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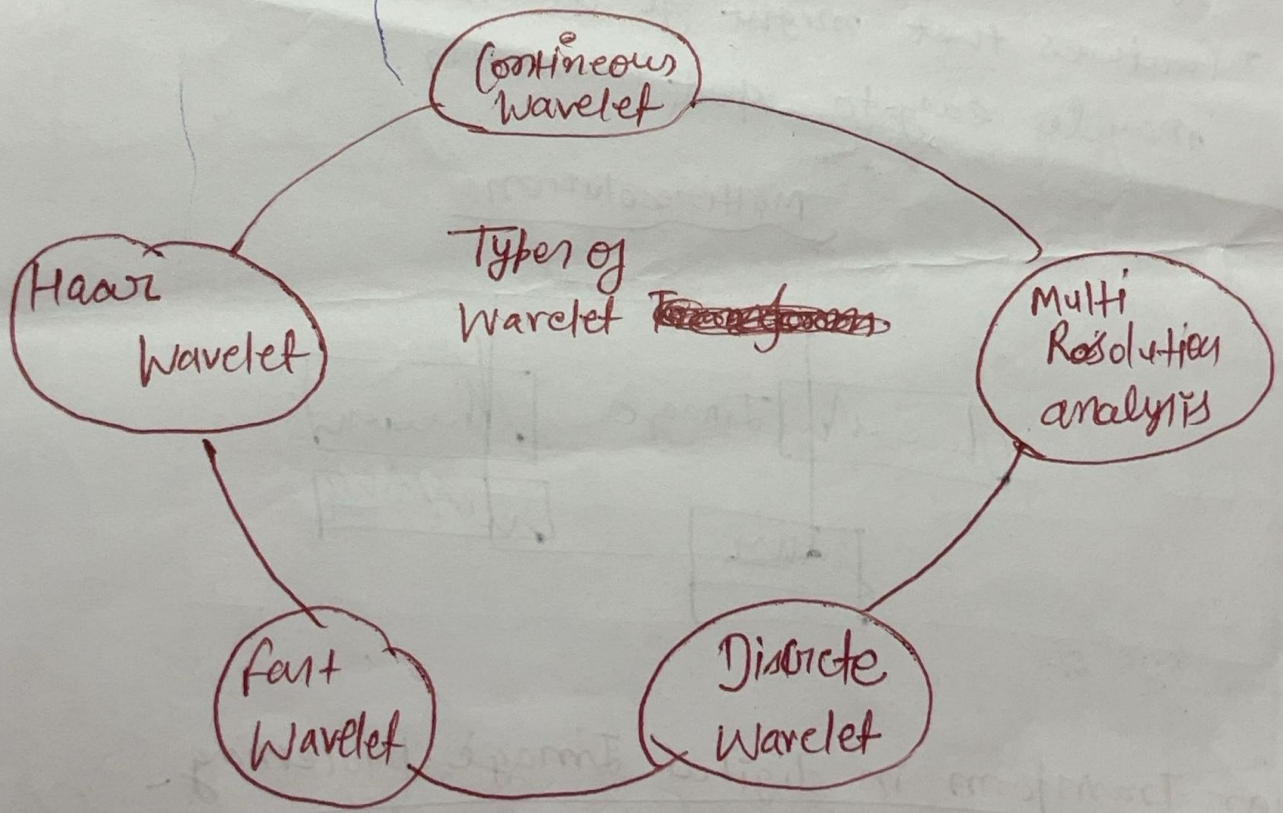
Wavelet transform

① **Wavelets** → Wavelets are mathematical functions that splits up data into different frequency components, elet transform decompose a signal into set of basis functions called wavelets



Use of wavelet transform — Wave transform is a widely used tool in signal processing for compression and denoising.

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Wavelet Transform (small waves) is mathematical function that represents scaled and translated copies of finite length waveform called mother wavelet.

→ It is used to analyze signal (image) into different frequency components at different resolution scales.

2-D Discrete wavelet transform

→ The DWT provides compact representation of signal's frequency components with strong spatial support. DWT decomposes a signal into frequency subbands at different scales from which it can be perfectly reconstructed.

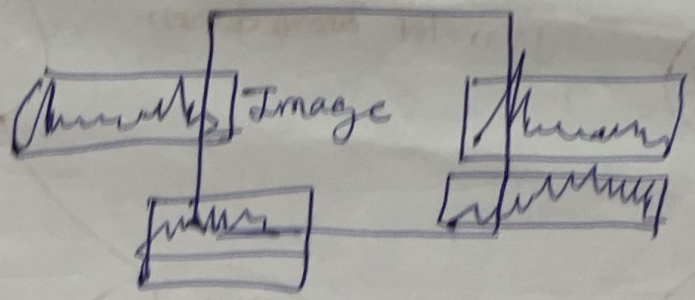
Basic difference between Fourier transform and wavelet transform

Fourier transform	Wavelet transform
① Fourier transform whose basic functions are sinusoids	① Wavelet transforms are based on small waves.
② Fourier transform provides only frequency information but	② Wavelet transform provides time-frequency information.

Multiresolution Analysis in digital Image processing – Representation of Signal in more than one resolution / scale.

* Features that might go undetected at one resolution may be easy to spot in another.

Multiresolution



Haar Transform in digital Image processing –

→ Haar Transform – Haar Wavelet Compression is an efficient way to perform both lossless and lossy image compression. It relies on averaging and differencing values in an image matrix to produce a matrix which is sparse or nearly sparse.

→ Haar wavelet is discontinuous and resembles a step function. For a function f, the HWT is defined as:

$$f \rightarrow (a^L | d^L)$$

$$a^L = (a_1, a_2 \dots a_{N/2})$$

$$d_L = (d_1, d_2 \dots d_{N/2})$$

L = decomposition level

a = approximation subband

d = detail subband.

Following structure defines one and two level HWT based on the pyramid decomposition-

LL	HL
LH	HH

Decomposition level 1

LL	HL	HL
LH	HH	
LH		HH

Decomposition level 2

Haar Transforms –

- Two major scale-operations –
  - Scaling captures information at different frequencies
  - Translation captures information at different locations