1)Haar Wavelet

Advantages: Simplest wavelet; fast computation; good for detecting sudden transitions

Disadvantages: Poor frequency localization; not smooth

When to choose: For edge detection, simple data compression

Example application: Simple image compression, **financial time series** analysis

2)Daubechies Wavelets (Db2, Db4, Db6, etc.)

Advantages: Orthogonal; compact support; good for smooth signals

Disadvantages: Asymmetrical; can introduce phase distortion

When to choose: For general signal and image processing tasks

Example application: **ECG signal analysis**, **seismic data** processing

3)Symlets (Sym2, Sym4, Sym8, etc.)

Advantages: Nearly symmetrical version of Daubechies; less phase distortion

Disadvantages: Slightly less compact support than Daubechies

When to choose: When symmetry is important but orthogonality is still needed

Example application: **Image denoising**, **feature extraction in pattern recognition**

4)Coiflets (Coif1, Coif2, Coif3, etc.)

Advantages: More symmetrical than Daubechies; vanishing moments for both scaling and wavelet functions

Disadvantages: Longer filters than Daubechies of same order

When to choose: For applications requiring higher order vanishing moments

Example application: Turbulence analysis, **electrocardiogram (ECG) classification**

5)Biorthogonal Wavelets (Bior1.1, Bior2.2, Bior3.3, etc.)

Advantages: Symmetrical; allow perfect reconstruction

Disadvantages: Not orthogonal; can be more complex to implement

When to choose: When linear phase is crucial (e.g., image processing)

Example application: **JPEG2000 image compression** standard

6)Reverse Biorthogonal Wavelets (Rbio1.1, Rbio2.2, etc.)

Advantages: Similar to biorthogonal but with decomposition and reconstruction filters swapped

Disadvantages: Same as biorthogonal

When to choose: Similar contexts to biorthogonal, but with different filter characteristics

Example application: **Audio signal compression**

7)Meyer Wavelet

Advantages: Orthogonal; defined in frequency domain; smooth

Disadvantages: Infinite support (typically approximated); computationally intensive

When to choose: For theoretical analysis; when smoothness in frequency domain is crucial

Example application: Harmonic analysis, **speech recognition**

8)Gaussian Wavelets (gaus1, gaus2, etc.)

Advantages: Smooth; good time-frequency localization

Disadvantages: Not orthogonal; infinite support

When to choose: For analysis of smooth, continuous signals

Example application: **Medical image analysis, EEG signal processing**

9)Mexican Hat Wavelet

Advantages: Good for detecting scale and location of edges

Disadvantages: Not orthogonal; poor frequency localization

When to choose: For edge detection and scale analysis

Example application: **Computer vision**, astronomical image analysis

10) Morlet Wavelet

Advantages: Good frequency localization; complex-valued (captures amplitude and phase)

Disadvantages: Not orthogonal; infinite support

When to choose: For analysis of oscillatory patterns

Example application: Geophysical signal processing, music analysis

11)Complex Gaussian Wavelets

Advantages: Complex-valued; good time-frequency localization

Disadvantages: Not orthogonal; infinite support

When to choose: When phase information is important

Example application: **Radar signal** processing, **ultrasound imaging**

12)Shannon Wavelet

Advantages: Optimal frequency localization; orthogonal

Disadvantages: Poor time localization; infinite support

When to choose: For theoretical frequency analysis

Example application: **Telecommunication** signal analysis

13)Frequency B-Spline Wavelets

Advantages: Good frequency localization; can be designed for specific frequency bands

Disadvantages: Not orthogonal; can be computationally intensive

When to choose: For precise frequency band analysis

Example application: **Speech signal processing**, **vibration** analysis

14)Complex Morlet Wavelet

Advantages: Excellent time-frequency localization; complex-valued

Disadvantages: Not orthogonal; infinite support

When to choose: For analysis of modulated signals

Example application: **EEG/MEG analysis in neuroscience**

15)Fejér-Korovkin Wavelets

Advantages: Good frequency localization; compact support

Disadvantages: Less common; limited availability in some software

When to choose: For specialized signal processing tasks

Example application: **Acoustic signal analysis**

16)Discrete Meyer Wavelet

Advantages: Approximation of Meyer wavelet with finite support; orthogonal

Disadvantages: More complex than Daubechies; less smooth than continuous Meyer

When to choose: When Meyer-like properties are needed with finite support

Example application: **Image fusion**, **multispectral image** analysis

17)Least Asymmetric Wavelets (Symlets variant)

Advantages: More symmetrical than standard Symlets; good for reducing border effects

Disadvantages: Slightly less compact support than equivalent Daubechies

When to choose: When high symmetry and orthogonality are both important

Example application: **Medical image segmentation**

18)Battle-Lemarié Wavelets

Advantages: Orthogonal; derived from splines; smooth

Disadvantages: Infinite support (usually truncated); can be computationally intensive

When to choose: For analysis of very smooth signals

Example application: **Biomedical signal processing**, curve fitting

19)Beylkin Wavelet

Advantages: Good numerical stability; suitable for solving differential equations

Disadvantages: Less common; limited availability in some software

When to choose: For numerical analysis and solving PDEs

Example application: Computational fluid dynamics

20)Vaidyanathan Wavelet

Advantages: Optimized for signal coding; good frequency selectivity

Disadvantages: Less smooth than some other wavelets

When to choose: For specific signal coding applications

Example application: Speech coding, **data compression in communications**

21)Mathieu Wavelet

Advantages: Suitable for analyzing patterns on elliptical domains

Disadvantages: Complex implementation; not widely available

When to choose: For specialized problems involving elliptical geometries

Example application: Analysis of elliptical membrane vibrations

22)Legendre Wavelet

Advantages: Orthogonal; good for approximating polynomials

Disadvantages: Limited time localization; not widely used

When to choose: For analysis involving polynomial approximations

Example application: Solution of differential equations, **function approximation**