

# 0920 Discussion

Wednesday, 20 September 2017 11:28

## EECS 442 Discussion

09/20/2017

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# Announcements

- Homework2 out tomorrow, due in two weeks.
- Quiz at the beginning of Thursday's lecture. Also a mini quiz on Canvas at the end.

# Topics

- Examples of DoG and LoG
- Geometric Transformation in practice

# Review: DoG and LoG

- Laplacian of Gaussian

$$L(x, y) = \frac{\partial^2 I}{\partial x^2} + \frac{\partial^2 I}{\partial y^2}$$

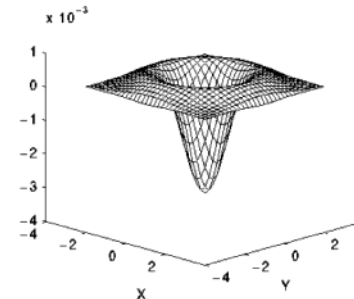
Laplacian operator

0	-1	0
-1	4	-1
0	-1	0

-1	-1	-1
-1	8	-1
-1	-1	-1

$$L \otimes (G \otimes I) = (L \otimes G) \otimes I$$

Convolution

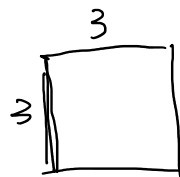



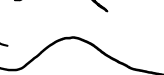
Mexican Hat

- Difference of Gaussians

$$(G(\sigma_1) - G(\sigma_2)) \otimes I$$

## Matlab Tips



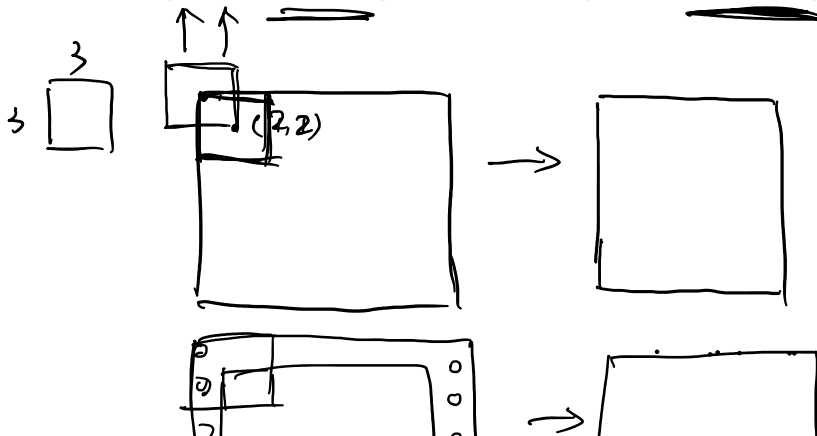
big sigma   
small sigma 

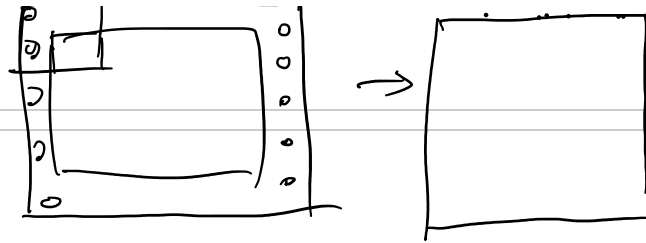
- `K = fspecial ('gaussian', HSIZE, SIGMA)`

