Assignment 5 -- 2

Solution) For 1-D image

Gradient kernel can be given as [-1, 0, 1].

It can be written as $g(x) = f(x+1) - f(x-1)$

Taking Descrete fourier transform :→

$$G(u) = F(u)\cdot e^{\frac{i2\pi u}{N}} - F(u)\cdot e^{-\frac{i2\pi u}{N}}$$

$$\because \mathcal{F}(f(x-x_0))(u) = F(u)\cdot e^{-\frac{i2\pi u x_0}{N}}$$

$$G(u) = F(u)\left[e^{\frac{i2\pi u}{N}} - e^{-\frac{i2\pi u}{N}}\right]$$

$$F(u) = \frac{G(u)}{e^{\frac{i2\pi u}{N}} - e^{-\frac{i2\pi u}{N}}}$$

Now, problem with the formula is that u can be 0, hence denominator will become 0. This will ~~lead~~ lead to problem of estimating DC component of F. So for evaluation purpose we have to ~~set~~ assume DC component to some value.

For 2-D image.

Now with the 2-D images also it is not easy to get back the images given derivative in x & y direction.

Derivative in x-direction = ~~$g(x) = f(x+1) - f(x-1)$~~

$$g(x,y) = f(x+1, y) - f(x-1, y)$$

Taking DFT → $G_x(u,v) = F(u,v)\cdot e^{\frac{i2\pi u}{N}} - F(u,v)\, e^{-\frac{i2\pi u}{N}}$

$$F(u,v) = \frac{G_x(u,v)}{e^{\frac{i2\pi u}{N}} - e^{-\frac{i2\pi u}{N}}}$$

Now here same problem remains when $u=0$, denominator will be 0. So this will lead problem of calculating DC component. So there will be problem in generating image ~~from~~ given $G_x(u,v)$.

Similary for Gradient in y-direction

$$g(x,y) = f(x,y+1) - f(x,y-1)$$

Taking DFT $\rightarrow G_y(u,v) = F(u,v)\, e^{\frac{i2\pi v}{N}} - F(u,v)\, e^{-\frac{i2\pi v}{N}}$

$$F(u,v) = \frac{G_y(u,v)}{e^{\frac{i2\pi v}{N}} - e^{-\frac{i2\pi v}{N}}}$$

Now here same problem remains when $v=0$, Denominator $=0$. So this will again create problem in calculating DC component. So there will be problem in generating image from $G_y(u,v)$.

if ~~Both~~ Both gradient are given i.e. x & y direction then still we can't estimate DC component at $u=v=0$.

Hence to solve this problem we have to assume some ~~DC~~ Component, which ~~creates pro~~ is problemetic.