Ingrid Daubechies

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Abstract

Baroness Doctor Ingrid Daubechies has pioneered a new language in Mathematics, Wavelets, that allows practical mathematicians to understand esoteric research Mathematics and allows practical researchers in a vast number of fields to understand sufficient advanced Mathematics to create many new interdisciplinary discoveries.

Significance of Her Work

Her original concepts are the basis of JPEG 2000, a favorite standard for sending pictures over the internet. Similar compression tools are used by the FBI to send and receive fingerprints by email. Signals received by cell phones are more clear thanks to her work in signal recognition. Digital image enhancement has been improved by wavelets because now each section can be enhanced without reference to the entire data set.

Several fields have been modified substantially by wavelets. Statistics research altered direction in the early 1990s due to wavelets. [Cipra 1994] In Murray H. Protter's book, *Basic Elements of Real Analysis,* the author recommends that any student of computer science should learn about "not only Fourier series, but also the application of Fourier series to wavelet theory." [Protter 1994, page viii]

OVERVIEW OF HER WORK

Wavelets take their name from two desirable properties: admissibility and regularity. Wavelets are built on top of Fourier transforms. Admissibility requires "that the average value of the wavelet in the time domain must be zero, and therefore it must be oscillatory" or it must be a **wave**. [Valens1999] Thus the entire Fourier transform disappears.

Wavelets originally had more output dimensions than input dimensions:

- The wavelet transform of a 1D function is 2D,
- The wavelet transform of a 2D function is 4D.

Daubechies used the concept of vanishing moments to regulate the clutter. Vanishing moments are a measure of how many terms disappear. If a wavelet has N vanishing moments, then N-1 terms can have coefficients of zero. Very complex equations can become smaller as unnecessary terms decay out of existence. Thus, regularity is the source of *let* in wavelet. [Valens1999]

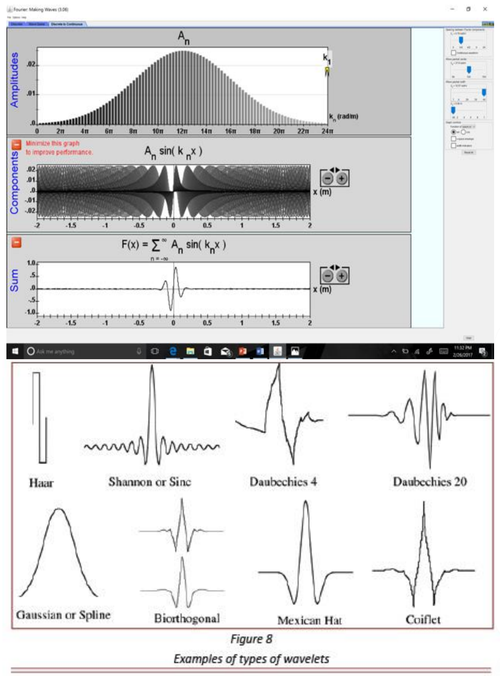
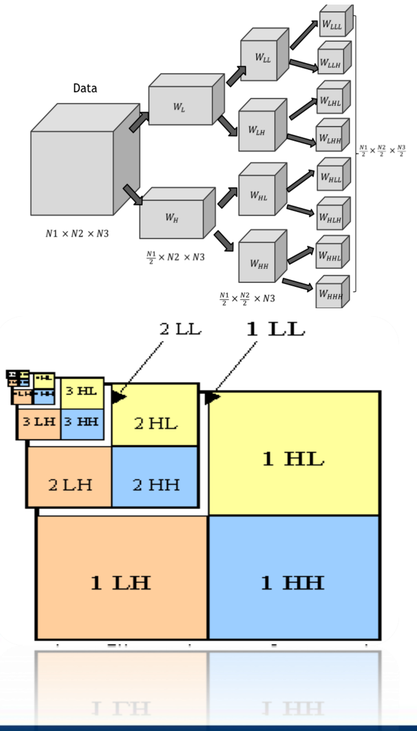


Figure 8
Examples of types of wavelets

Common Mother Wavelets



Significant Lifetime Achievements

- 1994 Steele Prize from American Mathematical Society
- 1997 Ruth Lyttle Satter Prize from American Mathematical Society
- 2007 Pioneer Prize
- 2011 Jack S. Kilby Signal Processing Medal from IEEE
- 2012 King Albert II of Belgium granted the title, Baroness [St Andrews 2017]

Education Required

- Differential Equations
- Linear Equations.

References

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