(2) $g = h * f$

1D Case

Taking $h = [-1, 1] \Rightarrow g(x) = f(x+1) - f(x)$
$\forall\ 1 \le x \le N$

$$G(\mu) = \left(e^{\frac{j2\pi\mu}{N}} - 1\right) F(\mu)$$

$$\Rightarrow F(\mu) = \frac{G(\mu)}{e^{\frac{j2\pi\mu}{N}} - 1}$$

when $\mu = 0$, we get $F(\mu) \to \infty$

To prevent this, we have to estimate the DC component.

Using the boundary condition $f(N+1) = 0$ we can avoid the above issue.

2-D Case

As derived from 1 direction above,

$$G_x(u,v) = \left(e^{\frac{j2\pi u}{N}} - 1\right) F(u,v)$$

and

$$G_y(u,v) = \left(e^{\frac{j2\pi v}{N}} - 1\right) F(u,v)$$

Thus, we get

$$F(u,v) = \frac{G_x(u,v)}{e^{\frac{j2\pi u}{N}} - 1} = \frac{G_y(u,v)}{e^{\frac{j2\pi v}{N}} - 1}$$

For $u = 0$/ $v = 0$, we'll get $F(u,v) \to \infty$

- We hence need to estimate the DC component.
- If we use a certain boundary condition, we might get different results based on if we'll take gradient wrt X-direction / Y-direction.

Hence one possible solution might be to use the esimate DC component from an average of a class of known images of a similar kind. i.e for example, if we have a face image, then we can take average of DC component of similar kinds of known face images and use it for our unknown image.