Wavelet Toolbox 4

Analyze and synthesize signals and images using wavelet techniques

Wavelet Toolbox extends the MATLAB® technical computing environment with graphical tools and command-line functions for developing wavelet-based algorithms for the analysis, synthesis, denoising, and compression of signals and images. Wavelet analysis provides more precise information about signal data than other signal analysis techniques, such as Fourier.

Wavelet Toolbox supports the interactive exploration of wavelet properties and applications. It is useful for speech and audio processing, image and video processing, biomedical imaging, and one-dimensional (1-D) and two-dimensional (2-D) applications in communications and geophysics.

Wavelet Toolbox authors are Michel Misiti, École Centrale de Lyon; Georges Oppenheim, Université de Marne-La-Vallée; Jean-Michel Poggi, Université René Descartes, Paris 5 Université; and Yves Misiti, Université Paris-Sud.

Applying Wavelet Methods

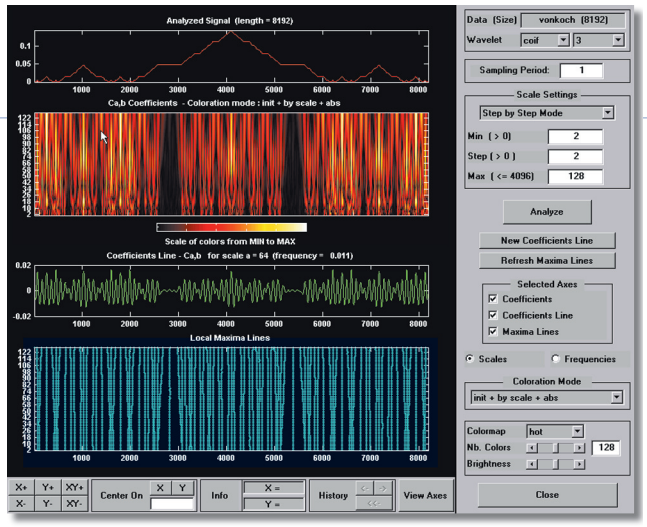
Wavelet methods provide powerful tools for analyzing, encoding, compressing, reconstructing, and modeling signals and images. They are useful in capturing, identifying, and analyzing local, multiscale, and nonstationary processes, enabling you to explore aspects of data that other analysis techniques miss, such as trends, breakdown points, discontinuities in higher derivatives, and self-similarity.

Wavelet Toolbox supports a full suite of wavelet analysis and synthesis operations. You can use it to:

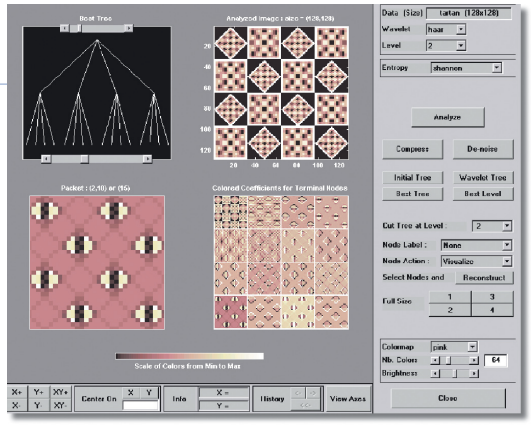
- Enhance edge detection in image processing
- Achieve high rates of signal or image compression with virtually no loss of significant data
- Restore noisy signals and degraded images
- Discover trends in noisy or faulty data

KEY FEATURES

- Standard wavelet families, including Daubechies wavelet filters, complex Morlet and Gaussian, real reverse biorthogonal, and discrete Meyer
- Wavelet and signal processing utilities, including a function to convert scale to frequency
- Methods for adding wavelet families
- Lifting methods for constructing wavelets
- Customizable presentation and visualization of data
- Interactive tools for continuous and discrete wavelet analysis
- Wavelet packets, implemented as MATLAB objects
- One-dimensional multisignal analysis, compression, and denoising
- Multiscale principal component analysis
- Multivariate denoising



Fractal signal decomposed using the Continuous Wavelet Transform, with a scalogram showing the self-similarity of the signal at various scales. The bottom axes display the coefficient line and local maxima lines, respectively, for exploring continuous wavelet coefficients.



