Wavelet Transform

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Introduction

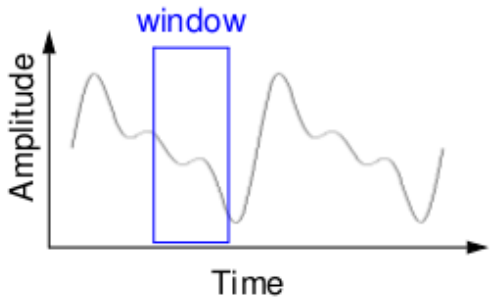
Fourier Transform

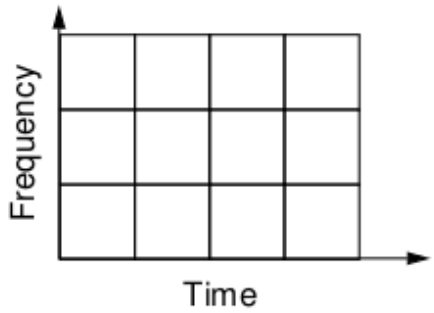
- frequency representation
- time information lost
- for stationary signals

Introduction

Short-Time Fourier Transform

- *windowing* (static size)

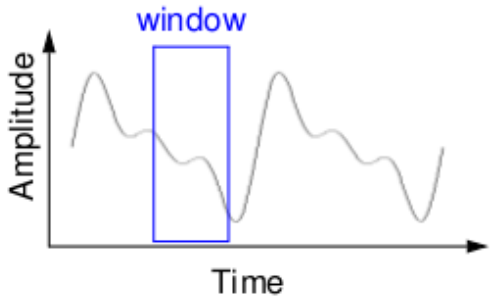




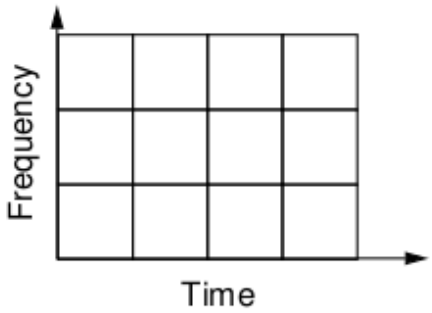
Introduction

Wavelet Transform

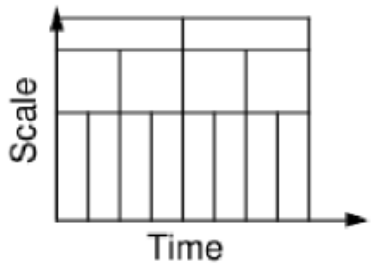
- windowing (variable size)



