Digital Image Processing

Lecture 5

Image Pre-processing

(Image Local Pre-processing: Image Smoothing)

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3. Image Pre-processing

3.1. Color Transformations

3.2. Geometric Transformations

3.3. Local Pre-processing

3.3. Local Pre-processing

3.3.1. Image Smoothing

3.3.2. Edge Detection

3.3.1. Image smoothing

3.3.1.1. Averaging filter

3.3.1.2. Gaussian filter

3.3.1.3. Median filter

3.3.1. Image smoothing

3.3.1.1. Averaging filter

$$g(x,y) = \sum_i \sum_j f(x-i, y-j).h(i,j),$$

$$(i,j) \in O$$

$$h = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

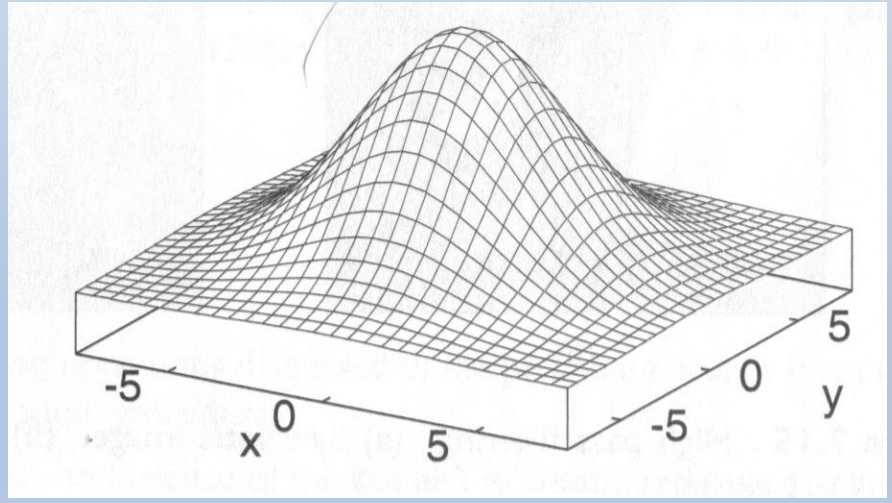
3.3.1. Image smoothing

3.3.1.2. Gaussian filter

$$g(x,y) = \sum_i \sum_j f(x-i, y-j).h(i,j),$$

$$(i,j) \in O$$

$$h(i,j) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{i^2+j^2}{2\sigma^2}}$$



3.3.1. Image smoothing

3.3.1.3. Median filter

$$g(x,y) = med\{ f(x+i, y+j), (i,j) \in O\}$$

Suppose that $\{ f(x+i, y+j), (i,j) \in O\}$

is sorted in ascending order and redefined as

follows: $I_1 < I_2 < ... < I_n, n = 2\nu + 1$,

Then $med(I_i) = I_{\nu+1}$

3.3.1. Image smoothing

3.3.1.3. Median filter

Properties

$$g(x,y) = med\{ f(x+i, y+ j), (i, j) \in O\},$$

$$\sum_{(i,j)\in O} | f(x+i, y+ j) - med | =$$

$$\min_{(i',j')\in O} \sum_{(i,j)\in O} | f(x+i, y+ j) - f(x+i', y+ j') |$$

3.3.1. Image smoothing

3.3.1.3. Median filter

Properties