Imaging with wavelet transforms

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Objective:
At the end of the course the student should be able to:

- Enunciate principles of continuous and discrete wavelet transform theory
- Implement wavelet transform of images
- Apply wavelet transform to image enhancement such as noise removal and edge sharpening
- Implement wavelet based image compression
- Do pattern recognition with wavelets.

Topics:

- Continuous wavelet transform. Definition. Properties. Interpretation. Time-frequency resolution. Inverse transform.
- Discrete wavelet transform. Dyadic sampling. Orthogonality. Compact support. Bandlimited wavelets. Examples. Digital filter implementation.
- Biorthogonal decomposition. Linear phase filters. Wavelet packets. Two-dimensional transforms.
- Image compression. Advantages of wavelets.
- Application to pattern recognition, noise removal, image sharpening and image fusion.
- Image and video compression standards based on wavelets. FBI image compression. JPEG-2000. MPEG-4.
- Advanced topics. Regularity. Scale-invariance. Optimal wavelet matching.

Companion textbook:
Wavelet Transforms: Introduction to Theory and Applications, by Raghuveer M. Rao and Ajit S. Bopardikar. Addison-Wesley Longman, 1998.

Prerequisite:
The imaging science linear math sequence.