Short
Time
Fourier
Transform

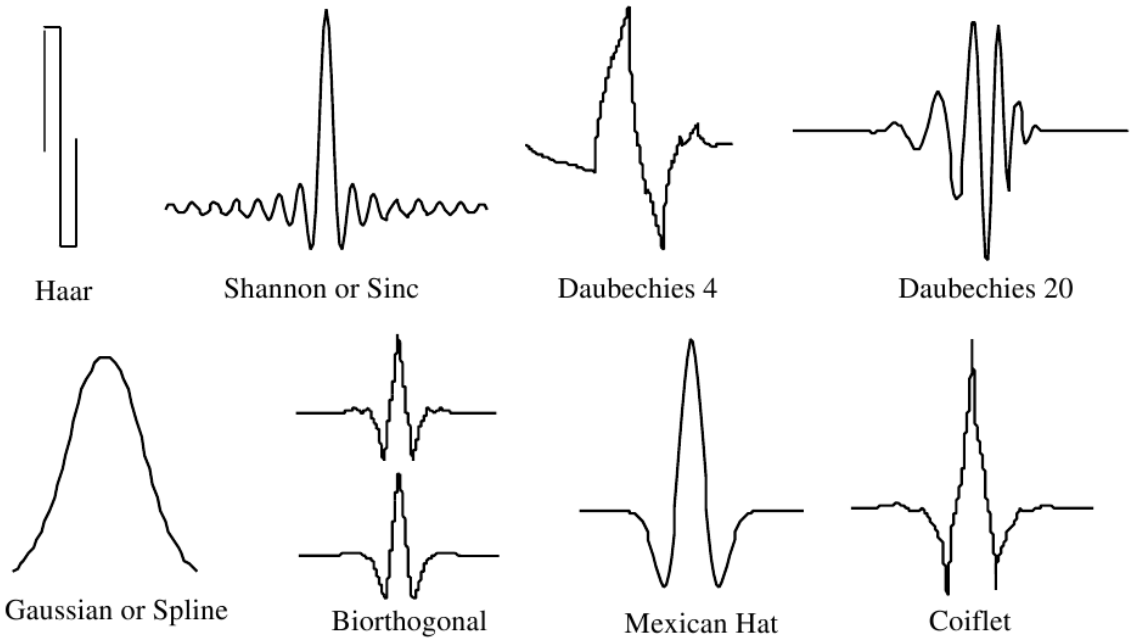


W

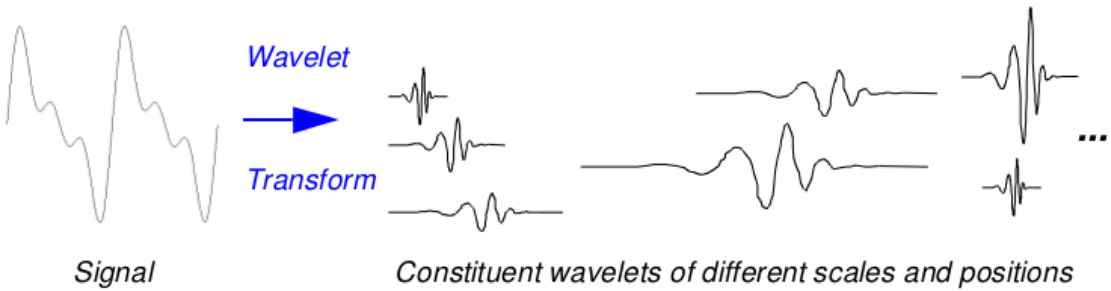


Wavelet Analysis

- wavelet – a waveform with a zero average

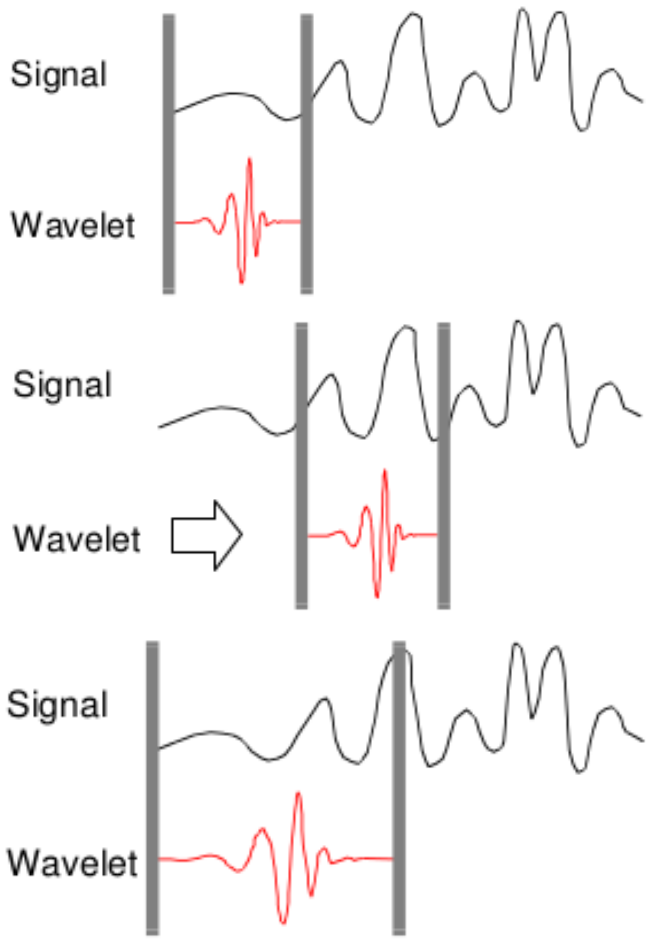