Wavelet decomposition using wavelet packet analysis.

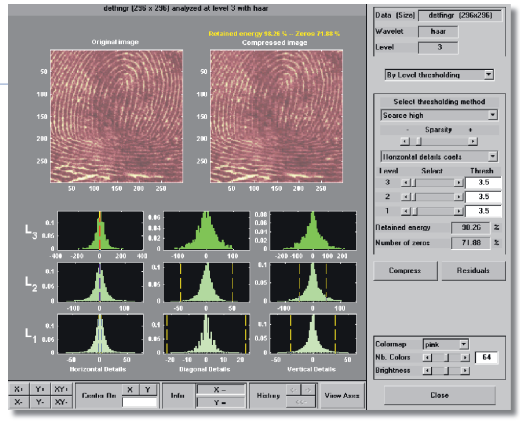


Image from the U.S. Federal Bureau of Investigation fingerprint database. The automatic thresholding feature of Wavelet Toolbox produces a compressed image with about 72% zeros and 98% of the original signal.

- Study the fractal properties of signals and images
- Extract information-rich features for use in classification and pattern recognition applications
- Perform multivariate denoising of signals with multiscale principal component analysis

Analyzing Signals and Images

The Wavelet Toolbox graphical user interface (GUI) provides a comprehensive set of tools for analyzing 1-D and 2-D signals, including tools for wavelet analysis, wavelet packet analysis, denoising, and compression. For 1-D signals, you can use the GUI tools to:

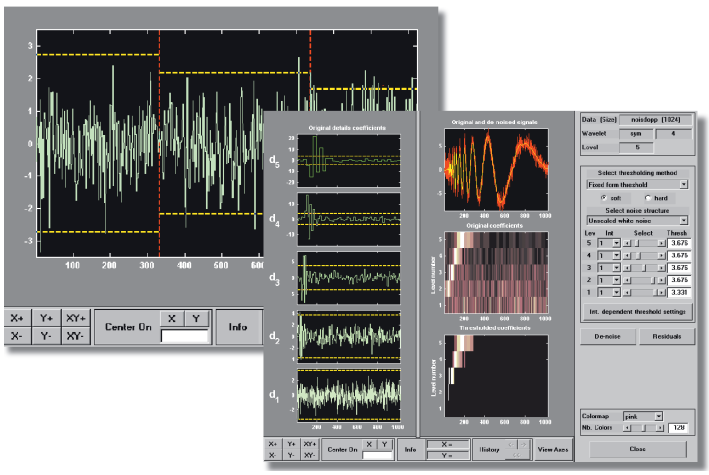
- Perform discrete wavelet analysis of signals
- Perform continuous wavelet analysis of real signals using complex wavelets
- Denoise signals
- Estimate wavelet-based density
- Perform wavelet reconstruction schemes based on various wavelet coefficient selection strategies
- Randomly generate fractional Brownian motion
- Perform 1-D signal extension and truncation using periodic, symmetric, smooth, and zeropadding methods
- Perform 1-D signal clustering and classification using wavelet analyses (with Statistics Toolbox, available separately)

For 2-D signals, you can use the GUI tools to:

- Perform discrete wavelet analysis of images
- Fuse two images
- Perform translation-invariant denoising of images, using the stationary wavelet transform
- Reconstruct wavelet schemes based on various wavelet coefficient selection strategies

Required Products

MATLAB



Wavelet denoising, with instant visualization of the results. Threshold settings can be applied using the denoising and compression tools in the Wavelet Toolbox graphical user interface (GUI).

Related Products

Image Processing Toolbox. Perform image processing, analysis, and algorithm development

Signal Processing Toolbox. Perform signal processing, analysis, and algorithm development

Statistics Toolbox. Apply statistical algorithms and probability models

For more information on related products visit *www.mathworks.com/products/wavelet*

Platform and System Requirements

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