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In recent years, the advent of new sensor technologies and social network infrastructure has provided huge opportunities and challenges for analyzing data recorded on such networks. In the case of data on regular lattices, computational harmonic analysis tools such as the Fourier and wavelet transforms have well-developed theories and proven track records of success. It is therefore quite important to extend such tools from the classical setting of regular lattices to the more general setting of graphs and networks. In this talk, we first review our recent effort of constructing multiscale basis dictionaries on a graph, including the Hierarchical Graph Laplacian Eigenbasis Dictionary and the Generalized Haar-Walsh Wavelet Packet Dictionary, which are viewed as generalizations of the classical hierarchical block Discrete Cosine Transforms and the Haar-Walsh wavelet packets, respectively, to the graph setting. Finally, we demonstrate the usefulness of our dictionaries by applying them in some signal and image processing problems where classical tools have difficulty, e.g., simultaneous segmentation and denoising of noisy signals sampled on regular lattices, and analysis of term-document matrices. (Received September 22, 2015)