- breaking a signal into shifted and scaled versions of the wavelet



Continuous Wavelet Transform

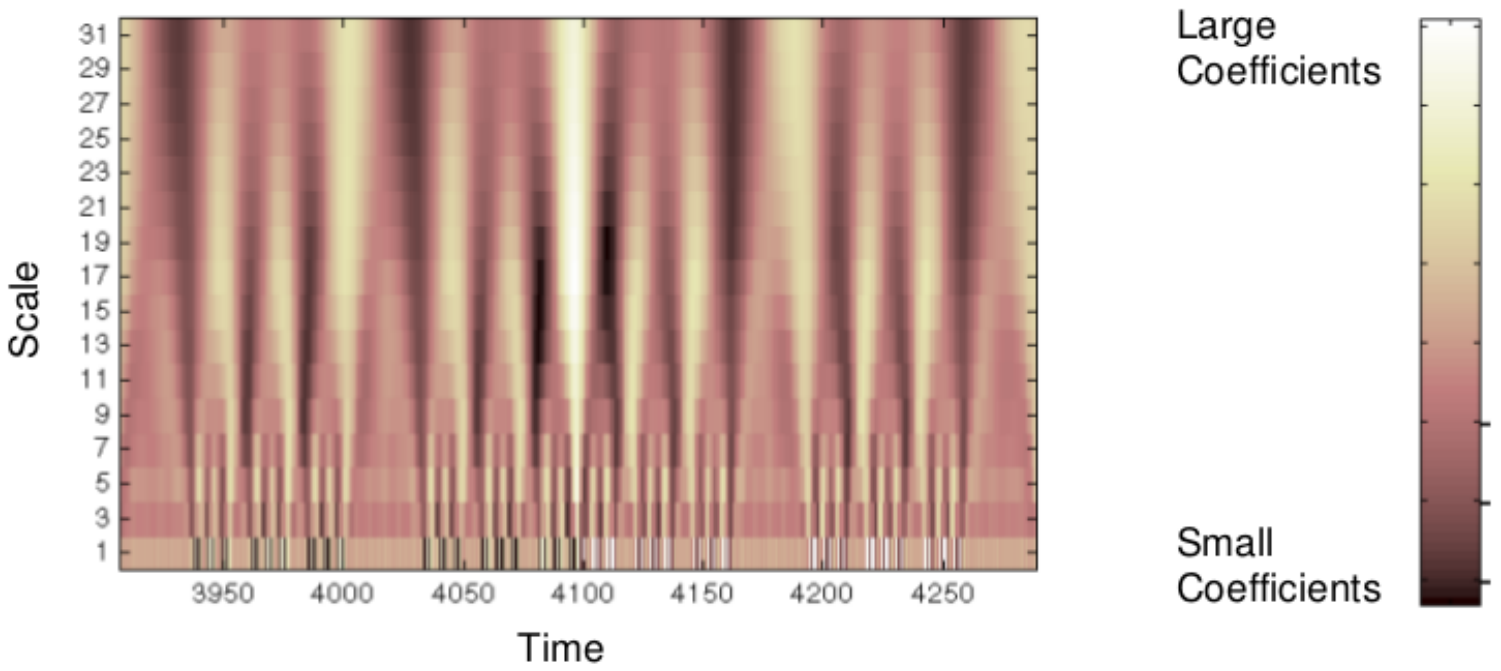
$$C(scale, position) = \int_{-\infty}^{\infty} f(t)\psi(scale, position, t)dt$$



