The process of recovering an input of a system from its output is called inverse filtering. If the noise level is low and degradation model is known then this technique can be used. An input signal in anticipation of degradations caused by a system can be pre-corrected by using inverse filters. If an image is corrupted by a blurring functions then easiest and quickest way to restore that is by inverse filtering. The frequency response of inverse filter is reciprocal of frequency response of a given system.

Inverse Filtering:

The simplest approach to restoration is direct inverse filtering where we complete an estimate $\hat{F}(u,v)$ of the transform of the original image simply by dividing the transform of the degraded image G(u,v) by degradation function H(u,v)

$$\hat{F}(u,v) = \frac{G(u,v)}{H(u,v)}$$

We know that

$$G(u,v) = H(u,v)F(u,v) + N(u,v)$$

Therefore

$$\hat{F}(u,v) = F(u,v) + \frac{N(u,v)}{H(u,v)}$$

From the above equation we observe that we cannot recover the undegraded image exactly because N(u,v) is a random function whose Fourier transform is not known.

One approach to get around the zero or small-value problem is to limit the filter frequencies to values near the origin.

We know that H(0,0) is equal to the average values of h(x,y).

By Limiting the analysis to frequencies near the origin we reduse the probability of encountering zero values.

Disadvantages

1. It is sensitive to the presence of noise.
2. It is difficult to build.
3. It is unstable.