Chapter 5
Image Processing
linear filters and convolution
Lecture *Digital Image Processing,* Oct20th, 2010

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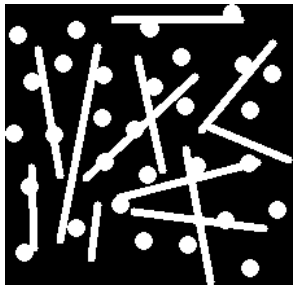
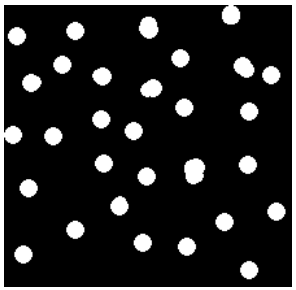
What can it be used for?

- Many many things defined by the programmer…. and some standard operations:
  - Blur image
  - Remove noise
  - Object detection
  - Morphology (later)
  - Edge detection (later)



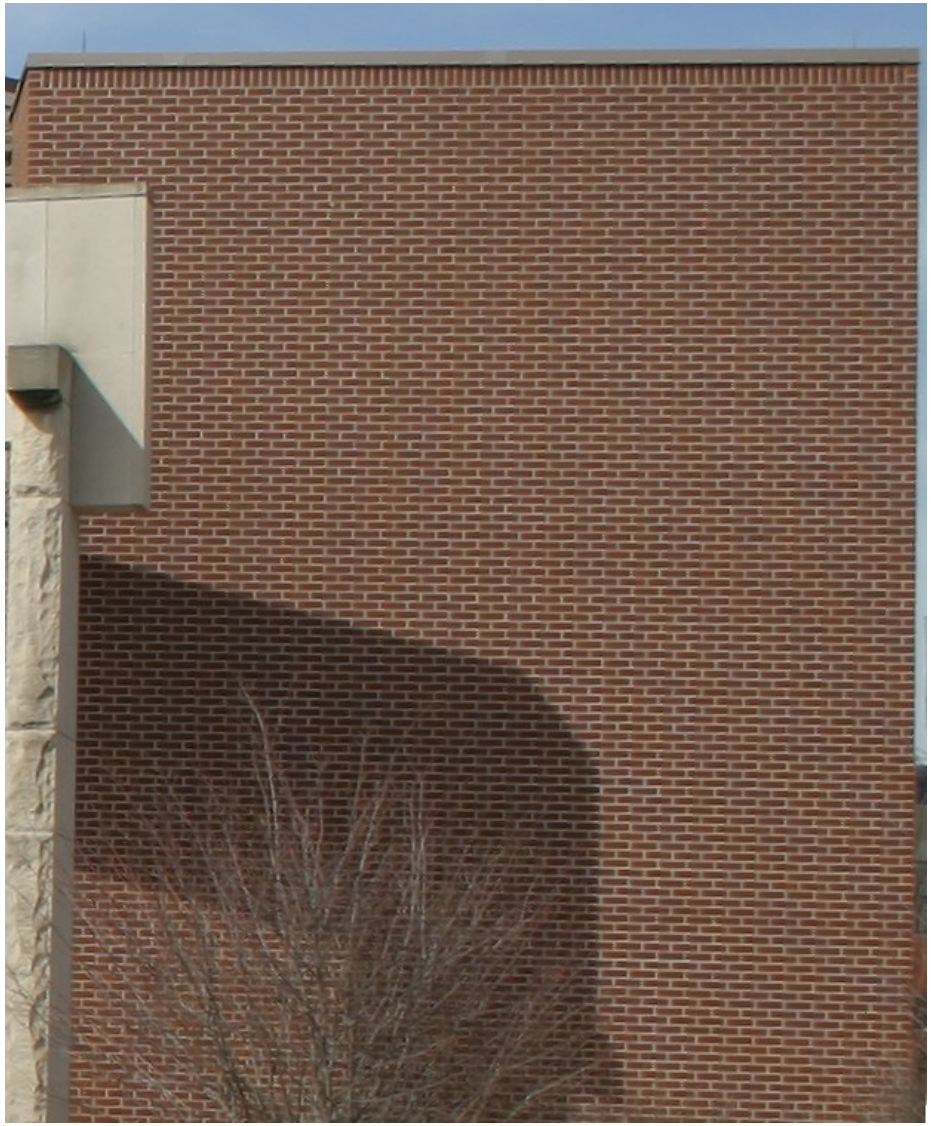


Applications of blurring

- Blurring to remove identity or other details
  - Degree of blurring = kernel size
- Remove noise
- Preprocessing (show: camera,TH,25xMean)