Continuous Wavelet Transform

$$C(scale, position) = \int_{-\infty}^{\infty} f(t)\psi(scale, position, t)dt$$

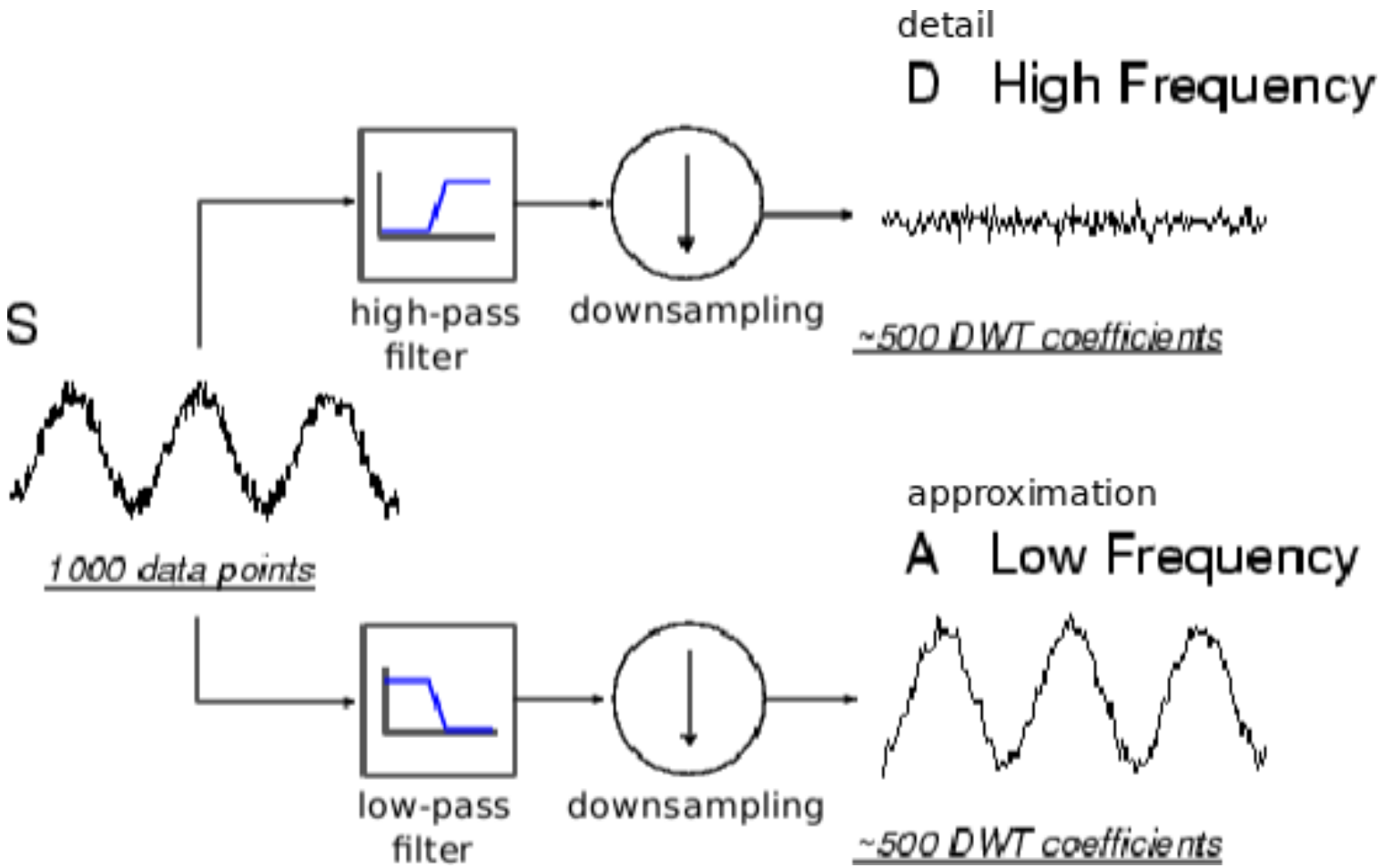
- scalogram:



