filters

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Smoothing frequency domain filters

- Ideal lowpass filter:
  - The simplest lowpass filter
  - Cuts of all high frequency components that at distance grater than Do from the origin of the transform
  - The transfer function :

$$H(u,v) = \begin{cases} 1 & \text{if } D(u,v) \le D_0 \\ 0 & \text{if } D(u,v) > D_0 \end{cases}$$

Butterworth Lowpass Filters

- The transfer function of a Butterworth lowpass filter of order n with cutoff frequency at distance Do from the origin is defined as:

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

- Gaussian Lowpass Filters
  - The transfer function of a Gaussian lowpass filter is defined as:

$$H(u,v) = e^{-D^2(u,v)/2D_0^2}$$

  - A low pass Gaussian filter is used to connect broken text
  - Different lowpass Gaussian filters used to remove blemishes in a photograph

Sharpening Frequency Domain Filter

- Edges and fine detail in images are associated with high frequency components
- High pass filters – only pass the high frequencies, drop the low ones •
- High pass frequencies are precisely the reverse of low pass filters

Ideal Highpass Filters	Butterworth Highpass Filters	Gaussian Highpass Filters
$H(u,v)=\begin{cases}0 & \text{if } D(u,v)\le D_0\\ 1 & \text{if } D(u,v)>D_0\end{cases}$	$H(u,v)=\dfrac{1}{1+\left[D_0/D(u,v)\right]^{2n}}$	$H(u,v)=1-e^{-D^2(u,v)/2D_0^2}$