

ANALYSIS/RESYNTHESIS WITH THE SHORT TIME FOURIER TRANSFORM

Arbitrary modifications. 4 Appendix. Reconstruction from modified STFT. KW - TU Berlin/IRCAM - Analysis/Synthesis Team. Contents.

No frequency-domain aliasing occurs if the decimation factor L meets the Nyquist criterion, i. At the other end of the scale, the ms window allows the frequencies to be precisely seen but the time between frequency changes is blurred. In the frequency domain - by ensuring condition 2. Rayleigh frequency[edit] As the Nyquist frequency is a limitation in the maximum frequency that can be meaningfully analysed, so is the Rayleigh frequency a limitation on the minimum frequency. That is, signal at the frame n . The following spectrograms were produced: 25 ms window ms window ms window The 25 ms window allows us to identify a precise time at which the signals change but the precise frequencies are difficult to identify. The spectrogram can, for example, show frequency on the horizontal axis, with the lowest frequencies at left, and the highest at the right. In the time domain - by ensuring condition 3. In this case we can under-sample in frequency and still recover the sequence. The height of each bar augmented by color represents the amplitude of the frequencies within that band. This information can be used for equalization or tuning other audio effects. If zeros in $w[n]$ are allowed then condition 2 can be relaxed. It requires that the sum of all the analysis windows obtained by sliding $w[n]$ with L -point increments to add up to a constant as shown in the next figure. The depth dimension represents time, where each new bar was a separate distinct transform. Consider the case when $w[n]$ is bandlimited with bandwidth of B . Consider $X_{n,k}$ decimated in time by factor L , i. The analysis window is non-zero over its finite length N w . There are only two variables, but decreasing f_s and keeping N constant will cause the window size to increase $\hat{\epsilon}$ since there are now fewer samples per unit time. The other alternative is to increase N , but this again causes the window size to increase. It has been suggested that human ear extracts perceptual information strictly from a spectrogram-like-representation of speech J. Explanation[edit] It can also be explained with reference to the sampling and Nyquist frequency. So any attempt to increase the frequency resolution causes a larger window size and therefore a reduction in time resolution $\hat{\epsilon}$ and vice versa. The discrete STFT is considered to be the set of outputs of a bank of filters. Window is non-zero over its lengths N w 2. Take a window of N samples from an arbitrary real-valued signal at sampling rate f_s . Rayleigh frequency is the minimum frequency that can be resolved by a finite duration time window. Taking the Fourier transform produces N complex coefficients. The output of each filter is modulated with a complex exponential Modulated filter outputs are summed at each instant of time to obtain the corresponding time sample of the original sequence see Figure 7. To increase the frequency resolution of the window the frequency spacing of the coefficients needs to be reduced. In this case we can under-sample in time and still recover the sequence. Rayleigh frequency is important to consider in applications of the short-time Fourier transform STFT , as well as any other finite record length harmonic analysis method. Helical Interpolation Partnoff 2. Audio engineers use this kind of visual to gain information about an audio sample, for example, to locate the frequencies of specific noises especially when used with greater frequency resolution or to find frequencies which may be more or less resonant in the space where the signal was recorded.