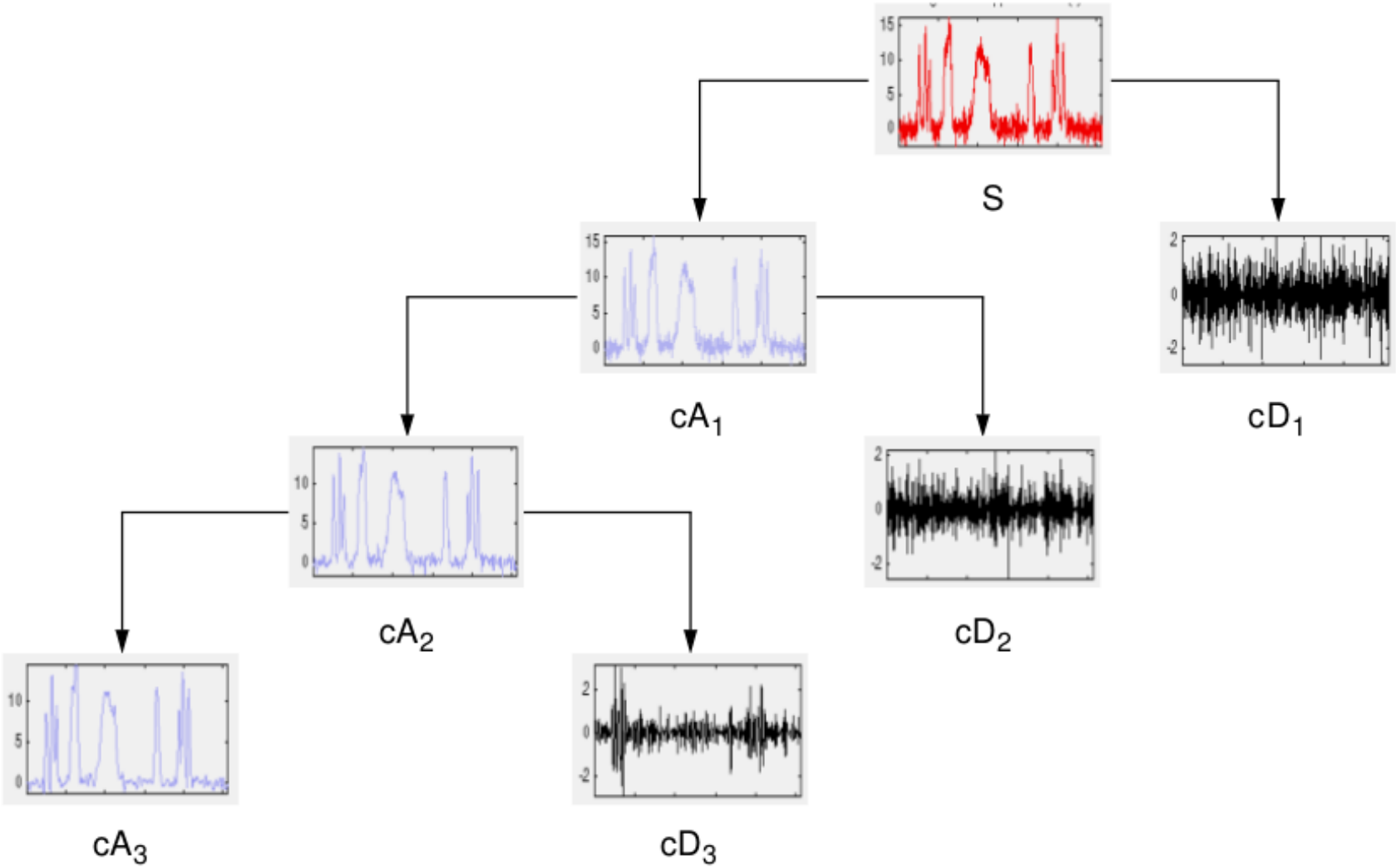
- continuous: scales, shifting

Discrete Wavelet Transform

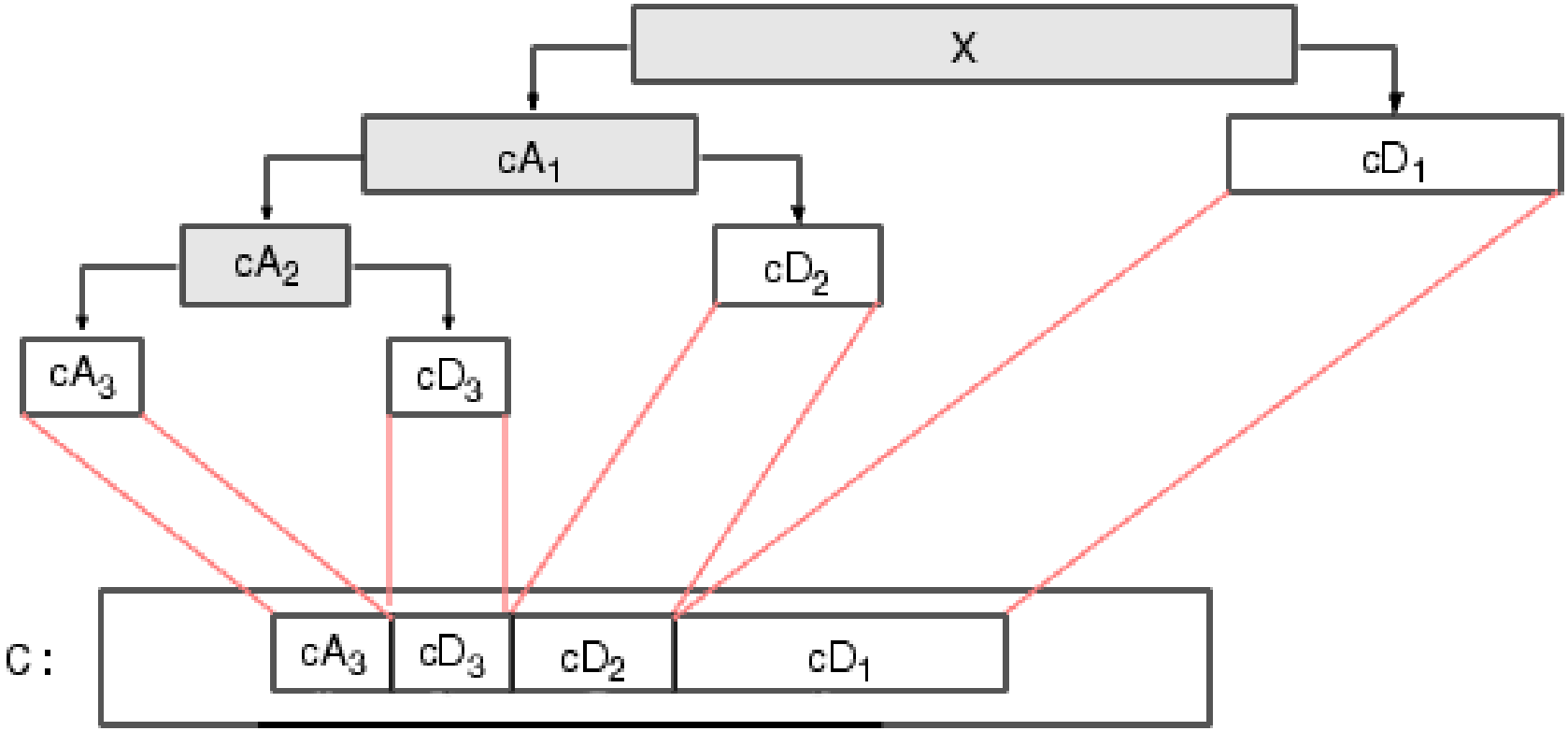
- scales and positions based on powers of two



