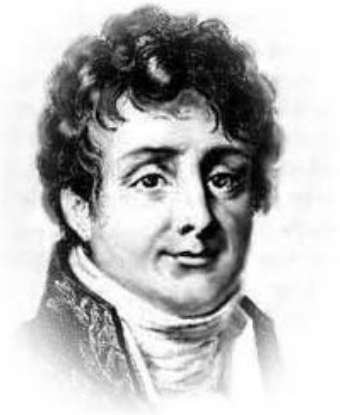
Script (Filters on frequencies) Low Pass Filters



1. Ideal low-pass filters (implemented)

- Observe the ideal high-pass filter according to:

$$H(u,v) = \begin{cases} 1 \rightarrow D(u,v) \geq D_0 \\ 0 \rightarrow D(u,v) < D_0 \end{cases}$$

Being

$$D(u,v) = \sqrt{u^2 + v^2}$$

and D_0 the cutoff frequency.

- Apply the ideal filter in fourier.tif and lena.tif, with the following cutting frequencies: π/2, π /4, π /8, π /16.

- To apply the filters, multiply the magnitude of the Fourier transform of the image, and apply the inverse transform. Preserve the phase information of the image.

- For each resulting image give the histogram, write down the mean and standard deviation values of the and comment on the result.

2. Butterworth Low-Pass Filters

- Implement the Butterworth high-pass filter according to:

$$H(u,v) = \frac{1}{1 + \left({D(u,v)}/{D_0}\right)^2}$$

Being

$$D(u,v) = \sqrt{u^2 + v^2}$$

and *D0* the cutoff frequency.

- Apply the Butterworth filter on fourier.tif and lena.tif, with the following cutting frequencies: π/2, π/4, π/8, π/16.

- To apply the filters, multiply the magnitude of the Fourier transform of the image, and apply the inverse transform. Preserve the phase information of the image.

- For each resulting image give the histogram, write down the mean and standard deviation values of the and comment on the result.

High-Pass Filters

3. Ideal high-pass filters

- Implement the ideal high-pass filter according to:

$$H(u,v) = \begin{cases} 0 \rightarrow D(u,v) \geq D_0 \\ 1 \rightarrow D(u,v) < D_0 \end{cases}$$

Being

$$D(u,v) = \sqrt{u^2 + v^2}$$

and D_0 the cutoff frequency.

- Apply the ideal filter in fourier.tif and lena.tif, with the following cutting frequencies: $\pi/2$, $\pi/4$, $\pi/8$, $\pi/16$.

- To apply the filters, multiply the magnitude of the Fourier transform of the image, and apply the inverse transform. Preserve the phase information of the image.

- For each resulting image give the histogram, write down the mean and standard deviation values of the and comment on the result.

4. Butterworth High Pass Filters

- Implement the Butterworth high-pass filter according to:

$$H(u,v) = \frac{1}{1 + \left({}^{D_0}/_{D(u,v)}\right)^2}$$

Being

$$D(u,v) = \sqrt{u^2 + v^2}$$

and D_0 the cutoff frequency.

- Apply the Butterworth filter on fourier.tif and lena.tif, with the following cutting frequencies: $\pi/2$, $\pi/4$, $\pi/8$, π /16.

- To apply the filters, multiply the magnitude of the Fourier transform of the image, and apply the inverse transform. Preserve the phase information of the image.

- For each resulting image give the histogram, write down the mean and standard deviation values of the and comment on the result.