DIP Assignment - 3

2016048

Q-1 $\delta(x+1, y) + \delta(x-1, y)$

In $\delta(x+1, y)$ is defined at $x=-1, y=0$. Taking mod

Final function is:

$$\delta(x-(N-1), y) + \delta(x-1, y)$$

$$F(k,l) = \sum_{n=0}^{N-1} \sum_{m=0}^{M-1} \left( \underbrace{\delta(x-(N-1), y) + \delta(x-1, y)}_{\swarrow} \right) e^{-j\frac{2\pi kn}{N}} * e^{-j\frac{2\pi}{M}}$$

only defined at $x = N-1$ & $x=1$ $y=0$

using sifting property we get.

$$F(k,l) = e^{-j\frac{2\pi k}{N}(N-1)} e^{0} + e^{-j\frac{2\pi k}{N}} e^{0}$$

$$F(k,l) = e^{-j\frac{2\pi k(N-1)}{N}} + e^{-2j\frac{2\pi k}{N}}$$

Checking value at different point $k, l$ in above equation.

① $(k,l) = (0,0)$.

$$F(0,0) = e^{0} + e^{0} = 1+1$$

$$= 2$$

② $(k,l) = (N/2, M/2)$

$$F\left(\frac{N}{2}, \frac{M}{2}\right) = e^{-j\frac{2\pi \cdot N}{2N}(N-1)} + e^{-j\frac{2\pi \frac{M}{2}}{2}\frac{N}{N}}$$

$$F\left(\frac{N}{2}, \frac{M}{2}\right) = e^{-j\pi(N-1)} + e^{-j\pi}$$

If $N \rightarrow$ even

$N-1 \rightarrow$ odd.

$$F\left(\frac{N}{2}, \frac{M}{2}\right) = e^{0} (-1)^{N-1} - 1$$

$$= -2$$

If $N \rightarrow$ odd

$(N-1) \rightarrow$ even

$$F\left(\frac{N}{2}, \frac{M}{2}\right) = (-1)^{N-1} - 1$$

$$= 1 - 1$$

$$= 0$$

We can see that → High frequency blocked.

value at $k = \frac{N}{2}$ $M = \frac{M}{2}$ is low which means it block DC value, whereas Top left allow DC value to pass through $k=0, M=0$ is low frequency.

Corner value ~~are blocked~~ so it's Low pass filter.

DC value passing through center are blocked.

Whereas DC value can pass through top left + corners, which are

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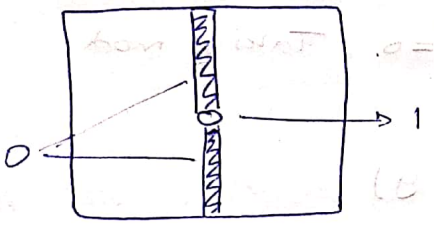
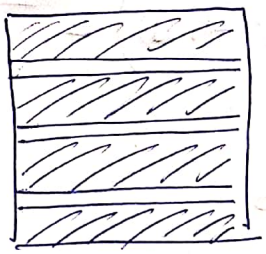
Q-2 Given an image having strong periodic horizontal lines.

For eliminating these lines, we can have a filter like this in frequency domain. We can use a Notch reject filter in frequency domain.



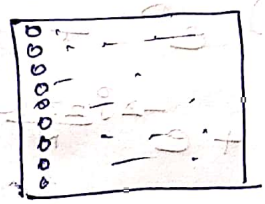

Black vertical strip with DC value at the center strip in frequency domain.

For a periodic image like this. (Below steps without shifting)



Taking a 2DFFT of this image we get vertical column on the left with nonzero values.

In order to suppress them we can take Hadamard product with a filter having zero value at left vertical column in frequency domain.



On taking product this will remove these periodic lines.

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