Multiple-Level Decomposition

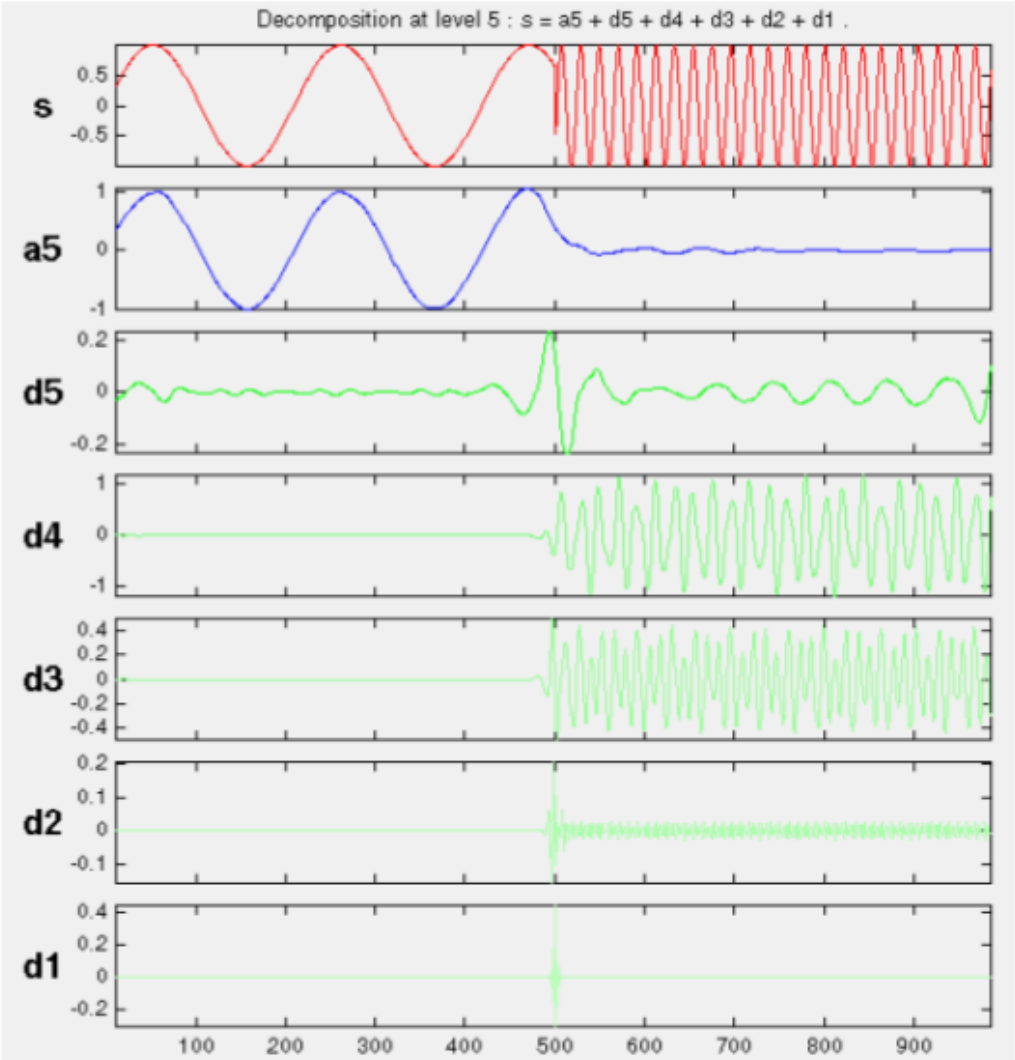


Multiple-Level Decomposition



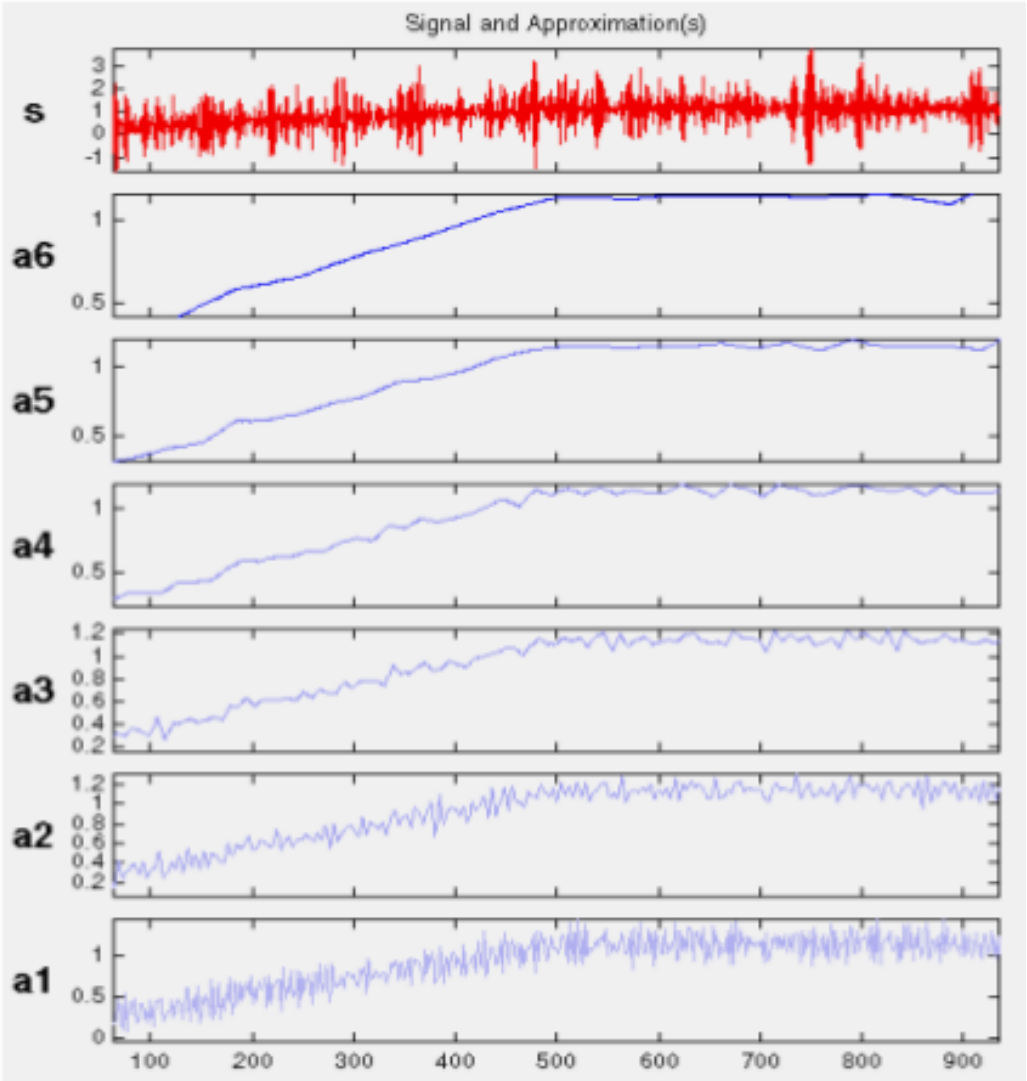
Applications

