COL783: Digital Image Processing

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Image Segmentation: Recap

Boundary Features Detection

    Point, Fixed Oriented Lines

    Edge: Gradient, LoG, DoG, Canny

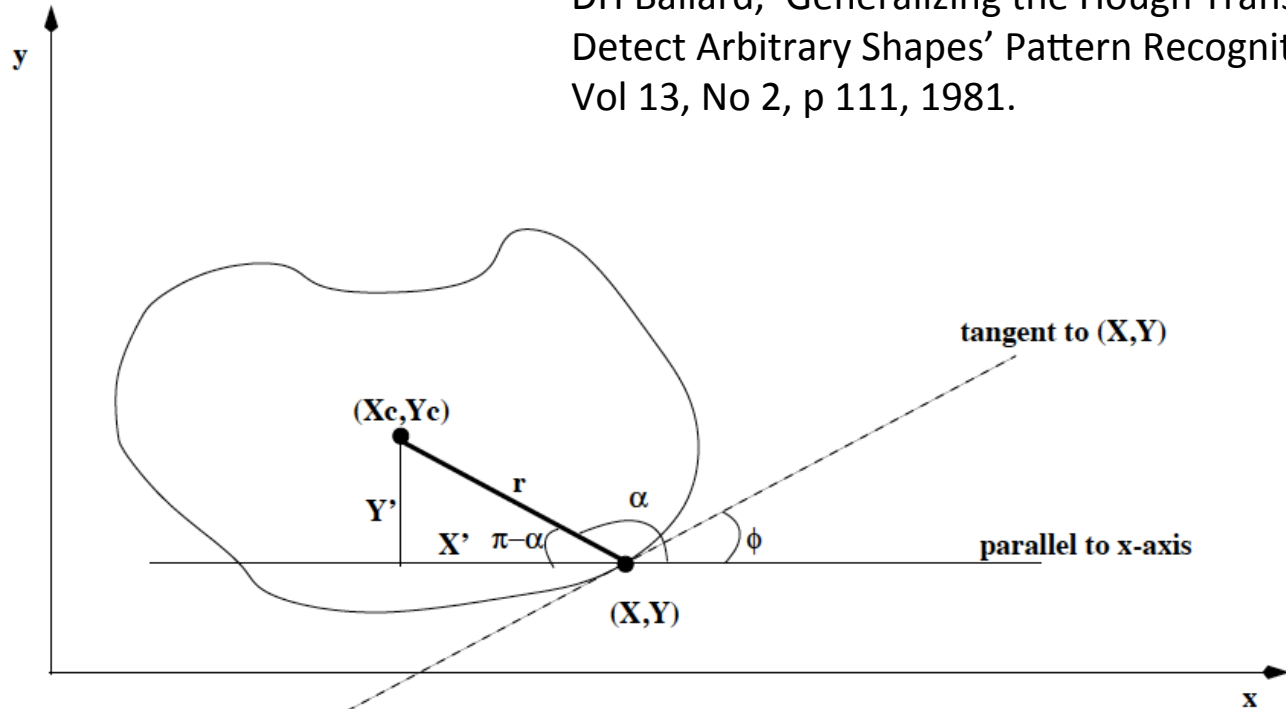**Hough Transform**

    Lines Detection

    Circle
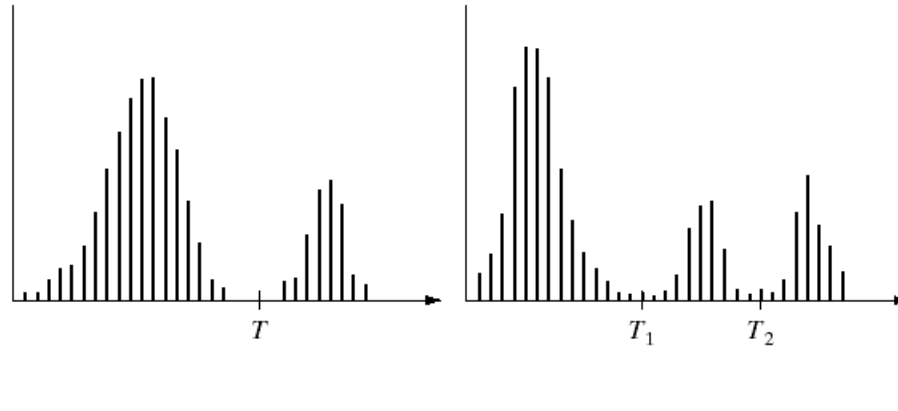
    Generalized Hough Transform

Image Segmentation

Generalized Hough Transform (GHT)

DH Ballard, 'Generalizing the Hough Transform to Detect Arbitrary Shapes' Pattern Recognition, Vol 13, No 2, p 111, 1981.

(Source: Notes by Prof George Bebis)
