

Tutorial 2

Image Enhancement in the Spatial Domain

COMP 4421: Image Processing

February 22, 2016

Outline

- Basic Enhancement Operations
 - Basic Transforms: inverse, log, and power-law
 - Contrast Stretching
- Histogram Operations
 - Obtaining a histogram
 - Equalization
- Filter Operations
 - Smoothing
 - Sharpening

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Basic Transforms

- `f=imread('charles_butter_2.jpg');`
- `imshow(f)`
- `imshow(uint8(255-f))` % inverse
- `imshow(uint8(30*log(1+double(f))))`
% log
- `imshow(uint8(0.1*double(f).^1.5))`
% power law



Contrast Stretching

Matlab Code

```
f=imread('charles_butter_2.jpg');  
figure; imshow(uint8((f>80)*255));  
figure; imshow(uint8((f>127)*255));  
figure; imshow(uint8((f>200)*255));
```

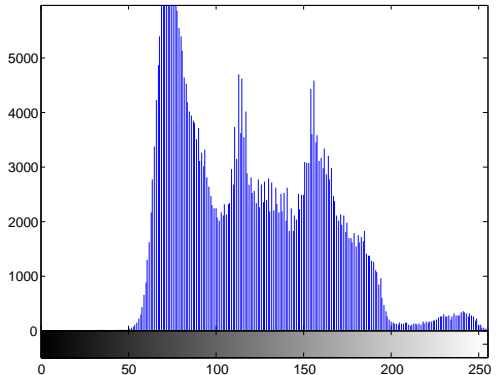


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How to obtain a histogram? (imhist)

- `f=imread('charles_butter_2.jpg'); imhist(f)`

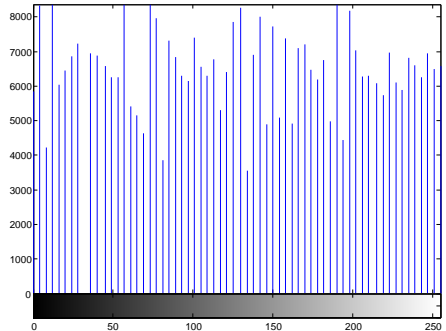


Global Equalization (histeq)

- `g = histeq(f); imshow(g)`



- `imhist(g)`



Local Equalization

- Window size = 9



- Window size = 100



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Image Operations (Add)

'>> image_add.m'

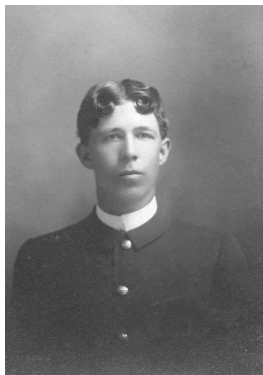


Smoothing via an Average Mask (imfilter, fspecial)

- '>> image_mask.m'

- 3×3

- 5×5

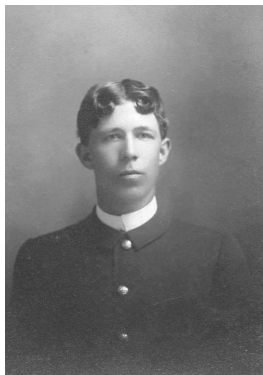


Smoothing via a Median Filter (medfilt2)

- '>> image_mask.m'

- 3×3

- 5×5



Gradients (gradient)

'>> image_gradient.m'

- Original



- df/dx



- df/dy



- magnitude

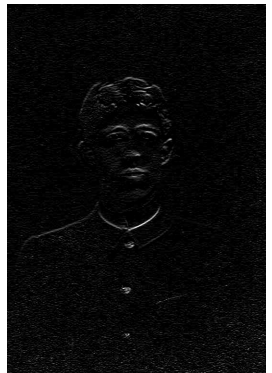
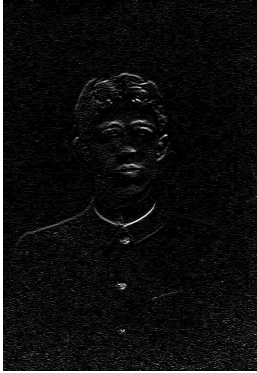


Sharpening via Approximated Derivative Filters (fspecial)

- '>> image_mask.m'

- `sobel`

- `prewitt`



Recap

- The following built-in functions are important:
 - imshow
 - imhist
 - histeq
 - imfilter
 - medfilt2
 - gradient
 - fspecial
- Please explore other interesting functions!

Exercise

Perform histogram equalization given the following histogram.
(r =Gray level, n =number of occurrences)

r	0	$1/7$	$2/7$	$3/7$	$4/7$	$5/7$	$6/7$	$7/7$
n	300	700	800	900	500	400	196	300