

1 Abstract

Briefly mention graph laplacian, the linear system, applications to problems, how I am doing it

2 Introduction

Why is this problem important. Talk about PageRank and other "ranks" ie proteinrank, generank

3 Background

Already written first draft
probably needs a lot more depth in the literature review
probably more papers out there on graph laplacian solvers besides LAMG, CMG, and the Penn state people

4 Methodology

Fan Chung's local and global portion
multigrid on local portion and why it is optimal
direct solve on sparse portion
linear algebra to combine
somewhere in here need to explain networkx and petsc i think?
if we write in C talk about how it is first implementation

5 Results

Complexity analysis of all the individual parts
how fast is splitting for n edges?
multigrid $O(n)$
direct sparse solve is ?
how many mat-mat, mat-vec multiplies in the sherman morrison
table of times for different size graphs
maybe try to get it on a cluster to parallelize, or maybe do this after initial thesis defense
maybe try to compare with LAMG in matlab

6 Applications

graph laplacian linear systems of different types
C. elegans neural network
proteins and genes
facebook social networks
others? electric grids?

7 conclusions

talk about what worked and didnt
what will be improved upon

8 Bibliography from bibtex file