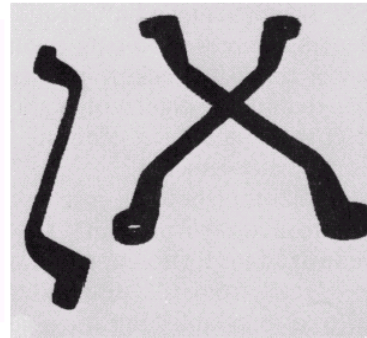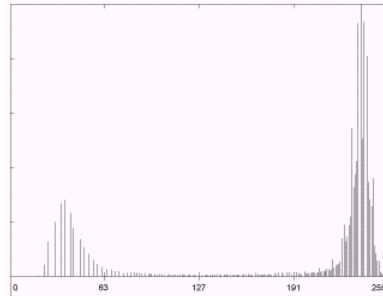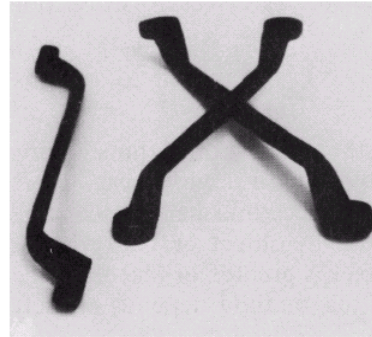
Image Segmentation

Thresholding

a b

FIGURE 10.26 (a) Gray-level histograms that can be partitioned by (a) a single threshold, and (b) multiple thresholds.
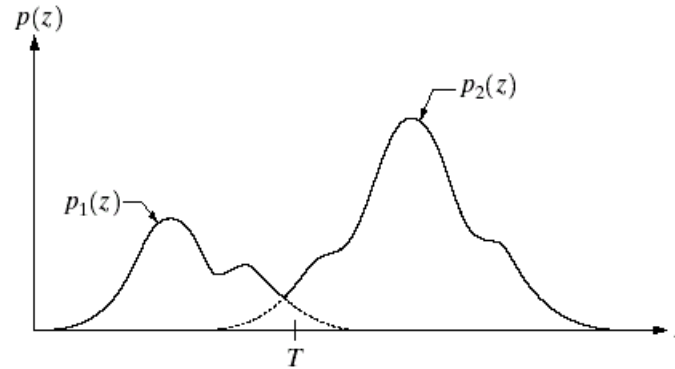
Image Segmentation

Thresholding

(Source: Gonzalez and Woods)

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Image Segmentation

Optimal Thresholding

FIGURE 10.32
Gray-level probability density functions of two regions in an image.

Image Segmentation

Otsu Method

Based on minimizing the within class variance or maximizing between class variance.

