EEE 5502 HW #09

Question #5

1. Sandryhaila, A., Moura, J.M.F.: 'Discrete signal processing on graphs', IEEE Trains. Signal Process., 2013, 61, (7), pp. 1644-1656

https://ieeexplore.ieee.org/abstract/document/6409473/citations?tabFilter=papers#citations

2. Sandryhaila, A., Moura and J.M.F.: 'Discrete Signal Processing on Graphs: Graph Fourier Transform'

http://users.ece.cmu.edu/~asandryh/papers/icassp13a.pdf

Question #6

Representation, analysis and processing of large datasets on graphs has attracted much interests, with the fact that graphs are thought and proven to be able to encode complex geometric structures. Examples of graph signals including social and economic networks, transportation networks, molecular and gene regulatory networks. Although a signal on a graph with N vertices and a classical discrete-time signal with N samples can be viewed as vectors and are thought to be sharing similarities, the truth that processing the graph signal in the classical way of processing discrete-time signal ignores the key dependencies arising from the irregular data domain becomes the main obstacle to the usage of classical signal processing techniques in the graph setting. Here we have reviewed the challenges of processing signals on graphs, and learned that algebraic and spectral graph theoretic concepts together with computational harmonic analysis are used to address those challenges, which is the emerging field of signal processing on graphs. The spectral graph theory is reviewed with basic graph theories, including the graph Laplacian, the graph Fourier transform, and most importantly, the generalized operators for signals on graphs. Graph Fourier transform, one of the operators, is further studied. It is demonstrated that the graph signals can be sparsely represented in their frequency domain, and the graph signals is a natural extension of the classical time-series DSP theory, with the potential application as efficiently representing structured data with sparseness.