Wavelets and filter banks on graphs

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In this talk I will first describe a simple construction of wavelets on graphs from spectral graph theory. Spectral graph wavelets are localized on the vertices of a (weighted) undirected graph and can be used to process data defined on networks for example. An efficient algorithm allows to implement the transform with a complexity scaling with the number of edges in the graph and is thus very useful for sparse graphs. Interestingly, spectral graph wavelets yield sparse representations of smooth functions on the set of vertices and in the graph topology. A few applications, for example in semi-supervised regression with sparsity constrains will be described. Then I will describe our ongoing efforts to construct critically sampled filter banks generating wavelets on graphs. A neat connection with nodal theorems will allow us to introduce and study downsampling on graphs and a reduction technique will allow us to iterate the construction through scales. Interestingly, these techniques lead, for a class of graphs, to explicit perfect reconstruction equations that take the form of quadrature mirror conditions