Does not require knowledge of probability distributions
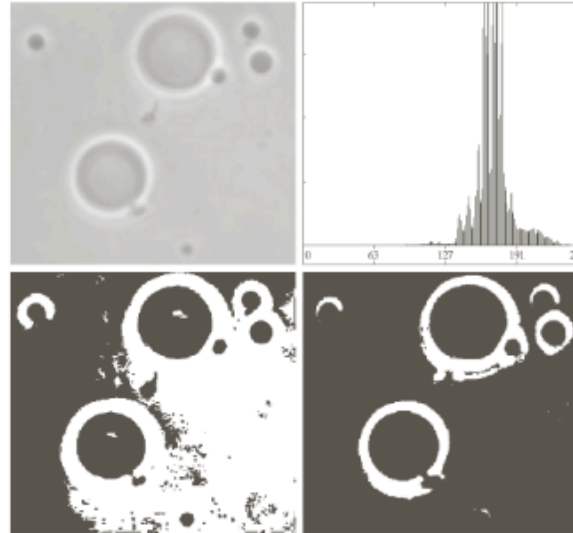
Works on bimodal histogram

Image Segmentation

Otsu Method

Original image.

Global thresholding calculating
$T=0.5*(\mu_1+\mu_2)$
until ΔT less than some ε

Global thresholding using Otsu algorithm

a b
c d

FIGURE 10.39
(a) Original image.
(b) Histogram (high peaks were clipped to highlight details in the lower values).
(c) Segmentation result using the basic global algorithm from Section 10.3.2.
(d) Result obtained using Otsu's method. (Original image courtesy of Professor Daniel A. Hammer, the University of Pennsylvania.)

Image Segmentation

Region Based

a) $\bigcup_{i=1}^{n} R_i = R$

b) R_i is a connected region.

c) $R_i \cap R_j = \phi$

d) $P(R_i) = True$

e) $P(R_i \cup R_j) = False$

Image Segmentation

Region Growing

0	0	5	6	7
1	1	5	8	7
0	*1*	6	*7*	7
2	0	7	6	6
0	1	5	6	5

image, 2 seeds

a	a	b	b	b
a	a	b	b	b
a	a	b	b	b
a	a	b	b	b
a	a	b	b	b

result for $T = 4$

a	a	a	a	a
a	a	a	a	a
a	a	a	a	a
a	a	a	a	a
a	a	a	a	a

result for $T = 8$

(Source: Gonzalez and Woods)

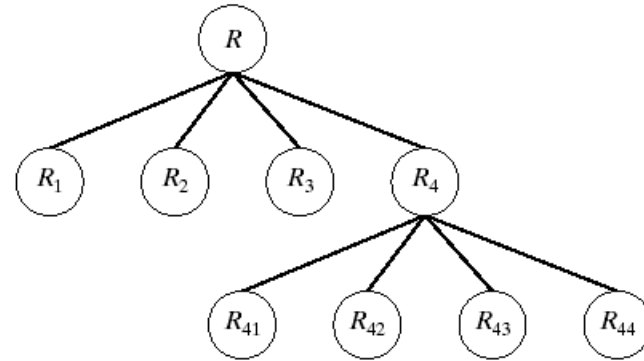http://www.cse.iitd.ac.in/~pkalra/col783

Image Segmentation

Region Splitting

a b

FIGURE 10.42
(a) Partitioned image.
(b) Corresponding quadtree.

(Source: Gonzalez and Woods)

