

EE513
Audio Signals and Systems

Wiener Inverse Filter

Kevin D. Donohue

Electrical and Computer Engineering
University of Kentucky

Weiner Filters

A class of filters, referred to as *Wiener filters*, exploit correlation information between signal and noise to enhance SNR or reduce distortion. The Wiener filter is the optimal filter for enhancing SNR of a random signal in random noise. The signals and noise are characterized by their PSDs or Acs, and objective metrics are either SNR enhancement or minimization of least-square error.

These filters are named after Norbert Wiener:

http://en.wikipedia.org/wiki/Norbert_Wiener

Wiener Filters and Noise

Let $s[n]$ be the original signal and $y[n]$ be the corrupted version. The error signal or noise is given by:

$$\eta[n] = y[n] - s[n]$$

Minimizing the error in the L2 or mean square error (MSE) sense means minimizing the expected value of:

$$E[\eta^2[n]] = E[|y[n] - s[n]|^2]$$

This is equivalent to maximizing the SNR:

$$E[\eta^2[n]] = \frac{E[|s[n]|^2]}{E[|y[n] - s[n]|^2]} = \frac{E[|s[n]|^2]}{E[\eta^2[n]]}$$

Signal Power

Noise Power