

PROCESSAMENTO DE IMAGEM

Análise na Frequência

Filtragem na frequência: *Filtragem homomórfica*

Modelo iluminância + reflectância

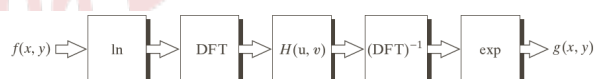
$$f[x, y] = i[x, y]r[x, y]$$

A transformada de Fourier de $f[x, y]$ não é igual ao produto das transformadas.

$$\mathfrak{F}[f[x, y]] \neq \mathfrak{F}[i[x, y]]\mathfrak{F}[r[x, y]]$$

$$\begin{aligned}\mathfrak{F}[z[x, y]] &= \mathfrak{F}[\ln(f[x, y])] \\ &= \mathfrak{F}[\ln(i[x, y]) + \ln(r[x, y])]\end{aligned}$$

FIGURE 4.60
Summary of steps
in homomorphic
filtering.



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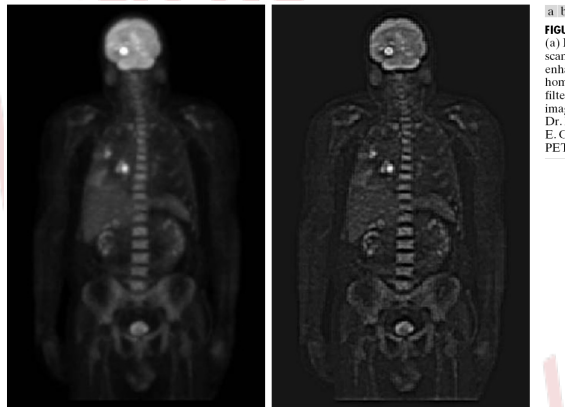


FIGURE 4.62
(a) Full body PET scan. (b) Image enhanced using homomorphic filtering. (Original image courtesy of Dr. Michael E. Casey, CTI PET Systems.)

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Filtros rejeita-banda e passa-banda:

TABLE 4.6

Bandreject filters. W is the width of the band, D is the distance $D(u, v)$ from the center of the filter, D_0 is the cutoff frequency, and n is the order of the Butterworth filter. We show D instead of $D(u, v)$ to simplify the notation in the table.

Ideal	Butterworth	Gaussian
$H(u, v) = \begin{cases} 0 & \text{if } D_0 - \frac{W}{2} \leq D \leq D_0 + \frac{W}{2} \\ 1 & \text{otherwise} \end{cases}$	$H(u, v) = \frac{1}{1 + \left[\frac{DW}{D^2 - D_0^2} \right]^{2n}}$	$H(u, v) = 1 - e^{-\left[\frac{D^2 - D_0^2}{W} \right]^2}$

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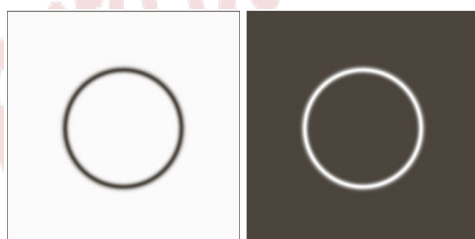


FIGURE 4.63
(a) Bandreject Gaussian filter.
(b) Corresponding bandpass filter.
The thin black border in (a) was added for clarity; it is not part of the data.

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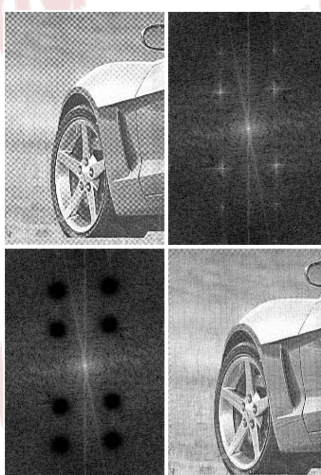
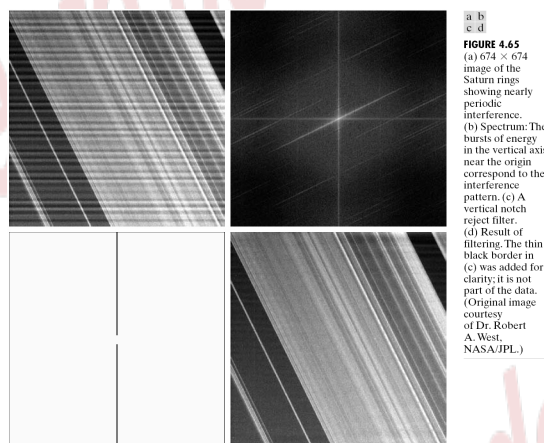


FIGURE 4.64
(a) Sampled newspaper image showing a moiré pattern.
(b) Spectrum.
(c) Butterworth notch reject filter multiplied by the Fourier transform.
(d) Filtered image.

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