Image Segmentation

Region Splitting

(Source: Gonzalez and Woods)   http://www.cse.iitd.ac.in/~pkalra/col783
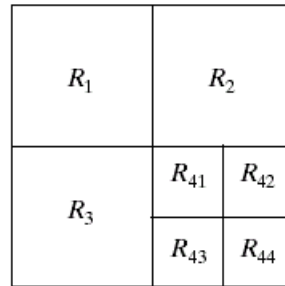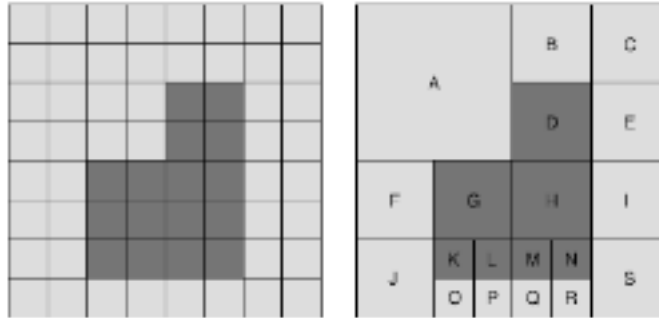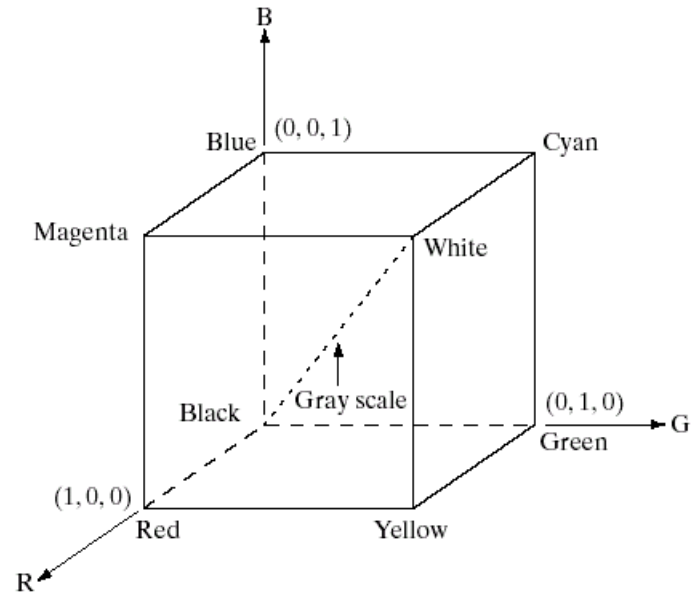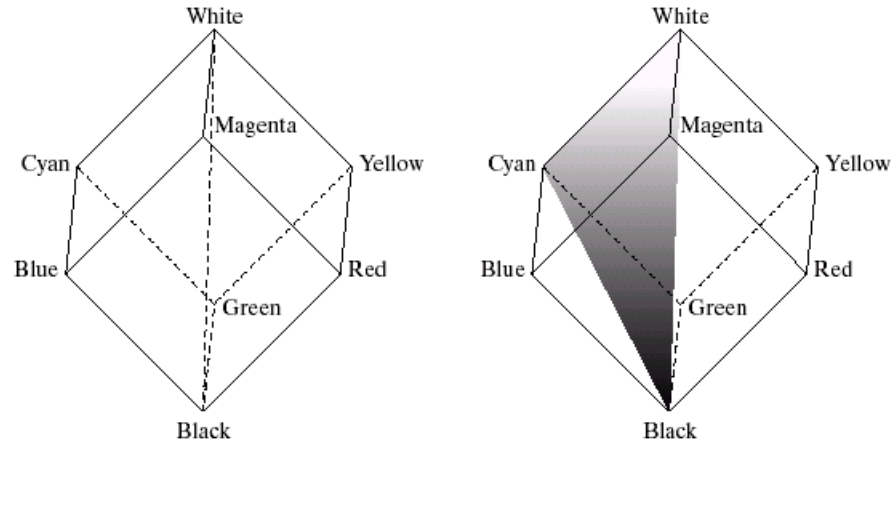
Color Image Processing
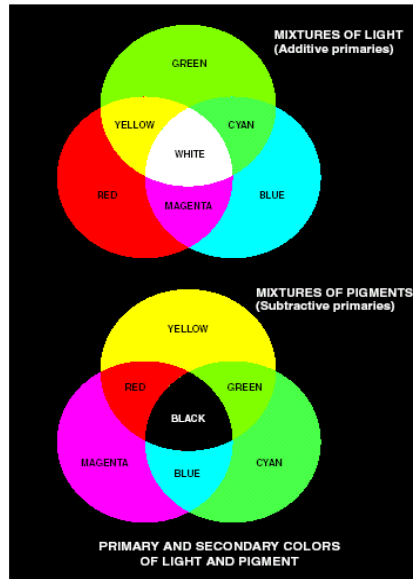
FIGURE 6.7 Schematic of the RGB color cube. Points along the main diagonal have gray values, from black at the origin to white at point (1, 1, 1).

