Major Changes:

Di Wang emailed us back with some major intuition.

What I have accomplished so far:

I had this idea I think a month ago about a way to make the algorithm more aggressive. I have become increasingly more and more unconvinced that it would work. I thought about it some more recently and I’m just going to abandon that idea.

However, during the last two meetings, we were focused on testing the CRD algorithm on a graph that the classic spectral methods fail on; specifically, this is the graph that is the Cartesian product of a tree and a line. We expect a cut of size $O(n^{1/3})$ but the spectral method gives a cut of $O(n^{2/3})$.

Andy coded the CRD algorithm up and have run preliminary tests on it with this graph. The results look unpromising; however, I decided to rerun the experiments mentioned on the paper (grid graph) on Andy’s implementation. When Andy’s implementation begins on a specific vertex, it seems like it returns a correct cut. However, on other vertices, it gives a pretty weird (suboptimal) cut that I did not expect. Perhaps this is a bug with Andy’s code, but we’ll see about it later.

Another development came out of the conversations on the Cartesian product of a tree and a path. In this case, I suggested that we should consider how fast certain vertices diffuse its weight/change its height. Based on that, perhaps we could say something since right now, the algorithm doesn’t really care about the speed of diffusion. This might prove to be an improvement since it seems that the speed of diffusion/change in level/distance that weight travels is essentially free information that we could use but the CRD algorithm currently doesn’t use it. Gary seems optimal about this idea of using some sort of “momentum” to improve the algorithm. I have thought about my idea since last week and but haven’t gotten too far. Gary and I hope to at least somehow adjust the CRD algorithm based on some momentum metric and try to solve the problem for the Cartesian product of a tree and a path.

The problem here is that there are multiple metric in which we can consider such as change in height/level of the vertex, how much weight a single vertex looses, and/or how far mass travels. Gary likes the idea of how far mass travels, but I have a hard time thinking of that idea so I spent this week thinking about how we can reason on how fast a vertex increases its height/level.

Meeting my Milestone

Here are the tasks that I set out to do:

- Experiment with this algorithm in terms of input and minor modifications
- Have a good picture of where I’m going and what I should do for the final product.
I experimented mostly with different inputs along with Andy. However, I didn’t get to try out minor modifications. I think I should try to think about the modifications I will make and only try them out if they seem to work intuitively.

Also, I have a pretty solid idea of where I’m going. I will be working to improve this algorithm to at least make it perform well on the Cartesian product of the tree and path graph. I’ll still consider it a success if I somehow make it work for the Cartesian product of a tree and path but break it for some other graphs. There are other counter examples to the spectral method, but at least for now, I’m not really working with them.

Surprises:
None.

Revisions to Milestones
For the next deadline, I would like to try to work with the algorithm with some modifications in terms of momentum. Hopefully, I get somewhere with this. It might be the case though, that CRD is equivalent to any spectral method; I don’t understand the proof of why it doesn’t fall under the spectral methods so maybe.

Resources Needed
No changes.