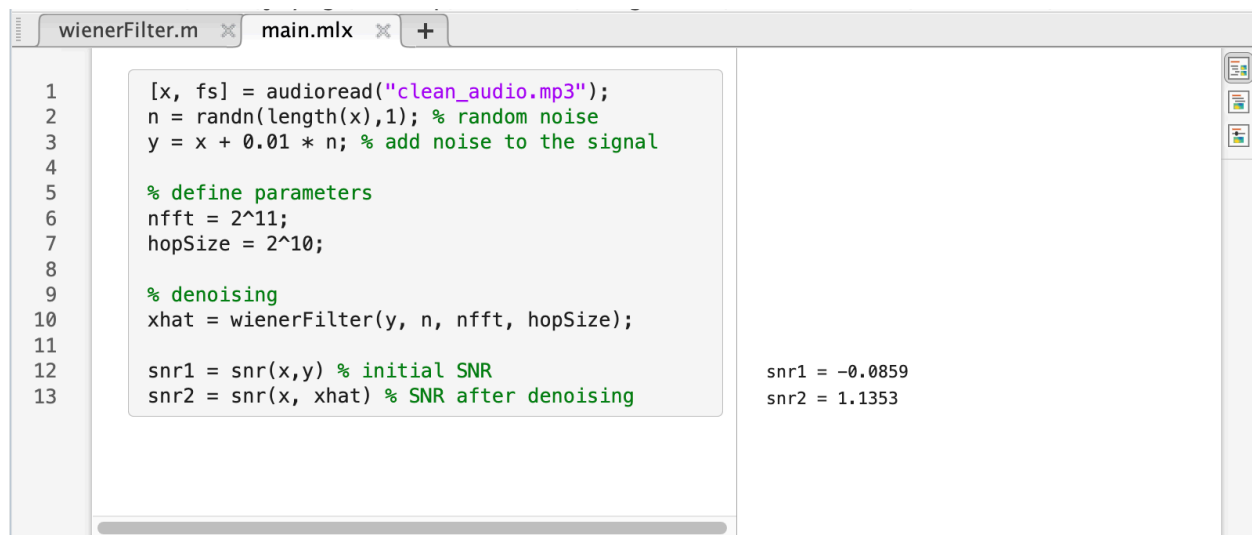


Design

A step-by-step guide for implementing the wiener filter is as follows:

1. Using "pwelch" with a Hann window of length "nfft" and a "hopSize" hop, estimate S_{YY} and S_{NN} , the power spectral densities of the noisy signal and the noise signal respectively.
2. Compute the transfer function $H(\omega) = 1 - \frac{S_{NN}(\omega)}{S_{YY}(\omega)}$. **Make practical modifications to this transfer function so that it is real-valued and non-negative.** Make sure to set the "freqrange" parameter of "pwelch" to "twosided".
3. Using "ifft", convert the transfer function back to time domain.
4. Use "fftfilt" to perform overlap-add filtering of "y" by the time-domain wiener filter obtained in Step 3.

Result



```
1 [x, fs] = audioread("clean_audio.mp3");
2 n = randn(length(x),1); % random noise
3 y = x + 0.01 * n; % add noise to the signal
4
5 % define parameters
6 nfft = 2^11;
7 hopSize = 2^10;
8
9 % denoising
10 xhat = wienerFilter(y, n, nfft, hopSize);
11
12 snr1 = snr(x,y) % initial SNR
13 snr2 = snr(x, xhat) % SNR after denoising
```

snr1 = -0.0859
snr2 = 1.1353