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A Foundation Framework for Graph Signal Processing

Abstract: In this talk, I first introduce the basics and motivations of graph signal processing (GSP). Then we define a set of energy-preserving shift operators that satisfy many properties similar to their counterparts in classical signal processing, but are different from the shift operators defined in the literature. We decouple the graph structure represented by eigengraphs and the eigenvalues of the adjacency matrix or the Laplacian matrix. We further define autocorrelation and cross-correlation functions of signals on the graph, enabling us to obtain the solution to the optimal filtering on graphs, i.e., the corresponding Wiener filtering on graphs and the efficient spectra analysis and frequency domain filtering in parallel with those in classical signal processing. This new shift operator based GSP framework enables us to extend the classical signal analysis on a general network.