**FIGURE 6.4** Primary and secondary colors of light and pigments. (Courtesy of the General Electric Co., Lamp Business Division.)

Digital Image Processing

(Source: Gonzalez and Woods)

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Color Image Processing

a b

FIGURE 6.12 Conceptual relationships between the RGB and HSI color models.

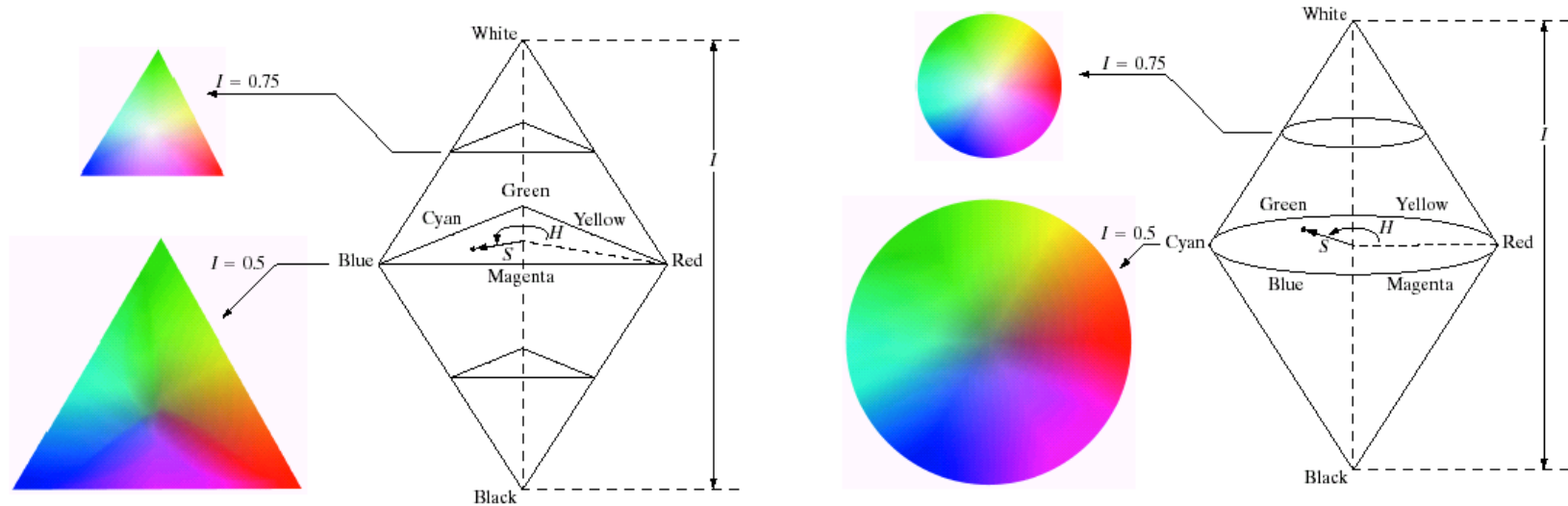(Source: Gonzalez and Woods)   http://www.cse.iitd.ac.in/~pkalra/col783
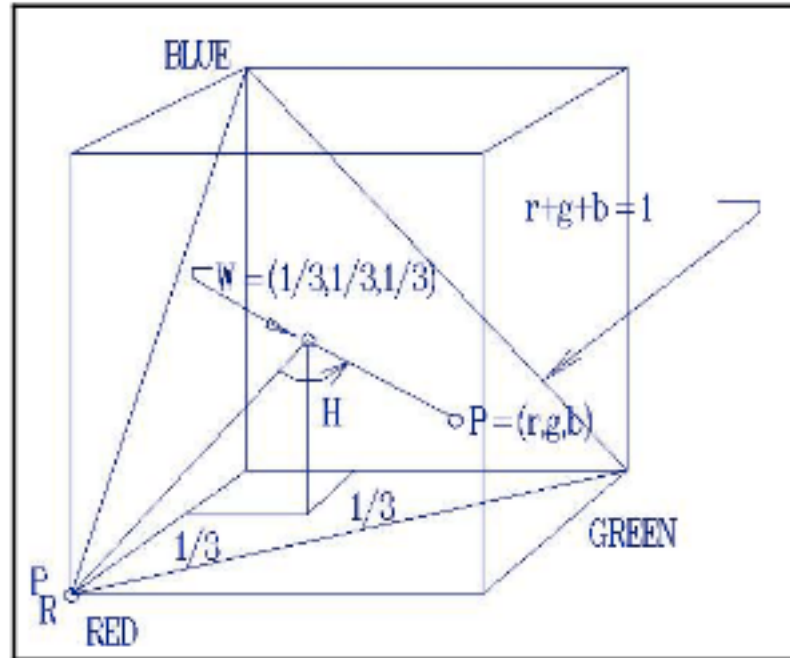
Color Image Processing
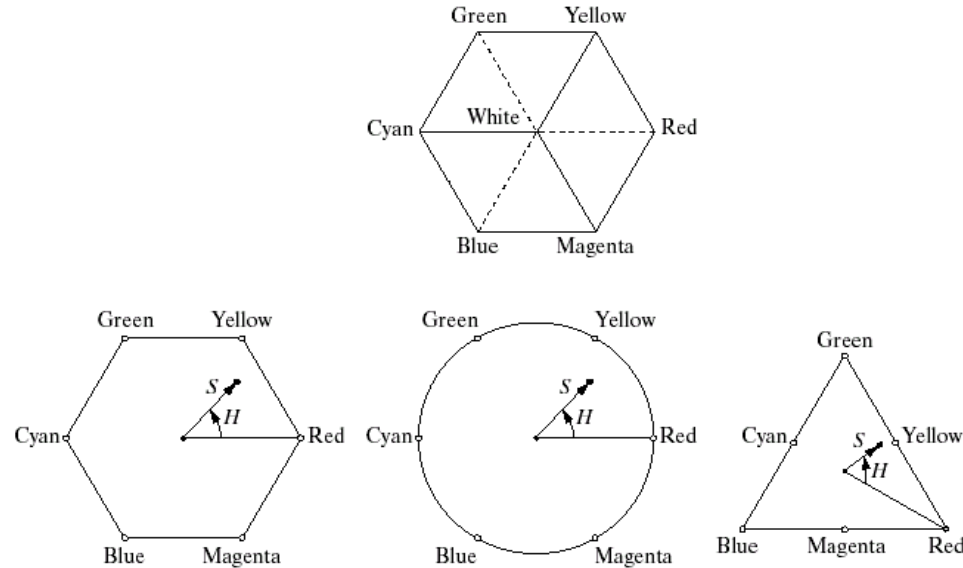
FIGURE 6.13 Hue and saturation in the HSI color model. The dot is an arbitrary color point. The angle from the red axis gives the hue, and the length of the vector is the saturation. The intensity of all colors in any of these planes is given by the position of the plane on the vertical intensity axis.

(Source: Gonzalez and Woods)

Color Image Processing

(Source: Gonzalez and Woods)

Color Image Processing

(Source: Gonzalez and Woods) http://www.cse.iitd.ac.in/~pkalra/col783

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(Source: Gonzalez and Woods)

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