Detecting discontinuities and breakdown points



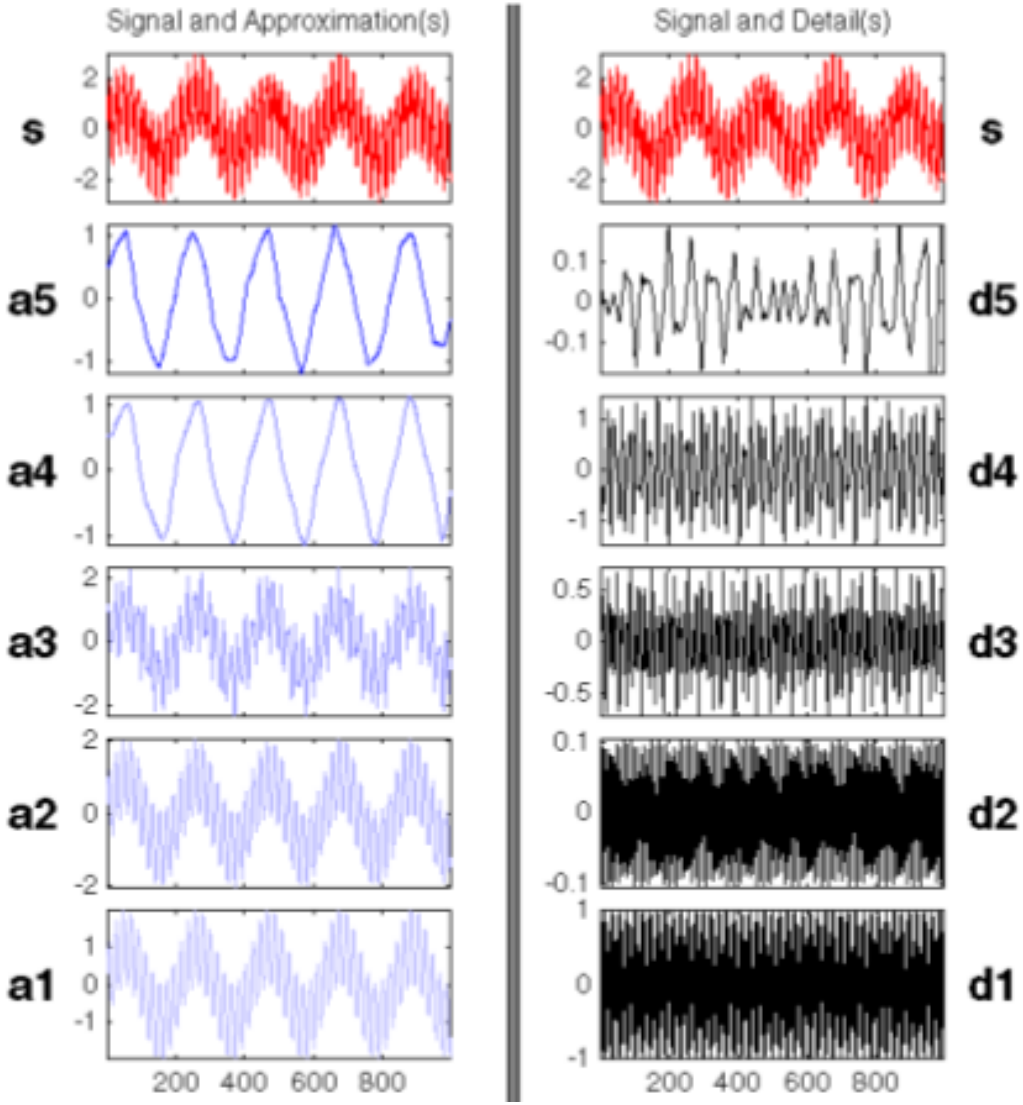
Applications

Detecting long-term evolution



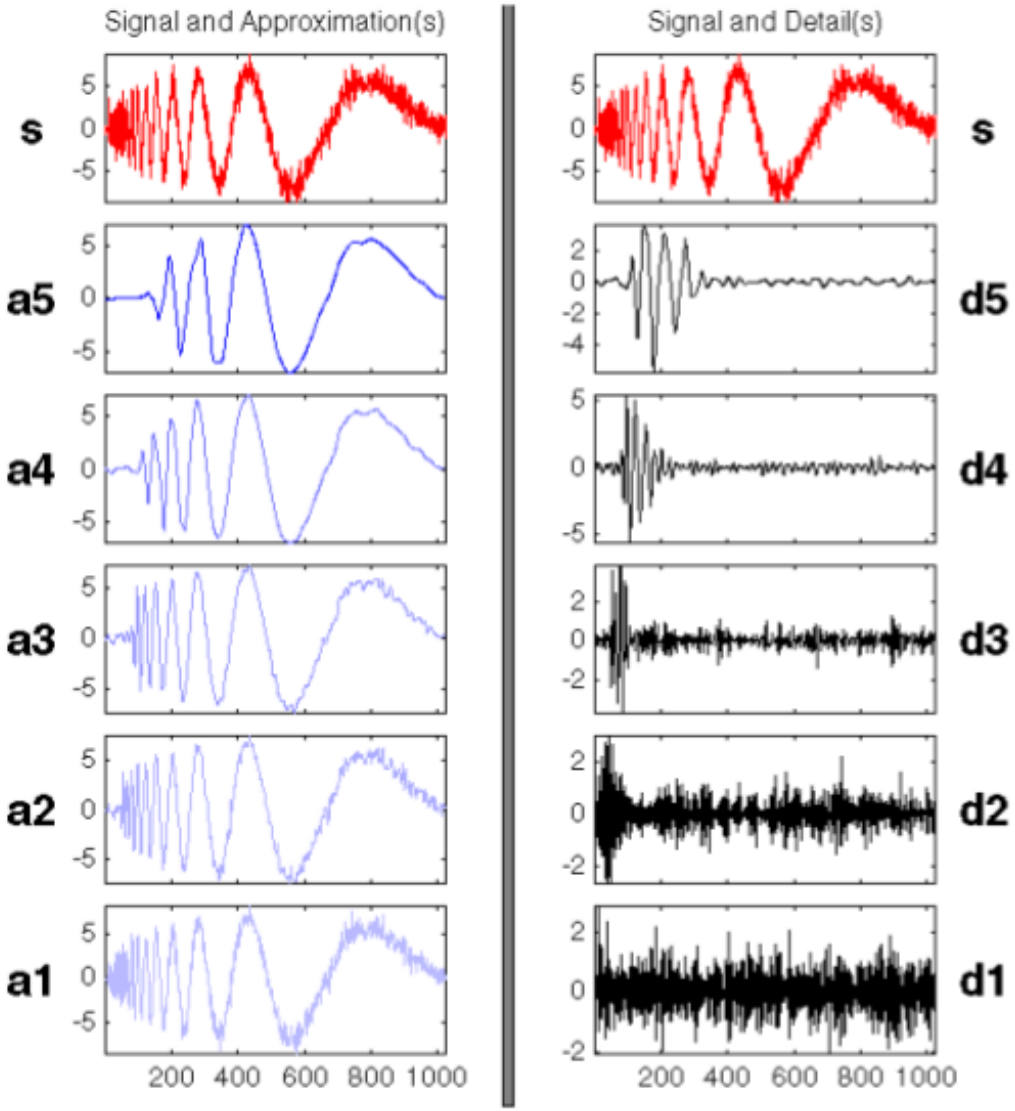
