AMG methods for signal processing on graphs

Juntuan Lin, Xiaozhe Hu and Shuchin Aeron
Tufts University
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Abstract

This project ties Algebraic Multigrid (AMG) methods with several recently proposed framework of Graph Signal Processing (GSP). Specifically we look at the problems of spectral clustering via graph filtering, termed as Compressive Spectral Clustering (CSC) and Graph Convolutional Neural Networks (G-CNN) and show that the smoothing and the coarsening (coarsening $\sim$ sampling for CSC) schemes used in these algorithms are related to AMG smoothers and pre-conditioners. Consequently we show that...

1 Quick Action Items

1. Set up Git-Hub repo for the project. Done.
2. Modify the recursive computation of the low-pass filtering using the graph Laplacian for CSC and test performance on SBMs. It turns out that one can recursively estimate any polynomial approximation of a filter in the graph Fourier domain but the authors chose to implement Chebychev filters.
3. Do the same and test performance on Graph-CNN. Shuchin needs to look for a small data set for testing this

2 Long-term Action Items

1. Apply CSC to PPI networks and compare with DSD based clusterings. Note that PPI networks are dense. Also note that the DSD is derived using a different metric as compared to the Diffusion Mapping **?**. We believe that this only changes the *effective* Laplacian for the CSC method. Need to verify.
2. What are the implications for AMG methods, which after all also estimate the spectral decomposition of the Lapalcian via coarsening and smoothing? This is very interesting to explore.