

1) Given :

$$g_1 = f_1 + h_2 * f_2$$

$$g_2 = h_1 * f_1 + f_2$$

Take fourier transform on both sides and use

$$F(f * g) = F(f) F(g)$$

$$G_1 = F_1 + H_2 F_2$$

$$G_2 = H_1 F_1 + F_2$$

$\left. \begin{array}{l} \text{capital letters} \\ \text{denote fourier} \\ \text{transforms} \end{array} \right\}$

Solving the two linear equations in F_1, F_2 , we get

$$F_1 = \frac{G_1 - H_2 G_2}{1 - H_1 H_2}$$

$$F_2 = \frac{G_2 - H_1 G_1}{1 - H_1 H_2}$$

$$\Rightarrow f_1 = F^{-1} \left(\frac{G_1 - H_2 G_2}{1 - H_1 H_2} \right), \quad f_2 = F^{-1} \left(\frac{G_2 - H_1 G_1}{1 - H_1 H_2} \right)$$

The problem with this formula is that since h_1, h_2 are blur kernels, H_1 and H_2 will be low pass filters which are close to 1 for small frequencies. So we can't extract low frequency components in F_1, F_2 since denominator will be close to 0, which is problematic since natural images have significant contribution of low frequency components.