:

1. Use the exponential law $W_{i,j} = exp(-d_{i,j}^2)$ to convert the weighted graph into a set of pairwise distances.

2. Write a CVX code that solves the SDP problem on the set of pairwise distances computed earlier:

$$\begin{array}{ll} \text{minimize} & trace(G) \\ \text{subject to} & G = G^T \geq 0 \\ & G \cdot 1 = 0 \\ & |\langle G e_{i,j}, e_{i,j} \rangle - d_{i,j}^2| \leq \varepsilon \ , \ (i,j) \end{array}$$

3. Run the CVX code for a few values of ε: start with a large value (e.g. the average values of $d_{i,j}^2$) and then decrease by a factor of 2 a few times (up to 10) until you no longer have a feasible solution. Report the last found solution G.

4. Implement the Gram matrix factorization algorithm $G \approx YY^T$ and run it to obtain Y for $d = 2$ and $d = 3$.

5. Plot the 2D and 3D geometric graphs.

6. Use the power law $W_{i,j} = \frac{1}{d_{i,j}^2}$ instead of the exponential law at 1, and repeat 1-5.

Your submission should include: 1. Matlab script code (including CVX) that solves the above tasks; 2. A total of four figures: two figures for the exponential law, and two figures for the power law.