

# Image Processing and Computer Vision

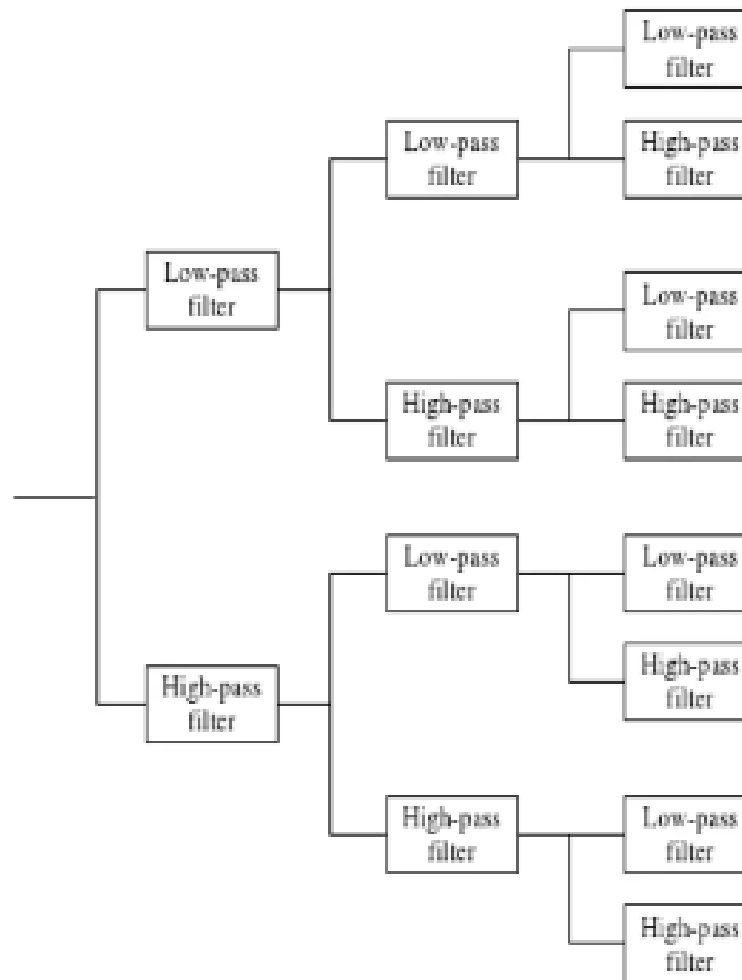


# Sub band coding

- A Source output is decomposed into its constituents. And each constituent is encoded and decoded separately to improve compression performance.
- It separates the source output into bands of different frequency using digital filters.
- Different filters are used like low pass filter or high pass filter.

# Filters

- A system that blocks certain frequency components is called a filter.
- Filters that only pass components below certain frequency  $f_0$  are called low pass filters.
- Filters that block all components below certain frequency  $f_0$  are called high pass filters.
- Filters that pass components that have frequency content above certain frequency  $f_1$  and below frequency  $f_2$  are called band pass filters.



This is the most frequently used filter banks which consists of a cascade of stages and each stage contains both low pass and high pass filter.

# Basic Subband Coding Algorithms

It consists of three phases:

1. Analysis
2. Quantization and Coding
3. Synthesis

# Analysis

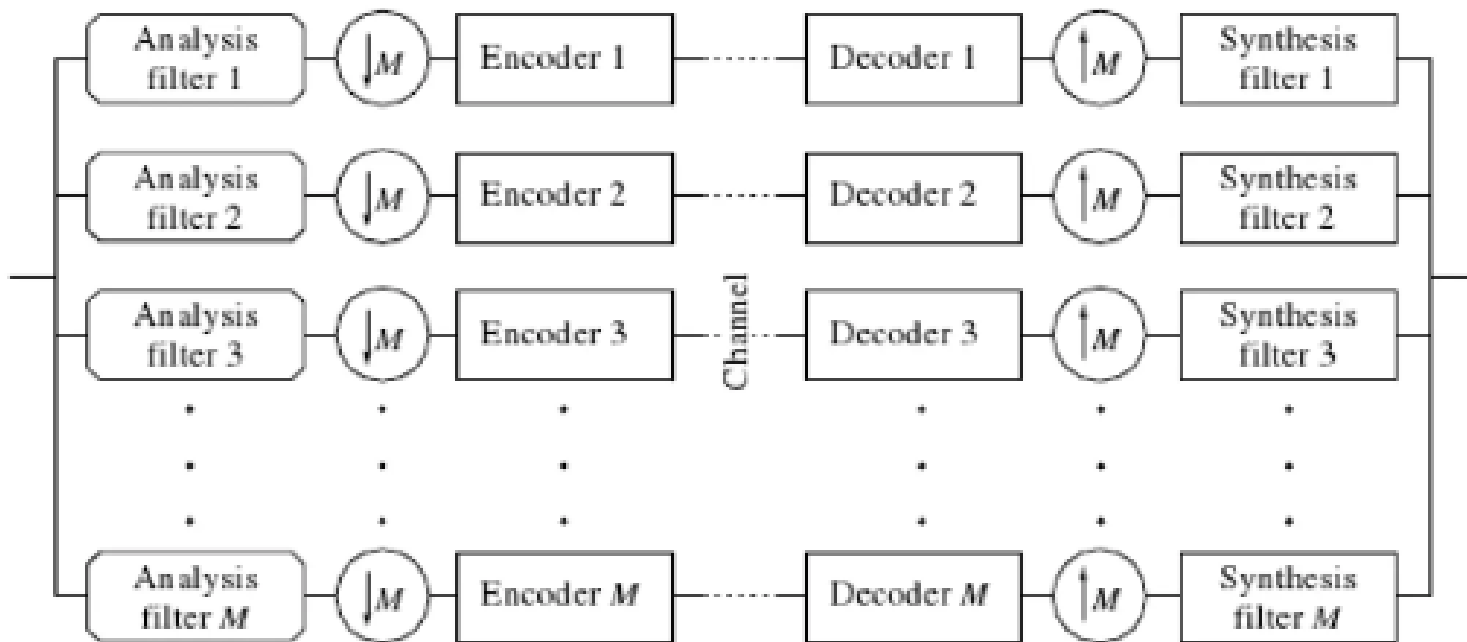


Fig-1. Block diagram of subband coding system



- Source output is passed through either non-overlapping or overlapping filters.
- The range of frequencies at the output is less than the range of frequencies at the input to the filter.
- The process of reducing the number of samples is called decimation or downsampling.
- The amount of decimation depends on the ratio of the bandwidth of the filter output to filter input.
- If the bandwidth of filter output is  $1/M$  of the bandwidth of filter input then the decimation will be of  $M$ .

# Quantization and Coding

- Allocation of bits between the subbands is the main issue.
- Bits are allocated according to the measure of information content between subbands.
- When the information content of bands is very different, bit allocation procedure has a significant impact.



# Synthesis

- Quantized and coded coefficients are used for the reconstruction of the original signal.
- From each subband, encoded samples are decoded at the receiver.
- Decoded values are unsampled by inserting an appropriate number of 0's between samples.
- The unsampled signals are passed through a bank of reconstruction filters when the number of samples per second has been brought back to the original rate.
- Summation of the reconstruction filter gives the final reconstructed output.

# Applications

- Speech Coding
- Audio Coding
- Image Compression

- The Moving Picture Experts Group ( MPEG ) has proposed an audio coding scheme which is based on subband coding.
- There are three layers in which layer 1 and layer 2 both use a bank of 32 filters. Input is splitted into 32 bands, each with the bandwidth of  $f/64$ , where  $f$  is the sampling frequency.
- 32000 samples per second, 44100 samples per second and 48000 samples per second are the allowable frequencies.