Aliasing



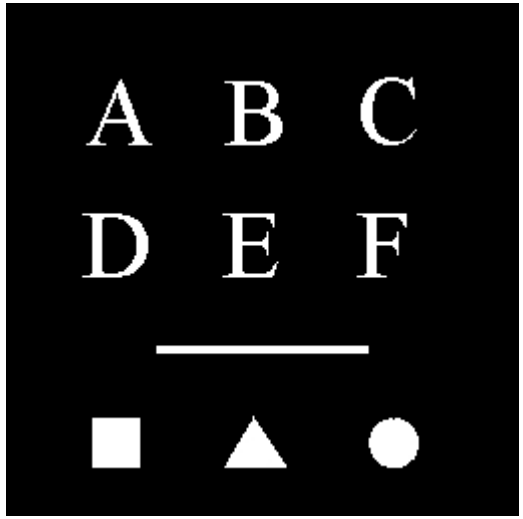
Convolution

Correlation

Template Matching

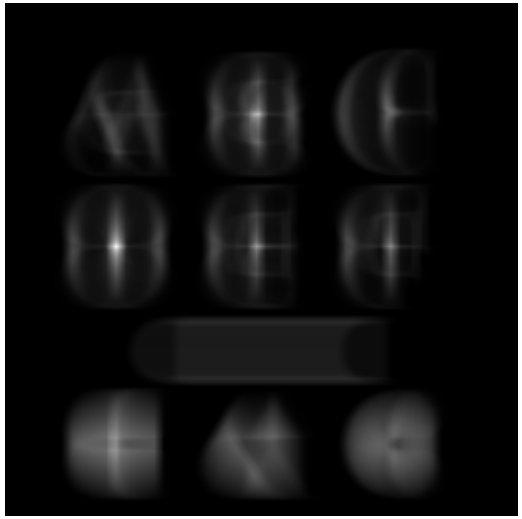
- The filter is called a template or a mask

Input image



Template

Output



- The brighter the value in the output, the better the match

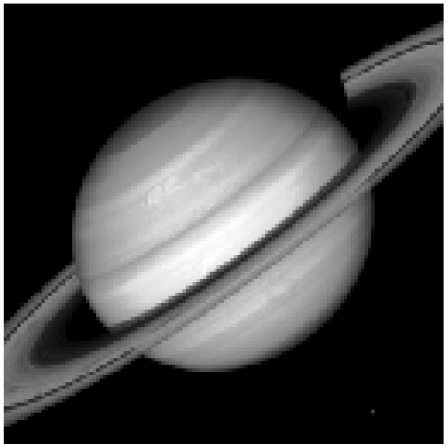
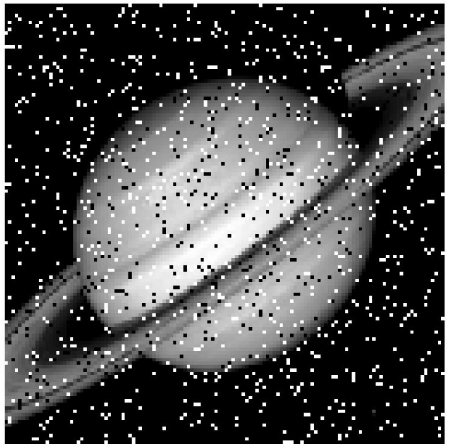
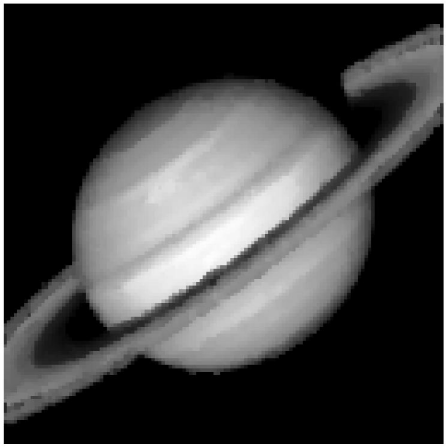
Rank Filters

Median Filter

- Median Filter
  - Good for cleaning salt-and-pepper noise
  - Minimized blurring, edges stay sharp

  (as opposed to the mean filter)

The Median filter is NOT a convolution filter!!!!!!

(show: boats, add noise: salt/pepper, Median (size=1))

What to remember

- Convolution versus correlation
- Kernel, mask, filter, template
- Border problems
- Mean filter: blur, preprocessing
- Template matching: object detection
- Other important applications of convolution: morphology and edge detection
- Rank filters: sort and then pick the:
  - Median: good at removing noise
  - Minimum, maximum, range.

Amazing Computer Vision

Exercises (1/2)

- Questions to the lecture?
- What was good about the lecture and what could have been better?
- Discuss the questions
- Program the convolution in C++/Matlab
  - The program should take any filter matrix.
  - Apply the Gaussian filter to the Dali-Image
    - Discuss/show the effects of different kernel sizes on the image!!
- Compare the Median and Mean filters on the following image:
  - Discuss the differences

1	2	0
2	2	4
1	202	1

Questions

1. What is Convolution and how is it different from correlation?
2. What role does the size of the Kernel play?
3. What is the “Border problem” and how can it be solved?
4. What is a Mean filter and what can it be used for?
5. What is Template matching and what can it be used for?
6. Name at least three different Rank filters
7. Is a Median filter better than a Mean filter regarding noise (salt and pepper) removal?
    1. Why/why not?