N₁ Q1) Sol)

Given equations are,

$$g_1(x,y) = f_1(x,y) + (h_2 * f_2)(x,y) \quad -① $$

and $$g_2(x,y) = (h_1 * f_1)(x,y) + f_2(x,y) \quad -② $$

Fourier transformation of the equations, we get

$$G_1(u,v) = F_1(u,v) + H_2(u,v)F_2(u,v) \quad -③ $$

$$G_2(u,v) = F_2(u,v) + H_1(u,v)F_1(u,v) \quad -④ $$

Solving, eq ④ × $H_2(u,v)$ we get,

$$H_2(u,v)G_2(u,v) = F_2(u,v)H_2(u,v) + H_1(u,v)F_1(u,v)H_2(u,v)$$

$$G_1(u,v) - H_2(u,v)G_2(u,v) = F_1(u,v) - H_1(u,v)F_1(u,v)H_2(u,v)$$

$$\Rightarrow \quad G_1(u,v) - H_2(u,v)G_2(u,v) = F_1(u,v) - H_1(u,v)F_1(u,v)H_2(u,v)$$

$$\therefore \quad F_1(u,v) = \frac{G_1(u,v) - H_2(u,v)G_2(u,v)}{1 - H_1(u,v)H_2(u,v)}$$

$$\Rightarrow \quad f_1(x,y) = \underbrace{\mathcal{F}^{-1}}_{\{\text{fourier inverse}\}}(F_1(u,v)).$$

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Similarly we get,

$$F_2(u,v) = \frac{G_2(u,v) - H_1(u,v)\,G_1(u,v)}{1 - H_1(u,v)\,H_2(u,v)}$$

$$\therefore\ f_2(x,y) = \mathcal{F}^{-1}\left(F_2(u,v)\right).$$

The main problem with this formulae is, It is given that both $h_1(x,y)$, $h_2(x,y)$ are blur Kernels, which implies both $H_1(u,v)$, $H_2(u,v)$ are low pass filters and at low frequencies low pass filters tend to 1,

$$\Rightarrow\ H_1(u,v)H_2(u,v) \approx 1$$

$$\Rightarrow\ 1 - H_1(u,v)H_2(u,v) \approx 0$$

So, ~~for low pr~~ we cannot use this approach to extract low frequency parts of ~~$H_1(u,v)$~~ $F_1(u,v)$ and $F_2(u,v)$. If the value of,

$1 - H_1(u,v)\,H_2(u,v) \approx 0$, then both $F_1(u,v)$ and $F_2(u,v)$ will increase which results ~~due~~ to noise in $f_1(x,y)$ and $f_2(x,y)$. to get increased.

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