Applications

Identifying pure frequencies

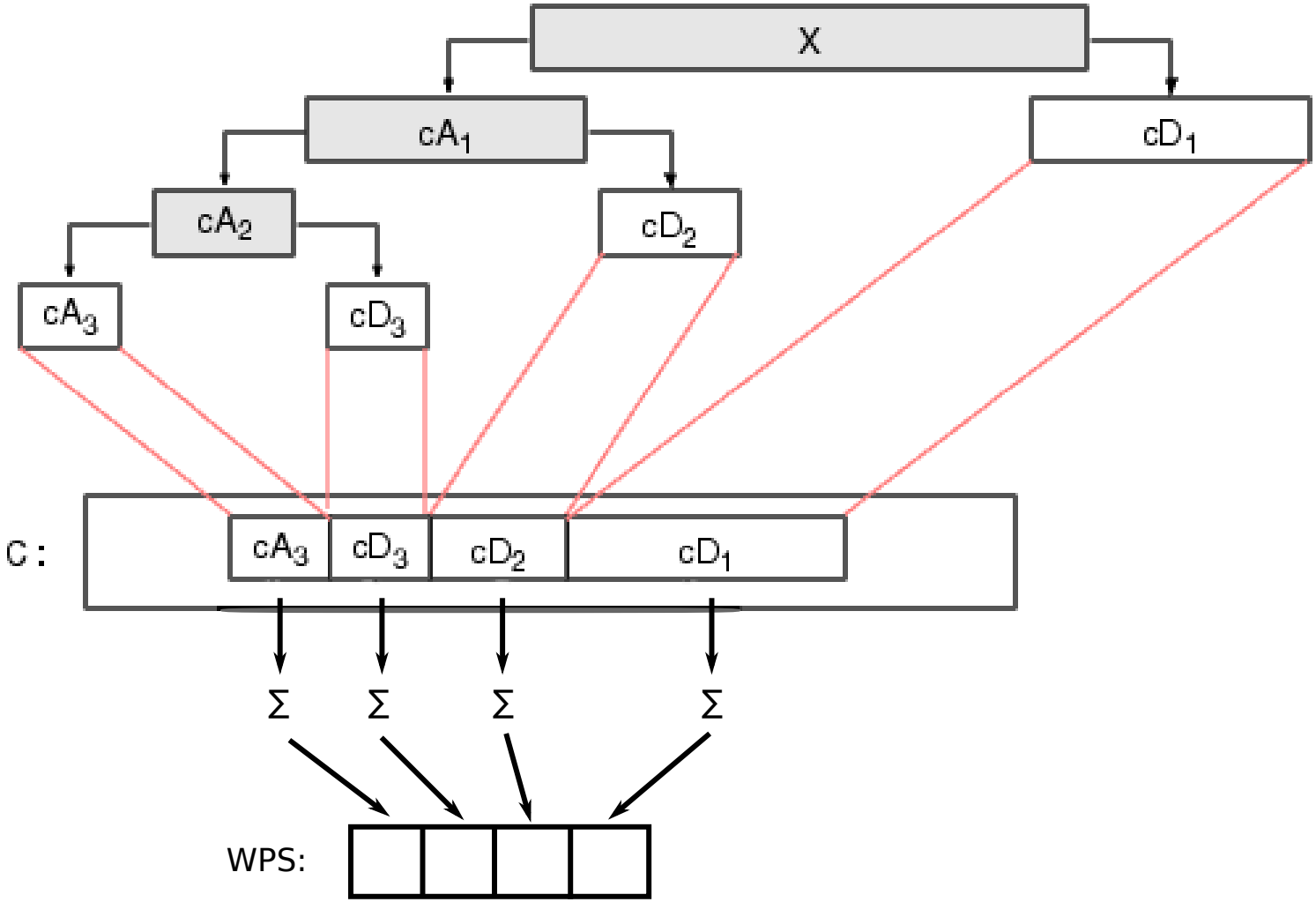


Applications

De-noising



Wavelet Power Spectrum



Wavelet Power Spectrum

Example: