

Department of Applied Mathematics and Statistics
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SEMINAR

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March 9, 2006
304 Whitehead Hall
Refreshments: 3:30 p.m.
Seminar: 4:00 p.m.

EFFECTIVE WAVELET-BASED REPRESENTATIONS
IN HIGH DIMENSIONS

ABSTRACT

I will first provide a brief overview of the wavelet representation and connect it with pyramidal representations such as the Laplacian. I will then discuss some existing challenges in the wavelet/pyramidal representations, especially in high dimensions.

Next, I will describe a new methodology for representing data on regular grids, which is a hybrid of the wavelet and the pyramidal representations. I will present the details of a subclass of these representations, dubbed L-CAMP. The specific highlights of the L-CAMP representation are three. First, it is computed and inverted by fast algorithms with linear complexity and very small constants; moreover, the constants in the complexity bound decay, rather than grow, with the spatial dimension. Second, the representation is accompanied by solid mathematical theory that reveals its performance in terms of the maximal level of smoothness accurately encoded by the representation. Third, the localness of the representation, measured as the sum of the volumes of the supports of the underlying mother wavelets, is extreme.

An illustration of this last property is done by comparing the widely used tensor-product biorthogonal 9/7 with a system of ours with similar performance. Our representation has, in dimension ten, localness score less than 29. The localness score of the 9/7 is, in that same dimension, greater than 575,000,000,000.

(This is joint work with Amos Ron.)