- Usually, `HSIZE = 2 * SIGMA + 1`  $= 0, 2$

- `K = fspecial ('laplacian', ALPHA)`

- `conv2 (I, K, 'valid')` or `conv2 (I, K, 'same')`



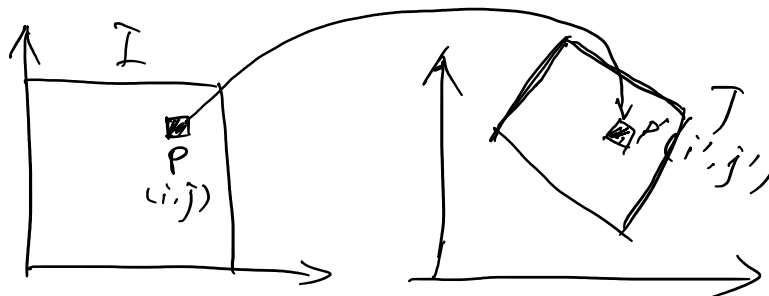


## Geometric Transformation in Practice

$T$   $3 \times 3$  matrix

$$I \xrightarrow{T} J$$

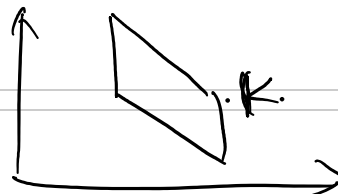
$$I(x) = J(\underline{T(x)})$$



Matrix  $M$

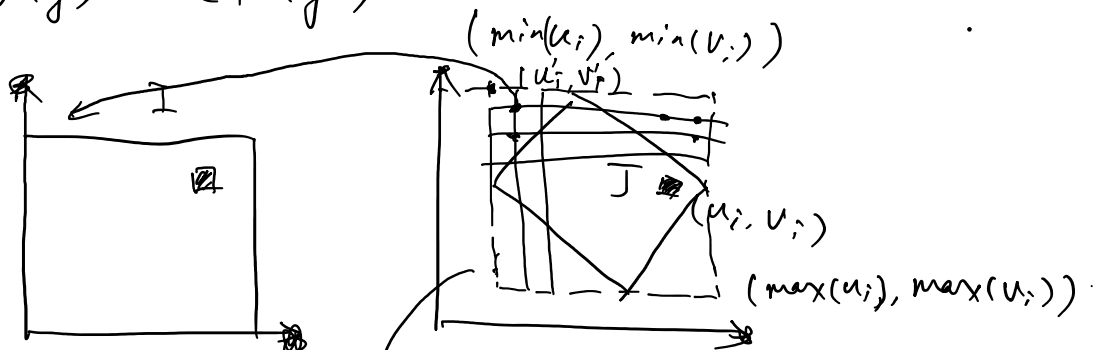


① Not integers (indices)



② How to store it in an 2D array?

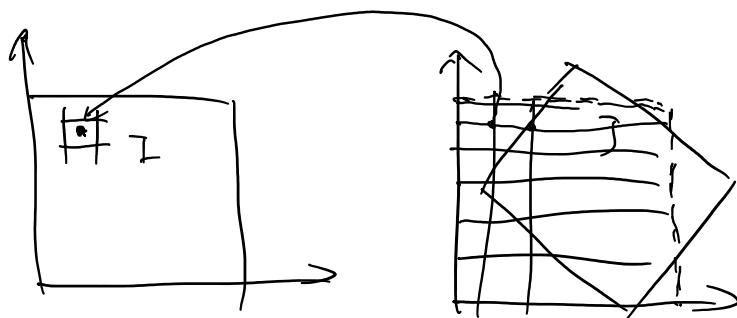
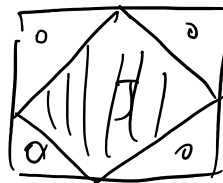
$$J(y) = I(T^{-1}(y))$$



$$J(u'_i, v'_i) = 0 \text{ if } T^{-1}(u'_i, v'_i) \notin I$$



$M'$



# Matlab Tips

- `affine2d` – create an object of affine transformation
  - Note that the matrix should be transposed before applying to the points.
- `interp2d` – 2D interpolation
- `meshgrid` – create a grid given x and y vectors

$$A = \begin{bmatrix} a & b & c \\ d & e & f \\ 0 & 0 & 1 \end{bmatrix} \quad \tilde{A} = \begin{bmatrix} a & d & 0 \\ b & e & 0 \\ c & f & 1 \end{bmatrix} \quad A^T$$

Matlab

$$x = [1 \quad 1 \quad 1]$$

$$y = \begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix}$$

$$X = \begin{bmatrix} \textcircled{1} & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \quad Y = \begin{bmatrix} \textcircled{2} & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$$

(1,2)

$$x = [1 \quad 2 \quad 3]$$

1 x 4

$$y = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

2 x 1

$$X = \begin{bmatrix} \textcircled{1} & 2 & 3 \\ 1 & 2 & 3 \\ \textcircled{1} & 2 & 3 \end{bmatrix} \quad Y = \begin{bmatrix} \textcircled{1} & 1 & 1 \\ 2 & 2 & 2 \\ \textcircled{3} & 3 & 3 \end{bmatrix}$$

