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MATLAB Techniques for Image Processing

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Agenda

- Assumptions
  - You know some MATLAB
  - You know image processing
- Goal
  - You will learn something useful about using MATLAB for image processing today
    - *Whether you know a little MATLAB … or a lot!*
- Topics
  - Synthetic images
  - Indexing
  - Binary image logic
  - Visualization

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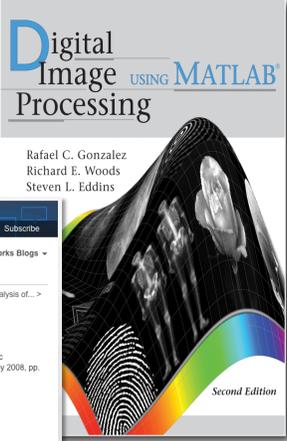
Resources
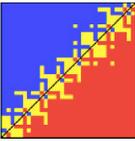
Synthetic Images

Use basic MATLAB math to create synthetic images, test patterns, etc.
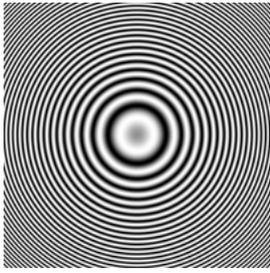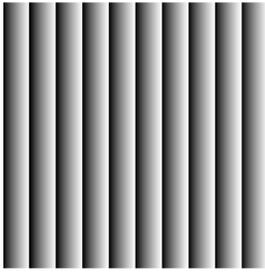
Synthetic Images

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Notes:

- Use `meshgrid` to to construct an image as a function of x,y.
- Use `cart2pol` to construct an image as a function of ρ,θ.
- The conventional dynamic range for displaying floating-point images in MATLAB is 0.0 to 1.0. Use `imshow(F,[a b])` or `imshow(F,[])` for other ranges.

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Indexing Concepts

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Indexing in MATLAB is more powerful than just specifying a set of rows and columns. You can use one image to index into another, or you can use advanced linear indexing concepts to implement recursive neighborhood operations.

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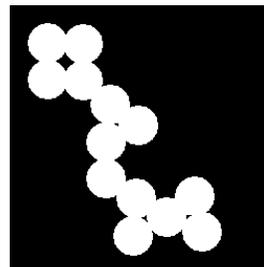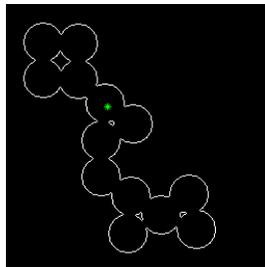
Indexing Concepts

Notes:
- Think of binary images and logical matrices as being equivalent.
- Element-wise logical operators and functions, such as `<`, `~`, and `isnan`, "make" binary images.
- Vectorizing computations involving arbitrary sets of pixels requires linear indexing.
- Avoid doing neighbor indexing on border pixels, or you'll get the wrong answer.
- Often you can use `bsxfun` instead of `repmat`.
- Use `timeit` to get reasonably repeatable execution time measurements.

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Binary Images

Correct illumination problems before trying to segment an image using thresholding.

Clean up binary images by filling holes, removing border objects, removing noisy pixels.

Add *reconstruction* to your morphological repertoire.

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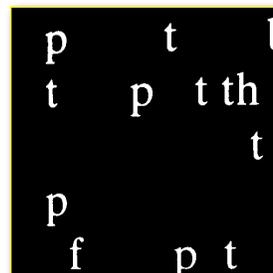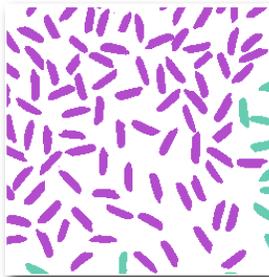
Binary Images

Notes:

- **bwareaopen** is commonly used to "clean up" binary images.
- **imfill**, **imclearborder**, **imreconstruct**: The most useful binary image functions that most users don't know about.
- Use an indexed image to visualize several different sets of objects in a binary image.
- Use linkaxes to zoom and pan in two images simultaneously. Helps answer the all-important "Compared to what?" question.

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Visualization

More "Compared to what?"

Mix image display with other kinds of graphics.

Use transparency to highlight regions or to compare input and output images.

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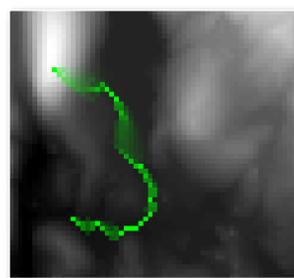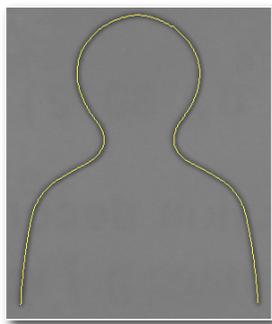
Visualization

Notes:
- Use contrasting colors and styles to guarantee plot visibility on top of an image.
- Images can have a single transparency value, or can have a different transparency for each pixel.

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Summary

Topics:
- Synthetic images
- Indexing
- Binary image logic
- Visualization

Did you learn something useful today?

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