

## ECE 802 Review Paper 2

Due: April 1, 2010

For this review paper, you are given three recent papers on extensions of wavelet decompositions to overcomplete sets. The first paper by Gribonval and Bacry introduce harmonic matching pursuit for audio signal analysis. The second paper by Vautrin et al. illustrates an application of wavelet packets for signal classification in Brain-Computer Interface. Finally, the third paper by Elad and Aharon show the application of overcomplete dictionary representations to image denoising. First, briefly summarize the three papers in your own words.

1. Based on the three papers, first define what we mean by overcomplete representations and then discuss the advantages and disadvantages of such representations over standard orthogonal, complete transforms such as the wavelet transform.
2. In Vautrin et al.'s paper, what is the cost function used for determining the 'best' tree in the wavelet packet decomposition? Why is this cost function preferred over the conventional energy or entropy based cost functions? Explain.
3. What is the major contribution of Gribonval and Bacry's paper over standard matching pursuit algorithm?
4. Describe the advantages of dictionary learning versus using a fixed dictionary in overcomplete and sparse representations.
5. Discuss the computationally complexity of the three methods qualitatively.